J. Petres · R. Rompel · P. Robins   Dermatologic Surgery

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Dermatologic Surgery

Textbook and Atlas

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With 454 Color Figures in 2211 Separate Illustrations

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Preface

The history of the healing arts forces us to be very modest.
There are no absolute truths and no eternally valid laws.
A new era will appear with new teachings and new ideas.
We need to be certain that we are receptive to change and approach the new times with understanding.

Ferdinand Sauerbruch

(Das war mein Leben. Kindler, Munich, 1951)

Many of our colleagues, especially the younger ones, have encouraged us to share our operative experiences with them. It is their please that have given us the resolve to write this book. We hope that we have met their needs with a volume which illustrates the broad spectrum of surgical techniques used in dermatology and related fields. In it we attempt to provide practical help to both practicing dermatologists and those in training, as they consider surgical therapeutic options and then seek to implement them.

Every operation requires courage, a sense of responsibility, patience, and imagination. The true quality of the surgeon is seen not in the extent and difficulty of his or her operations, but in the personal qualities that the physician brings to patient care.

Some readers may be disappointed when they fail to find certain surgical techniques dealt with here. In a small text such as this, one cannot hope to include everything, and we have concentrated on procedures with which we have extensive personal experience. We have tried to keep the amount of text to a minimum and to let our operative photographs speak for themselves.

This, as any translation of a medical text, is fraught with potential problems. Considerable differences may exist from one country to another in the way in which medicine is practiced. However, the bulk of our book consists of pictures, which need little language, and which should be equally valuable to dermatologists in many different countries. Only an English text can make these photographic descriptions accessible to the readers throughout the world.

We have included some procedures which we know are not performed by dermatologists in North America and the United Kingdom. These include lymph node dissections, vein surgery, testicular, nerve and muscle biopsies, and some proctologic procedures. Nonetheless, for two compelling reasons we felt it wise to retain this material. Colleagues in other countries who do perform these procedures may prefer the English language edition of our book. Furthermore, we hope that our American, Canadian, and British colleagues will be interested in the scope of dermatologic surgery in Germany and will appreciate learning about some of these complex procedures.

We would like to extend special thanks to Mr. C. van Velzen, scientific photographer at the Dermatology Clinic in Kassel, Germany, who provided almost all the photographs, and to Mr. R. Darroll (Hamburg, Germany) who prepared the drawings. We would also like to thank Prof. Dr. F. Härle (Klinik für Mund-, Kiefer-, und Gesichtschirurgie, University of Kiel, Kiel, Germany) for the pictures dealing with CO_2 laser surgery, and Dr. B. Konz (Dermatologische Klinik, University of Munich, Munich, Germany) for the material on tissue expansion techniques. We must also thank Dr. jur. G. Krieger (Freiburg, Germany) for legal advice as well as Mr. P. Asmussen of Beiersdorf AG (Hamburg, Germany) who supported the cost of the illustrations.

We thank especially Dr. Walter Burgdorf, who translated the manuscript. We have valued his highly qualified advice in several discussions about the text.

Our colleagues at the clinic in Kassel, Germany, willingly assumed additional burdens during the preparation of this book and showed patience and understanding as we worked on the project.

We also thank our families for their patience during the preparation process, and especially thank Mrs. W. Petres for critically reading the manuscript.

Finally we thank Springer-Verlag, in particular Drs. J. Wieczorek, V. Gebhardt, and W. Wiegers, for their excellent editorial support and W. Bischoff for the excellent design and layout.

Kassel, January 1996

Johannes Petres
Rainer Rompel
Perry Robins

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Introduction

Dermatologic surgery has formed a major part of dermatology since the founding of the specialty of dermatology and syphilology in the nineteenth century. Even in the very early days of German dermatology surgeons played an important role in the field. For example, Eduard Lang (1841–1916), a student of Theodor Billroth, performed the first dermatologic-plastic surgery repairing the ravages of lupus vulgaris. Since then a series of distinguished dermatologists have contributed to clinical and scientific advances in the field of operative dermatology, including Kromeyer (Halle), Doutrelepont (Bonn), von Düring (Kiel), Linser (Tübingen), Richter (Greifswald), Moncorps (Münster), Schreus (Düsseldorf), Kleine-Natrop (Dresden), Friederich (Marburg), Landes (Darmstadt), and Salfeld (Minden).

An important step was the formation of professional societies for dermatologic surgery, both in Germany and abroad, such as the *Vereinigung für Operative und Onkologische Dermatologie* and the *International Society of Dermatologic Surgery*. These groups have promoted the exchange of ideas among dermatologic surgeons, spreading new ideas and approaches and helping to expand to the discipline. Without the untiring efforts of these groups dermatologic surgery would not have gained such a wide acceptance as a field in so many countries in the past two decades, and dermatologic surgeons would not have been accorded such full recognition by surgeons in other fields.

Dermatologists are responsible for the diagnosis, treatment, rehabilitation, and, ideally, the prevention of diseases of the skin. While each country has its own definition of the role of a dermatologist, and the emphasis on various subspecialties varies somewhat from country to country, most dermatologists around the world accept this as a reasonable description of their field. Dermatologic surgery clearly plays an essential role in meeting these responsibilities, and it has therefore been included in formal residency training programs and in a wide variety of activities for continuing medical education. We feel that every dermatologist should be familiar with the principles of dermatologic surgery and should be capable of carrying out a basic group of procedures. How the particular dermatologist wishes then to expand his own operative repertoire is a matter both of personal interest and medicopolitical climate in his own country.

We consider dermatologic surgery as covering all surgical procedures of the skin and subcutaneous tissues as well as the structures in the skin, such as veins, and the adjacent mucous membranes. In each country there are slightly differing realms of competence. Possible gray zones or border regions include the eyelids, cartilage of the ear and nose, genital mucosa, muscles, nerves, and fascia. For example, some dermatologic surgeons are prepared to perform a muscle biopsy in the diagnostic evaluation of a patient with possible dermatomyositis.

Dermatologic surgery includes:
- Diagnostic biopsies
- Excisions of benign and malignant skin tumors
- Treatment of congenital and acquired malformations
- Treatment of inflammatory, postinflammatory and scarring conditions
- Cosmetic surgery
- Surgical proctology (in some countries)
- Surgical phlebology (in some countries)

There are areas in which the expertise of dermatologic surgeons overlaps with that of other specialists, such as plastic surgeons, otorhinolaryngologists, ophthalmologic surgeons, oral surgeons, and even general surgeons. At the present, the collegial exchange of information and the shared responsibility is threatened in some countries by a morass of administrative problems and "jurisdictional" controversies that are based to some extent on the particularistic pride of the various specialties and, unfortunately, on financial greed. Clearly, cooperation among all the physicians involved in skin surgery can only lead to improved patient care and to the advancement of knowledge.

Dermatologic surgery has expanded a great deal in recent years due to the increased incidence of skin cancer. This increase probably reflects the changing life-style of patients in Western countries, with more frequent and more intensive sun exposure. In any event, the dermatologist, with his special skill in recognizing early or premalignant changes, is ideally suited to treat cutaneous malignancies and their precursors. The expansion of this role is apparent in office-based practices, day surgery centers, and medical centers.

Part A
General Principles of Dermatologic Surgery

1 Preoperative Measures

1.1 Patient Selection

Cutaneous surgery is subject to the same rules and responsibilities as in all other branches of surgery, including the pre-, intra-, and postoperative periods. A basic rule is that the general condition of the patient must be taken into account when deciding whether to operate. Since in dermatologic surgery nearly all procedures are elective, one must also consider the many noninvasive techniques available when a patient appears to have operative risks. One must weigh especially carefully the risks and the benefits when considering a cosmetic procedure in a patient with other medical and psychiatric problems.

1.2 Consultation

1.2.1 History

As part of the initial discussion one should obtain a history covering both dermatologic allergies and past medical history. One should pay particular attention to previous infectious diseases, especially hepatitis and HIV infection, and to CNS disease, cardiac problems, and endocrine disorders.

In addition, one must be aware of all medications, including over-the-counter products, that the patient is taking. Anticoagulants are of obvious importance. Coumarin products should be discontinued and, if needed, replaced by heparin. Patients who are taking low-dose aspirin to inhibit platelet aggregation should stop this medication 10 days before the operation; this helps to avoid both intraoperative problems with bleeding and postoperative hemorrhage. Coagulation parameters should be assessed prior to surgery if the history suggests bleeding problems, or if the planned procedure involves marked blood loss.

Essential Aspects of Preoperative Dermatologic History

- Atopic diseases
  Atopic dermatitis
  Allergic rhinitis
  Allergic conjunctivitis
  Asthma
- Systemic allergies
  Local anesthetics
  Contrast material
  Antibiotics
  Anti-inflammatory agents
  Analgesics
- Topical allergies
  Tape
  Latex
  Antibiotics
  Anti-inflammatory agents
  Disinfectants
- Problems with wound healing
  Hypertrophic scars
  Keloids
  Tendency towards dehiscence

Essential Aspects of General History

- Infectious diseases
  HIV
  Hepatitis B
- Bleeding disorders
  Coagulation problems (recurrent thrombosis)
  Hemophilia and other causes of prolonged bleeding
- Cardiovascular disorders
  Cardiac arrhythmia
  Hypertension
  Insertion of a pacemaker
  Coronary artery disease
  Coronary valve disease
  Arterial occlusive disease
- Rheumatic disorders
  Rheumatic fever
  Rheumatoid arthritis
  Vasculitis
- CNS disorders
  Posttraumatic encephalopathy
  Epilepsy
- Endocrine disorders
  Diabetes mellitus
  Hyper- or hypothyroidism
- Ocular disorders
  Glaucoma
- Pregnancy
- Medications
  Anticoagulants
  Aspirin
  NSAIDs
  Corticosteroids
  Immunosuppressive agents
  Antibiotics
  Pain medications
  Psychotherapeutic agents
- Substance abuse
  Alcohol
  "Street" drugs
  Nicotine

1.2.2 Informed Consent

After taking the patient's history and evaluating the cutaneous problem, the physician must conduct a thorough discussion with the patient, informing him of the possible benefits and risks of the proposed operation. The reasons for the procedure, the planned approach, the expected results, and the risks entailed must all be explained by the physician in terms which the patient can understand. The possible complications should be discussed in greatest detail.

Possible Complications in Dermatologic Surgery
- Bleeding during operation
- Postoperative bleeding
- Wound infection
- Wound dehiscence
- Damage to sensory or motor nerves
- Unsatisfactory scars (hypertrophic scar, keloid)
- Recurrence of tumor

It is particularly important to explain changes in surgical approach which may become necessary intraoperatively. Since local anesthesia is used in most dermatolocal procedures, the patient should be informed in advance that bleeding may be profuse from a scalp operation, and that a certain flap may prove impossible once the actual wound defect is established intraoperatively. It is not desirable that the patient gleans this information from the physician's conversations during the operation. Less common complications should also be discussed. Furthermore, one must discuss the "pro's" and "con's" for alternative approaches such as radiation therapy or cryosurgery. The patient must also be informed about the possible consequences which refusal of an operation would have. The patient should be aware that a scar can be critically evaluated only after 6–12 months. This avoids unnecessary concern and worry in the initial days to weeks after an operation. The preoperative discussion is even more crucial when a cosmetic procedure is being planned.

For medical-legal purposes it is essential that the preoperative discussion will be carefully documented to cover all of the points mentioned above. Some surgeons prefer a preprinted page in the chart to ensure that everything they require is documented. In addition, the physician and the patient (or his representative, such as a parent for a child) generally sign an operative permit which covers many of the same points. However, a signed operative permit alone does not verify informed consent and must be supplemented by a chart note outlining the nature of the conversation. In general, individualized notes including specific questions of the patient are more valuable than simply checking off boxes as "questions answered."

Today we offer every patient the opportunity to donate his own blood for storage and eventual use during the procedure. A healthy adult can give blood every 2–6 weeks; it is therefore easy to accumulate three units of concentrated erythrocytes, which is more than adequate for all skin surgery. On the other hand, blood loss is usually minimal in skin surgery, and because of the cost blood should not be saved unless there is a reasonable likelihood that it will be used.

Postoperative care is essential. Considerate care and appropriate responses to complaints about pain, bleeding, and similar problems contribute substantially towards increasing patient satisfaction. In addition, follow-up should be scheduled at 3 and 6 months to supplement the routine postoperative care involving bandage changes and suture removal. This should be emphasized preoperatively so that the patient feels comfortable that the surgeon will have a lasting interest in his problem and will be available. Long-term follow-up over years is essential for cancer patients, but this is in fact advisable for all surgical patients. This allows the surgeon to learn exactly how effective his efforts have been, and the patient is more likely to remain satisfied and perhaps even return, as future needs dictate.

1.2.3 Operability

In general, for larger operations the patient should be seen by both an internist and an anesthesiologist. This permits the patient's general health and suitability for anesthesia to be best evaluated and documented. Most dermatologic cases, however, are less complicated and can be handled by the dermatologist alone, taking a careful history and performing a physical examination as needed. In complicated cases or when other problems are discovered, the preoperative evaluation must be expanded.

Standard Preoperative Tests
- Clinical blood count with platelet determination
- Liver function tests
- Creatinine
- Electrolytes
- Fasting blood sugar
- Electrocardiogram

Optional Preoperative Tests
- Coagulation studies
- Blood typing
- HIV status
- Hepatitis serology
- Thyroid evaluation
- Syphilis serology
- Chest X-ray
- Peripheral vascular evaluation

Local anesthesia is generally preferable. Of course, one must determine whether the patient has had previous untoward reactions, for example, in the dentist's office. The possibility of allergy can be further evaluated with appropriate testing.

1.3 Indications

A major aspect of dermatologic surgery is the removal of malignant and premalignant tumors. In addition, many benign tumors and malformations are removed both for aesthetic

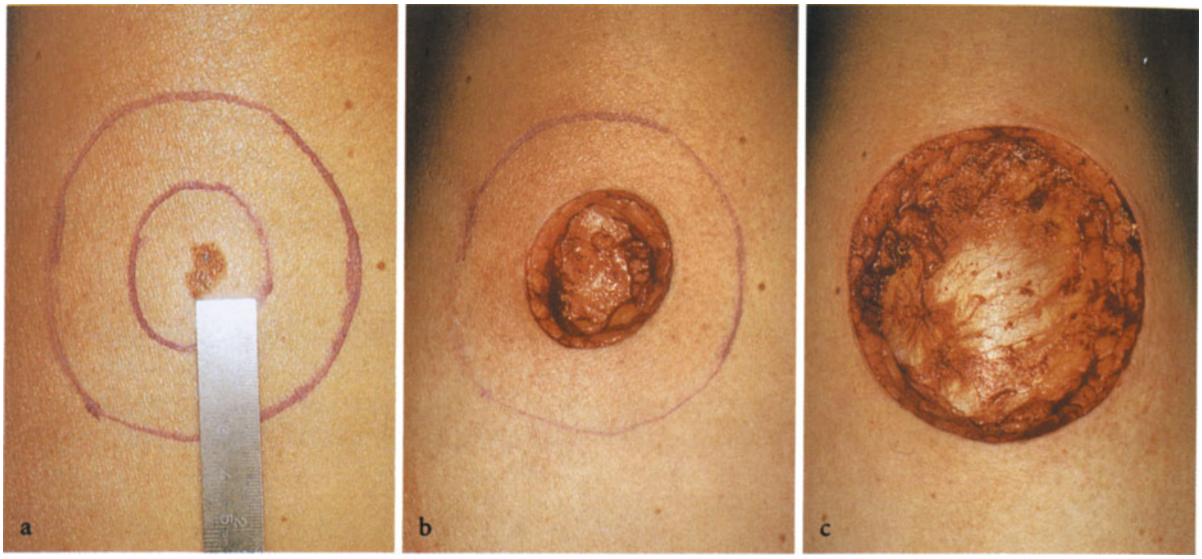


Fig. 1. Two-part operative procedure; as an example, the excision of a malignant melanoma
a Operative plan for the initial diagnostic excision with 1.0 cm margin
b Defect left open or covered with polyurethane film sheet while awaiting the histologic diagnosis, often performed using frozen sections
c After histologic diagnosis, the melanoma is excised with 3.0 cm margins

reasons and for prophylaxis to avoid malignant change (such as the development of a basal cell carcinoma in a nevus sebaceus). Another area in which surgery plays a major role is in the treatment of inflammatory conditions, especially those that have evolved into a scarring process, such as acne inversa.

In treating skin cancers the following considerations most often lead us to recommend surgery:

- The treatment and the recovery period are short.
- Surgical removal of precancerous lesions such as actinic keratosis, Bowen's disease, lentigo maligna, radiation dermatitis, and radiation ulcer eliminates the risk of malignant degeneration.
- The three-dimensional histologic examination of surgical specimens allows the most accurate determination of tumor removal.
- Surgery avoids damage to underlying structures such as cartilage or bone, which may occur when radiation therapy or cryosurgery is employed on the nose, ears, cheek, and fingers.
- Radiation therapy produces a scar which tends to worsen with time. The irradiated skin is at risk to later develop squamous cell carcinoma. Thus radiation is only suitable for older patients.
- Some tumors such as sclerotic basal cell carcinoma respond poorly to radiation therapy.
- Special areas such as the temporal and parietal regions develop a prominent vascular reaction with a subsequent delay in wound healing so that radiation is not recommended.
- Radiation therapy leads to hair loss which may be permanent, thus limiting its usefulness on the scalp.

Any suspicious lesion which has not responded after 1–2 months to a conservative treatment, such as topical chemotherapy or cryosurgery for a suspected actinic keratosis, should be biopsied or excised. This allows the diagnosis to be obtained and further treatment to be planned.

Most benign and premalignant lesions can be treated with narrow surgical margins and maximal tissue conservation. However, with malignant tumors such as malignant melanoma, sclerotic basal cell carcinoma, and dermatofibrosarcoma protuberans, larger surgical margins must be obtained to reduce the likelihood of local recurrence. Should a tumor such as a basal cell carcinoma recur, particular attention must be paid to the margins in the reexcision. Mohs micrographic surgery is particularly suitable for recurrences as it best combines margin control and tissue preservation. Intraoperative use of frozen-tissue sections for margin control is an alternative approach, although this fails to provide the three-dimensional margin control of Mohs' technique.

If the pathology report indicates involvement of the margins, a reexcision is necessary. This should be carried out promptly. It is the responsibility of the surgeon to review all pertinent pathology reports and ensure that appropriate clinical follow-up or reexcision be carried out. In difficult cases many surgeons choose to review the histologic specimens in collaboration with the pathologist.

Nodular or superficial basal cell carcinomas require a surgical margin of only a few millimeters. Larger tumors, especially those which are ulcerated, and sclerotic tumors may often have irregular borders reaching several centimeters from the clinically apparent tumor so that wider margins are needed. Most squamous cell carcinomas can be relatively accurately delineated clinically so that a surgical margin of 0.5–1.0 cm is sufficient.

The size of the surgical margin in treating malignant melanomas remains a controversial issue. Current recommendations range from 1.0 to 3.0 cm, based on factors such as tumor thickness and Clark level. Most major studies in recent years support a lessening of the traditional 5.0-cm margins, but a natural reluctance to undertreat a potentially fatal tumor has led to slowly evolving new standards. (Table 1) We often perform a simple excision with 1-cm margins and then, after receiving a histopathologic report, proceed with the larger excision, if needed (Fig. 1).

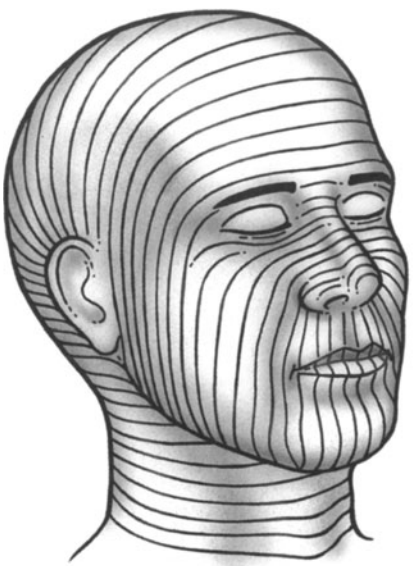
Table 1. Excision margins for primary malignant melanoma

	Margin
Author's recommendations: microstaging	
Level I, II and/or thickness ≤ 0.75 mm	1.0 cm
Level III and/or thickness 0.76–1.50 mm	3.0 cm
Level IV, V and/or thickness ≥ 1.51 mm	3.0–4.0 cm
Recommendations of the Melanoma Commission of the German Dermatological Society: thickness (after Breslow)	
≤ 1.0 mm	1.0 cm
> 1.0 mm	3.0 cm
Recommendations of the NIH Consensus Conference: thickness (after Breslow)	
in situ	0.5 cm
≤ 1.0 mm	1.0 cm
> 1.0 mm	2.0–3.0 cm

The goal of dermatologic oncology is identical to that of all other surgical oncology: total tumor removal. Intraoperative pathology reports, regardless of whether from the Mohs' technique or standard frozen section, may mandate a much larger operation than initially planned. The surgeon must therefore always prepare the patient for the eventuality that a larger procedure may be needed. Similarly, in planning the operation he must be aware of the possibility of facing a difficult primary closure and consider alternative ways of completing the procedure should more tissue removal be needed for tumor control.

1.4 Planning the Operation

In a scalpel excision the line of the excision should follow one of the relaxed skin tension lines (Figs. 2–5). These lines do not always follow the primary folds and wrinkles of the skin,



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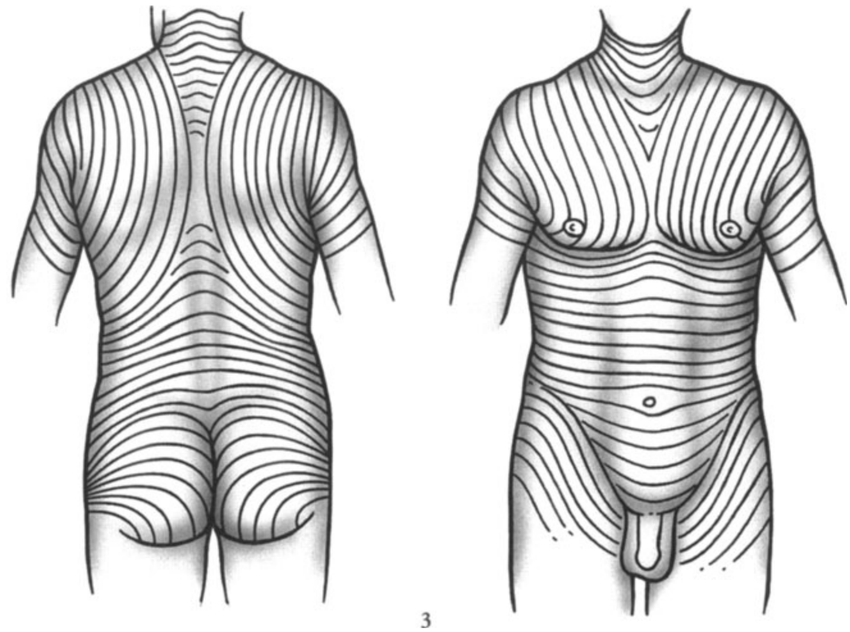

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Fig. 2. Relaxed skin tension lines in the head and neck region

Fig. 3. Relaxed skin tension lines on the trunk

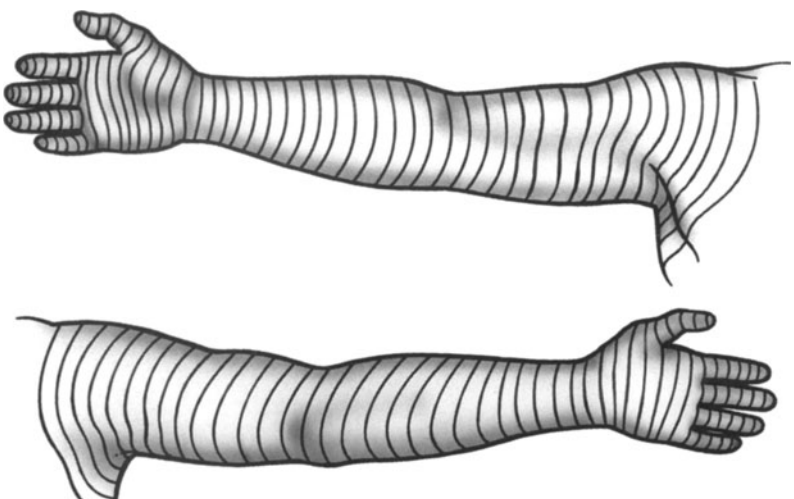
although they often do overlap. This goal of course is most easily reached when the wound can be closed primarily, usually with undermining. When flaps are planned, the major final closure lines should follow these lines, but consideration must also be given to avoiding underlying muscles, nerves, and vessels.

The vascular supply of a flap is of course crucial. Many factors are involved here: the patient's age and general condition, neurologic and cardiac problems, and any local arterial disorders that may particularly affect the flap tissue. Smoking is another negative influence on flap vitality. The type of flap that is designed depends greatly on the region being treated. Most small flaps are serviced by a random pattern of small blood vessels in the dermal-subdermal plexus. The width and length of the flap should be about 1:3 to 1:4 on the face, and 1:2 or 1:3 on other body sites. When axial pattern flaps are used, a single vessel serving the flap is carefully preserved during the operation; the vessel courses the flap from its base to its tip, thus allowing a greater width to length ratio.

When defects are covered by skin grafts, one must attempt to match the donor and recipient sites, considering such factors as skin color, skin texture, and hair growth. Grafts from the upper eyelid and the preauricular, retroauricular, and supraclavicular regions are those best suited for transfer to the face. The defect should be conditioned for 10–14 days with sheets of polyurethane foam to avoid surface irregularities. Changing these sheets daily produces healthy, well-vascularized granulation tissue which better fills the defect. When the graft is applied, it therefore reaches the level of the adjacent skin, allowing a smoother rather than sunken graft.

1.5 Preparing for the Operation

Preparations are naturally more complicated when general anesthesia is planned than in the case of a local procedure. The patient must not eat or drink during the preceding 6 h. Smoking during the preoperative period is also forbidden. The patient must be made fully aware



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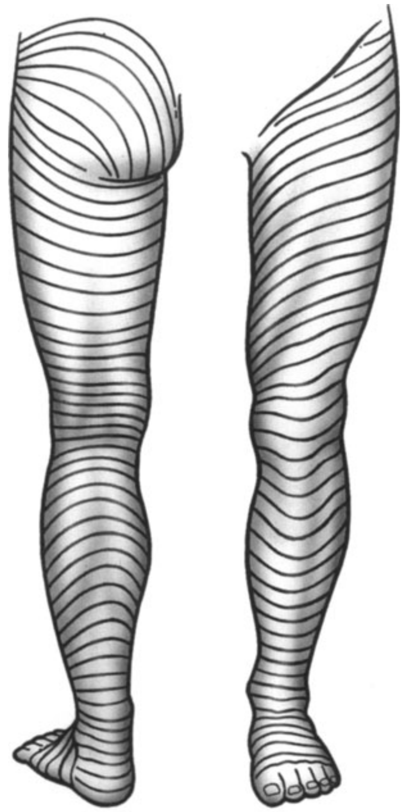

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Fig. 4. Relaxed skin tension lines on the arm

Abb. 5. Relaxed skin tension lines on the leg

of the danger entailed by violating these rules, for the danger of suffocation through an anesthetic accident is considerable. We also attempt to do carry out larger procedures that use local anesthesia under the same conditions, as emergency intubation is much safer in cases in which the patient develops shock from blood loss and those in which it becomes necessary to increase the amount of local anesthetic.

The administration of a preoperative sedative is not mandatory but does often prove very helpful. Very anxious patients facing local anesthesia and those requiring general anesthesia receive an intramuscular injection 30 min before the procedure. In adults we use compazine or a similar antiemitic agent as well as 0.25–0.50 mg atropine; the medication is given either in his room or in the preoperative area of the surgical suite. An intravenous line is generally inserted at the same time. Thereafter the patient must remain lying to avoid the risk of orthostatic hypotension.

Small children are strapped onto the operating table; we also tend to follow this procedure with all general anesthesia patients, although modern anesthetic techniques have reduced the risk of excessive aggitation reactions to almost nil. A broad, soft, padded belt which can be fastened over the hips is generally sufficient. The patient's position on the operation table is important. The surgeon must ensure that no unusual pressure points are present which could lead to damage of tissues or nerves. Branches of the brachial plexus are particularly susceptible to damage from stretching, producing paresthesias. Therefore the arm should not be markedly rotated externally or held at more than a 90° angle from the trunk. One must also be sure that no joints are hyperextended. After induction of anesthesia has led to full relaxation, the surgeon must again ensure than no body parts extend over the edge of the operating table.

When operating in the head and neck region, particular attention must be paid to ensure that the neck is not hyperextended. Elderly patients are at particular risk as they generally show arthritic changes and may suffer cervical spine fractures if positioned improperly. One must be especially cautious when repositioning a patient under general anesthesia due to the lack of both protective reflexes and normal muscle tension.

Preoperatively, the operative site is shaved if necessary and then cleaned with a disinfectant solution such as povidone iodine or chlorhexidine. One should not apply the disinfectants too liberally especially when cleaning around body openings such as the female genitalia or the ear; fluids may collect in these areas and cause a toxic local reaction. When operating around the ear, we generally pack the external canal with a piece of impregnated gauze. If the eyelids are likely to be exposed, a sterile ophthalmologic ointment should be inserted prior to cleansing. It is also helpful to gently tape the eyelids closed with a piece of nonallergic tape. These measures help to avoid a painful conjunctivitis.

After the skin has been disinfected, the area is covered with sterile towels. We prefer traditional reusable linen towels to the countless disposable products. Using a surgical light to maximally visualize the borders of the tumor, a skin marker is used to delineate the planned lines of incision. Although special pens are available, we use 1% gentian violet and a sterile wooden applicator stick. Stretching the skin enables one to best appreciate the margins of the tumor, the skin elasticity, and the direction of the relaxed skin tension lines. At this time one should also sketch the planned approach to closure, regardless of whether this is to be a flap or some other maneuver. All this should be done prior to injecting a local anesthetic as this distorts the anatomic structures to some extent.

When electrosurgical instruments are to be used, the grounding device must be placed in contact with a broad area of dry skin. No metal should be in contact with the skin, such as from the table or anesthetic devices. Electrosurgery should be avoided in patients with pacemakers and over areas of a metal implant.

1.5.1 Surgical Instruments

The choice of appropriate surgical instruments and suture material plays a major role in determining the success of an operative procedure. Coarse or toothed forceps, awkward needle holders and scissors, and excessively large needles all contribute to wound edge trauma. Microthrombi and wound necrosis may result, leading to wide or gaping scars. Therefore special instruments are essential for delicate cutaneous surgery (Fig. 6); a basic set consists of a scalpel handle, # 11 and # 15 disposable blades, skin punches (usually disposable in varying sizes), curettes, needle holder, forceps, clamps, scissors, skin hooks, and nail avulsion forceps (Fig. 6).

We favor fine, atraumatic sutures with small round needles, and delicate needle holders with narrow blades to reduce the possibility of the needle breaking during suturing. Small, rounded, slightly curved Metzenbaum scissors are essential for undermining and correctly preparing flaps. Delicate Adson forceps (dissecting and tissue forceps) and curved and straight mosquito clamps for bleeding sites are also needed. Wound edge approximation, however, should be carried out with single- or double-pronged skin hooks, not with forceps. We use tissue forceps to approximate subcutaneous tissue and also when sealing off bleeding vessels with electrocautery devices. Dissecting forceps, on the other hand, may be helpful to approximate wound edges; care must be taken not to avoid traumatizing the wound edges. An adjustable compass is helpful in planning flaps.

Naturally the choice of instruments must be appropriate to the site being treated. Cosmetic surgery of the face requires much finer

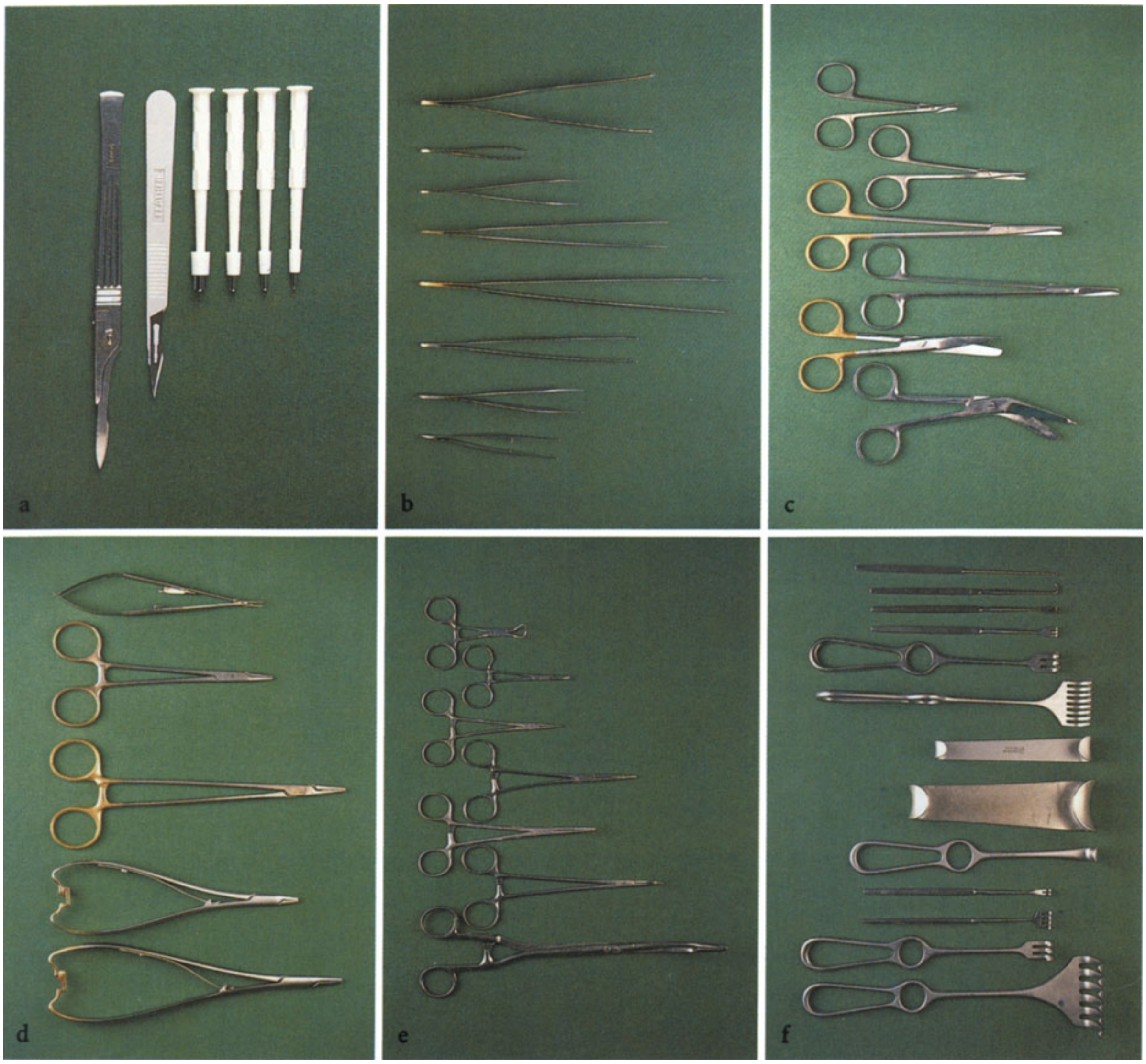


Fig. 6. Surgical instruments
a Scalpel with replaceable blade, disposable scalpel, disposable punches of various sizes (*from left to right*)
b Various forceps: staple, splinter, dissecting, and tissue forceps (*from top to bottom*)
c Various scissors: Graefe scissors, Metzenbaum, suture, and bandage scissors (*from top to bottom*)
d Various needle holders: fine Yasargil, small and large Hegar-Mayo, and small and large Mathieu (*from top to bottom*)
e Various clamps and hemostats: Backhaus towel clamp, curved and straight Halsted or Mosquito hemostats, curved and straight Pean clamps, Overholt suture clamp, Sims-Meier sponge clamp (*from top to bottom*)
f Various retractors: Gillies and Joseph small wound hooks, Volkman sharp-toothed retractors (2, 3, and multiple hooks), small and large Roux blunt retractors, Langenbeck retractor, Kocher dull-toothed retractors (2, 3, and multiple hooks), Israel large toothed retractor (*from top to bottom*)

Table 2. Resorbable suture materials

Suture	Composition
Catgut	Purified sheep collagen (from intestinal submucosa)
Vicryl	Copolymer of 1-lactide and glycoside
Dexon	Polyglycolic acid
PDS	*p*-Dioxan-polyester

Table 3. Permanent suture material

Suture	Composition
Surgical silk	Raw silk
Nylon (Ethilon, Supramid)	Polyamide polymer
Polypropylene (Prolene)	Propylene polymer
Polyester (Ethibond, Mersilene)	Ethylene glycol and terephthalic acid mixture

instruments than does lymph node dissection or vein surgery.

1.5.2 Suture Material

The major choice is between resorbable material, employed for subcutaneous sutures and ligatures (Table 2), and nonresorbable material, used for some subcutaneous work but primarily for approximating wound edges (Table 3). Resorbable material is digested or otherwise destroyed by the body enzymatically over a period of time. The newer synthetic resorbable materials have much greater tensile strength than the classic catgut suture. As the wound becomes stronger, one can accept a diminution in the strength of the suture material. Determination of the appropriate resorbable suture involves a balancing of these two factors.

One must also be aware of the properties of monofilament and woven sutures in tissues. Monofilament sutures elicit minimal tissue reaction and are easy to use but produce a knot which may work itself loose. On the other hand, woven sutures have greater tensile strength and knot security but may function with a sawlike effect when under tension in tissue. Some newer woven sutures are coated with a thin sheet of polyglactin 370, which minimizes the sawing effect (Table 4)

Each surgeon should choose his suture material based on both personal preference and the nature of the operation, taking advantage of the many unique features of the wide range of modern sutures. One should be aware that not only catgut but also the newer

Table 4. Characteristics of various suture materials

Material	Handling	Tear resistance	Knot safety	Tissue tolerance	Duration in tissue[a]
Silk	+	+	++	–/(+)	Permanent
Nylon, Perlon	+	++	–	++	Permanent
Polypropylene	(+)	++	–	++	Permanent
Polyester	+	++	+	(+)	Permanent
Catgut	–	–	+	(+)	70–90 days
Vicryl	(+)	+	+	+/++	75–90 days
Dexon	+	+	(+)/+	+/++	90–120 days
PDS	+	++	–	++	150–180 days

++ very good, + good, (+) mediocre, – poor; [a] Time until suture is completely removed.

Table 5. Recommended suture thickness for various locations

Location	Subcutaneous suture	Skin suture
Face	4–0 to 5–0	5–0 to 7–0
Neck and nape	3–0 to 5–0	4–0 to 6–0
Scalp (with hair)	2–0 to 4–0	2–0 to 4–0
Trunk	1–0 to 4–0	2–0 to 5–0
Arms and legs	2–0 to 4–0	3–0 to 5–0
Hands and feet	3–0 to 4–0	3–0 to 4–0
Palms and soles	3–0 to 4–0	3–0 to 4–0
Genitalia	4–0 to 5–0	4–0 to 5–0

resorbable sutures can lead to granuloma formation before they are absorbed.

Virtually all dermatologic surgeons use atraumatic needles already swedged onto the suture material as such needles create minimum damage at entry and exit sites. We prefer cutting needles for the skin sutures, while the subcutaneous sutures can be placed with either a round or cutting needle. On mucosal surfaces we experience better success with round needles. The exact type and size of the needle depends on both the suture size and the preference of the surgeon (Table 5).

2 Postoperative Measures

There are a wide range of possibilities for covering a wound. The various recommendations encountered in the literature are often confusing: occlude versus leave open, ointment versus no ointment, pressure versus no pressure. Each surgeon must develop his own approach to wound dressings that allows him or his assistants most effectively to dress wounds on different body sites. One must be aware of the various functions of the dressing, such as absorbing secretions, occlusion, and immobilization.

A dry wound dressing is practical actually only for small noncontaminated wounds, such as a simple closure or following a small transposition flap. Here a light pressure dressing is sufficient, fixed with a nonirritating adhesive tape. We change such dressings every second day. The therapeutic value of antibiotic creams, ointments, and powders is controversial. If creams and ointments do have a role, it is in the first 24 h, when occlusion seems to speed healing. If powders are used, they should not contain talc so as to minimize the risk of granuloma formation.

For larger wounds, such as those resulting from flaps, grafts, and dermabrasion we favor a moist wound dressing (Table 6); this reduces the danger of flap or graft necrosis and speeds healing. Following flaps and dermabrasion this dressing includes an impregnated gauze and an enzymatic ointment. The dressing is first changed after 24–48 h and then daily. It is fixed in place with soft gauze pads and an adhesive tape to immobilize the flap or graft. The dressing changes are usually pain free, and crusting is minimized.

Following a skin graft we are somewhat more cautious. A dressing is applied for immobilization and remains in place for 8–10 days. In this situation the restriction of motion takes precedence over the other functions of the dressing. On the extremities we often achieve further immobilization with a simple plaster cast at the same time. Donor sites for split-thickness skin grafts can be covered with polyurethane, alginate, or hydrogel sheeting. We generally leave the site covered until the wound is fully reepithelialized. If there is excessive drainage, one must change the dressing sooner. Such approaches help to minimize necrosis.

We prefer to cover the wound with polyurethane sheeting when multiple procedures are anticipated, such as after the initial excision of a malignant melanoma or other tumor while awaiting the final histologic report, or when conditioning a defect prior to skin grafting. This produces a clean wound which can then be closed as needed or grafted after an adequate base has evolved.

Table 6. Moist wound dressings

Material	Occlusion	Disadvantages
Woven gauze	(+)	Adheres to wound
Monofilament gauze	(+)	Adheres to wound
Polyurethane film	++	Masks infections (?)
Polyurethane foam	+	Adheres to wound
Hydrocolloids	++	Masks infections (?)
Hydrogels	+	Hard to use
Alginates	+	Adheres to wound

The skin surface is never really sterile at the time of operation, despite the surgeon's best efforts preoperatively. In the case of major procedures a postoperative course of a broad-spectrum antibiotic may therefore be useful. In larger procedures surgical suction drains should be placed to avoid fluid accumulation and hematoma formation.

In hospitalized and especially in immobilized patients one must also be concerned about the risk of thrombi and emboli. At a minimum, compression stockings and post-operative exercise regimens are required. The patient's internist should be consulted regarding the need for heparinization or anticoagulation.

3 Anesthesia

Every surgeon must be capable of resuscitating a patient who develops shock on the operating room table. Necessary skills include the ability to place an intravenous line, to provide external cardiac massage and to properly intubate and ventilate a patient. The operating area must thus provide all the equipment required for these essential tasks. In particular, a laryngoscope, endotracheal tubes, tracheotomy set, suction equipment, oxygen, and some form of ventilator (e.g. Ambu-Bag) are needed. In addition, the standard emergency medications (epinephrine, atropine, corticosteroids for injection, intravenous fluids) must be readily available. For many patients it is wise to establish an intravenous access prior to the operation.

Emergency Equipment in the Operating Area
- Endotracheal tubes
- Laryngoscope
- Tracheotomy tray
- Ambu-Bag
- Breathing masks for children and adults
- Suction equipment
- ECG monitor
- Defibrillator

Medication Tray for Operating Area
- Atropine
- Epinephrine (1:1000, 1:10 000)
- Soluble methylprednisolone (250, 500, 1000 mg)
- Dextrose solution (e.g. 50% solution)
- Physiologic saline solution
- Bronchodilators
- Blood substitutes

The choice of anesthetic technique for most dermatologic surgery cases is a matter of individual preference, both from the perspective of the patient and from that of the physician. One must consider not only the technical aspects of the operation but also the emotional status of the patient. In general, however, we prefer the use of local or regional anesthesia, especially in patients with cardiovascular or respiratory disease, because of its convenience and greater margin of safety.

3.1 Local Anesthesia

One advantage of local anesthesia is that it permits the surgeon to communicate with the patient during the operation. This is of particular importance when operating near critical nerves, for the patient can help in retaining nerve function (or, if a nerve is damaged, the surgeon can attempt an immediate repair). A disadvantage of an awake patient is that the surgeon must be very careful with his conversation and not alarm the patient or convey inappropriate information. For example, a patient who hears the surgeon discussing an upcoming golf game or trip with his nurse may fear that the surgeon is not devoting his undivided attention to the patient's best interests. A technical disadvantage is that the injection of local anesthetic may lead to swelling of the tissues, making it more difficult to align the wound edges exactly. In some areas, such as the lips, eyelids, and eyebrows, anesthetic-induced swelling made be great enough to jeopardize the final cosmetic result. To ameliorate the situation somewhat we always plan the case and draw the operative lines before injecting the anesthetic.

Table 7. Classification and pharmacology of local anesthetics

Anesthetic	Type	Onset of action	Maximum adult dose (child)[a]	Duration of action
Procaine	E	Slow	500 mg, (2 mg/kg)	15–30 min
Mepivacaine	A	3–5 min	300 mg, (4 mg/kg)	30–120 min
Lidocaine	A	3–5 min	300 mg, (7 mg/kg)	45–120 min
Prilocaine	A	< 3 min	400 mg, (5.7 mg/kg)	30–120 min
Etidocaine	A	3–5 min	300 mg, (4.2 mg/kg)	120–180 min
Bupivacaine	A	3–5 min	175 mg, (2 mg/kg)	120–180 min

E ester, *A* amide. [a] Single application in adults (70 kg)

Ideally, local anesthetic agents are characterized by rapid onset of action, sufficiently long duration of action to cover the operation, and minimum degree of toxicity and allergenicity. For the most part the amide type of local anesthetics largely meet these criteria (Table 7). Lidocaine, mepivacaine, and prilocaine are especially useful in dermatologic surgery because of the low doses required for prolonged action. While maximum dosage recommendations should be carefully followed, one can reinject up to 25% of this amount after a 30-min interval, if additional anesthesia proves necessary.

The addition of vasoconstrictive agents such as epinephrine causes a transitory vasoconstriction and reduces intraoperative bleeding. This vasoconstriction also speeds the onset of action and prolongs the duration of effect. In addition, somewhat higher tissue concentrations can be achieved since less of the agent is carried away by the circulation. A disadvantage is that vasodilatation results when the vasoconstrictor wears off, which may increase bleeding.

In some body areas vasoconstriction may be undesirable and can lead to tissue damage. Traditionally it has been recommended not to use epinephrine-containing agents when anesthetizing digits or the penis; the nose and ears are other possible risk areas. However, podiatrists almost routinely use epinephrine in their digital blocks. It is probably more important to avoid epinephrine in patients with peripheral arterial disease, diabetes, and perhaps other vascular disorders. Even the small amounts of epinephrine may precipitate cardiovascular disease in susceptible patients, leading to tachycardia, angina, and hypertension. Epinephrine should also be avoided in patients with glaucoma and during pregnancy.

Finally, epinephrine interreacts with a variety of medications, including antihypertensives, antidepressants, amphetamines, and hydantoin. Thus it should be clear that while the use of local anesthetics containing epinephrine may be of great convenience, it should be undertaken carefully, especially in older patients.

The risk of traumatic damage to peripheral vessels and nerves is minimal if the local anesthetic is used properly.

Allergic reactions to local anesthetics are often feared and are described by patients, but they are actually extremely uncommon when the amide type of agents is employed. When a patient describes an allergic reaction, often during a dental procedure, the usual explanation is that the patient fainted. When allergic reactions do occur, they are more likely to be caused by preservatives such as parabens than by the anesthetic itself. If any doubt exists, one is well advised to use individual ampules that are available without the preservatives employed in multiuse bottles.

The next most common cause of adverse reactions is simply exceeding the maximum recommended dosage and producing a toxic effect. Accidental intravenous injection, more rapid absorption, and delayed metabolism in patients with hepatic disease may also lead to toxic changes. The symptoms of an overdose of amide anesthetics include paresthesia, sensitivity to light, hyperactivity, and abnormal speech. In more severe cases respiratory and cardiovascular collapse can occur, leading even to death. It is therefore crucial to adhere to the maximum recommended doses of the amide agents, especially in large or long cases, when it is very easy over a period of time to inject too much.

Side Effects of Local Anesthetics
- Nerve damage (traumatic or toxic)
- Allergic reactions (uncommon with amide anesthetics)
- Vascular injury
- Pneumothorax (in plexus blocks)
- Infection in area of injection
- Intravascular injection
- Tissue necrosis (when a vasoconstrictor is used)
- Systemic toxic reactions
- CNS reactions
- Hyperventilation
- Agitation
- Depressed breathing
- Cramps
- Hypotension
- Arrhythmias

Some patients find the actual injection of the anesthetic agent quite painful. A small bore needle in the hands of a skilled surgeon usually leads to less pain. Some surgeons add sodium bicarbonate to the anesthetic solution to increase the pH value and subsequently to reduce pain (Table 8). Solutions containing sodium bicarbonate should be prepared fresh, at least on a daily basis. Another useful additive is hyaluronidase. This enzyme reduces edema and enables the agent to diffuse more easily. It is especially useful when anesthetizing the eyelids, where edema is common and often severe. Finally, hyaluronidase is useful in performing nerve blocks as it helps to produce a wide area of diffusion. We usually add 150 IU to 30 ml anesthetic agent.

Table 8. Possible additives for local anesthetics

Substance	Amount to be added	Comment
Epinephrine	1:100000 or less	Prolongs duration Reduces bleeding Reduces total dose Lowers toxicity
Sodium-bicarbonate	1 ml (1mEq/ml) per 10 ml anesthetic solution	Reduces pain on injection by raising pH
Hyaluronidase	50 IU per 10 ml	Speeds onset Reduces swelling

3.1.1 Cryoanesthesia

Cryosprays produce a transient anesthesia for superficial procedures. Spraying for 5–10 s produces about 1 min of partial anesthesia; this is sufficient for curetting seborrheic keratoses and performing shave biopsies and perhaps some punch biopsies. We prefer dichlorotetrafluoroethane (Freon 114, Frigiderm) as this has less toxicity than the older agents.

The first spray anesthetic was chloroethyl, but this is rarely used today as it may cause hepatotoxity, and if sufficiently vaporized, can be inhaled and lead to systemic anesthetic effects. Furthermore, the mixture of chlorethyl and air is explosive. In addition to cryosprays, cryogels can be employed. These produce enough anesthesia to make injections less painful, but they are rarely used for even the most superficial surgery.

3.1.2 Topical Anesthesia

A commercial mixture of 2.5% lidocaine and 2.5% prilocaine in a special vehicle known as eutectic mixture of local anesthetics (EMLA) is a relatively effective topical anesthetic. It must be applied under occlusion for 45–60 min but then produces a good level of anesthesia. We often use it to remove molluscum contagiosum

Fig. 7. Local anesthesia: fan-shaped infiltration of anesthetic

in children and for curetting of seborrheic keratoses in adults. In addition, it is often all that is needed in many laser cases. Pediatricians often use EMLA to anesthetize the skin prior to drawing blood or inserting intravenous lines in children. If EMLA is used over large wide areas in children, methemoglobinemia has been reported, but otherwise the product is very safe.

3.1.3 Infiltration Anesthesia

Local infiltration of the operative site is the most commonly employed form of anesthesia in cutaneous surgery; this produces safe and very rapid anesthesia. In general, we do not inject directly into the lesion but instead perform a ring or peripheral injection, using several injection sites to encompass the operative field entirely (Fig. 7). This approach also minimizes the theoretical risk of spreading a malignant tumor by traumatizing it with the needle and perhaps moving cells along the needle track lines. Furthermore, histologic evaluation of the excised tissue is facilitated by lack of dermal edema from the injection. Finally, aspirating each time the needle is moved effectively avoids intravascular injections.

3.2 Regional Anesthesia

3.2.1 General Principles

Another effective approach is to inject a long-acting local anesthetic proximal to the operative site around the major sensory nerve. One must avoid traumatizing the nerve and instead surround it with 1–2 ml of anesthetic agent. We favor this approach especially in the face, digits, and male genitalia. In the face one can block the sensory nerves where they pass from the foramina of the skull into the skin. We find a 0.5-mm needle to be especially suitable. For example, blocking the sensory branches of the trigeminal nerve can anesthetize wide areas of the face (Fig. 9).

When injecting the digits, we use the technique recommended by Oberst. One begins dorsally and moves ventrally, injecting

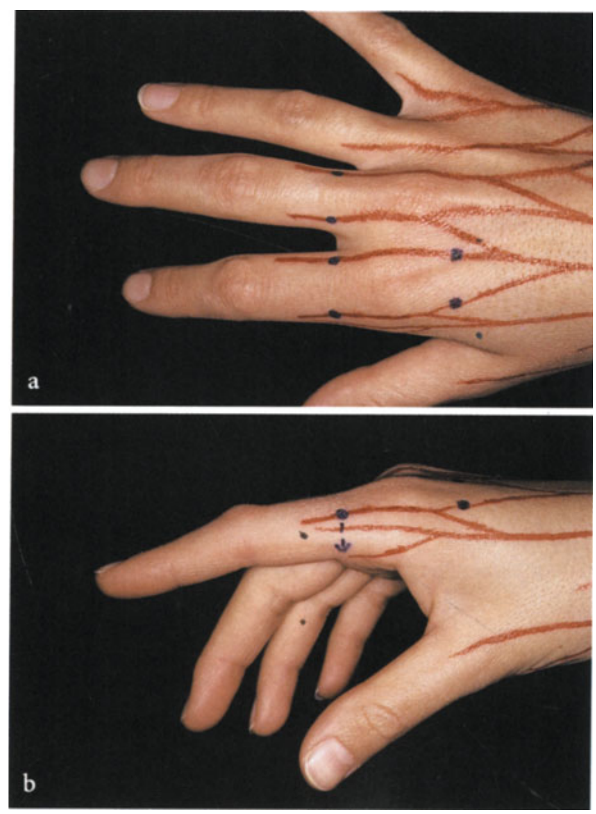


Fig. 8. Nerve blocks (after Oberst)
a Injection sites at the base of the fingers and also in the metacarpal region
b Diagram showing how one injects from the dorsal aspect in the palmar direction

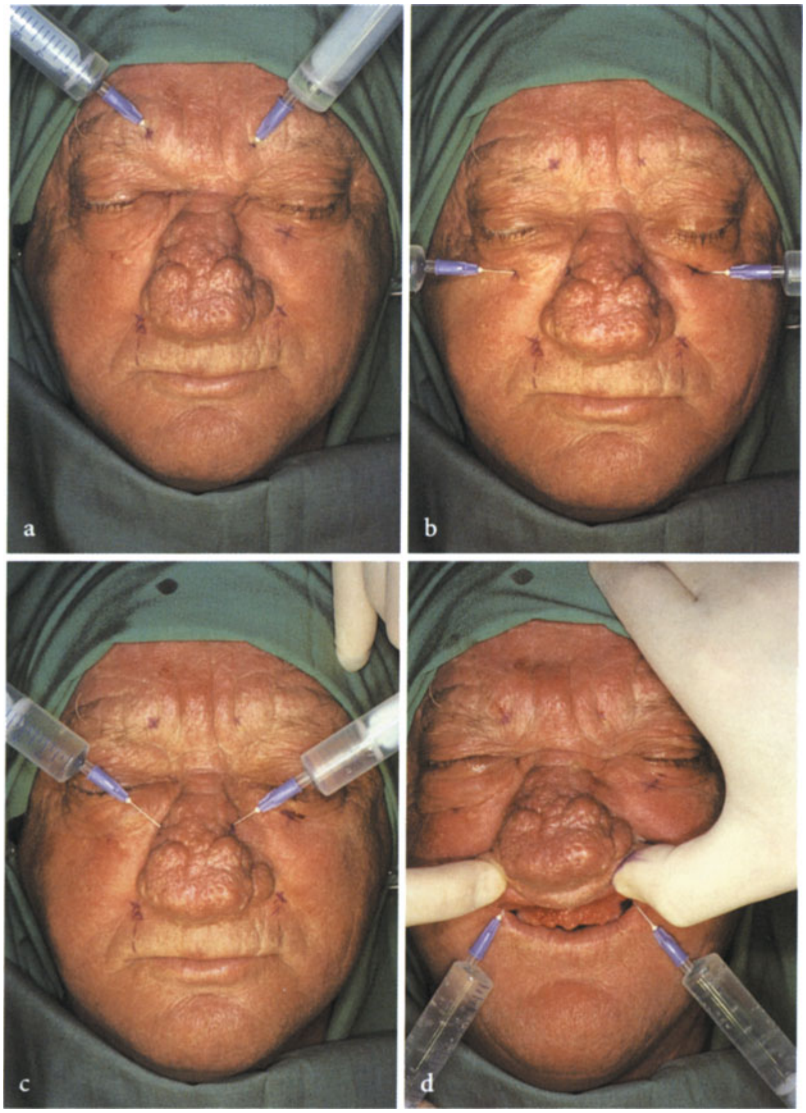


Fig. 9. Injection sites to block the branches of the trigeminal nerve (*V*) about the nose prior to rhinophyma surgery
a Supraorbital nerve
b Infraorbital nerve
c Anterior ethmoid nerve – external nasal branch
d Alveolar branches of infraorbital nerve

both sides of the digit at its base. This blocks both the dorsal and palmar digital nerves (Fig. 8). On the penis one also begins on the dorsal surface, blocking the dorsal penile nerves on both sides. The needle can be advanced just beneath the skin and above the penile fascia to perform a circumferential block. Finally, the genital branch of the genitofemoral nerve can be blocked through an approach in the inguinal canal (Fig. 10).

3.2.2 Special Techniques

Nerve blocks of the hand and foot provide an elegant method to block the extremities, but they are rarely used in dermatological surgery. They are particularly useful for achieving a wider field of anesthesia when removing multiple palmar or plantar verrucae. In the hand block one must numb the sensory branches of the ulnar, radial, and median nerves (Fig. 11). The

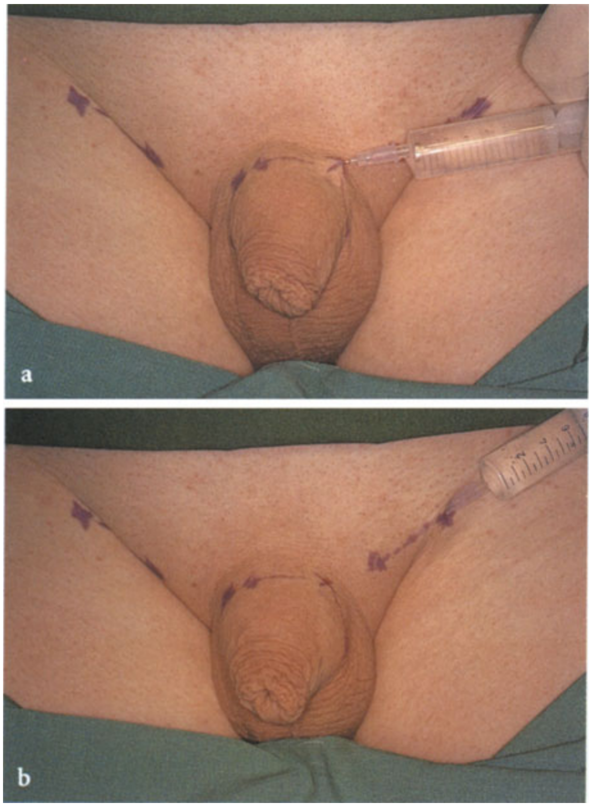


Fig. 10. Anesthesia of the penis
a Circular injection at the base of the penis to block branches of the dorsal penile nerve and the ilioinguinal nerve
b Blocking the genital branch of the genitofemoral nerve

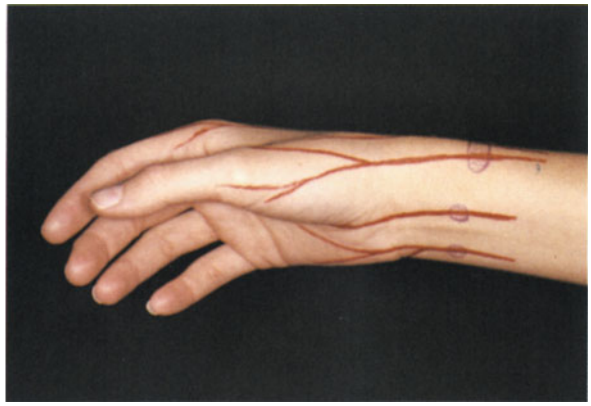


Fig. 11. Hand block including the following sites: superficial branch of the radial nerve at the styloid process, the median nerve between the tendons of the flexor carpi radialis and the palmaris longus muscles and the ulnar nerve next to the flexor carpi ulnaris muscle

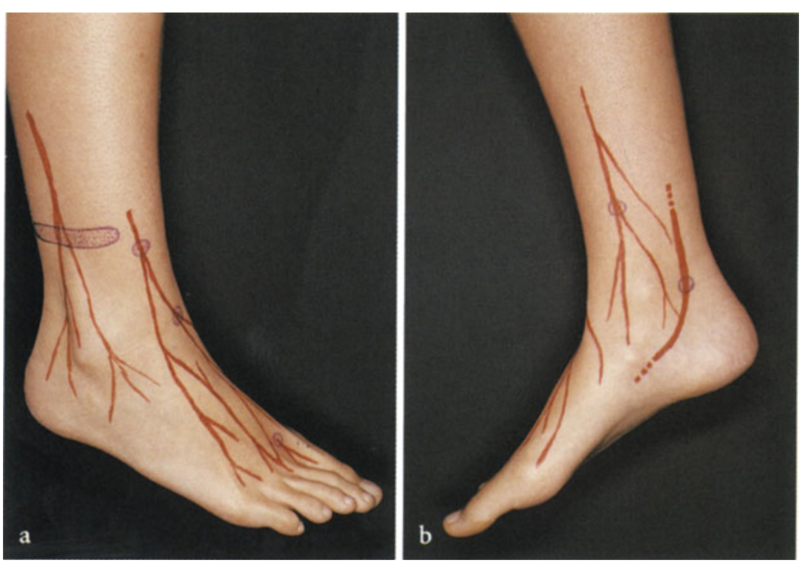


Fig. 12. Foot block
a Lateral injections to block the sural nerve, dorsal injections to block the superficial peroneal nerve (*proximal*), the dorsal cutaneous nerve (*middle*), and the deep peroneal nerve (*between the 1st and 2nd toes*)
b Medial injections to block the saphenous nerve anterior to the medial malleolus and the tibial nerve posterior to the medial malleolus

superficial branch of the lateral radial nerve is the sensory branch. The median nerve can be approached between the tendons of the palmaris longus and the flexor carpi radialis, while the ulnar nerve is best reached next to the tendon of the flexor carpi ulnaris.

The foot block requires the injection of anesthesia around the medial and lateral malleoli as well as across the back of the foot. In addition, one must subcutaneously inject approximately 5 cm above the lateral malleolus, moving posteriorly towards the Achilles tendon. The complete blockade involves the tibial, deep peroneal, superficial peroneal, sural, and saphenous nerves (Fig. 12).

More complicated forms of nerve blocks are generally performed by anesthesiologists, often with special training in peripheral anesthesia. Helpful techniques for cutaneous surgery include the brachial plexus block and spinal and epidural techniques.

3.3 General Anesthesia

General anesthesia is of course the province of the anesthesiologist. Considerably more dermatologic surgery is probably carried out under general anesthesia in Europe than in the United States, simply because in Europe many operations are performed in hospitals while in the United States most skin surgery is carried out in the outpatient setting. However, the trend towards ambulatory or day surgery centers has made general anesthesia more attractive for some of the larger cutaneous cases.

Dermatologic surgeons should be aware of the basic, proven principles. First, endotracheal intubation is generally preferred if the operative field involves the upper lip, while the endonasal approach is more desirable if the site involves the lower lip or chin. One must avoid situations in which the anesthetic equipment interferes with the operative field, especially if the operative field must be enlarged because of intraoperative findings. The option of general anesthesia plays no role in determining the viability of flaps or grafts. When an ambulatory case with general anesthesia is undertaken, the postoperative period is also crucial, for the patient must be carefully monitored before he is discharged to return home.

4 Basic Surgical Techniques

4.1 Incision Techniques

In cold steel surgery it is very important that the incision through the skin be made in a vertical fashion, perpendicular to the skin surface (Fig. 13). In this was wound edges can be best aligned in a perfect match, minimizing the scar. It is easier to obtain such an incision if the skin is slightly stretched during the procedure. For small lesions a gifted surgeon can stretch with one hand and guide the scalpel with the other, but usually the services of an assistant are helpful. The cut begins at the most critical point (for example, near the tear duct or at the ear canal). Ideally it is performed in a single stroke, so that the inevitable bleeding has little chance to obscure skin markings. Once the excision is completed, the skin is elevated with a skin hook, and the underlying tissues are separated with either the scalpel or Metzenbaum scissors. Bleeding must then be controlled. Vessels should be clamped and tied, or ligated with resorbable 3–0 to 5–0 sutures, or sealed with electrocautery.

One must also pay particular attention to the deep margins when excising a malignant tumor. Skin thickness varies greatly from site to site. For example, an excision deep enough to reach the subcutaneous fat on the cheek would, on the eyelid, involve the orbital muscles and, on the nose, the nasal cartilage. If in viewing the base of the wound the surgeon is uncertain whether the tumor has been completely excised at its base, an immediate reexcision should be performed. One should excise the muscle or cartilage if it appears clinically to be involved. Finally, some authors feel that once a tumor has been excised the surgeon should switch scalpels to reduce the risk of spreading malignant cells during the reconstructive part of the operation.

In excising malignant tumors the margins must be carefully marked so that the pathologist can obtain a three-dimensional view of the specimen. Traditionally, one end of an ellipse is marked with a suture. This is sufficient for orientation, assuming that a sketch is also provided. If the specimen is more rounded or irregularly shaped, other marking sites should be identified. Mohs surgeons often use special marking inks to identify their specimens more completely. This approach is discussed in more detail below in the section on Mohs surgery. When a second subcutaneous excision is performed from the base of a defect, the pathologist must be aware of the orientation of this tissue. The top and one side should both be marked, for a subcutaneous piece of tissue with no overlying epidermis invariably causes orientation problems in a histopathology laboratory which is accustomed to dealing with pieces of skin

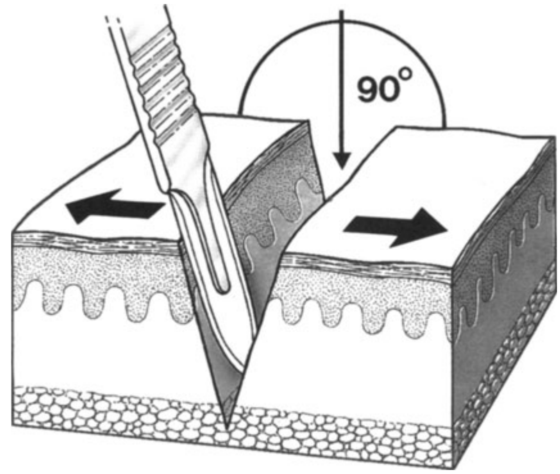


Fig. 13. Correct incision of the skin, holding the scalpel perpendicular to the surface

with epidermis on top. Regardless of whether Mohs' technique, standard frozen sections, or traditional formalin-fixed paraffin-embedded sections are used, the surgeon must be able to identify residual tumor so that reexcision can be more precise. Only when pathologic evaluation indicates a tumor-free defect should reconstruction and closure be undertaken.

4.2 Suturing Techniques

Along with careful planning of the incision, attention to relaxed skin tension lines, natural skin folds, and aesthetic regions, the surgeon's suturing technique plays a major role in determining the final cosmetic result. The following points should be given particular attention:

- Since subcutaneous sutures are primarily responsible for holding the wound edges in approximation, they must be placed extremely carefully. Skin sutures serve only for fine approximation.
- Wound tension should always be reduced by subcutaneous sutures and not by using larger sized skin sutures.
- The knots of skin sutures must not deform or squeeze the skin. This pressure leads to a ladder-type scar.
- Some surgeons use resorbable sutures for percutaneous stitches, but this practice entails problems: the sutures generally remain in place too long, and the suture tracks epithelialize, producing an unsatisfactory result.
- The thickness of sutures for the skin vary between 7-0 for the eyelids and 0-0 for the trunk and limbs. The surgeon must choose the appropriate suture material based on both skin thickness and wound tension (Table 5).

4.2.1 Subcutaneous Sutures

Even when wound tension is minimal, it is often wise to place a subcutaneous suture. Vicryl or PDS sutures are generally used. Since they remain in the body for a long period of time, a granulomatous reaction may occur, again diminishing the cosmetic results. We always try to use a minimum number of subcutaneous sutures for this reason. PDS is present for a much longer period of time than vicryl and thus helps to prevent dehiscence when wound tension is considerable.

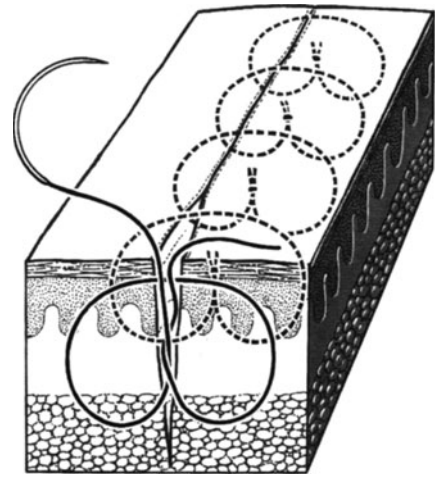


Fig. 14. Placing subcutaneous sutures. The knots are placed deep, reducing distortion of the skin and allowing optimal approximation of wound edges

One generally chooses between 3-0 and 6-0 suture material, again, depending on the body site and wound tension. While it is possible to insert running subcutaneous sutures, we prefer single sutures. In a simple buried suture the needle enters through the subcutaneous tissue, exits through the dermis, reenters through the opposing dermis, and exits through the subcutaneous fat. Thus, when tied, the knot is inverted at the base of the suture (Fig. 14). The possibility of a visible reaction to this deeply placed suture is far less than with a more superficial placement.

4.2.2 Skin Sutures

Simple Suture

One should choose as fine a suture as possible. We favor either monofil or coated woven polyester or polypropylene sutures. Alternatives

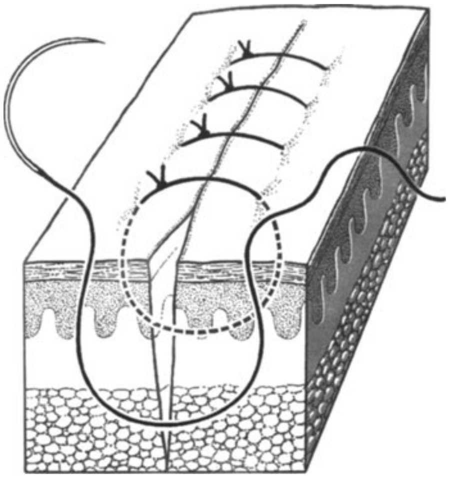


Fig. 15. Placing interrupted skin sutures. Entry and exit sites must correspond exactly in a three-dimensional manner

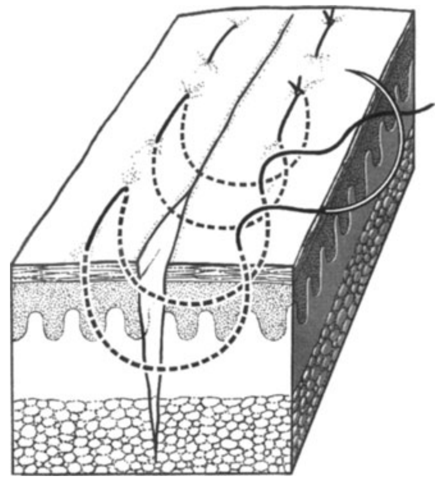


Fig. 16. Horizontal mattress sutures are especially suitable for approximating wound edges that are under considerable tension

are silk and PDS. The latter materials are all very well accepted by the tissues and show minimal tissue reaction. Advantages of braided or twisted sutures include their strength and the ease with which they can be manipulated. The coating tends to reduce the sawing effect on the tissue and the resulting ladder-type scars. Other braided suture material such as silk is not as tissue-friendly but allows the exact placement of stable knots without squeezing or compromising the tissue. On visible body parts sutures should enter and exit about 1–2 mm from the wound edge. One should view the skin sutures as approximating the wound edges or placing them next to each other, rather than as "pulling them together." To minimize the risk that one wound edge is higher or lower than the other, producing an unacceptable step scar, one must pay careful attention to making a vertical incision and then to pacing the suture at the same depth on both sides. Often a three-dimensional view of the wound helps in this task (Fig. 15).

Horizontal Mattress

The first component of the stitch is identical to the simple interrupted suture. The suture is continued parallel to the wound, and a second stitch is placed in the reverse direction. The suture thus consists of two vertical buried sequences perpendicular to the wound, and two horizontal exposed segments parallel to the wound edges. The horizontal mattress is a convenient skin suture, as it is similar to simple sutures but closes the wound more quickly, with the placement of fewer sutures. One must adjust the size of the suture material to the skin site and wound tension (Fig. 16).

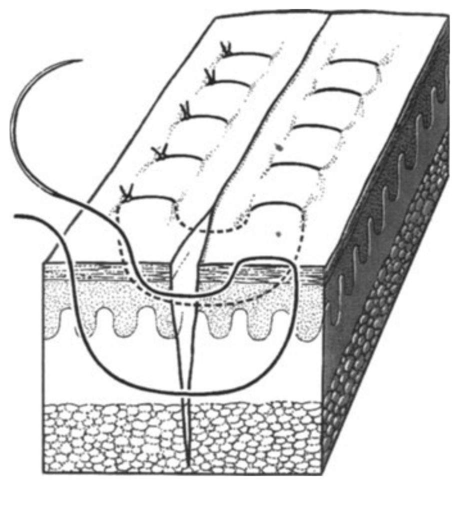


Fig. 17. Vertical mattress suture (after Donati). These sutures are useful for approximating wounds under considerable tension while at the same time everting the wound edges and adjusting the approximation of the skin with the second, more superficial part of the stitch

Vertical Mattress (Donati)

In this stitch the initial entry and exit points are placed somewhat farther back from the wound edge. The suture material reenters the skin in line with the exit point but closer to the wound edge and, similarly, exits a second time closer to the opposite wound edge. The vertical mattress (Fig. 17) provides an excellent way in which to evert skin, avoiding sunken wounds and improving approximation.

Half-Buried Vertical Mattress (Allgöwer)

In this modification there is an incomplete intracutaneous suture. The entry point is similar to that in the standard vertical mattress suture, but there is no exit point on the opposite side. Instead, an intracutaneous stitch is placed on the opposing wound edge. The exit point is then placed exactly as in Donati's suture (Fig. 18). The half-buried vertical mattress suture requires considerable experience. The intracutaneous sutures must be placed symmetrically; otherwise the wound edges may remain poorly approximated, leading to an unsatisfactory cosmetic result.

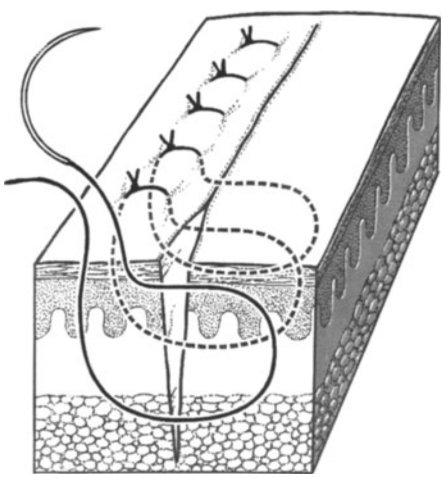


Fig. 18. Vertical mattress suture (after Allgöwer). While similar to Fig. 17, here the more superficial stitch is also partially buried

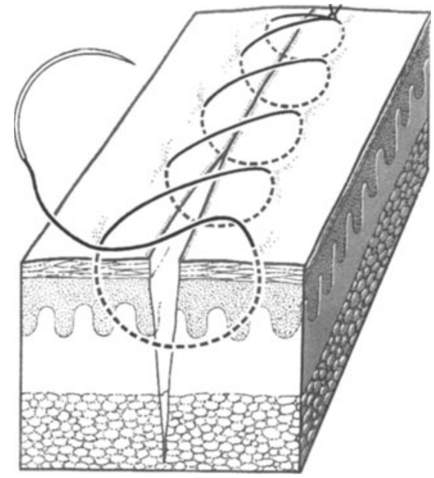


Fig. 19. Running cutaneous suture

Running Suture

There are many types of running sutures, such as the running locked suture and the running horizontal mattress. Each is far more rapid than the simple interrupted sutures and are thus favored by general surgeons who often need to close a large wound quickly. However, all invariably lead to a less than perfectly approximated wound edge and may result in an unacceptable scar (Fig. 19).

Running Intracutaneous Suture

The running intradermal suture is an elegant suture that offers many advantages. After appropriately reducing wound tension with subcutaneous sutures, the wound is placed under longitudinal tension with two skin hooks, one at each end. The initial entry point is near the skin hook, and the exit point is in the dermis just at the apex of the wound. The suture is then placed horizontally across the wound, staying at exactly the same level in the skin. Each entrance site in the dermis is backtracked slightly from the opposite exit point. When the wound is closed, the suture exits the skin about 0.5 cm from the distal wound end (Fig. 20).

By holding the wound under slight tension it is generally easier to place the suture absolutely parallel to the skin surface and to ap-

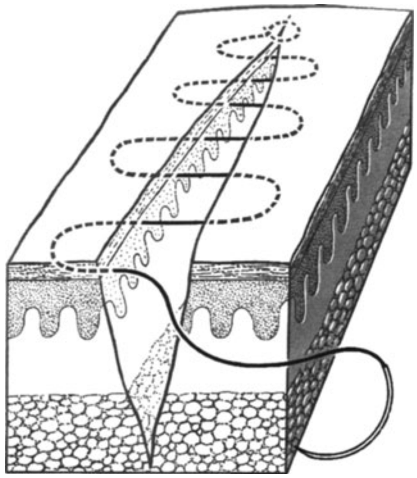


Fig. 20. Running intracutaneous suture

proximate the wound edges more accurately. This approach also greatly helps in reducing dog-ears (see Sect. 8.4). The suture is then manipulated back and forth until the wound is as flat and uniform as possible. Some surgeons fix the ends with knots, but we prefer sterile adhesive tape. This facilitates suture removal and eliminates the pitted scars which may arise if the entry and exit knots are under too much tension. We also tend to reinforce the wounds further with sterile adhesive tape. If wound tension appears to be too great, we also use simple or horizontal mattress sutures as an adjunctive measure.

While the greatest problem with the running intradermal suture is the skill needed to place the stitches symmetrically, a second problem arises with removal. Especially in larger wounds this may be quite difficult, and sutures often break. If the suture cannot be retrieved and must be left in the wound, a foreign body reaction eventually occurs, and the scar becomes more prominent. One approach is to use a long-lived but resorbable suture such as PDS for this stitch. If this breaks, resorption still occurs.

Again, one should choose an appropriate suture thickness; we tend to use 3–0 to 5–0 sutures. Wound healing is more rapid with an intradermal suture, and wound tension is evenly distributed. Even with somewhat larger sized suture material, the track marks are absent.

Skin Staples

A wound can also be closed with a variety of metal skin clips or staples. This technique was perfected in Japan for closing abdominal skin rapidly after the very common stomach surgery required in that country for gastric carcinoma. Today a variety of stapling systems are available, including some with staples that are fine enough for use in cosmetic skin surgery. Many staples are already loaded in a plastic stapler to simplify application. After the wound edges have been approximated with subcutaneous sutures and then manually brought together with a fine forceps, the staples are inserted transcutaneously approximately every 0.7–1.0 cm. They are removed with a special forceps which simply opens them

Fig. 21. Skin stapling
a Placing the staples in line
b Appearance after stapling

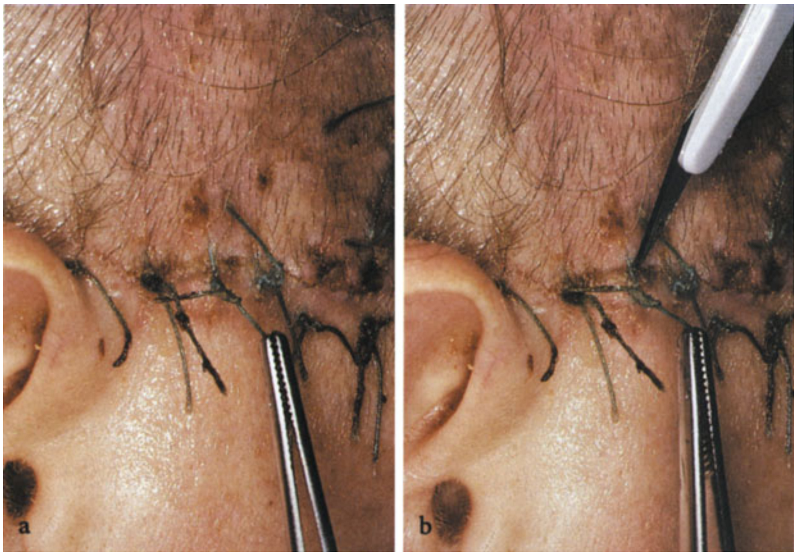


Fig. 22. Removal of sutures
a Lifting a suture with the forceps
b Dividing the suture with a scalpel blade just beneath the knot

(Fig. 21). In general, staples are a rapid way for closing a wound, they but rarely if ever yield the cosmetic results obtainable with conventional skin suturing.

Suture Removal

Transcutaneous sutures should be removed as soon as possible to reduce scarring at entry and exit sites, as well as pressure or ladder-type scars. Tied sutures are removed by cutting the suture beneath the knot and as close to the skin as possible with a scissor or scalpel and then removing the suture without pulling any exposed suture through the tissue (Fig. 22) This technique avoids the possibility of stitch track infections. The timing of suture removal depends on the body site and the degree of wound tension. The times given in Table 9 are simply suggestions or approximations; the surgeon must always balance these suggestions against personal experience and the appearance of the wound. It is often appropriate to remove some of the sutures or staples on one day and the rest a day or two later.

When removing running intradermal sutures, one must wait 10–14 days. After gentle tugging one end is cut off just at the skin surface, and the thread is pulled out in the other direction. Again, the goal is to avoid pulling a contaminated suture through the wound. Here, because of the length of the wound, this precaution is even more important.

After removing sutures the patient should be instructed not to "test" the wound by marked stretching or other physical activity but instead to protect the area. For example, regardless of how excellent the surgical technique is, if a muscular person with a fresh scar over the shoulder tightens the deltoid muscle, the risk of wound dehiscence is considerable. We almost always reinforce wounds with sterile adhesive strips or even thicker, stronger adhesive plasters for a period of days.

Table 9. Optimal time for suture removal

Location	Days after operation
Face	3–7
Neck and nape	5–7
Scalp	7–14
Trunk	7–14
Arms and legs	7–14
Hands and feet	10–14
Palms and soles	10–20
Genitalia	7–10

5 Diagnostic Biopsies

5.1 Skin Biopsy

The use of a tissue biopsy to aid in the diagnostic process is far more common in dermatology than in any other specialty. The skin is readily accessible, a biopsy can be obtained easily, and it is often the only way in which to identify a malignancy with certainty or to distinguish between two clinically similar dermatoses. Similarly, an accurate biopsy and tissue diagnosis is essential for planning an operation. Only when the surgeon knows exactly the margins that are required, he can intelligently map out a surgical approach for a given lesion. Of course, a biopsy generally fails to answer the question of how wide and how deep a tumor is situated.

We tend to perform preliminary biopsies when the diagnosis of squamous cell carcinoma or basal cell carcinoma is entertained. The risk of spreading the tumor via lymphatics or seeding the field through the incision are minimal. One exception is when the lesion is so small that an excision can be accomplished as easily as a biopsy. Incisional biopsies of pigmented lesions suspected of being malignant melanomas is slightly controversial. While there are no convincing data that patients with melanoma fare less well with an incisional biopsy, most surgeons, including ourselves, try to avoid traumatizing a melanoma because of the theoretical risk of tumor spread. On the other hand, a large facial lentigo maligna with a tiny nodule suspected of being a malignant melanoma should be approached by an initial excisional biopsy of the nodule. Similarly, a changing mass within a large congenital nevus should also be biopsied. In both instances the rendering of a benign diagnosis would make excision of a large difficult lesion unnecessary.

Two types of biopsies are generally performed: the spindle-shaped, or elliptical, biopsy and the punch biopsy.

The spindle-shaped, or elliptical, biopsy is performed with a scalpel and closed with several skin sutures (Fig. 23); in some situations an elliptical biopsy is preferable. If one wishes to examine subcutaneous fat, such as

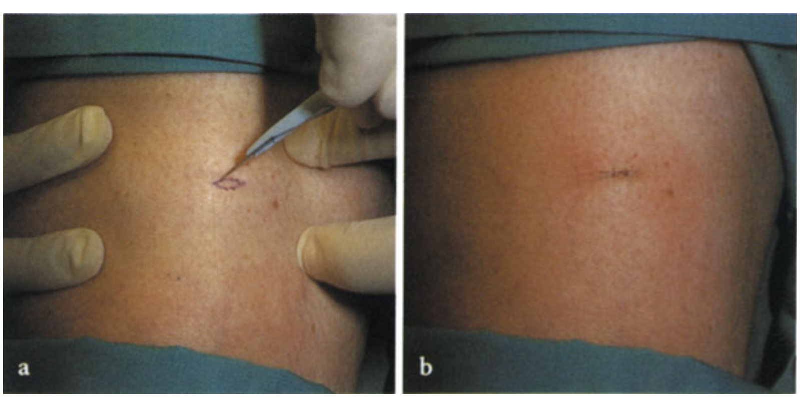


Fig. 23. Excisional biopsy
a Excision in the direction of skin tension lines
b Suture closure

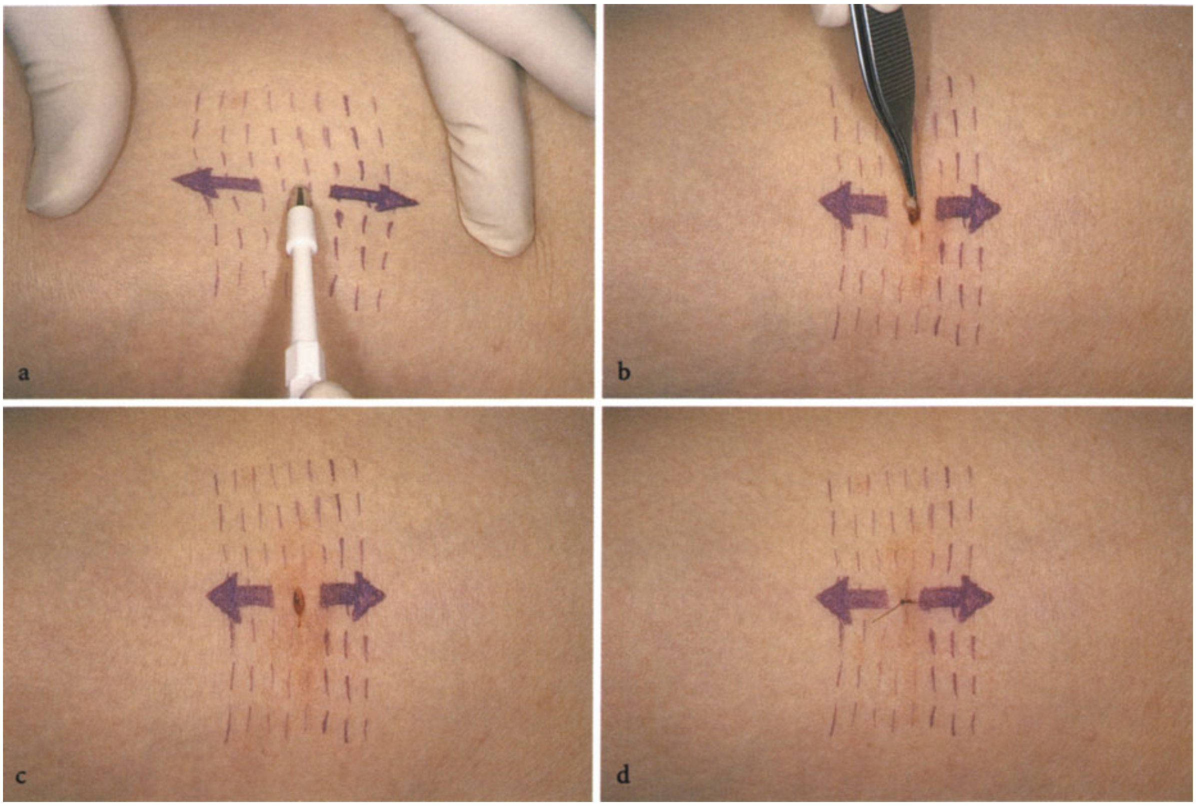


Fig. 24. Punch biopsy using a disposable punch
a Skin stretched perpendicular to tension lines and punch rotated
b Biopsy cylinder removed
c Defect is oval when skin is relaxed
d Suture closure

in the diagnosis of panniculitis, a deep nodule should be sampled. Alternatively, if one wishes to orient a specimen across the edge of a lesion to contrast normal and abnormal tissue, such as in diagnosing an atrophic or sclerotic condition, the ellipse is the preferable method. In addition, control of bleeding is far easier with a small ellipse than with a punch, where the base may be difficult to see.

In the punch biopsy a cylindrical instrument sharpened on one end (the punch) is used (Fig. 24) to excise a cylinder of tissue. Punches vary in diameter from 2 to 8 mm. They may be either disposal or permanent surgical instruments, capable of being resharpened. The punch is twisted between the surgeon's fingers as it is pressed into the tissue. We prefer disposable punches. The cylinder is grasped with an atraumatic forceps and separated at its base with scissors. One should take great care not to squeeze the tissue, for this may radically distort the tissue and interfere with the histologic interpretation. Often one can pop the cylinder up out of the skin and snip off the base, placing the untraumatized specimen in the specimen bottle with the scissors.

We tend to close punch biopsy wounds with one or several stitches. Even a 2 mm punch which is left to granulate heals with a scar that can be improved by a stitch. Larger punch biopsy sites heal far more slowly and with more scarring if they are not sutured. One exception is when a punch biopsy is performed in the center of a tumor which is to be excised in any event; under these circumstances suture closure is not needed. Punch biopsies are more difficult to perform in areas where the skin is thin and subcutaneous tissue sparse. In such areas the cartilage or even periosteum may be injured.

A further variant is the power-driven punch. We tend not to use this instrument, but if one is readily available, it may of course replace a punch. Care must be taken not to overheat the tissue (such as with a dull blade or excessive pressure)

5.2 Muscle Biopsy

Some dermatologic surgeons may wish to undertake muscle biopsies, primarily when evaluating patients for the suspected diagnosis of dermatomyositis. The biopsy is performed on a muscle that shows clinical involvement and electromyographic abnormalities. The quadriceps and the deltoid muscles are often chosen.

Local anesthetic is used to numb the overlying tissue, but the muscle fibers themselves must not be traumatized by an injection. We make an incision approximately 5 cm long over the muscle and then gently and bluntly dissect down to the muscle fascia, which is then exposed with a second scalpel incision. A muscle fiber bundle is exposed that is about 3 cm long and 0.5 cm in diameter. Using an Overholt or Deschamps hook, ligatures are placed around the bundle and tied at both ends. Only then is the tissue excised (Fig. 25).

Every effort must be made to avoid any damage to the muscle, which should be handed immediately to the appropriate pathologist or his technician. A muscle biopsy should never be placed in formalin and then sent to the laboratory. Enzymatic stains on frozen-tissue form an essential part of the diagnostic evaluation.

The wound is then closed in multiple layers, with sutures placed in the fascia, subcutaneous tissue, and skin.

5.3 Nerve Biopsy

Biopsy of a superficial nerve is often necessary in the evaluation of patients with a variety of neurologic disorders, some of which may be associated with cutaneous findings. Typically the sural nerve in the distal lower leg is chosen. Preoperatively its course is mapped with the aid of electroneurologic methods. The procedure is carried out best under local anesthesia. The sural nerve is marked on the skin, and a linear incision is performed (Fig. 26). Blunt dissection to the level of the fascia is then carried out. The sural nerve passes through the crural fascia just beneath the gastrocnemius muscle. Here the nerve may lie upon the fascia or be situated just beneath it. In the latter case the fascia must be dissected carefully. An approximately 4–5 cm segment of nerve is excised. No attempt is made to repair the nerve. The wound is closed in layers.

5.4 Testicular Biopsy

In Germany some dermatologists also practice andrology, and a testicular biopsy is therefore often needed. This can be carried out with local anesthesia; in general, both testes are biopsied at the same time for an endocrine workup. The biopsy of a testicular mass is best left to a urologic surgeon. The procedure is complicated by the peripheral nature of the testicular arteries, which can be easily damaged and lead to parenchymal necrosis. Therefore the site of the biopsy must be chosen carefully.

The biopsy is performed with the scrotal skin stretched over the testes. Under local anesthesia an incision 1–2 cm long is made over the lateral third of the testes, and the tunica vaginalis is exposed with blunt dissection. The tunica vaginalis is incised and retracted with a small-hook lid retractor. The testis is inspected for pathologic changes, and the least vascularized site in the tunica albuginea is identified. Here as a tiny 0.5-cm incision is made, the testicular material oozes out of the wound. It can be cut off with a small scissors and transferred to the histologic medium (Fig. 27). The tunica albuginea, tunica vaginalis, and skin are then closed with resorbable sutures. For the tunica albuginea we use 5–0 vicryl sutures while for the more external layers 3–0 or 4–0 is suitable.

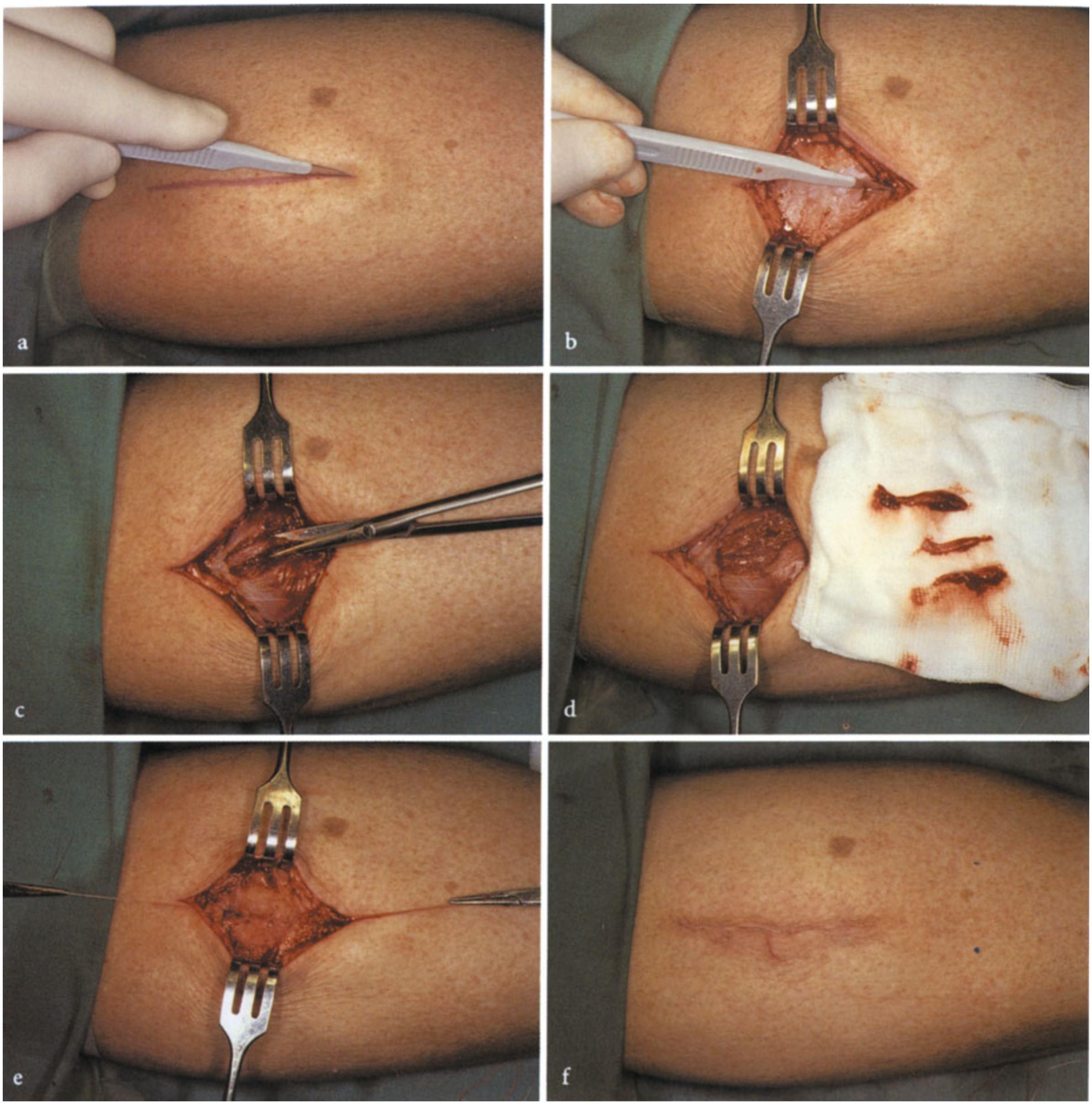


Fig. 25. Muscle biopsy
a Skin incision in longitudinal direction
b Exposure and division of muscle fascia
c Removal of a cylinder of muscle, taken in the direction of the fibers, with every attempt to handle the tissue gently
d To facilitate the histologic evaluation the biopsy cylinder should be 2.0–3.0 cm long
e Closure of the fascia
f Skin closure

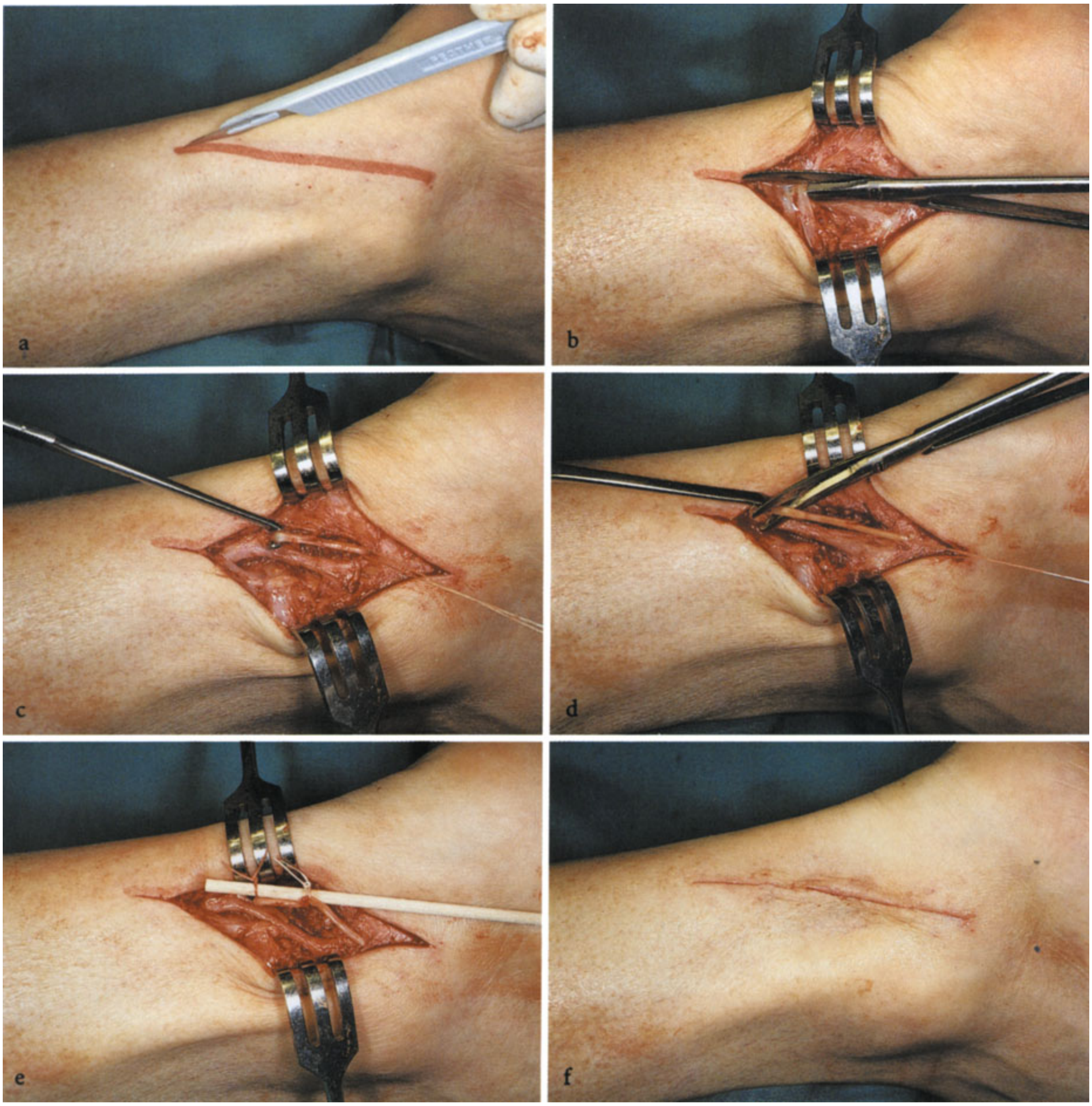


Fig. 26. Nerve biopsy
a Skin incision along the course of the sural nerve after neurologic identification
b Splitting the fascia
c Elevating and exposing the nerve
d Dissecting the nerve
e Removal of a portion of the nerve for histologic evaluation
f Skin closure

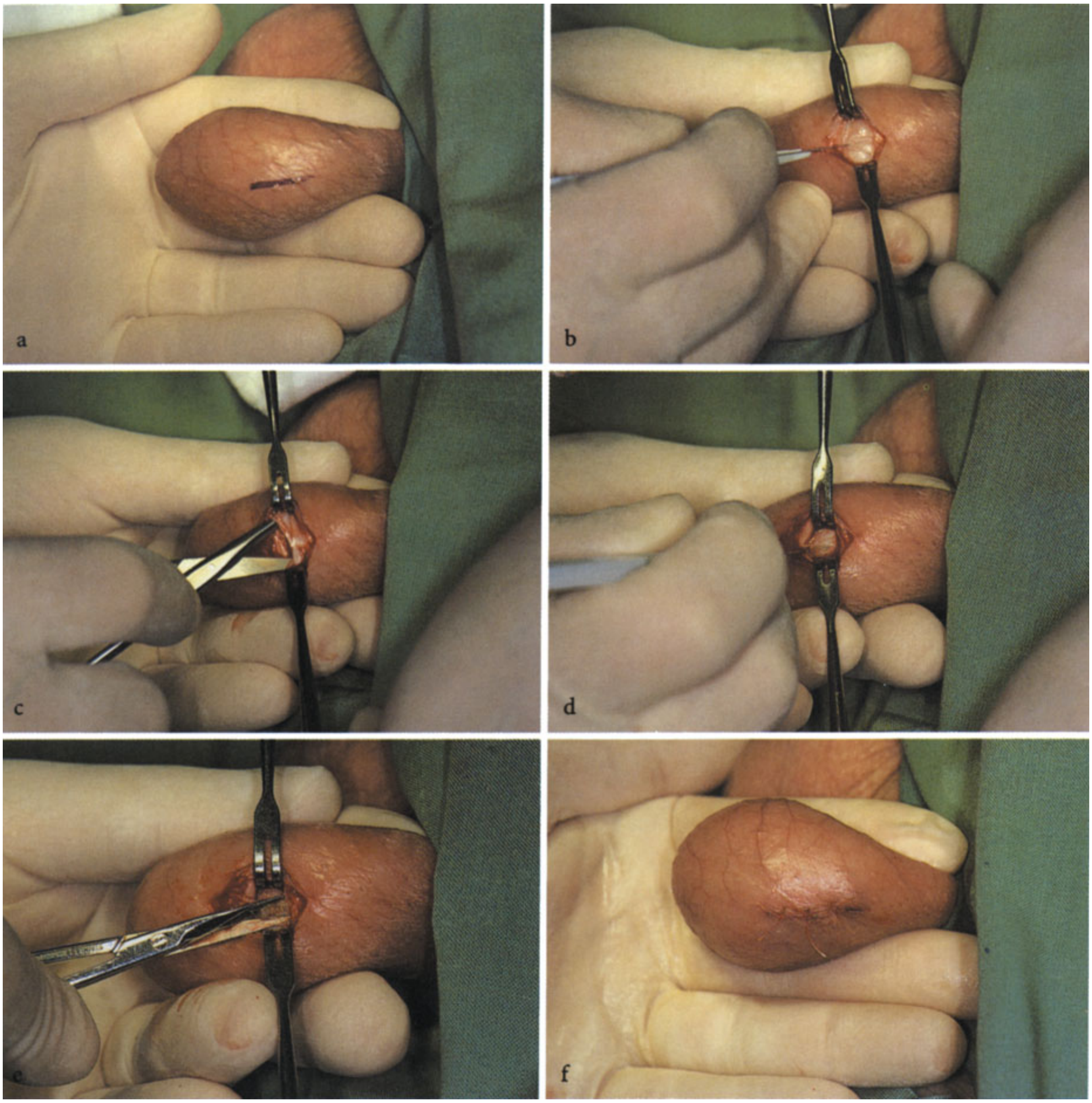


Fig. 27. Testicular biopsy
a Manual fixation and incision
b Separating the scrotal fascia
c Separating the tunica vaginalis
d Exposure and opening the tunica albuginea for a length of about 5 mm
e Removing a piece of testes which protrudes from the tunica with a surgical scissors
f End of operation after multilayered closure

6 Methods of Superficial Tissue Removal

6.1 Curettage

Curettage consists of the removal of superficial tissues with the use of a sharp curette (Figs. 28, 29). Typically, epidermal proliferations such as verrucae, condylomata, seborrheic keratoses, molluscum contagiosum, and actinic keratoses are treated by this method. The curetted material should always be submitted for histologic evaluation. Although the pathologist does not receive an ideal specimen, interpretation is usually possible. If the diagnosis is unclear or if a malignant process seems likely, a punch biopsy should be performed initially.

As long as only superficial elements are curetted, the wound usually heals without scarring. There may be hypo- or hyperpigmentation, but this change typically resolves over time. Bleeding is generally minimal, and simple pressure is therefore adequate for control. One can use light electrocautery or ferric subsulfate solution if needed. For larger lesions, such as large seborrheic keratoses, cryosurgery of the lesions prior to curettage is often helpful.

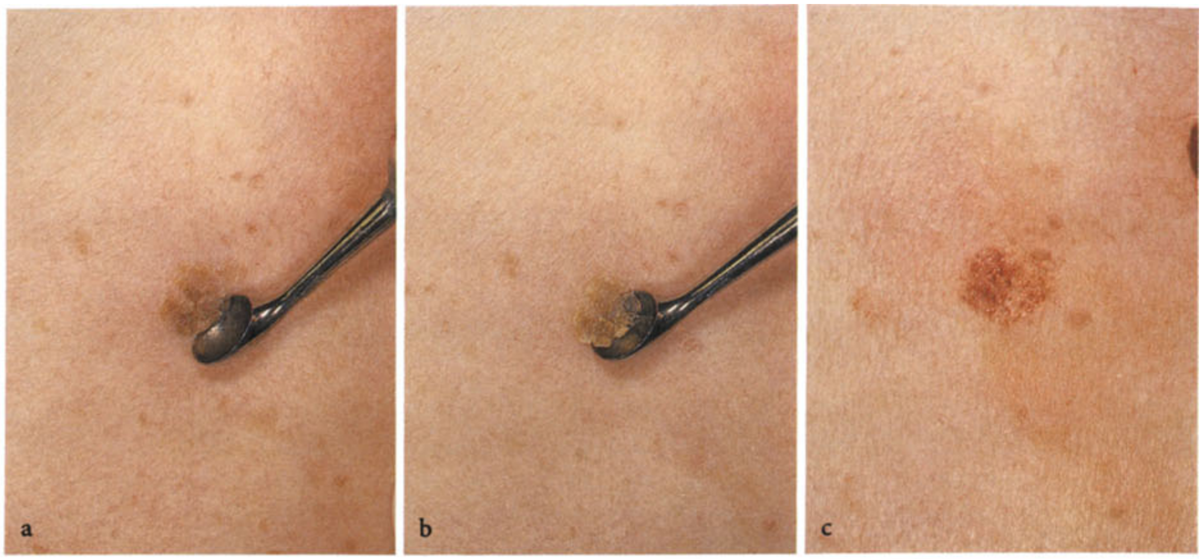
Small or superficial basal cell carcinomas are also often treated by curettage combined with electrodesiccation or electrocautery. In the United States three such rounds of treatment are traditionally employed in a single sitting. Although the cure rate for basal cell carcinomas smaller than 1 cm and for superficial basal cell carcinomas is quite good (greater than 90% in most centers), the cosmetic results are less acceptable in most cases. Creating a dermal defect and adding to this the trauma of electrocautery further disturbs the wound healing. Thus we only rarely use curettage for basal cell carcinomas.

6.2 Shave or Tangential Excision

A shave biopsy is performed with a scalpel or double-edged (i.e., flexible) razor blade. A cut is made roughly parallel to the skin surface, removing superficial tissues (Fig. 30). The procedure is ideal for small papillomatous melanocytic nevi, skin tags, and similar lesions. The wound is allowed to heal secondarily, and scarring is minimal. The use of shave biopsies or shave excisions on larger nevi with a dermal component is less straightforward. A so-called deep shave, adequate for removing an entire nevus, generally leaves a defect which heals with a scar. In addition, a shave biopsy of a lesion which turns out to be a malignant melanoma may yield a histologic specimen in which the depth of the tumor cannot be measured simply because the tumor extends to the depth of the shave.

In the treatment of rhinophyma sculpting with a razor blade or scalpel is often the first step in removing excess tissue. We tend to complete the procedure with dermabrasion, but some dermatologic surgeons use only superficial excision to achieve the desired cosmetic result.

The dermatome is designed to remove skin for split-thickness grafts. It can be adjusted to a specific depth and is used to remove large pieces of tissue of uniform depth. We have employed the dermatome with good success to remove the involved skin in Darier's disease and in cases of traumatic tattoos.



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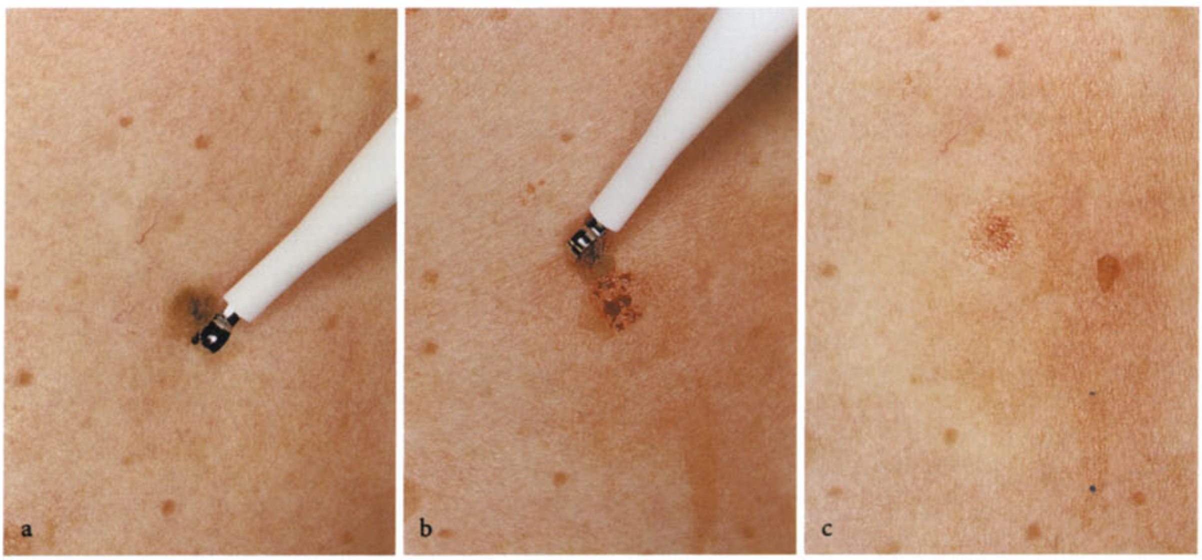

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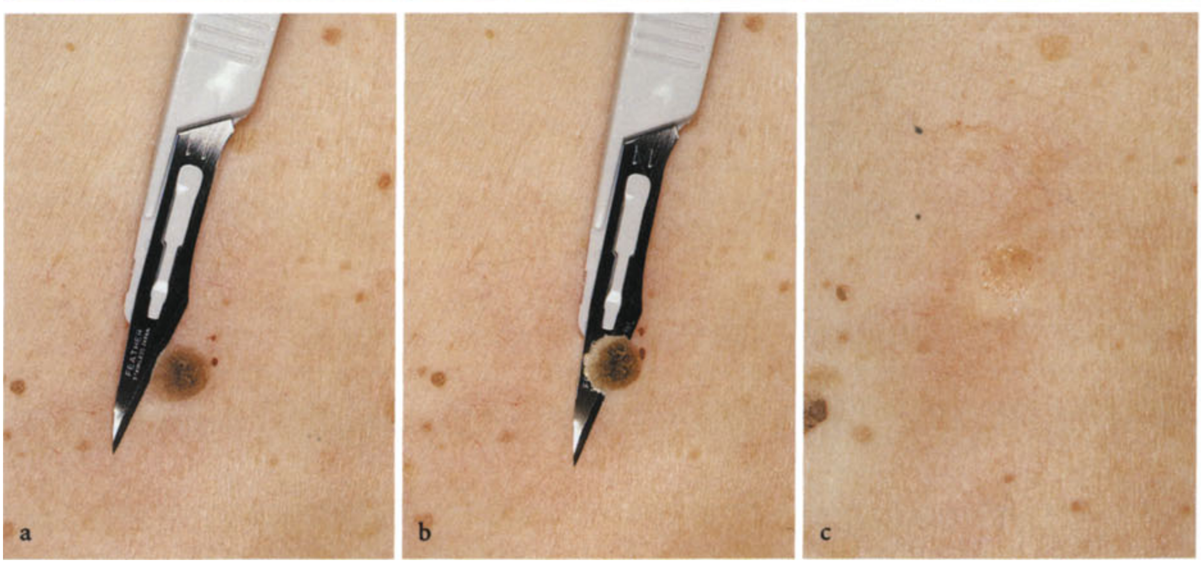

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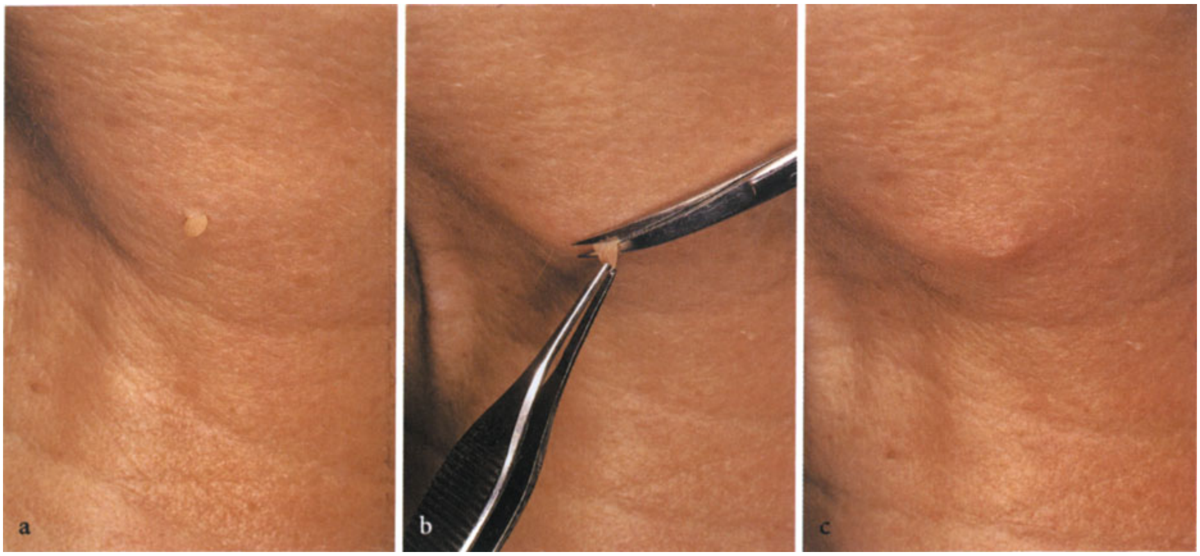


Fig. 28. Removal of seborrheic keratosis with curettage
a Prior to the procedure
b During the procedure
c After completion

Fig. 29. Removal of seborrheic keratosis using a disposable curette
a Prior to the procedure
b During the procedure
c After completion

Fig. 30. Removal of seborrheic keratosis with shave excision
a Prior to the procedure
b During the procedure
c After completion

Fig. 31. Removal of a skin tag with scissors excision
a Prior to removal
b Skin tag stretched and severed excised at the base
c Usually no suture is needed

6.3 Scissors Excision

Scissors excision is simple and quick. A pedunculated lesion, usually a skin tag or small nevus, is grasped with forceps and snipped off at the base (Fig. 31). Most defects are allowed to heal secondarily, but a skin suture may be helpful to speed healing after the removal of larger skin tags. We generally submit all such lesions for pathologic interpretation since it is sometimes impossible to distinguish clinically between a skin tag and a nevus.

6.4 Dermabrasion

Dermabrasion with high-speed instruments (up to 60 000 rpm) was developed independently by Schreus and Kurtin. Kromayer initiated the procedure using instruments of much lower speed. Dermabrasion today is a widely employed technique with many indications.

Indications for Dermabrasion
- Acne scarring
- Rhinophyma
- Congenital melanocytic nevus (in infancy)
- Epidermal nevus
- Adenoma sebaceum (in tuberous sclerosis)
- Syringoma
- Lentigo
- Seborrheic keratosis
- Telangiectasia
- Favre-Racouchot's disease
- Scars
- Traumatic tattoo
- Decorative tattoo
- Superficial wrinkling (such as perioral)
- Amyloidosis

We use the instruments from Aesculap (up to 22 000 rpm) and from Schumann (up to 60 000 rpm); both power systems have foot pedals that allow easy control of the speed. The

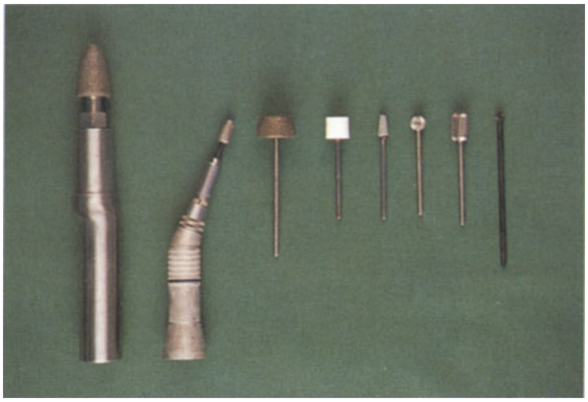


Fig. 32. *Left*, two handpieces for dermabrasion. *Right*, various diamond and carborundum fraizes, as well as metal fraizes and diamond burrs which can also be used to débride bone and burr holes in the external table of the skull during cancer surgery

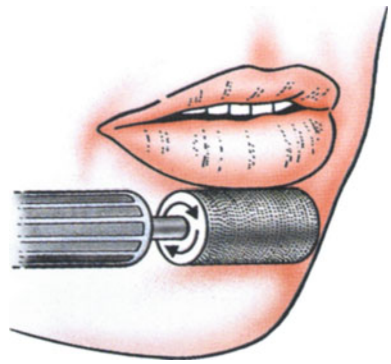


Fig. 34. Correct positioning of the rotating fraize when working about orifices is crucial. As the illustration shows, the direction of rotation must be away from the orifice. This avoids injuries in which the soft orificial skin is inadvertently entrapped by the rotating dermabrader

choice of abrasive head is crucial to the success of the procedure. The standard instrument is a diamond fraize. Carborundum fraizes or wire or nylon brushes may be employed for special sites or problems. These attachments are available in a wide range of sizes and varying degrees of abrasiveness for different purposes (Fig. 32). We tend to use only diamond or carborundum fraizes, as the other materials produce excessive tissue damage. Rarely, one may employ a wire or nylon brush for deep tattoos.

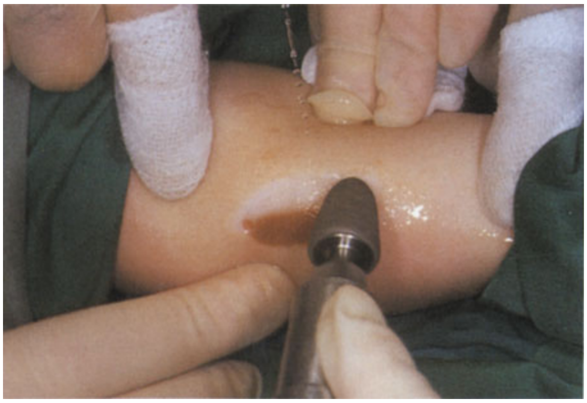


Fig. 33. Technique of dermabrasion. Positioning of the fraize while the operation field is tightly stretched. The skin is continuously rinsed with sterile saline to avoid thermal injury

The preoperative discussion with the patient is a vital part of any dermabrasion procedure. This is especially true when cosmetic procedures, such as whole-face dermabrasion for acne scarring, are being considered. We find that patients' expectations generally exceed what we can realistically hope to achieve. We therefore discuss carefully both the common and the less common side effects and risks of the procedure.

We especially warn acne patients that we cannot promise an improvement. It is gratifying, however, that patients are generally better satisfied with the final result than is the surgeon.

Complications of Dermabrasion
- Milia
- Persistent erythema
- Hyperpigmentation
- Hypopigmentation
- Scarring
- Exacerbation of herpes simplex
- Bacterial infections
- Hypertrichosis

We usually perform whole-face dermabrasion and other large procedures under general anesthesia. The procedure requires an experi-

Fig. 35. Correct depth of a dermabrasion. Close-up view of a congenital melanocytic nevus which has been partially removed

enced surgeon with a light touch. The skin must be stretched tight by an assistant (Fig. 33). Kaufman and Landes suggest that the assistant wears cotton gloves to improve traction. The surgeon must be aware of the direction in which the fraize is turning so that mobile tissues such as the lower lip or eyelid do not become caught in the rotations (Fig. 34). We cool the skin during the procedure with normal saline to avoid thermal tissue damage from the warmth created by the fraize as it rotates. To avoid scarring one must try to avoid going deeper than the epidermal-dermal junction. Of course, with tattoos or marked acne scarring, it may be necessary to go deeper, but the dermabrasion scar can be regarded as cosmetically less objectionable than the preexisting lesion. The depth of the procedure is determined by the speed of the fraize and by the pressure which the surgeon generates between the fraize and the skin. When working with thin skin (eyelids, nose, lips) or with infants, one should use low speeds and minimal pressure in order to best control the depth (Fig. 35)

In some lesions, primarily older foreign-body or traumatic tattoos, there may be particles deep in the dermis or even in the subcutaneous fat. Here it is best to combine dermabrasion with excision of the deeper lesions. We use a punch and close each small excision with a suture.

The postoperative care of dermabraded tissue is crucial. After cleaning the skin with normal saline we apply an impregnated gauze dressing which remains in place for 2–3 days. Thereafter it is changed daily until the wound has entirely reepithelialized. The major problem during subsequent months is postoperative hyperpigmentation, usually as the result of sun exposure. We prefer to perform dermabrasion in the fall or early winter and insist that the patient wear a sun screen with a high sun-protection factor for at least 6 months postoperatively. In some sun-sensitive patients we also use systemic β-carotene during this period.

6.5 Salabrasion

In our hands, salabrasion is a modification of dermabrasion and is most useful for removing decorative tattoos. After completing the dermabrasion ordinary kitchen salt is rubbed aggressively into the wound, which is then bandaged with dry dressings (Fig. 36). The bandages are changed daily. While wound healing is delayed, a thick crust develops which aids in the removal of the deeper pigment particles not removed by the dermabrasion. Formerly, salabrasion was performed without dermabrasion, using coarse salt which was rubbed into the skin manually. With this method, however, the procedure rarely reached an effective depth.

6.6 Removal of Superficial Foreign Bodies

The prompt removal of superficial particles after an accident is one of the few emergency procedures in dermatologic surgery. If the powder and dirt from an explosion (such as misfire of a gun, accident with a firecracker) are removed within the first 48 h, the likelihood of scarring and tattooing is greatly reduced. We employ sterile toothbrushes and hand brushes to perform the dermabrushing procedure (Fig. 37). Both soft and hard brushes, made

Fig. 36. Salabrasion
a Decorative tattoo just as dermabrasion is begun
b Salt being applied to dermabrasion scar
c Typical erythema after salt application
d Appearance 1.5 years after surgery

only of nylon, should be available. Particles that are too deep to be reached by the brushes can be removed with splinter forceps or can be excised with a small punch and then closed with a stitch. We use sterile saline to rinse the wound and then employ the same wet dressings used after dermabrasion. Bleeding is rarely a problem.

General anesthesia is usually the anesthetic of choice, but local anesthesia may suffice when very small areas are involved. Tetanus prophylaxis should be administered. If there is facial involvement, an ophthalmologic consultation should be obtained to exclude or treat corneal injuries.

Fig. 37. Dermabrushing to remove foreign bodies (after misfire of a gun)

a–c Removing the particles by vigorous brushing with various brushes
d Touch-up dermabrasion
e At the end of the procedure
f Appearance after 2 weeks

7 Micrographic Surgery

7.1 Principles and Indications

The fundamental principle of micrographic surgery is serial excision and microscopic study of tissue to identify malignant cells. All the various modifications of the techniques result in total ablation of the malignancy while sacrificing the least amount of uninvolved tissue.

Micrographic surgery is effective particularly in treating recurrent basal cell carcinomas, malignant epithelial tumors with subcutaneous extensions difficult to eradicate by surgical means, multicentric tumors, and tumors in areas where tissue needs to be conserved, such as the eyelids, inner canthus, and ala. Aggressive histopathologic types such as morphealike, infiltrating, and fibrotic basal cell carcinomas should be included in this high-risk group. Large tumors and those with poorly demarcated clinical borders represent additional indications for the use of micrographic surgery.

Micrographic surgery is valuable in treating carcinomas of the centrofacial area, periorbital region, and auricles. Malignant epithelial tumors, especially basal cell carcinomas, invade in a surprisingly irregular and unpredictable manner, with a tendency to spread a great distance from the apparent clinical border. Basal cell carcinoma rarely invades cartilage of the nose or ear but tends to glide off and extend a considerable distance from its origin in a plane between cartilage and epidermis. For example, it is not uncommon for the tumor to extend from the anterior to the posterior surface of the ear. In addition, the higher recurrence rate in special locations such as the auricular and retroauricular area may have its origin in their embryologic development, while in these areas, containing many different fusion planes and layers, the tumor may penetrate and disperse itself between the different planes.

Cure rates for basal cell carcinomas are about 98% and 96% for primary and recurrent tumors, respectively. Thus it is statistically advantageous and clinically wise to treat higher risk tumors initially with micrographic surgery.

The technique is equally effective in the treatment of other malignant lesions such as Bowen's disease, erythroplasia of Queyrat, and squamous cell carcinoma of the skin, including penile and vulvar carcinoma. Rare but not less useful indications are dermatofibrosarcoma protuberans, adnexal carcinoma, and extramammary Paget's disease.

7.2 Mohs Micrographic Surgery

7.2.1 Mohs Fixed-Tissue Technique

Classical chemosurgery, or fixed-tissue micrographic surgery, as originally developed by Frederick Mohs at the University of Wisconsin, is rarely employed today. This is a modification of Schreus' technique of removing basal cell carcinomas with zinc chloride. Mohs' method incorporated the fixation of tissue in situ without altering its architectural structure. Mohs first debulked the tumor by a deep shave excision or even curettage. He then applied either dichloroacetic or trichloroacetic acid to increase tissue permeability, followed by 40% zinc chloride paste which was left on for 24 h. This paste was very painful. After 24 h the tissue, now fixed in vivo, was excised, care-

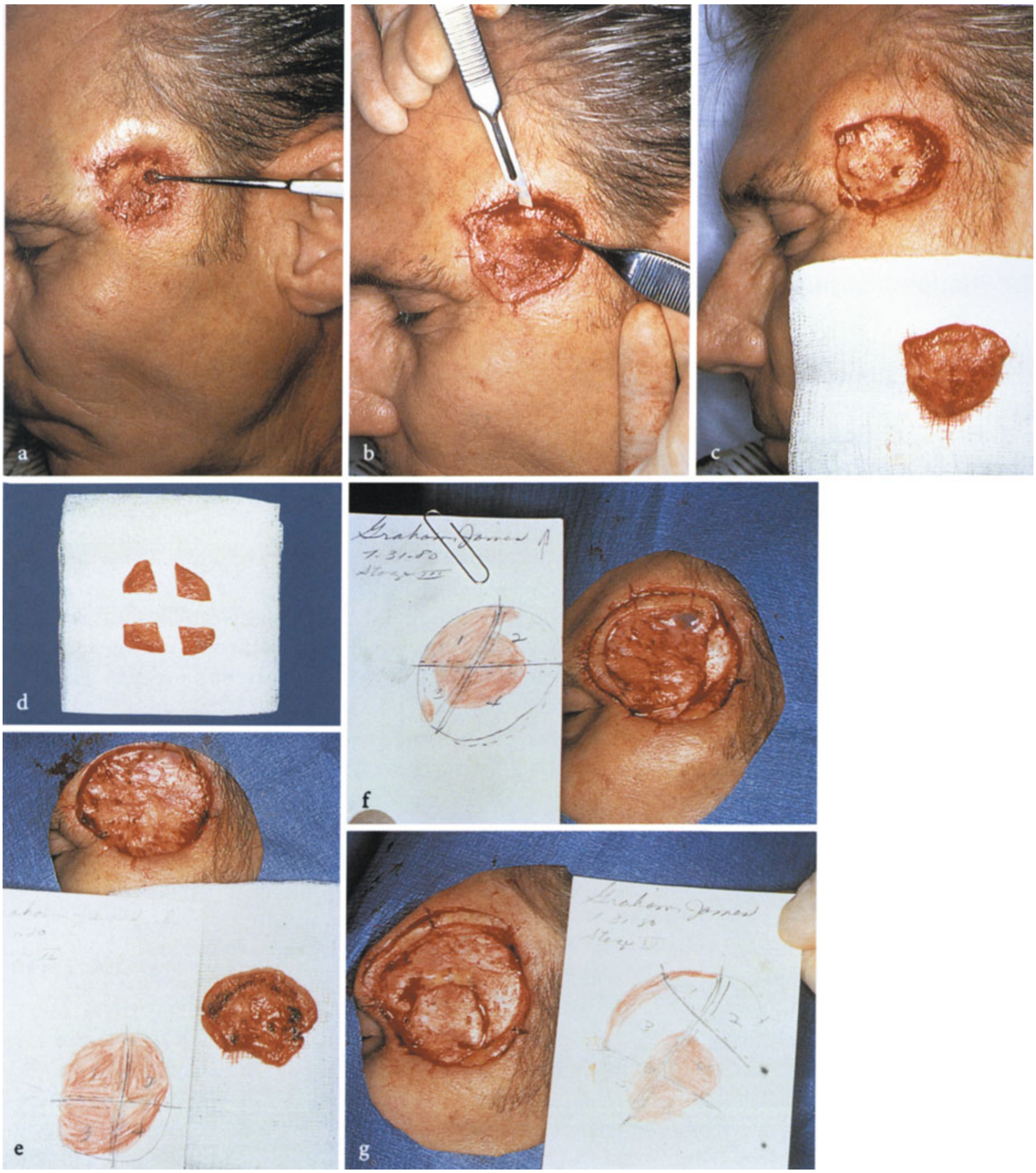

a
b
c
d
e
f
g

Fig. 38. Mohs micrographic surgery
a Recurrent basal cell carcinoma at the temple. The area is first treated by curettage
b A thin layer of tissue is excised
c A saucerlike shape of tissue will be prepared for marking
d The tissue is cut into sections and color coded. A corresponding map is drawn to reveal the location of each section
e Following microscopic examination of the horizontal frozen sections, the presence of tumor was colored in red on the corresponding map. The lateral inferior border was shown to be free of tumor
f Another layer of tissue still shows tumor at the base and superiorly
g Tumor still persists at the base and along the periphery superiorly
h The final defect following excision by micrographic surgery
i Final status 6 months after closure by full-thickness skin graft

fully marked, and examined histologically. If the tumor remained in certain areas of the excision, these areas were then refixed and excised until a tumor-free plane was obtained. The microscopic sections can be performed as frozen sections or as permanent sections.

Mohs originally favored letting the resultant wound heal by secondary intention. The initial fear was that in high-risk tumors a plastic closure would obscure clinical evidence of a possible recurrence. However, because the wound healing process was extremely long, and the risk of recurrence proved extremely low, almost all Mohs cases today are primarily repaired immediately.

7.2.2 Mohs Fresh-Tissue Technique

Almost all Mohs surgery is performed today using frozen sections of fresh tissue. This eliminates the painful 24-h wait for zinc chloride fixation, allows multiple stages to be carried out on the same day, and produces a less traumatized wound that can be closed more easily and with better cosmesis. This refinement of Mohs' technique using fresh tissue permits the same pinpoint precision to be achieved in the eradication of skin cancer. The fresh-tissue technique was first employed when the chemosurgical procedure of Mohs was performed in the periorbital area, namely the medial canthus and the upper and lower eyelids. Zinc chloride paste is not applied to these sites because of the possibility of the fixative causing irritation and damage to the globe. Instead the tissue is excised under local anesthesia and without the use of chemicals. The application of this technique to other areas of the body was first described by Tromovitch and Stegman.

The clinical extent of the tumor is first evaluated by gross examination. The area is anesthetized either regionally or locally. A curette may be used to debulk the tumor and remove any necrotic tissue.

The essence of the technique is the removal of disc-shaped pieces of tissue. Thus the initial skin incision is performed at about a 45° angle and then extended parallel to the skin surface at the base of the tumor (Fig. 38). The excision specimen is removed, carefully mapped, and then sectioned. This is the crucial step. The first section must include the entire base and sides of the disc; in other words, the disc must be flattened at its sides. This requires considerable dexterity and some brute force to achieve this charge. A specimen with a vertical margin cannot be sectioned properly.

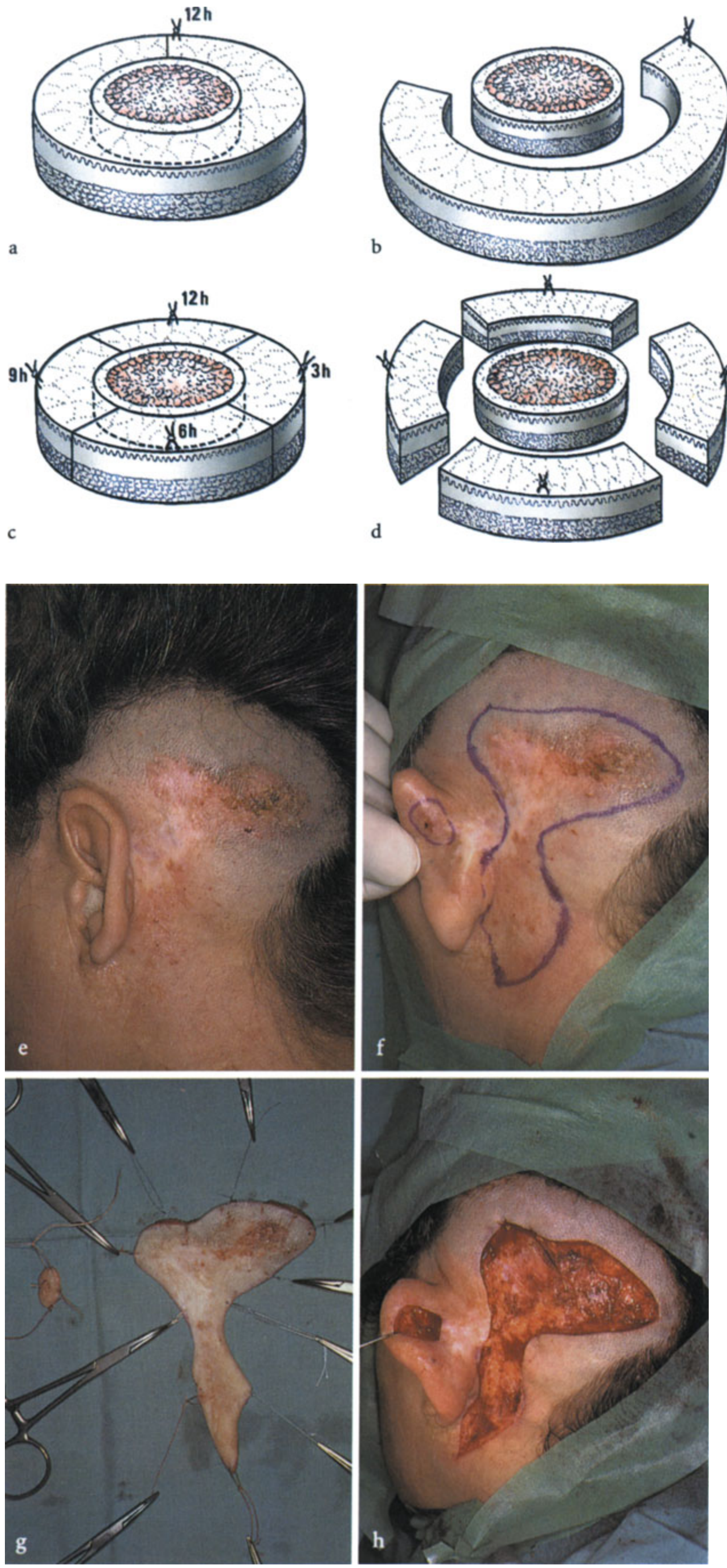
The surgeon interprets his own histologic sections. In the United States this is part of the reimbursement-related definition of the procedure: the same physician performs the surgery and the pathology on same day. Careful mapping, often with multicolored tissue marking inks, allows any residual tumor at the side or base of the tumor site to be identified and reexcised, using the same approach until the entire site is shown to be free of tumor.

The sloping margins must generally be excised then to allow a cosmetically acceptable closure. All of the closures presented in the second part of this volume can be used following Mohs micrographic surgery.

7.2.3 Mohs Check

The Mohs check is a modified one-stage procedure that uses microscopy to confirm whether

Fig. 39. Modifications of histographically controlled surgery ▷
a Specimen marked at 12 o'clock
b Circular border cut around the specimen
c Multiple points marked with sutures
d Multiple pieces of adjacent tissue cut
e Multilocular basal cell carcinoma arising within a nevus sebaceus of the retroauricular region
f Planning the borders of the excision
g Lateral margins are marked with sutures
h Excision defect left open until histologic assessment of lateral and deep margins proves to be tumor free. If any margin shows tumor cells, further excisions are made


12h
a
b
12h
9h
3h
6h
c
d
e
f
g
h

a cutaneous cancer treated by electrodessication and curettage has been completely ablated. The following steps are taken: (a) a thin slice of tissue is removed by scalpel in a saucer-like shape; (b) the excised specimen is cut into several pieces, and frozen sections from the undersurface of each are stained for microscopic examination; (c) if no signs of malignancy are found, nothing more needs to be done. If, however, malignancy is detected in some or all of the sections, the Mohs surgical steps are continued selectively or entirely until complete extirpation is achieved.

7.3 Other Modifications of Micrographic Surgery

In Germany one performs so-called histographically controlled surgery, which is a modification of the Mohs technique and corresponds well with the aims and principles of Mohs micrographic surgery. Generally the excision is performed in a hospital or private office, and the specimen is sent to a pathologist or dermatopathologist for interpretation, again using either frozen or fixed tissue sections. As shown in Fig. 39, the tumor is excised in the shape of a "hockey puck" or "cake" with vertical margins. A strip is then cut around the lateral periphery of the tumor and divided into conventionally sized pieces that are sectioned starting on the outer rim. These semicircular fragments must be flatted, but this is an easier task than with Mohs sections. In addition, a flat section is taken across the base of the tumor, and the central tumor is sectioned in routine fashion. During the histologic examination the excision site is dressed by polyurethane sheets. If tumor is found to extend to the margin of the excision, further excisions are performed in the involved areas. The process is repeated as often as needed to produce a tumor-free wound, which can then be closed using a variety of reconstructive procedures.

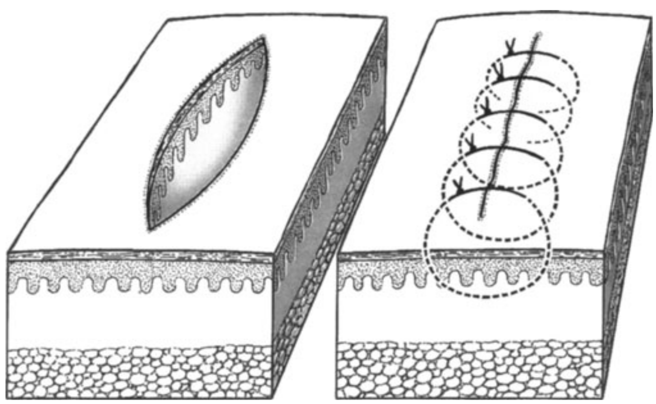
Many other methods have also been proposed, but our personal experience is principally with the Mohs technique and histographically controlled surgery. Each produces a tumor free site in almost all cases. Rarely, however, the microscopist is deceived either because of technical difficulties with embedding and sectioning, or by tumors with skip or jump regions or long tentaclelike extensions.

8 Simple Excision and Repair Techniques

8.1 Primary Closure

The defect created by a spindle-shaped or elliptical excision is closed by bringing the wound edges together with single or running skin sutures (Fig. 40a). The wound edges are usually easier to approximate precisely if subcutaneous stitches are first used. In some locations accurate subcutaneous stitches can be combined with superficial closure using butterfly tapes. If an oval defect is created, dog-ears at each end of the wound are almost inevitable and must be excised. One should therefore always attempt to create an elliptical defect.

Fig. 40a. Simple elliptical excision with primary closure. Wound edges brought together with individual sutures



8.2 Undermining

Larger elliptical excisions generally require undermining before closure can be attempted. The area adjacent to the wound is separated from its subcutaneous connections so that the skin moves freely over the fat. There is a risk of cutting vessels and damaging small nerves. After undermining, the skin edges can then be approximated more easily, first with subcutaneous sutures and then with skin sutures.

Undermining allows one to produce a cosmetically far more acceptable wound that is less likely to stretch during the late stages of healing as the resorbable sutures weaken. The ellipse must be planned properly to lie along the relaxed skin tension lines, and undermining must be adequate. As a rule of thumb, we undermine about three to four times as much in the midregions of the wound as at the end (Fig. 40b). When undermining is optimally employed, relatively large defects can easily be closed with minimal tension. In many instances there is less wound trauma than with a small flap, and the results are

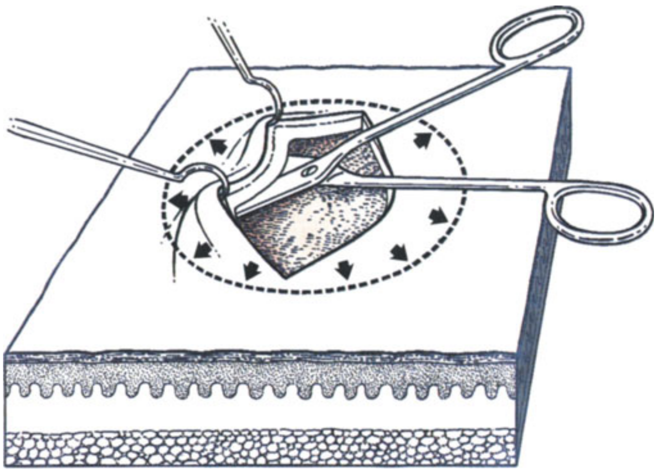


Fig. 40b. Undermining. The periphery of the surgical field is undermined at either the subcutaneous junction or fascia, depending on body site, using a surgical scissors. The undermining should be sufficient to allow the wound to be closed without tension

thus better. If a wound is closed, however, under marked tension even after undermining, both dehiscence and a spread scar are possible sequelae.

8.3 Serial or Staged Excision

Some benign skin lesions, for example congenital nevi and large cosmetic tattoos, sometimes cannot be removed in a single procedure with satisfactory cosmetic results. In such cases a partial excision or serial excision is performed. Part of the nevus is excised, and the wound is closed and allowed to heal. After the skin has stretched somewhat (after about 9–12 months) another part of the wound is excised. Closure is usually accomplished with undermining and a two-layered closure or occasionally with a simple flap. The skin is very forgiving, and amazingly large lesions can be removed by this approach. Each time, of course, the old scar is also excised (Fig. 41).

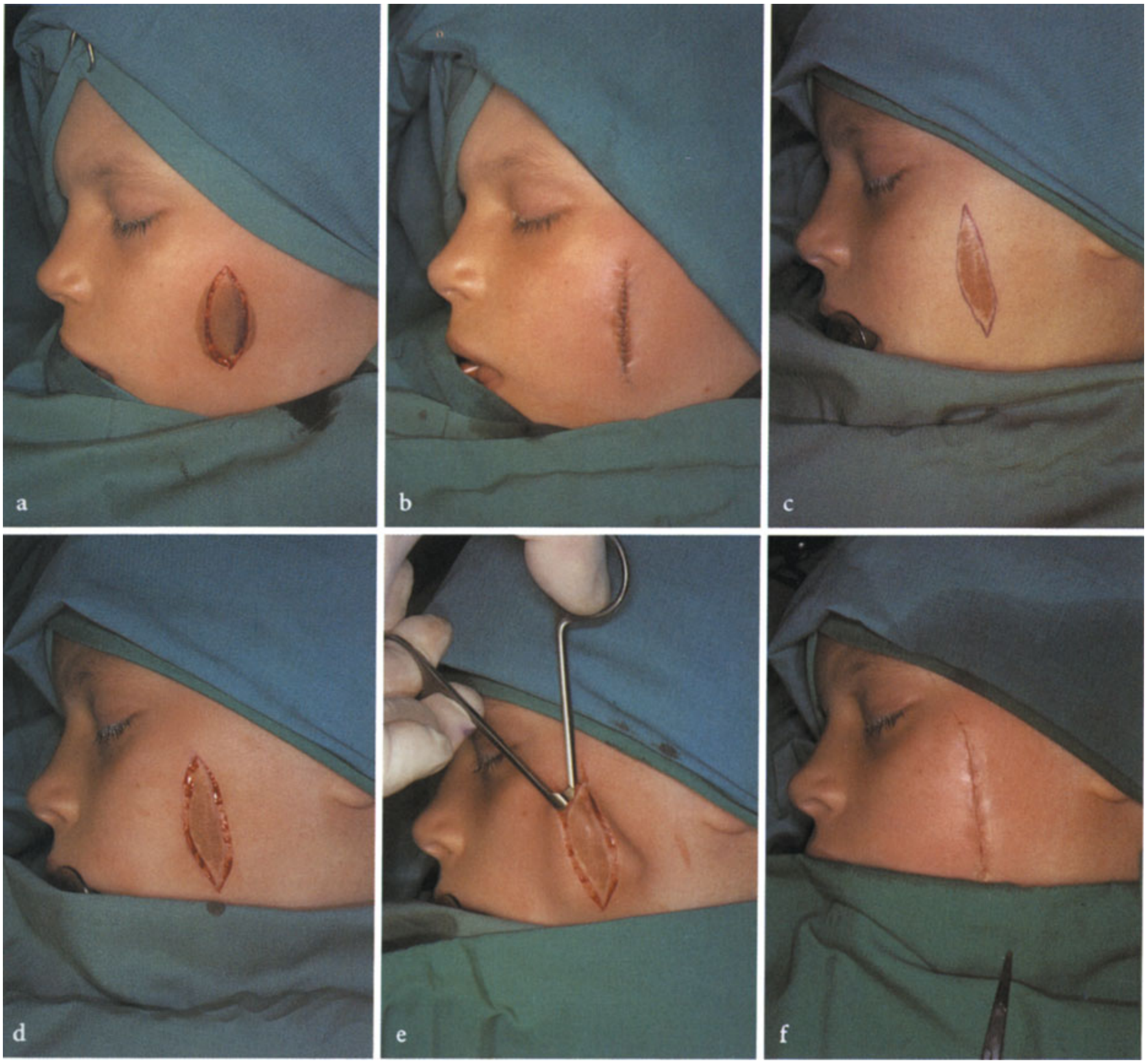


Fig. 41. Serial excision of a congenital melanocytic nevus
a–b First excision and closure after undermining
c–f Reexcision 1 year later, with extensive undermining and closure

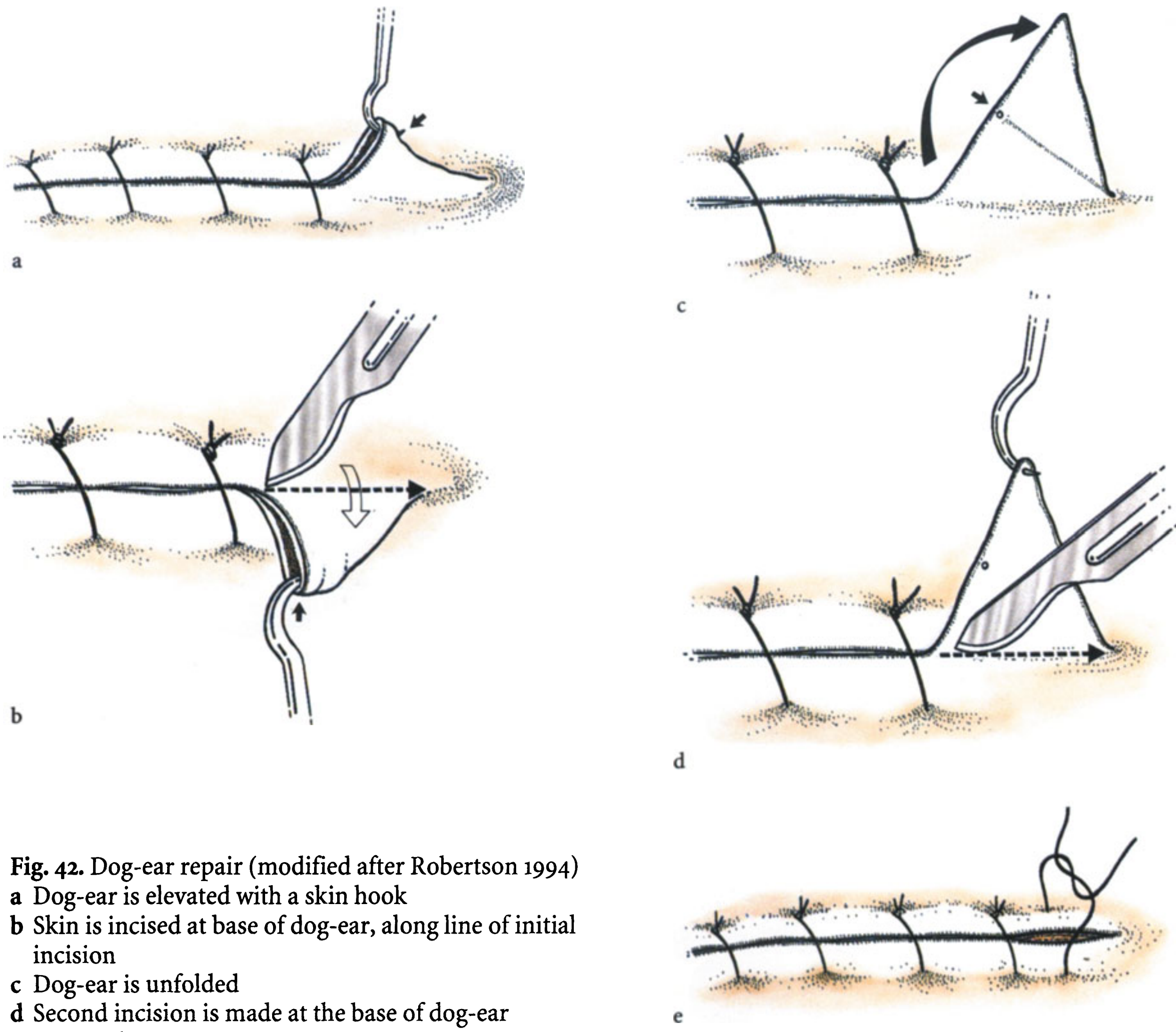


Fig. 42. Dog-ear repair (modified after Robertson 1994)
a Dog-ear is elevated with a skin hook
b Skin is incised at base of dog-ear, along line of initial incision
c Dog-ear is unfolded
d Second incision is made at the base of dog-ear
e Suture closure

8.4 Dog-Ear Repair

After a wound is closed, swellings or folds of tissue are occasionally created at one or both ends. These folds, called dog-ears, are usually the result of a wound which is too wide for its length or of the opposite sides being of unequal length. Dog-ears are generally corrected by excision; the fold is elevated with a wound hook and then excised with a scalpel, lengthening the wound (Fig. 42). Another possibility is to excise tiny triangles of tissue (Burow's triangle) on one or both sides of the sutured incision (Fig. 43). When a sutured wound crosses a convex surface, such as on the extremities or the chin, even a perfectly planned wound can show dog-ears or folds. These can be avoided somewhat by closing the skin in a curved or S-shaped fashion.

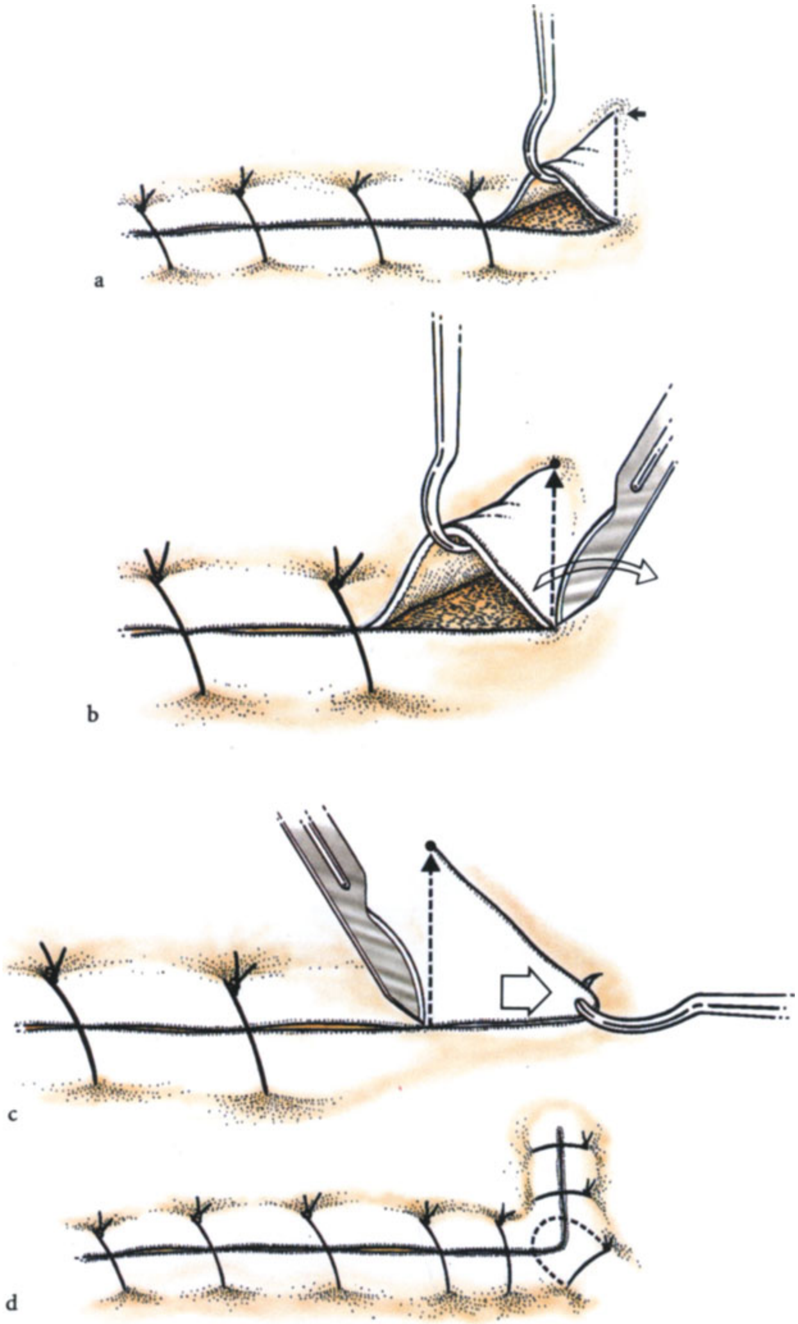


Fig. 43. Lateral dog-ear repair (modified after Robertson 1994)

a Elevation of the dog-ear with a skin hook
b Excision of base perpendicular to excision line
c Folding over of dog-ear and second excision
d Closure with buried suture at corner

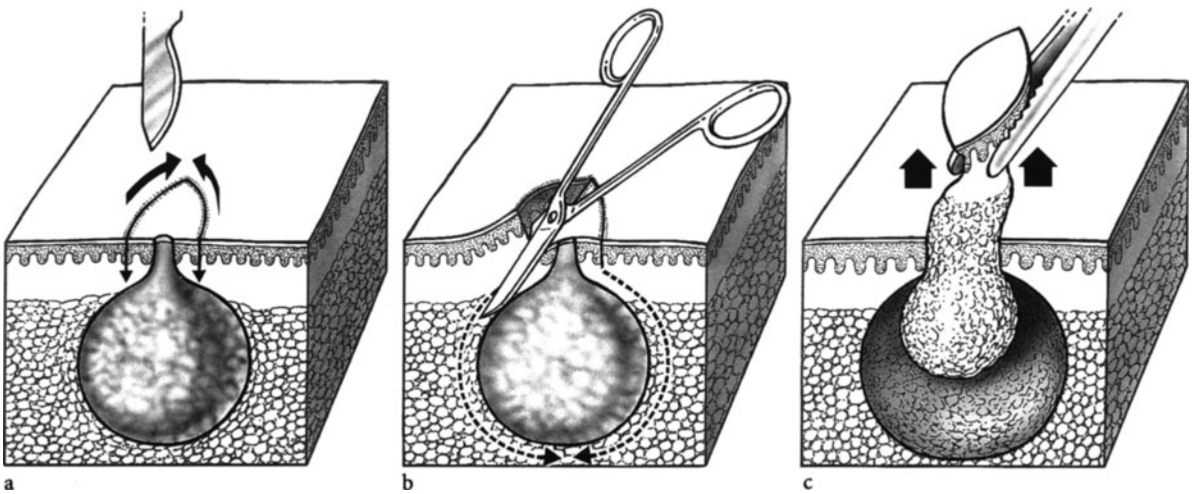


Fig. 44. Extracting a cyst
a Small ellipse to include the pore of the cyst
b Freeing up the cyst wall with a dissecting scissors
c Removal of cyst

8.5 Excision of Cysts

Tiny cysts or milia can generally be removed by making a small incision in the overlying skin and simply squeezing the cyst out. Sutures are seldom necessary. With large cysts one can excise a small ellipse to include the area of the central pore. It is important not to incise the cyst during this stage. The cyst is then freed by blunt dissection and removed. A few subcutaneous sutures are usually needed to close the dead space before the skin sutures are then placed (Fig. 44). One can also excise smaller cysts by using a 3- to 5-mm punch to excise the pore and then extrude the cyst wall and contents (Fig. 45)

An inflamed cyst is somewhat more difficult to handle. Often one can simply incise and drain the cyst to remove pus and infected cyst contents, treat the patient with antibiotics, and await secondary wound healing. Such cysts tend to scar and often become reinfected, so that excision during a quiescent period is appropriate. Following an episode of inflammation it is more difficult to extrude a cyst, and one must generally perform a sharp surgical excision of the cyst and scarred surroundings. The defect is then closed with subcutaneous and skin sutures.

The ganglion can be viewed as a variant of a cyst. Here not only must the entire cyst wall be removed, but all its connections to the joint surface must also be severed. To reduce the likelihood of recurrence we tend to leave the main connection between the joint space and the subcutaneous tissue open. The dead space must then be closed and the skin sutured.

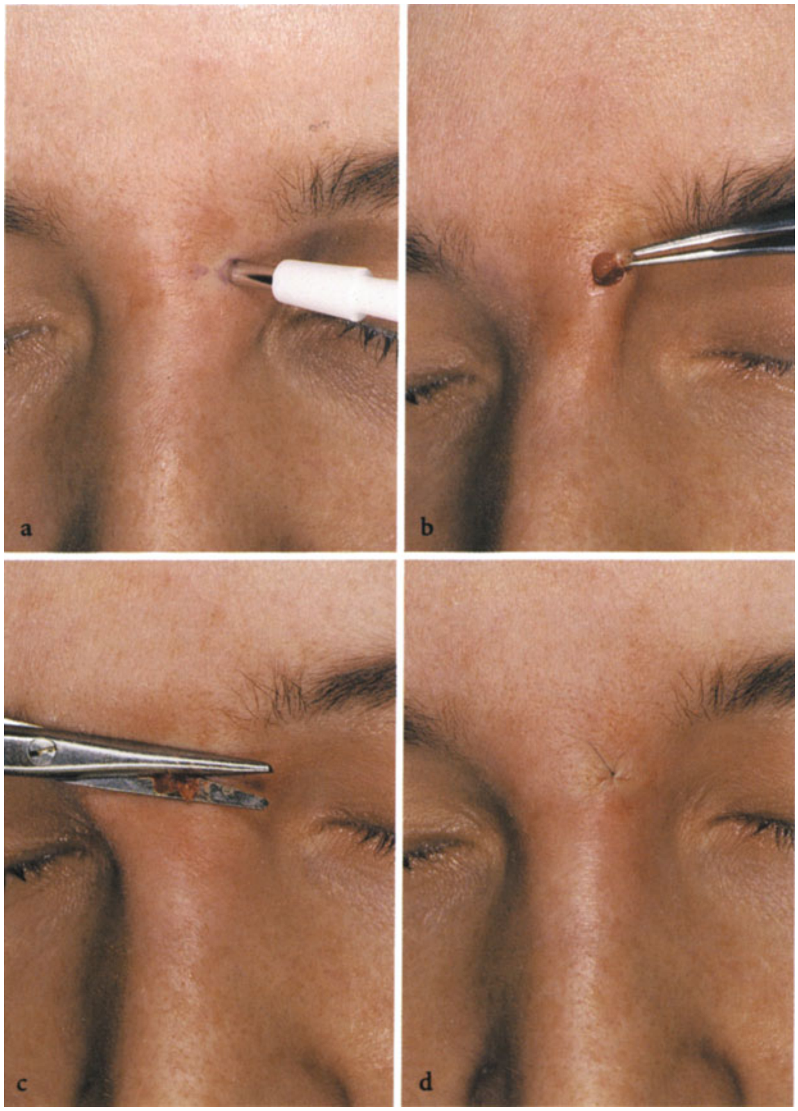


Fig. 45. Removal of small cysts with a punch biopsy
a Punch excision which is large enough not to damage cyst wall
b Removal of cyst
c Excising the connective tissue stalk
d Closure

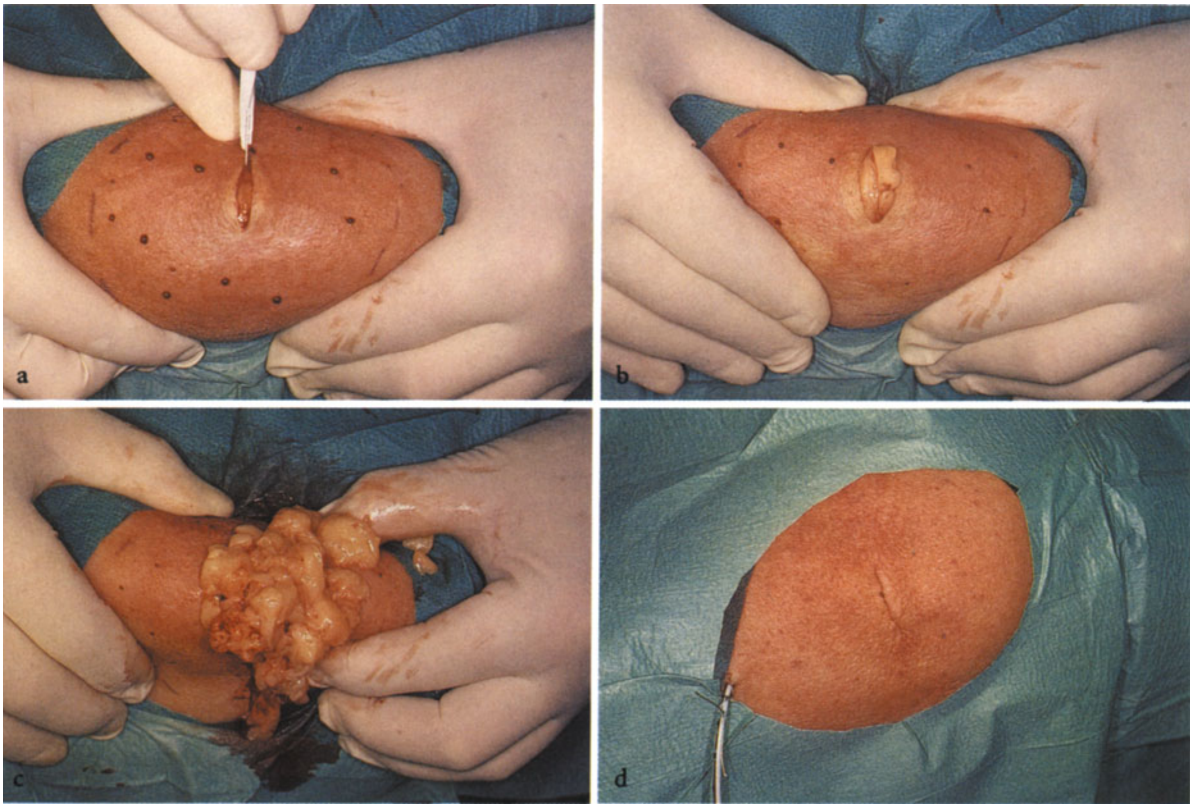


Fig. 46. Simple removal of subcutaneous lipoma
a Skin incision
b Exposure of lipoma
c Manual expression of lipoma
d Skin closure and suction drain

8.6 Excision of Lipomas

Lipomas are usually simple to remove. A small incision is made over the tumor under local anesthesia. Pressure is applied to the sides of the tumor to express it through the incision (Fig. 46). Sometimes the edges must be freed with blunt dissection. Bleeding is rarely a problem. After closing the dead space with subcutaneous sutures the skin edges are under so little tension that butterfly tapes generally suffice, although skin sutures can certainly be used. Deeper and larger lipomas are approached in the same fashion; one needs simply to make a larger incision. Some lipomas, known as mobile encapsulated lipomas, have a true capsule and are easily removed; these occur most often about the elbows.

8.7 Excision of Deep Lipomas

Some lipomas lie within the subcutaneous muscle, such as over the masseter and zygomatic arch or along the rib cage, or under the muscle fascia, such as on the forehead. Here the clinically apparent lesion is not visible after the skin incision. Once one reaches the fascia, this should be separated with an incision parallel to the direction of the muscle fibers. The muscles themselves are separated by blunt dissection until the lipoma becomes apparent. It is then freed using a blunt technique. Because the risk of bleeding at this relatively deep site is high, we insert a deep ligature at the base of the lipoma before removing it. The muscle and fascia are closed in layers to avoid herniation, followed by a standard skin closure. Such wounds tend to be painful for a long period of time.

9 Plastic Procedures: Flaps

When a defect cannot be closed using simple closure techniques, with or without undermining, some sort of plastic surgical repair must be undertaken. In most cases tissue is moved about locally, generally in the form of a flap or advancement procedure. In a few cases it is more appropriate to transfer tissue from a distant site, creating a graft. We find the most uses for flaps and grafts in repairing defects created by the histographically controlled removal of skin cancers.

Flaps provide a multitude of ways for ideal closing of a wound and thus achieving good cosmetic results with minimum risk for the patient. These are especially effective in the head and neck region. Here the donor and recipient areas are generally quite good matches, and a satisfactory cosmetic result is achieved more easily.

Local flaps may be classified in many ways. One can distinguish between random pattern flaps and axial flaps which have a specific vascular supply. The latter can therefore have a relatively higher length to breadth ratio (see page 8). Another method of classifying flaps is by the various ways of moving tissue: advancement flaps, rotation flaps, and transposition flaps. Most of the flaps discussed in this chapter are variants of one of these basic types. A final important point is that in general the longest incision should lie in one of the relaxed skin tension lines. In deciding which type of flap to use we weigh the following factors:

- The shape of the surgical defect and the direction of the skin lines. Depending on the age of the patient, we try to orient the incision in either the wrinkle lines or the lines of skin tension.
- Matching the skin texture and color. One should choose the technique which allows one to fill the defect with skin that most closely resembles that which has been removed; in other words, one should be aware of aesthetic units.
- Vascular supply. One should consider the regional variations in vascularity to minimize flap necrosis.
- Hair. When skin containing hair is moved, one must be aware of the consequences, considering the direction of hair growth.
- Natural lines. Every effort should be made to place the major scar in a natural fold, such as the nasolabial fold, forehead wrinkle, or anterior to the ear, where it will be much less noticeable.

9.1 Z-Plasty

Two opposing triangular pieces of skin are cut and then freed by undermining. The two flaps are then simply transposed, gaining length along the long axis of the wound. This is an effective way to correct a scar which crosses skin tension lines or a major fold (Fig. 48). The angle at the tip of the two triangles should be identical but can vary between 30° and 60°. These two extremes allow a gain in length from 25% to 75%. Z-plasties are particularly useful on the face, neck, and extremities.

Multiple Z-plasties can be employed to correct larger scars which are cosmetically unattractive and restrict motion, especially if they cross a joint (Fig. 47). Designing the long axes of the individual Z-plasty procedures to lie in natural tension lines affords

Fig. 47. Multiple Z-plasties
a Scar contracture after burn
b Operative plan for multiple Z-plasties
c Excision of the scar and preparation of Z-plasties
d Transposing the tips
e Closure of the excision
f Appearance after 2 years

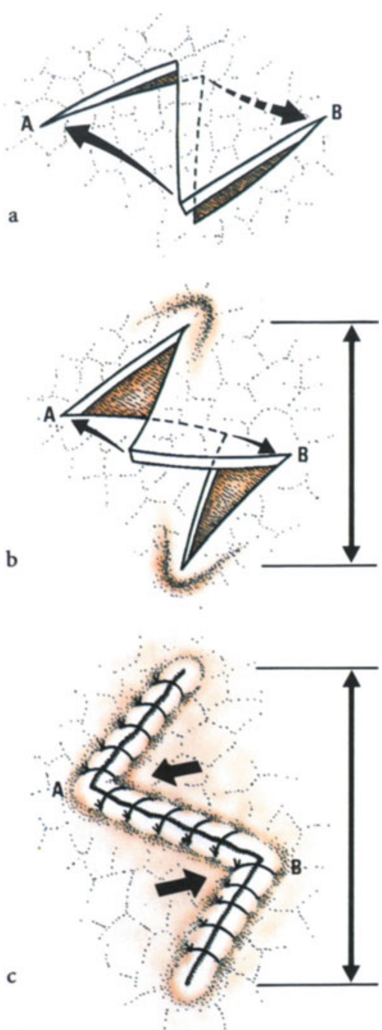


Fig. 48. Principle of the Z-plasty
a The longitudinal tension is corrected by making two 45° lateral incisions, creating two triangular flaps or a Z
b After mobilization, if the flaps have been correctly planned, they will fall into their new locations
c Closure with a demonstration of the gain in length

not only functional improvement but also a degree of cosmetic benefit.

9.2 VY-Plasty

Classical VY-plasty allows a reduction in longitudinal tension and thus an apparent increase in tissue length. After a V-shaped incision the tissue is undermined and then closed in a Y-shaped fashion (Fig. 49). Just as with the Z-plasty, the VY-plasty is very useful for correcting scars and reducing skin tension. In addition, V-shaped or arrow-shaped defects can be closed by lateral undermining and then performing a Y-closure (Fig. 50). This flap is especially useful around orifices, such as the mouth, eyes, and female genitalia.

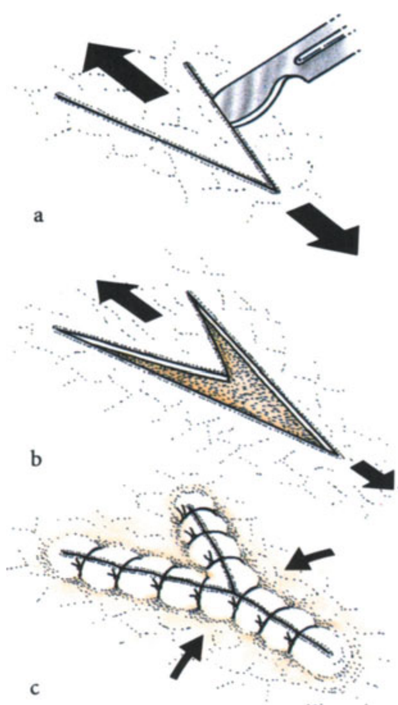


Fig. 49. VY-plasty to reduce tension
a V-shaped incision with longitudinal tension
b The wound converts itself into a Y
c Tension-free closure

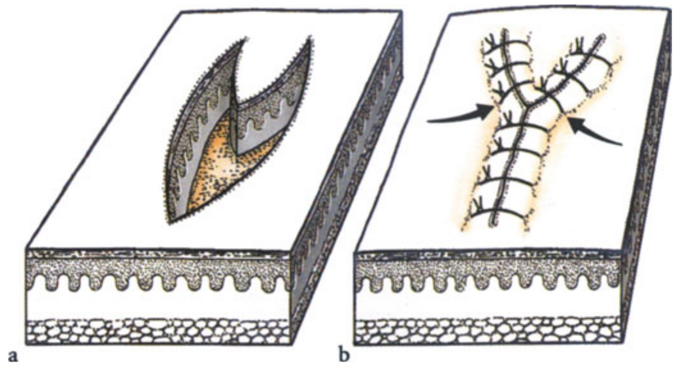


Fig. 50. Excision using a VY-plasty
a V-shaped excision
b Y-shaped closure

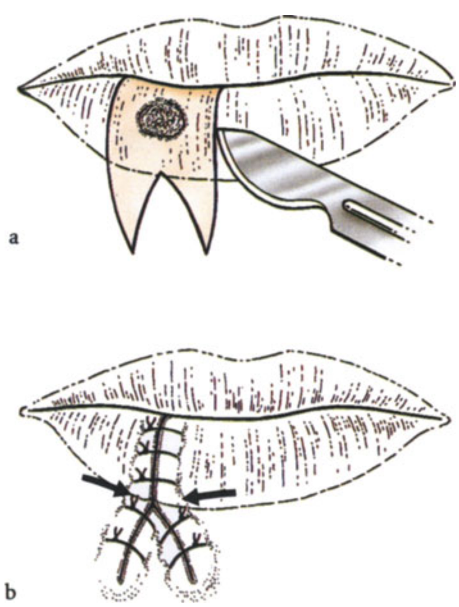
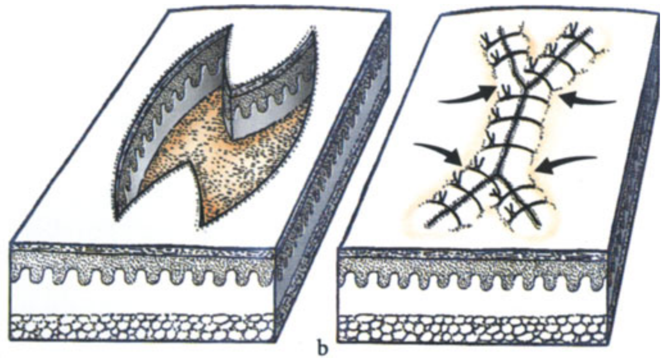


Fig. 51. WY-plasty on the lower lip
a W-shaped excision
b Y-shaped closure with careful attention to vermilion border

9.3 WY-Plasty

Larger wedge-shaped excisions, such as those of the lip, produce a long, vertical scar which is cosmetically unattractive. To improve the situation one can perform an M- or W-shaped excision which, when closed, produces a Y-shaped scar that is shorter, more interrupted, and thus cosmetically more acceptable. The WY-plasty can be combined with a variety of other flaps to achieve the twin goals of minimizing the primary defect and avoiding lengthy uninterrupted scars. We use this flap primarily on the lower lip. The short arms of the Y can be placed in the mental crease. In addition, the somewhat curved contours of the lower lip and chin are better preserved (Fig. 51).



a b

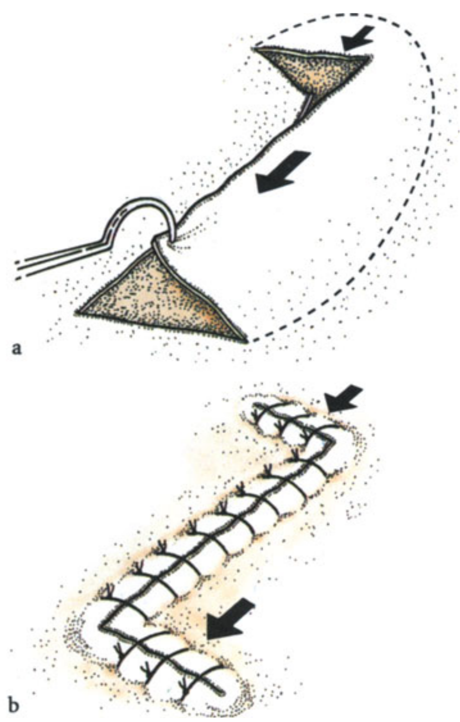
9.4 Double WY-Plasty

This flap combines two M- or W-shaped excisions placed at opposite ends of the wound. These are each closed in a Y-shaped manner (Fig. 52). This approach is employed in closing larger defects on the trunk and on the back of the neck.

Fig. 52. Double WY-plasty (also known as double MY-plasty)
a W-shaped defect on both ends of excision
b Two Y-shaped closures

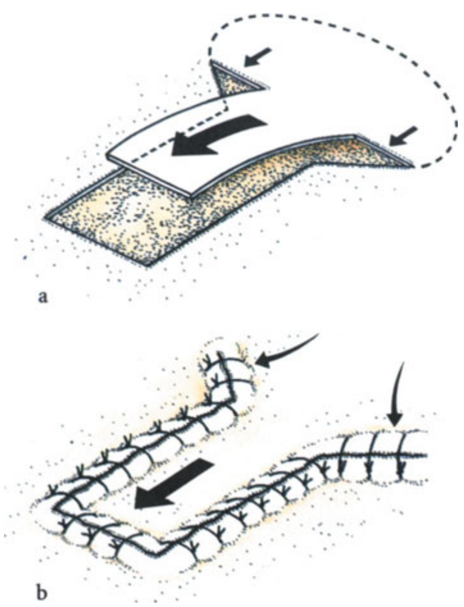
9.5 Advancement Flap (Burow)

The lesion is excised in the shape of an equilateral triangle. One arm of the triangle is then extended either caudally, cranially, or laterally. At the same time a small triangle (Burow's triangle) is excised on the contralateral side of the extension. After undermining the area between the primary defect and the Burow's triangle the tissue can be advanced and the wound closed under relatively little tension (Fig. 53). In a bidirectional Burow's flap the excision is extended in both directions along one side of the triangle and then closed just as described above. This flap is used most often on the head and neck, as well as the trunk, when the incisions can be placed in skin tension lines or along natural anatomic boundaries to maximize the cosmetic result.



a b

Fig. 53. Burow's advancement flap
a Burow's triangle placed laterally and wound undermined to allow motion (*in direction of arrow*)
b Closure after advancing the flap



a

b

Fig. 54. U-plasty
a Parallel lines of incision with removal of Burow's triangles and undermining
b Closure after advancing flap (*in direction of arrow*)

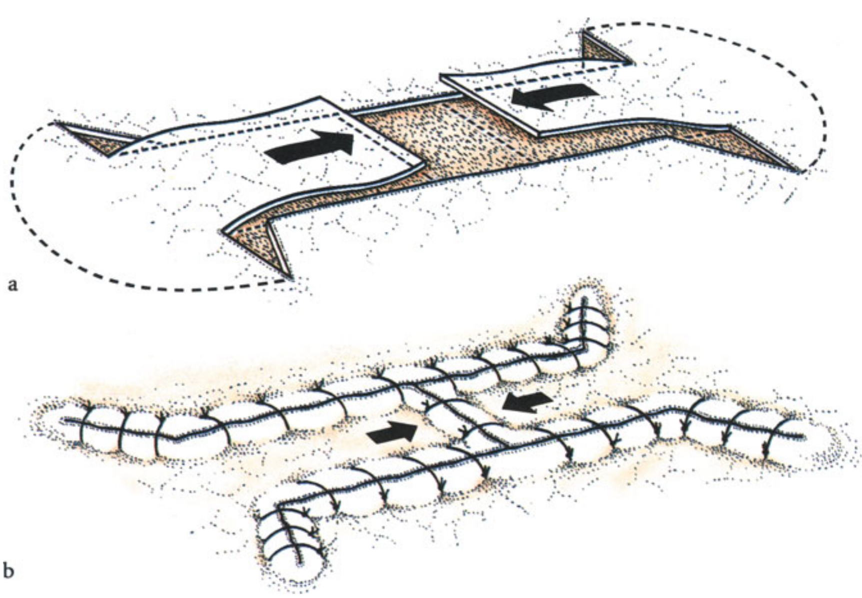
9.6 U-Plasty (Schimanowski)

The U-plasty designed by Schimanowski is a variant of the Burow's flap. The defect is excised in a square or rectangular fashion and an incision extended in the same direction on two opposing (i.e., parallel) sides of the defect. A small Burow's triangle must be created at the end of each extension. One then frees the U-shaped flap and undermines the adjacent tissue, paying special attention to the base of the flap. Finally, the flap is moved into the defect, producing a relatively tension-free wound (Fig. 54). We use the U-plasty most often around the nose, eyes, and lips.

9.7 H-Plasty

The H-plasty is actually a double U-plasty, or double-advancement flap. This is especially effective on the forehead and when closing defects of the eyebrows. Two U-plasty flaps are created as mirror images of one another (Fig. 55). One must be very meticulous and gentle with the tissue, for in the end two flaps meet and are sewn together. The junctional area thus has a poor vascular supply and may be under some tension, increasing the risk of necrosis.

Fig. 55. H-plasty
a Two U-plasties are created with leading edges meeting each other
b Closure after advancing both flaps (*in direction of arrows*)



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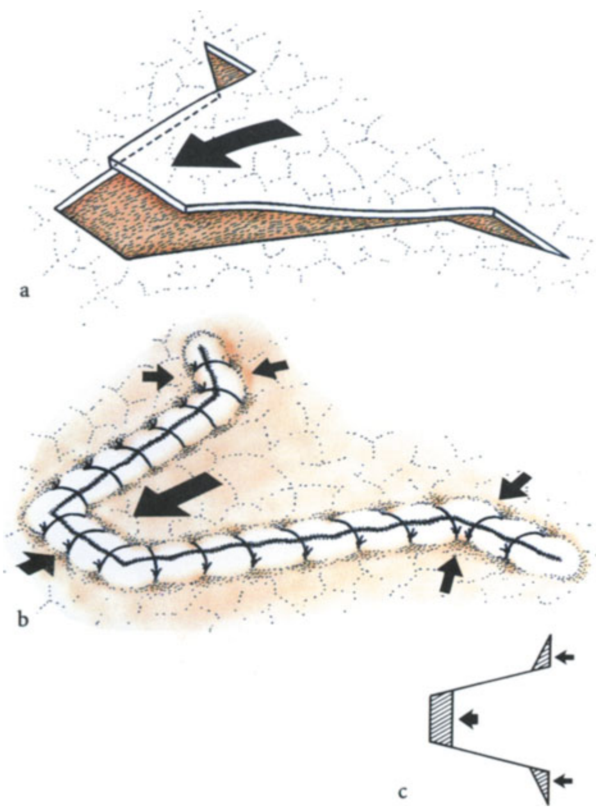


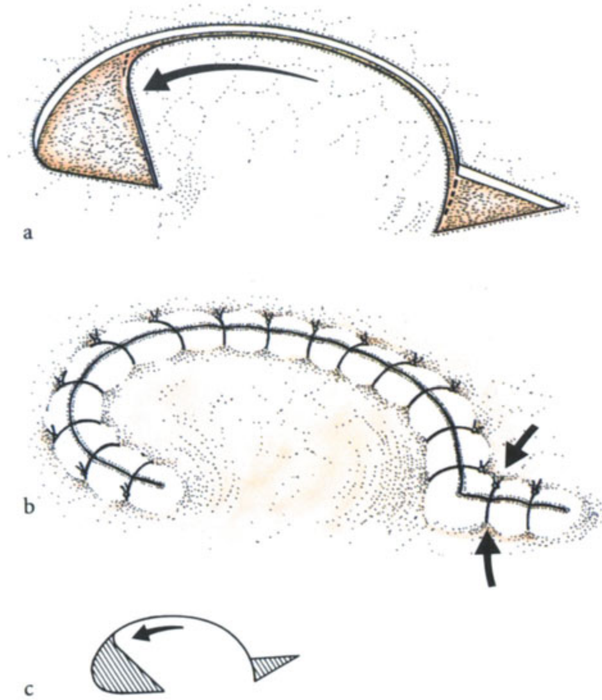


Fig. 56. Trapezoid flap
a Similar to U-plasty but the edges diverge
b After moving flap (*in direction of arrow*), closure is accomplished
c Schematic diagram

Fig. 57. Simple rotation flap
a Defect (*left*). Counterclockwise rotation of flap with corrective triangle (*at right*)
b Closure after moving flap
c Schematic diagram

9.8 Trapezoid Flap

The trapezoid flap is yet another modification of the U-plasty. Here the incisions are extended in a diverging fashion, rather than being parallel (Fig. 56). It is used to close large and deep defects on the lateral nose and cheeks.

9.9 Rotation Flap (Imre)

The rotation flap is a modification of Burow's advancement flap as developed by Imre. The incision is extended along the short edge of the triangular defect in a curved fashion, again using Burow's triangles on the contralateral side to allow further motion. After undermining and mobilization the flap is rotated into the primary defect, which is then closed under relatively little tension (Fig. 57). Areas in which the rotation flap works particularly well include the scalp, face, lateral neck, and trunk.

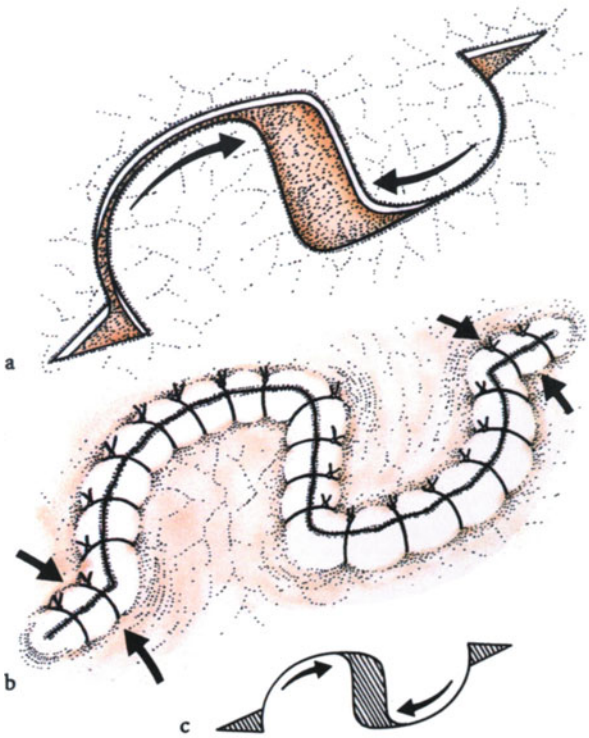


Fig. 58. Double rotation flap (after Webster)
a Rotation occurs in opposite direction in opposing flaps
b Closure after moving flaps
c Schematic diagram

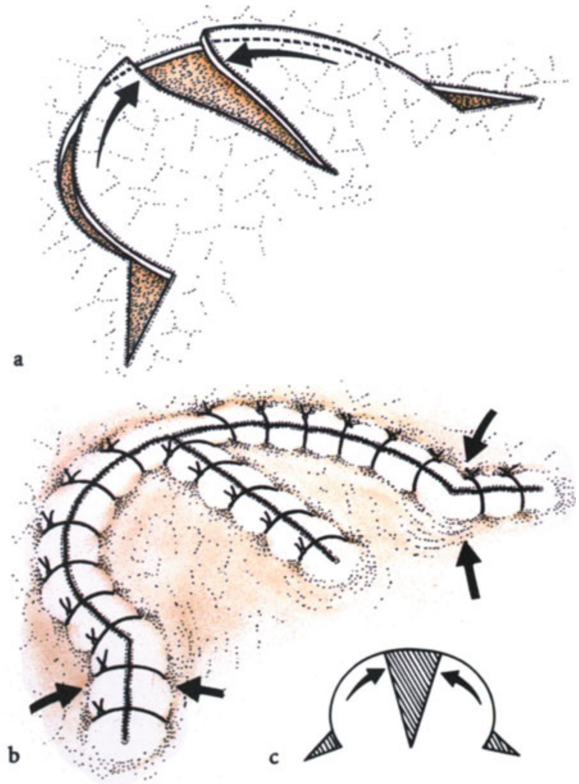


Fig. 59. Double rotation flap (O to T)
a Flaps are both rotated centrally from base on same side of defect
b Closure after moving flaps
c Schematic diagram

9.10 Double Rotation Flap (Webster)

Large round or oval defects can be effectively closed with this approach. Starting at two points which lie directly opposite each other on the wound edges, one creates two curved incisions going in opposite directions. After the two flaps have been freed by subcutaneous dissection, they are rotated past each other, and the wound is closed (Fig. 58). One or more Burow's triangles are generally required to facilitate approximation of the wound edges. We employ this flap most often on the scalp and trunk.

In certain regions, such as the chin and forehead, it is sometimes difficult to close larger triangular defects with a simple rotation flap. Here we have had good success with a modified double-rotation flap where the flaps are rotated towards each other along the base of the triangle (Fig. 59). Undermining and closure is identical to that with a simple rotation flap.

9.11 Advancement or Rotation Flap with Back Cut

This flap is also known as an axe flap or a J-shaped rotation flap. Introducing an incision at the back end of an ordinary advancement or rotation flap can often avoid the use of a Burow's triangle. This technique has two major advantages. First, there is a sparing of tissue since the triangles are not sacrificed. Second, the flap is significantly easier to move since the back cut is placed in the direction in which the flap rotates (Fig. 60). The defect left by the

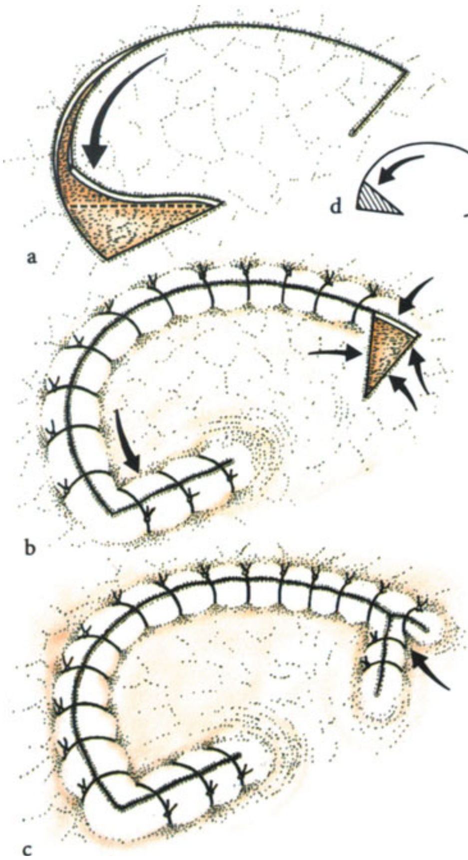


Fig. 60. Rotation flap with back cut
a After making a curved or bow-shaped incision, a small back cut is made instead of removing a Burow's triangle
b After closure of the flap, a small defect remains which can be closed primarily
c Completed closure
d Schematic diagram

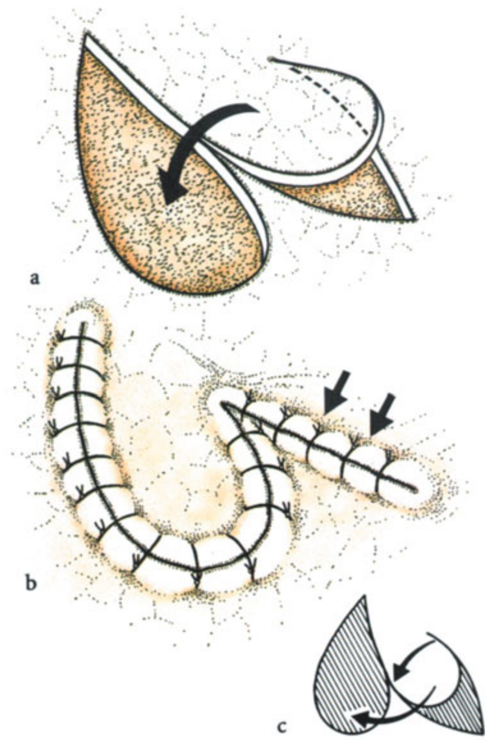


Fig. 61. Transposition flap (lobed flap)
a Preparation and movement of flap
b Closure
c Schematic diagram

back cut is then closed in the same way as a VY-plasty. One must be cautious not to compromise the base of the flap through the back cut.

9.12 Transposition Flap

The basic concept of a transposition flap, or lobed flap, is to cover a drop-shaped defect with a similar smaller drop-shaped flap. The flap is taken from nearby tissue and after appropriate undermining moved over the intervening normal tissue into the defect. The donor site of the flap is closed primarily (Fig. 61). Dog-ears at the base of the flap are almost inevitable and must be excised. In planning the operation one must pay particular attention to the lines of tension. In addition, the ratio between the length and width of the flap should be about 4:1. This relatively simple flap produces good results in the midfacial region, around the ear, and on the neck and trunk. We use it most often on the ala nasi, where it is crucial to thin the flap by removing the subcutaneous fat. Failure to do this, out of fear of flap necrosis, produces an irregularly raised flap on the nose which is cosmetically less than ideal.

9.13 Bilobed Flap

This flap resembles to the transposition except that two successively smaller lobed flaps are created to close a defect. A flap is raised to cover the original defect, and a second smaller flap is then created to repair the defect left by the first flap. The defect left by the second flap is closed primarily. The two flaps share a common base (Fig. 62). Two important conditions must be met to employ this flap:

- Since the base of the flaps may be turned as much as 180°, the tissue must be soft and flexible with an adequate vascular supply.
- The second flap should be selected so that its scar lies in an already existing fold.

Occasionally one must create Burow's triangles to achieve the optimal result. The bilobed flap is a well-established technique which can be employed in almost any area of the body.

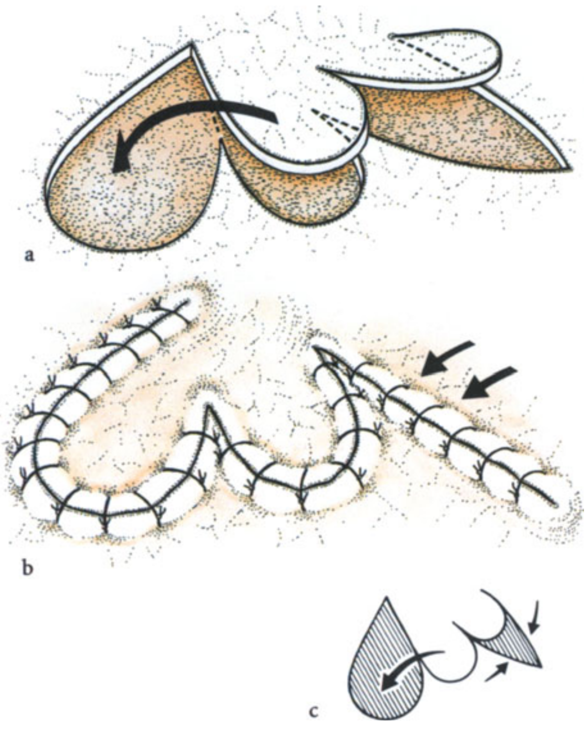
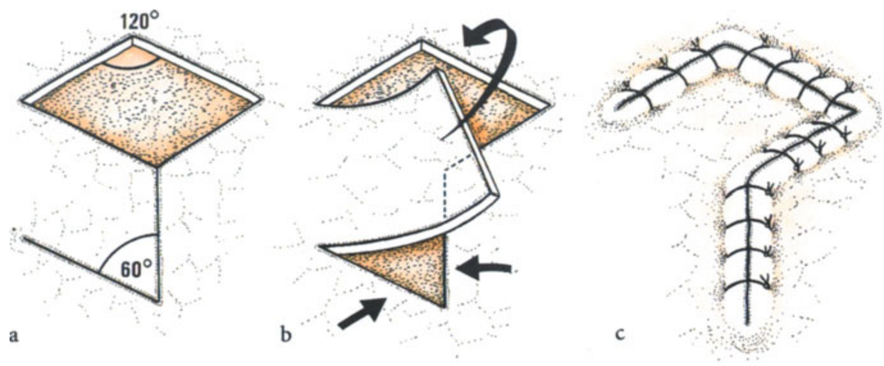
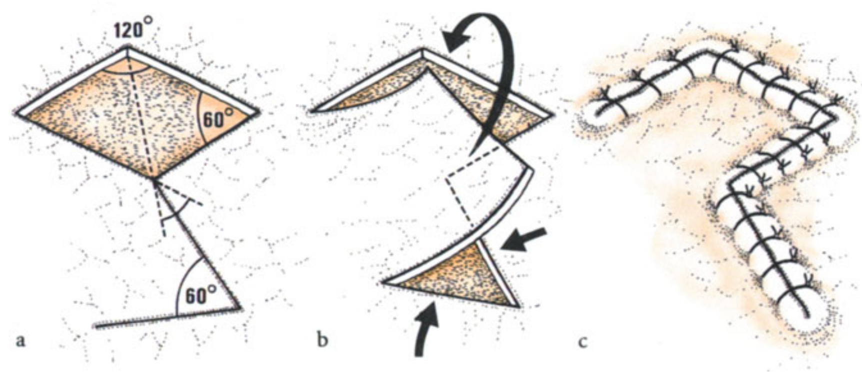


Fig. 62. Double transposition flap (bilobed flap)
a A second smaller flap is prepared to cover the defect created by the first flap
b Closure
c Schematic diagram



△
Fig. 63. Rhomboid flap (after Limberg)
a Rhomboid defect; the adjacent congruent flap forms a mirror image of the defect
b Moving the flap
c Closure

Fig. 64. Rhomboid flap (after Dufourmentel)
a Rhomboid defect; the flap is moved slightly lateral in comparison to the Limberg variant (Fig. 63)
b Transposing the flap
c Closure
▽



9.14 Rhomboid Transposition Flaps (Limberg, Dufourmentel)

These two modifications of the transposition flap differ only slightly. They are used to close a round or oval defect. A rhomboid flap is created in the adjacent tissue; in the Limberg technique the tip should have an angle of 50°–60°. After undermining the flap and adjacent skin the triangle is transposed into the defect and the flap defect closed primarily (Figs. 63, 64). In the Dufourmentel variant the geometry of the flap is altered slightly from the parallelogram form, reducing the amount of rotation needed (Fig. 64). Dog-ears may arise at the base of the flap and must be corrected. Either of these flaps can be used in closing small and large defects almost anywhere on the skin.

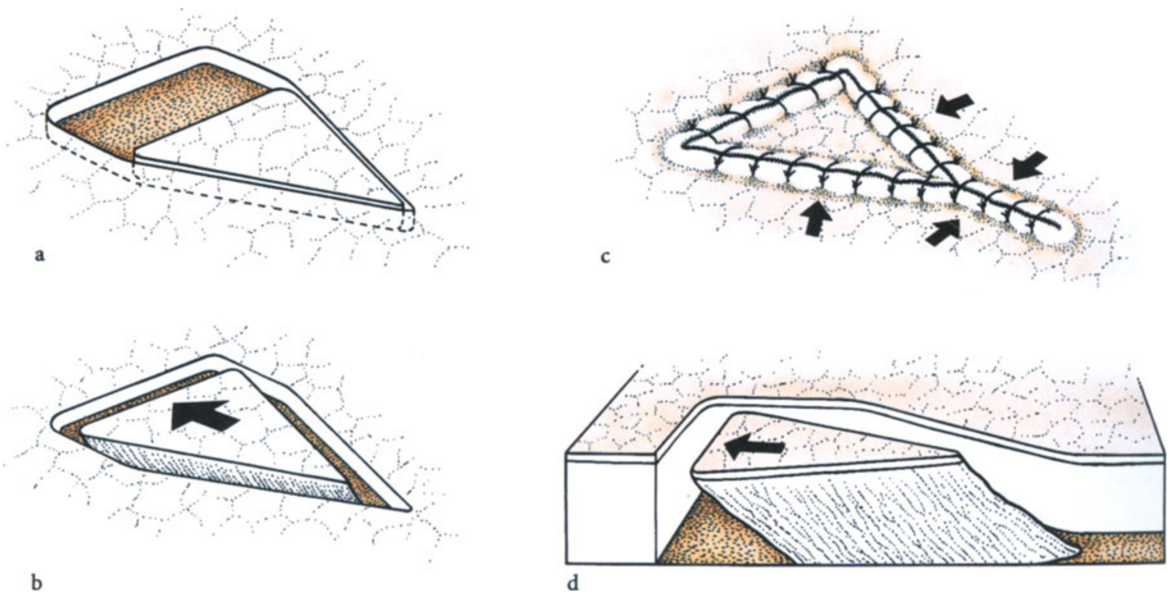
9.15 Subcutaneous Pedicle Flap

This closure is created by separating a flap completely from the adjacent skin but leaving it attached to a subcutaneous pedicle. The flap is nourished solely through this subcutaneous connection. The preparation of the subcutaneous pedicle is a delicate task. If the pedicle is too thick, the flap lacks the required mobility; if it is too thin, the vascular supply is inadequate, leading to necrosis. We attempt to point the subcutaneous arm in the direction of the vascular supply and to rotate the flap about its vascular base. The island of skin can then be placed in the defect with minimum tension (Fig. 65). The flap defect is closed primarily after undermining. In planning the flap one must pay particular attention to tissue distensibility and skin tension lines. Because the flap can be cut to an exact size, it produces excellent cosmetic results, in the midface as well as on the trunk and extremities. Double pedicle flaps are sometimes employed to close larger wounds, moving one flap from each of two opposite sides of the defect.

9.16 Island or Tunnel Flap

This intriguing flap resembles a pedicle flap, but the free piece of skin with its subcutaneous vascular supply is developed at a distance from the wound edge and tunneled under the normal skin into the defect (Fig. 66). If carefully prepared, the pedicle can be rotated as much as 180° without producing necrosis. This flap is most often used around the nose, with the flap raised either on the forehead or in the nasolabial region.

Fig. 65. Subcutaneous pedicle flap (sliding flap)
a Round or rectangular defect with creation of wedge-shaped flap which retains its subcutaneous connections
b Moving the flap into the defect
c Closure
d Sagital section showing the subcutaneous stalk



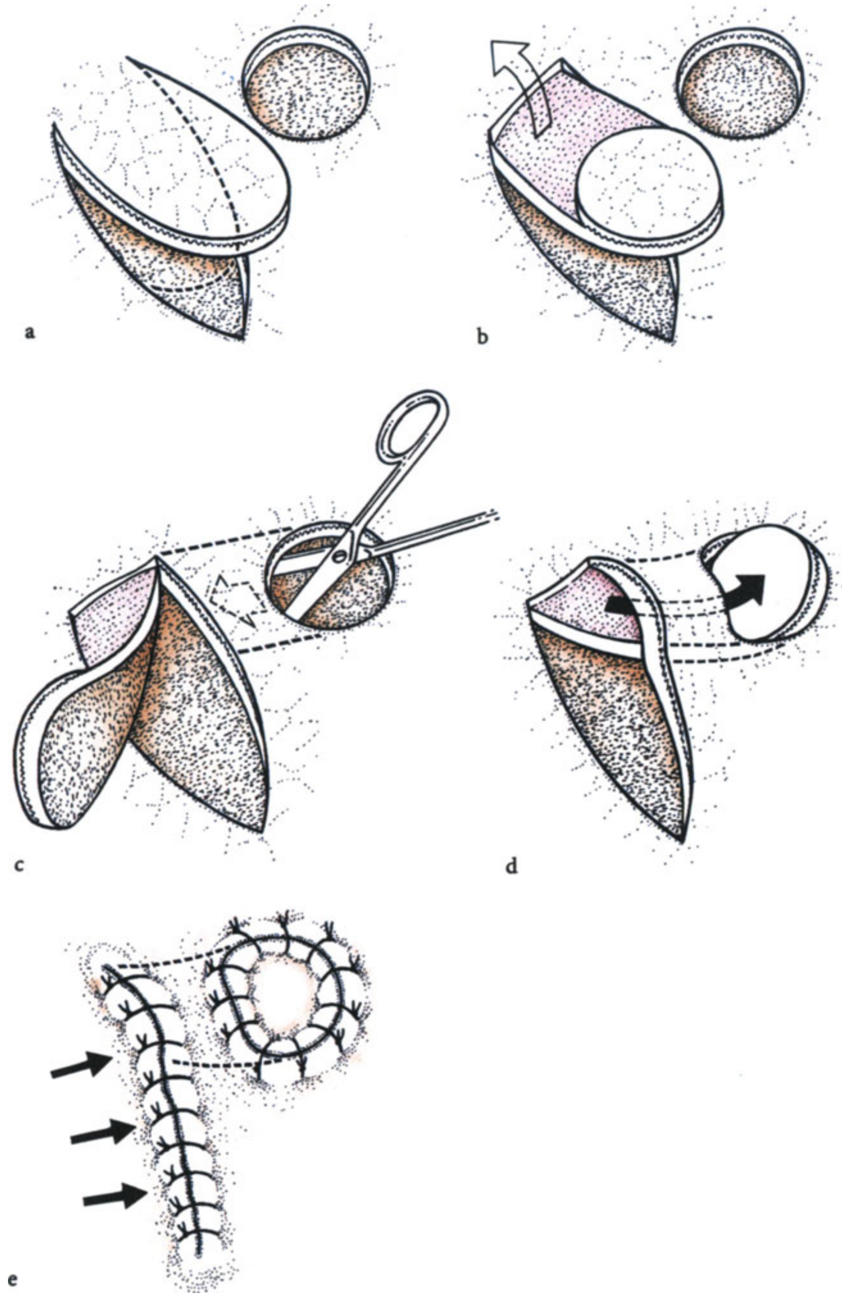


Fig. 66. Island or tunnel flap
a Defect and preparation of a lobed flap
b Removal of epithelium from pedicle of flap
c Creating subcutaneous tunnel to the defect
d Transposing the flap through the tunnel
e Closure of both the defect and the donor site of the flap. The deepithelialized stalk remains in place

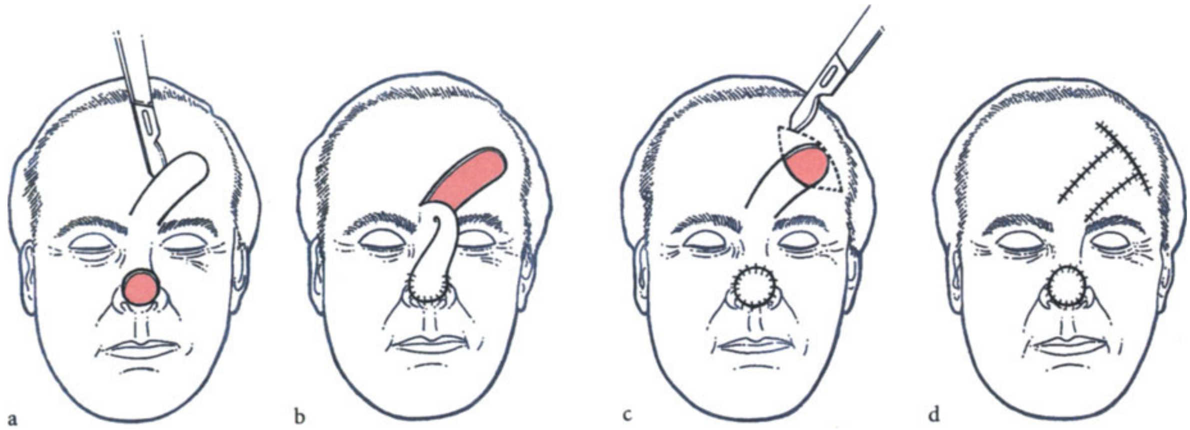


Fig. 67. Paramedian forehead flap; an axial pattern flap
a Nasal defect and creation of paramedian forehead flap
b Transposition of flap to cover defect
c After 2–3 weeks, the pedicle of the flap is returned to donor site
d The remaining defect is closed primarily

9.17 Forehead Flap with Vascular Pedicle

This procedure involves a modified transposition flap that can be used to cover larger defects in the midfacial region. The flap is based on a specific vascular supply. In one form it is placed in the midline or mediolaterally with its base at the glabella (Fig. 67). Because the vascular supply is so critical, we attempt to localize exactly the vessels preoperatively using Doppler ultrasound. The flap can be rotated up to 180° because of its excellent vascularity. The operation is performed in two parts. In the first, the flap is excised and sewn into the defect. Then, after 2–3 weeks, the pedicle of the flap is divided and repositioned. At the same time the transplanted flap must often be trimmed or remodeled. The donor defect created by the flap is generally closed by undermining and a primary closure. Alternatively, a free skin graft can employed.

9.18 Temporal Flap with Vascular Pedicle

This procedure is a modification of the forehead flap with vascular pedicle in which forehead skin serviced by the temporal artery and vein is used to cover a more central defect. When opposing temporal flaps are performed, one speaks of a visor flap. Again, exact preoperative identification of the vessels is important. After the flap has been allowed to take for 2–3 weeks, its pedicle is severed and returned partially to the donor site (Fig. 68). The flap must often be modeled or trimmed by carefully removing subcutaneous fat. At the same time the donor site is closed with a local flap or a graft.

9.19 Other Two-Stage Flaps

The same principles can be employed in other anatomic regions. For example, a flap can be raised in the nasolabial area to repair a defect in the ala nasi. On the ear pre- or retroauricular flaps can be used to cover defects in the concha or helix (see Sect. 19.10.4). The pedicle of the flap is separated after about 14 days and either discarded or used to help close the donor site.

9.20 Tissue Expanders

A pouch is inserted in the vicinity of a lesion which is to be excised. The pouch is usually made of silicone or another material which elicits little tissue reaction (Fig. 69). It is inflated initially with normal saline through a one-way valve until the overlying tissue is suf-

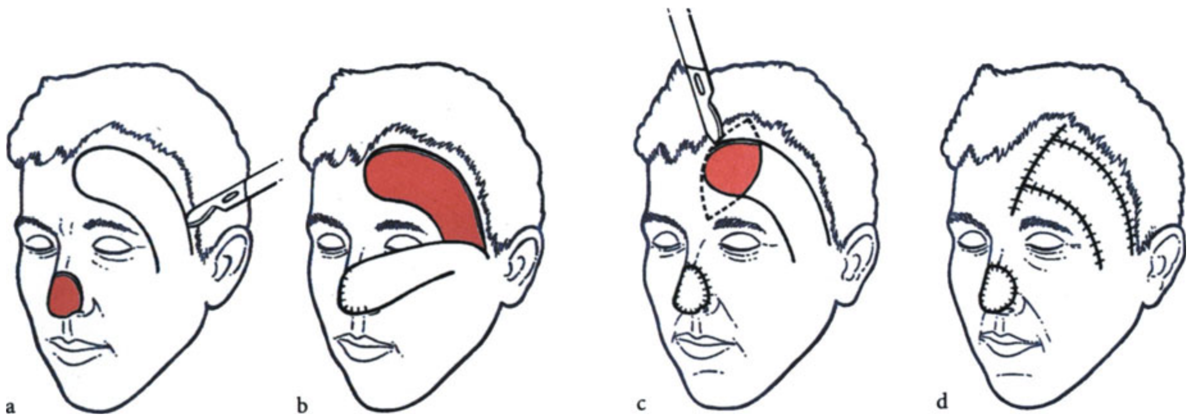


Fig. 68. Temporal flap
a Nasal defect and creation of temporal flap based on temporal artery
b Flap transposed for coverage
c After 2–3 weeks, the pedicle of the flap is returned to donor site
d The remaining defect is closed primarily

ficiently compressed to produce mild ischemia. Inflating an expander too aggressively can severely compromise the vascular supply of the skin producing necrosis. Over a period of 4–6 weeks the pouch is inflated periodically as the skin expands and grows over it. The skin that is gained by this technique is then used to close the defect. The rationale is that, with additional skin, one can perform a simple closure or a less problematic flap (Fig. 70). Often a tissue expander is the only way in which to avoid using a skin graft in an area where such a procedure promises to be difficult or cosmetically compromising.

Tissue expansion is indicated particularly in removing large benign lesions such as congenital nevi and scars, as well as in scalp reduction surgery for androgenic alopecia. We have also used it with good success in treating skin with chronic radiation damage (Fig. 71). Tissue expanders are more difficult to use in infants and small children because the pressure created by the expanded pouch may press upon and damage the underlying bone at the same time that it stretches the skin. We tend not to use tissue expansion in treating malignant tumors, preferring instead to remove the lesion immediately.

Immediate intraoperative tissue expansion uses the skin's ability to immediately stretch and increase in surface area; it thus represents a modification of the conventional technique. The expander is placed in a one-stage procedure and undergoes three or four expansion cycles before it is removed and the stretched skin used for reconstruction. However, the gain of additional tissue to be used for closure of the defect is much less than that with the conventional tissue expansion technique.

Fig. 69. Various types of tissue expanders with both integrated and external valves

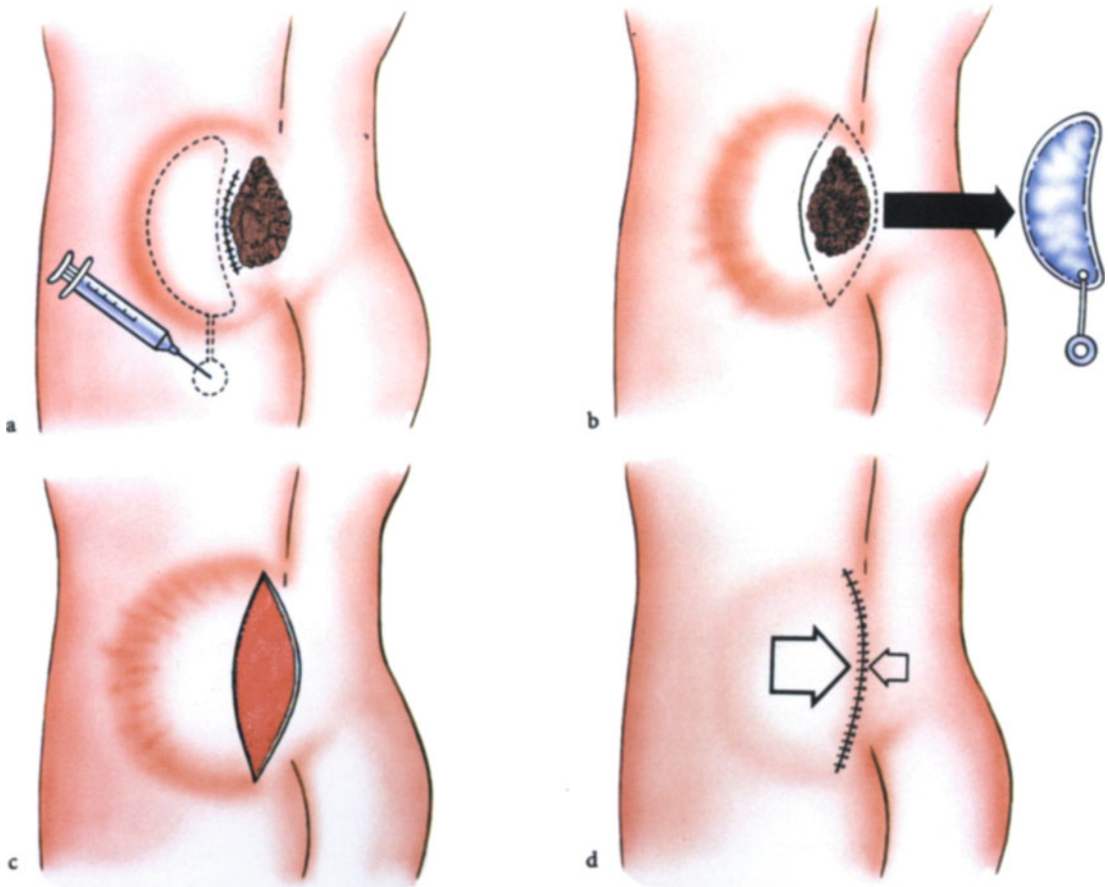


Fig. 70. Use of a tissue expander

a The tissue expander is inserted adjacent to the lesion which is to be removed, in this case a congenital melanocytic nevus. The device is periodically expanded by injecting sterile saline through the subcutaneous valve

b During surgery, not only is the lesion excised but also the expander is removed

c The lateral skin reservoir created by the expander is used to close the defect primarily

d Final result

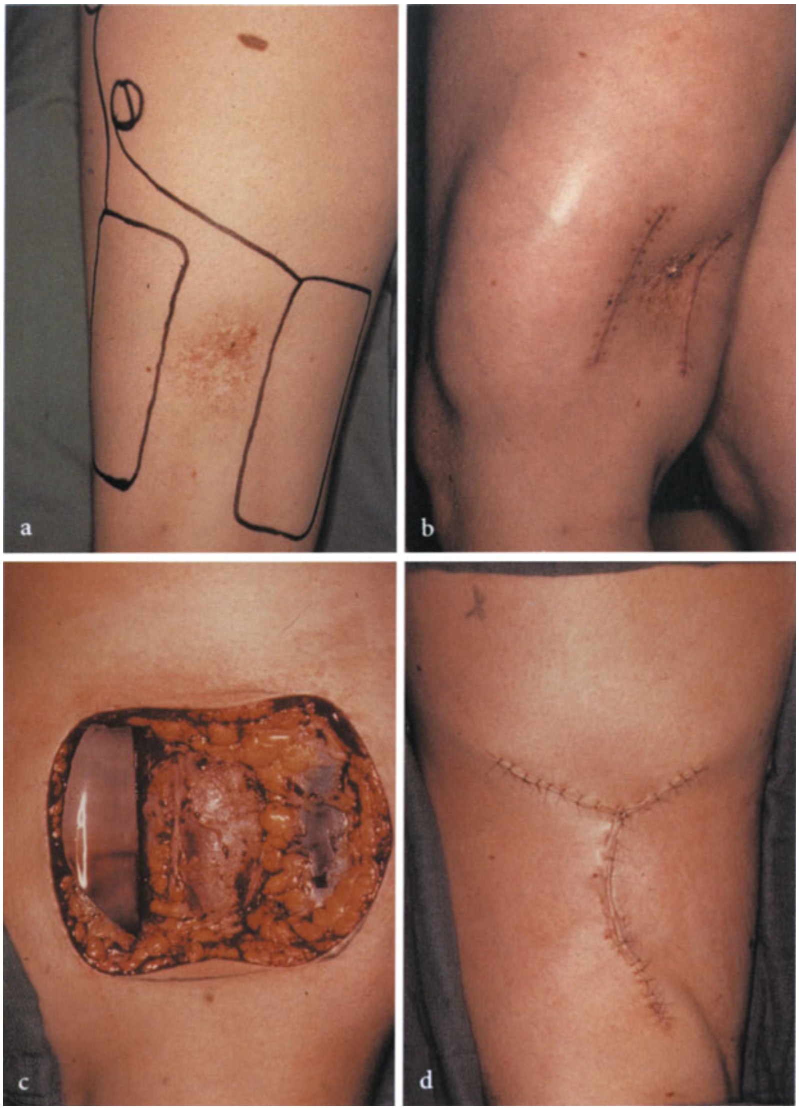


Fig. 71. Example of application of tissue expander
a Area of radiation dermatitis on upper leg. Diagram showing where two tissue expanders will be inserted
b Expanders in place for 7 weeks with weekly expansions in size by injections of sterile saline
c Excision of radiation dermatitis and removal of the expanders
d Final closure

10 Plastic Procedures: Grafts and Transfers

Grafts and more complicated flaps with a tubed pedicle designed for transfer to a distant site are employed when simple wound closure or a local flap is impossible or is unlikely to produce satisfactory results.

10.1 Skin Grafts

Free skin grafts require a healthy recipient site. Ideally, neither ligatures nor electrocautery has been used for hemostasis during the excision of the original lesion. We often prefer to precondition the graft site by covering it with polyurethane foam dressings for 8–14 days; the dressings are changed every 1–2 days. In this approach one creates a site composed of vascular granulation tissue, which increases the likelihood of a successful graft. The postoperative dressing is also crucial. This must be designed to produce gentle but uniform pressure across the entire graft in order to provide maximal contact between the transplanted tissue and its new vascular supply. When free grafts are used on the extremities, especially near joints, we prefer immobilization of the extremity with a splint or cast for 7–10 days.

10.1.1 Split-Thickness Skin Grafts

Split-thickness skin grafts consist of epidermis and the superficial part of the dermis, thus containing few if any appendageal structures (Fig. 72). They are divided into thin (up to 0.3 mm), medium (0.4–0.5 mm) and thick (about 0.6 mm) grafts. One can harvest split-thickness skin grafts either with a manual device or with a motor-driven electric dermatome. We prefer the latter because they produce a more uniform graft. We generally use an Aesculap dermatome, which can be adjusted to produce grafts 0.1–3.0 mm thick at increments of 0.05 mm, with widths of up to 8 cm (Fig. 73). Before harvesting the graft the donor site and the dermatome are first lubricated with an ointment. The donor skin is then stretched by the assistant, creating a level area for cutting. This tension is needed to produce uniform grafts. A minor catastrophe can occur when the successfully harvested graft rolls up into the rotating dermatome and is cut apart by the sharp blades. To avoid this, another assistant should hold the newly harvested graft under slight tension. The dermatome is then advanced forward slowly under light pressure (Fig. 74).

Every split-thickness graft shrinks after it is cut. This must be borne in mind as the graft is obtained so that adequate tissue is available. The graft is then harvested somewhat generously based upon the pattern

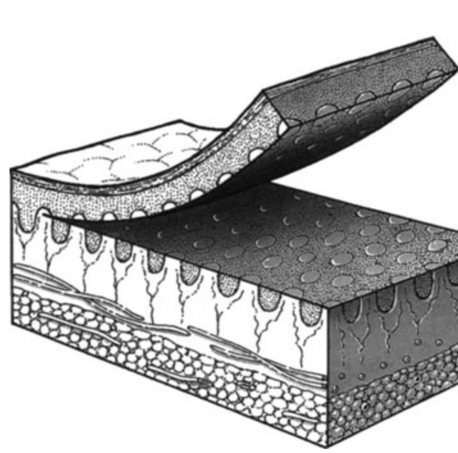


Fig. 72. Diagram showing the correct depth for harvesting a split-thickness skin graft; the cut is made through the papillary tips

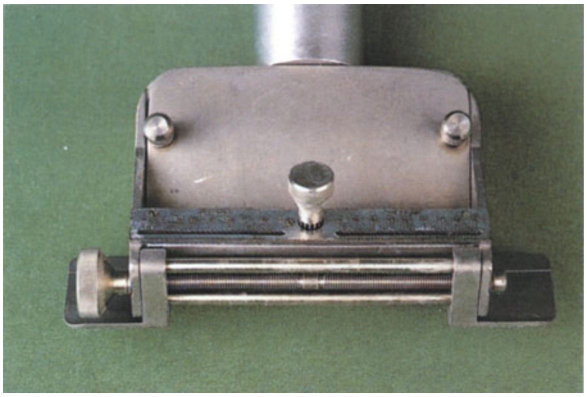


Fig. 73. Motor-driven dermatome which can be adjusted for depth and width of graft

made from the recipient site and sewed in under light tension with resorbable suture (Fig. 75). Alternatively, staples or fibrin glue can be employed.

We prefer to harvest our split-thickness skin grafts from the thigh, buttocks, or inner aspect of the upper arm. Generally the donor site heals by secondary intention with little scarring. Both the donor and recipient sites are treated with moist wound dressings. The recipient site should have a light pressure dressing to minimize motion and ensure adequate vascular nourishment.

The great advantage of split-thickness skin grafts is that they are more easily maintained, thus making necrosis relatively unlikely. A disadvantage is the approximately 20% rate of shrinkage, which occurs even if the donor site is immobilized, and the graft takes rapidly. In addition, split-thickness skin grafts are easily traumatized and therefore cannot be used in weight-bearing areas (soles of the feet) or when much manual pressure is expected (palms). Split-thickness skin grafts are not the repair of choice for the face as the match in skin texture and color between the donor and recipient sites is usually cosmetically inferior. In elderly patients we use split-thickness facial skin grafts only in those who cannot tolerate a more complicated procedure, in cases where no other flap or graft seems optimal, and in areas to provide temporary coverage until a more cosmetic procedure is later performed. On the other hand, split-thickness skin grafts are ideal for covering leg ulcers and larger defects on the trunk and extremities, especially after the recipient site has been appropriately conditioned.

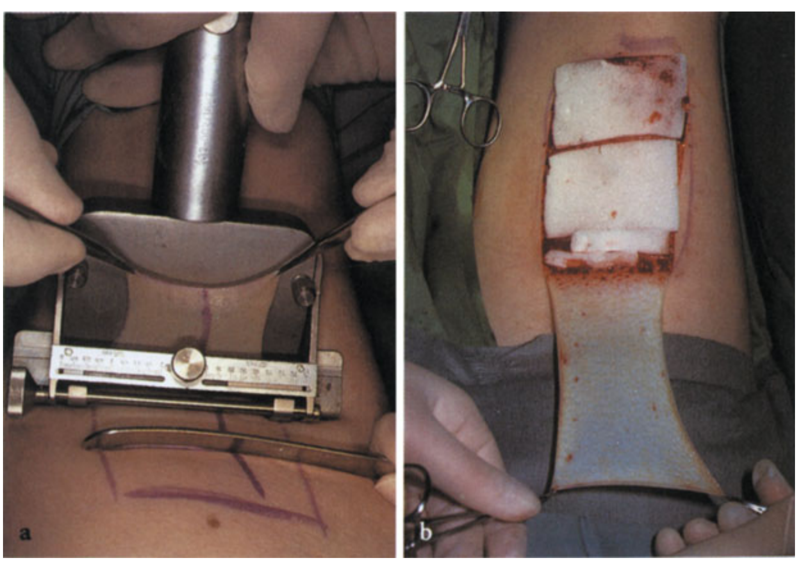


Fig. 74. Removal of a split-thickness skin graft from the thigh
a The operator advances the dermatome with uniform pressure while the assistant carefully harvests the graft
b Polyurethane foam pads are used to dress donor site; complete graft is still attached

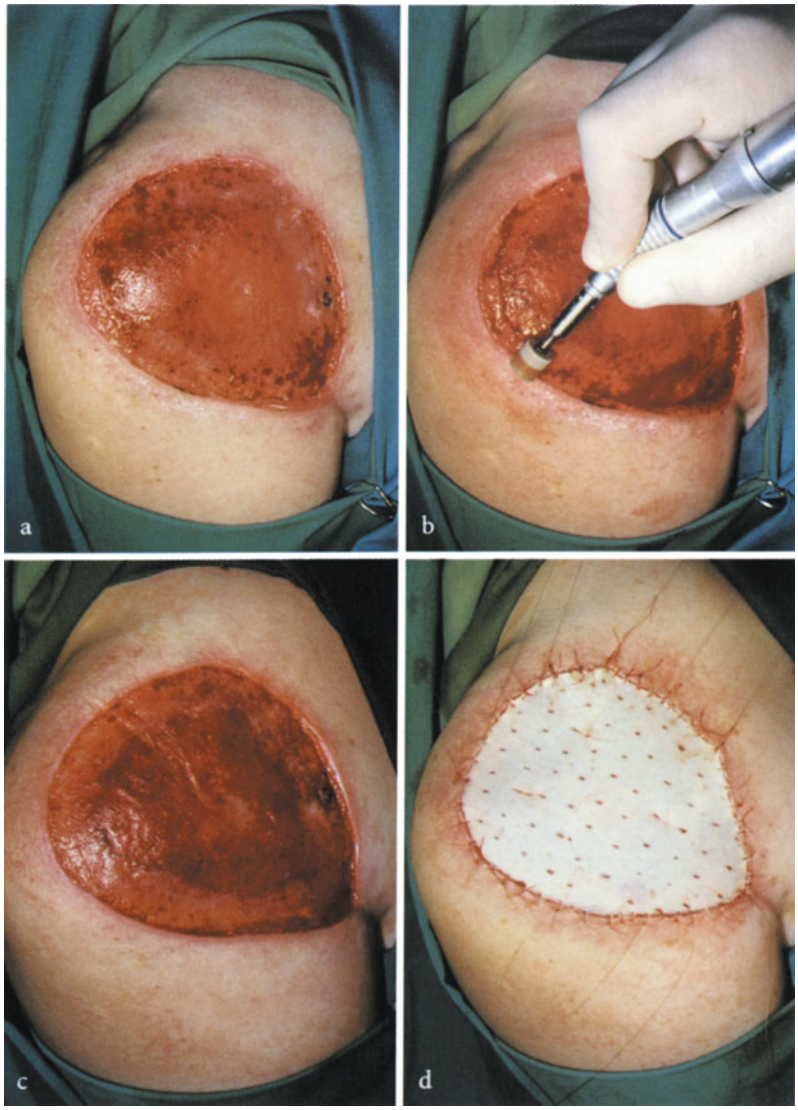


Fig. 75. Split-thickness skin graft
a The wound base has been conditioned after wide excision of a malignant melanoma
b Wound edges freshened up with a carborundum fraize
c Ideal wound condition for grafting
d Graft sewn in place. Tiny punctures made with scalpel to avoid hematoma formation. The dressing is tied in place over the graft with the long suture ends

Fig. 76. Preparation of mesh graft
a Split-thickness skin graft is passed through meshing machine
b Screenlike appearance of mesh graft after preparation

10.1.2 Mesh Grafts

Mesh grafts are created by mechanically dividing or cutting off split-thickness skin grafts to create a screen net or meshlike appearance. The meshing produces a donor graft capable of covering much larger areas than a simple split-thickness graft. This procedure has made possible the dramatic coverage often achieved in severely burned patients, but it has many other applications as well. After the mesh graft is applied, areas that are not covered by the graft reepithelialize by seeding from the graft.

A special instrument, the so-called skin graft mesher, is needed to cut mesh grafts. Initially a split-thickness skin graft is harvested and placed onto a hard plastic sheet with a pattern for cutting a mesh. The skin and plastic sheeting are then rolled through a device that resembles an old-fashioned washing machine wringer in order to cut out the pattern. The skin graft mesher cuts the skin graft into a geometrically defined form, while the expansion ratio is predetermined by the plastic skin carriers (e.g., 1:1.5, 1:3, 1:6; Fig. 76). Thereafter the skin can be spread out to cover the defect (Fig. 77). Increasing the amount of surface area gained produces a finer mesh which is less likely to take and requires more time to fill in. Once the mesh graft has been cut and fit into place, it is tacked with resorbable sutures and dressed just as a split-thickness skin graft. The main advantage is that wide areas can be covered; mesh grafts can be used only where cosmetic results are unimportant and rapid coverage is crucial, such as with large wounds on the trunk and extremities.

Fig. 77. Mesh graft
a Dermatofibrosarcoma protuberans removed from its typical shoulder location
b Considerable defect after excision to include fascia
c Coverage with mesh graft after wound conditioning
d Appearance after 1 year

10.1.3 Pinch Grafts (Reverdin)

This technique is a modification of the split-thickness skin graft. Here one cuts multiple small grafts by hand less than 1.0 cm in diameter, lifting the skin with a needle, and attempts to shave through the dermis. Obviously even an experienced surgeon creates grafts of varying depths. The grafts are then simply spaced about the defect (Fig. 78). This technique produces cosmetically unacceptable results at both the donor and recipient sites. Today its use is restricted primarily to treating leg ulcers.

Fig. 78. Pinch grafts
a The skin is lifted with a needle and the small graft shaved off
b The donor sites can be allowed to heal secondarily or converted to ellipses and closed with simple sutures
c Grafts are placed on the ulcer base
d Appearance after 3 months

10.1.4 Full-Thickness Skin Grafts

Full-thickness or whole skin grafts contain both the epidermis and entire dermis with appendages, extending down to the subcutaneous fat (Fig. 79). Thus the donor site does not heal primarily but must be closed with local techniques or covered with a split-thickness skin graft.

The two main advantages of full-thickness skin grafts are that they do not shrink, and they can be used on weight- or pressure-bearing surfaces. They take longer to become vascularized and are more likely to undergo necrosis and graft failure, especially if there is bleeding from the recipient bed. Again, the recipient site must be conditioned. Full-thickness skin grafts work best over flat bony surfaces and over firm, level areas such as the skull, forehead, and extremities.

Performing a full-thickness skin graft requires careful operative technique. The recipient site should be well vascularized, but absolute hemostasis must be achieved. The graft is then excised free-handedly with a scalpel, usually based on a pattern from the recipient site. Only rarely for larger grafts is a dermatome necessary. The graft is fixed in place under slight tension, using 5–0 or 6–0 vicryl sutures (Fig. 80). Sometimes it is helpful to place a few stitches in the center of the graft, as well as those at the periphery. This approach improves the fixation of the graft, but if bleeding occurs from one of the suture sites, the take is jeopardized. Fibrin glues also increase the fixation but can theoretically interfere with the diffusion of nutrients into the graft.

In dealing with full-thickness skin grafts the postoperative dressing is even more important than with split-thickness skin grafts. The moist dressing (e.g., fatty ointment plus impregnated gauze) must exert a gentle, evenly distributed pressure and also ensure that no motion occurs in the area for at least 5 days. Again, when working on extremities a splint or cast is a useful adjunct. If there is no clinical suggestion of a wound infection, the initial dressing can be left in place as long as 10 days.

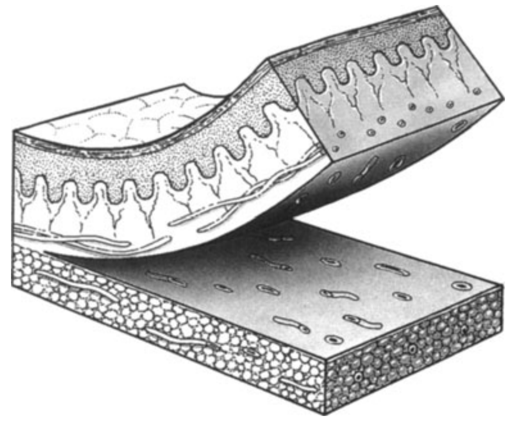


Fig. 79. Full-thickness skin graft. The skin is harvested at the dermal-subcutaneous border

In general, it is very difficult to anticipate the aesthetic quality of full-thickness skin grafts. Our long-term results have convinced us of this fact; they range from very good with the graft almost invisible to unsatisfactory without any clear correlation to operative technique.

10.1.5 Composite Grafts

Composite grafts contain two different tissues; in dermatologic surgery the most common composite graft contains skin and cartilage. They are used to reconstruct the nose and ears and occasionally to repair eyelid damage. The donor sites are the ear for repairing the nose, or contralateral ear, and the healthy eyelid. The composite graft is generally excised in a wedge-shaped form so that the defect can be closed primarily (Fig. 81). Composite grafts are even more sensitive to vascular problems than full-thickness skin grafts. Minimal seepage can lead to necrosis, while a far longer period of time is needed for the cartilage to become vascularized.

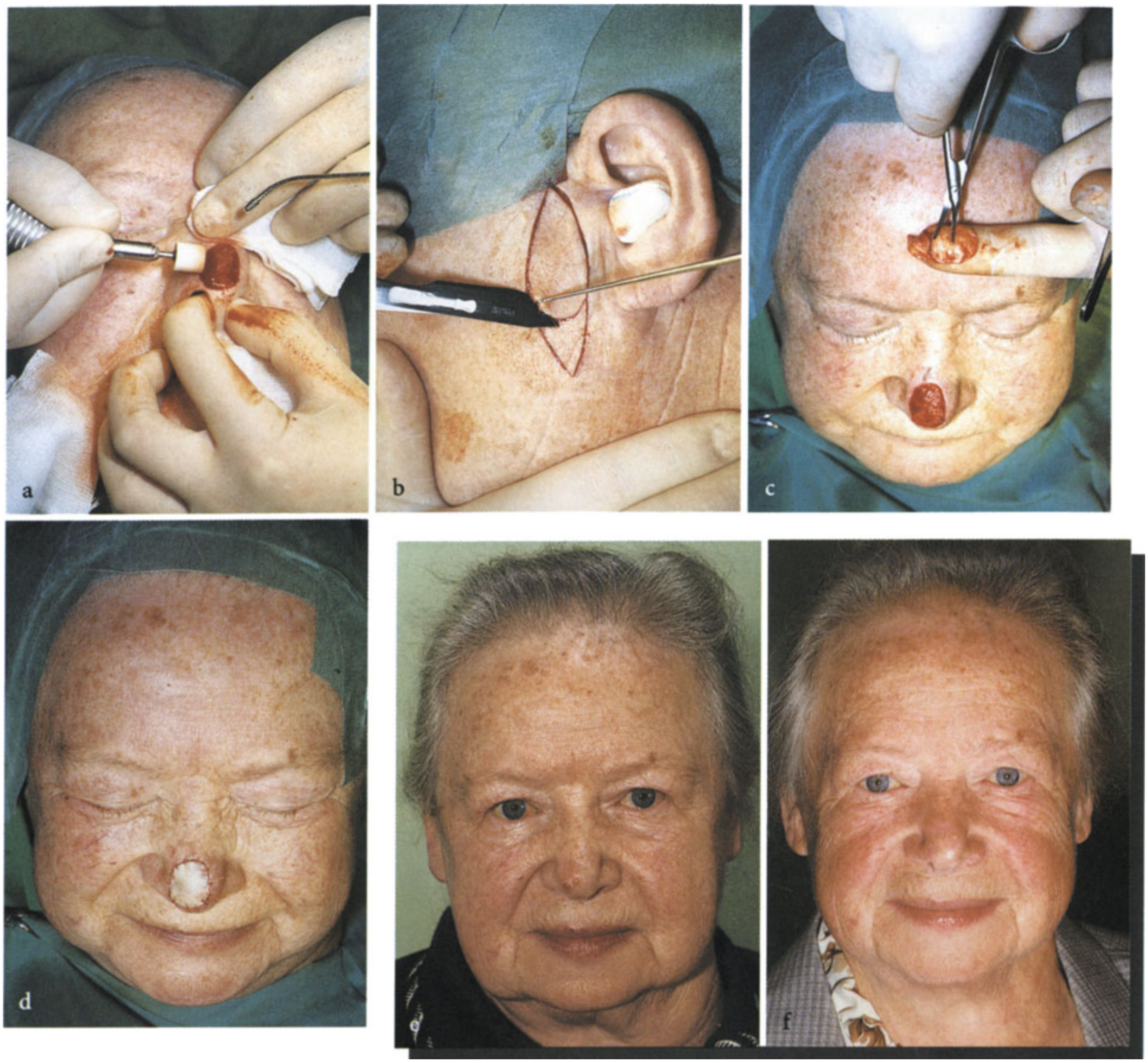
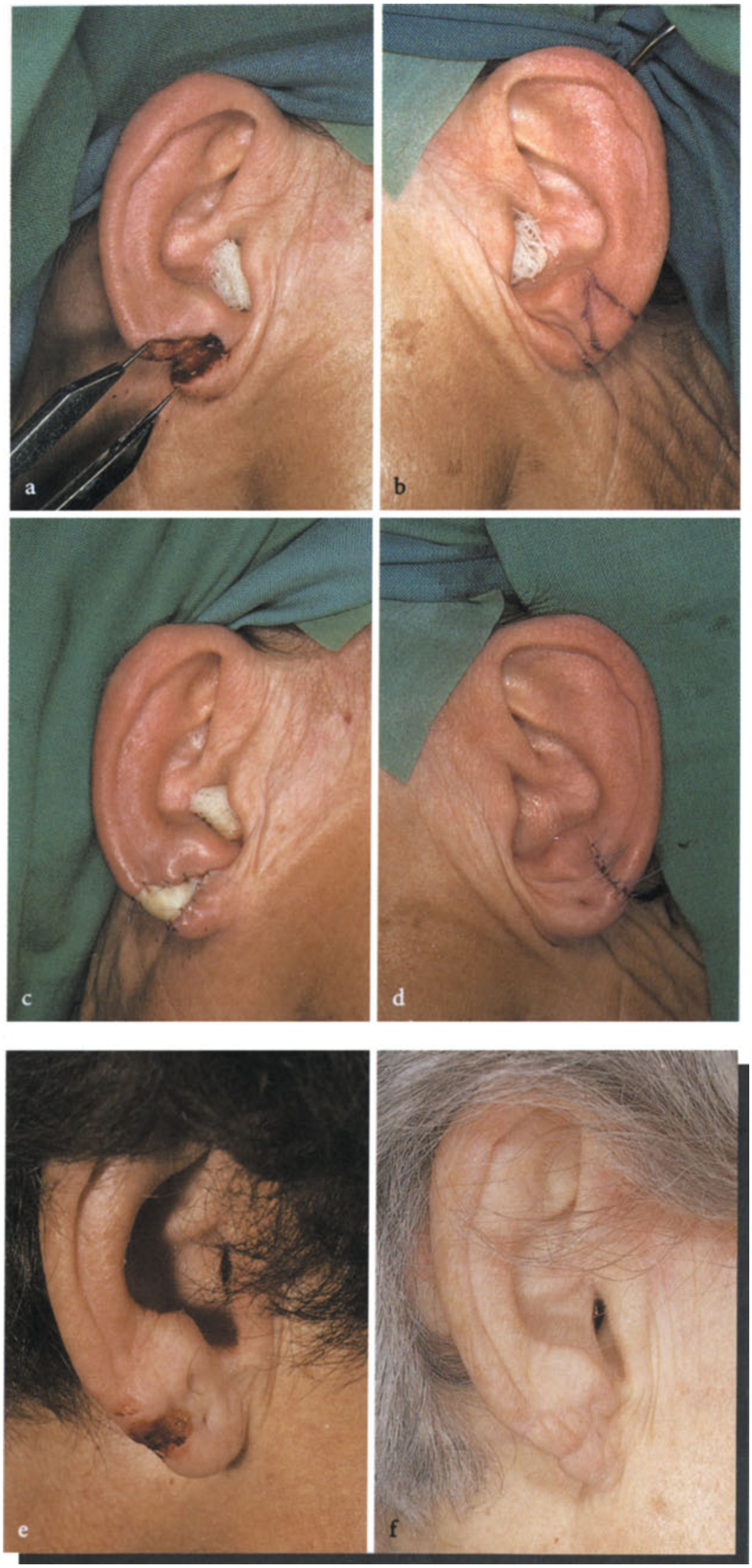


Fig. 80. Full-thickness skin graft
- **a** Freshening the defect prior to grafting
- **b** Harvesting the graft from the preauricular region
- **c** Defatting the graft
- **d** Well-fitted graft
- **e** Preoperative appearance: basal cell carcinoma of the nasal tip
- **f** Appearance after 2 years

Fig. 81. Composite graft
- **a** Defect of skin and cartilage after excising a basal cell carcinoma of the helix
- **b** Removal of a wedge-shaped graft including cartilage from opposite ear
- **c** Composite graft in place
- **d** Closure of donor site
- **e** Preoperative appearance
- **f** Appearance after 4 years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b
c
d
e
f

10.1.6 Fat Transplantation

Fat can be transferred relatively easily to fill in defects. We use fat transplantation to treat conditions in which there is a loss of skin volume, such as hemifacial atrophy and sunken scars following orthopedic procedures. The fat can be obtained by liposuction or simple excision, using the buttocks as a donor site. An incision is made over the defect, and the fat tissue is gently inserted into the wound. However, this technique is reserved for experienced and skilled surgeons, for if necrosis of the fat transplant occurs, the final result may be compromising. Microlipoinjection of smaller amounts of harvested fat can be used to fill small depressed scars.

10.2 Advanced Flaps

A variety of more complicated flaps can be used to produce very acceptable cosmetic results in difficult situations. These include tubed pedicle flaps, myocutaneous flaps, and microvascularized flaps. Each of these allow the surgeon to repair large and deep defects with tissue from a distant site. In general, such flaps lie beyond the needs and capabilities of dermatologic surgery and are best left to the plastic surgeons, to ear, nose, and throat surgeons, and to facial reconstructive surgeons.

10.2.1 Tubed Flaps

Here a flap with a tubed pedicle is developed and then transferred, occasionally with intermediate steps, to the recipient site. After 2–3 weeks, when the graft has taken, the nutrient pedicle is severed, and the flap is remodeled or thinned. The remnants of the pedicle can be used to repair the donor or intermediate site, or discarded.

10.2.2 Myocutaneous Flaps

Myocutaneous flaps are based on a combination of skin and muscle, acquiring their nutrients from the musculocutaneous vascular system. The two most common examples are the platysma flap and the deltopectoral flap. Either can be used to cover extensive facial defects. Multiple revisions are generally needed after the initial take of the flap.

10.2.3 Microvascularized Flaps

In this highly specialized procedure, a full-thickness skin graft is harvested with careful attention being paid to the local vascular supply. The donor vessels are anastomosed to feeder vessels in the recipient site, using microvascular surgical techniques. However, these techniques are rarely necessary in dermatologic surgery.

11 Electrosurgery

The terminology of electrosurgery is quite confusing. We find the nomenclature proposed by Goodman most acceptable. Table 10 is based on this work.

There are two basic types of electrosurgery. Electrocautery, or cautery, involves the use of a hot instrument, similar to a toaster filament or soldering iron, to damage tissue. No electric current enters the patient, and the procedure is therefore safe for patients with pacemakers. Small battery-operated ophthalmologic units are currently in wide use for hemostasis. In addition, the Shaw scalpel is available for cautery cutting.

All other electrosurgery involves high-frequency alternating current and must be used with a large neutral grounding electrode. The tip of the instrument is "cold," but the electric current delivered to the tissue encounters resistance, producing heat and tissue damage. There are four types of high-frequency electrosurgery: electrosection or electrocutting, electrocoagulation, electrodesiccation, and electrofulguration (see below). The patient must be carefully positioned on the table so that there is no contact with metal table parts or anesthesia equipment (Fig. 82). The presence of a pacemaker is a relative contraindication to high-frequency electrosurgery. If the surgery cannot be performed without electrosurgery, one must contact the pacemaker manufacturer and the electrosurgical device manufacturer. The various instruments available for electrosurgery are shown in Fig. 83.

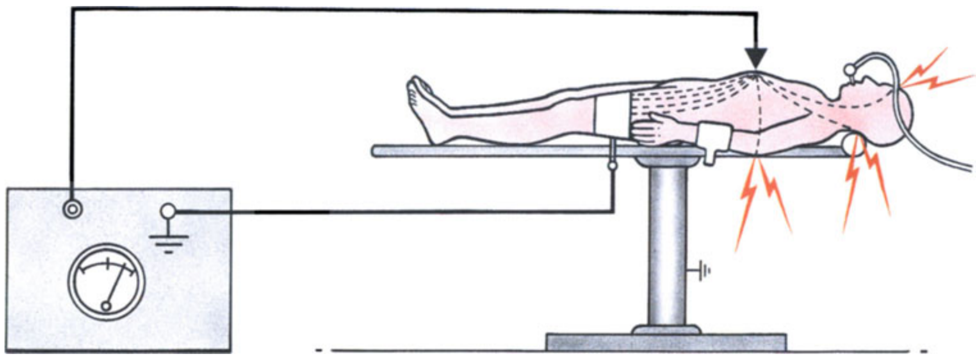
11.1 Electrosection or Electrocutting

Electrosection or electrocutting uses a high-voltage, high-amperage current to separate tissue (Fig. 84a). Since a pure cutting current provides almost no hemostasis, most devices produce a combination of cutting and coagulation currents. Fine-needle or wire loop electrodes or very thin blade electrodes are used to produce a fine incision with minimal damage to adjacent tissues. The blade electrodes tend to produce too much heat. Since tissues handled with electrocutting have delayed healing, it is often wise to incise the skin with a scalpel

Table 10. Electrosurgery

	Tip	Current	Mono- or biterminal	Tissue touched	Degree of damage
Electrocautery	Hot	Direct	Mono-	+	++++
Electrocutting	Cold	Alternating HF	Bi-	+	++++
Electrocoagulation	Cold	Alternating HF	Bi-	+	+++
Electrodesiccation	Cold	Alternating HF	Mono-	+	+
Electrofulguration	Cold	Alternating HF	Mono-	–	+

HF, High-frequency



△
Fig. 82. Possible dangers during electrosurgery. Patient is inadequately grounded and may have contact with metal table or anesthetic instruments

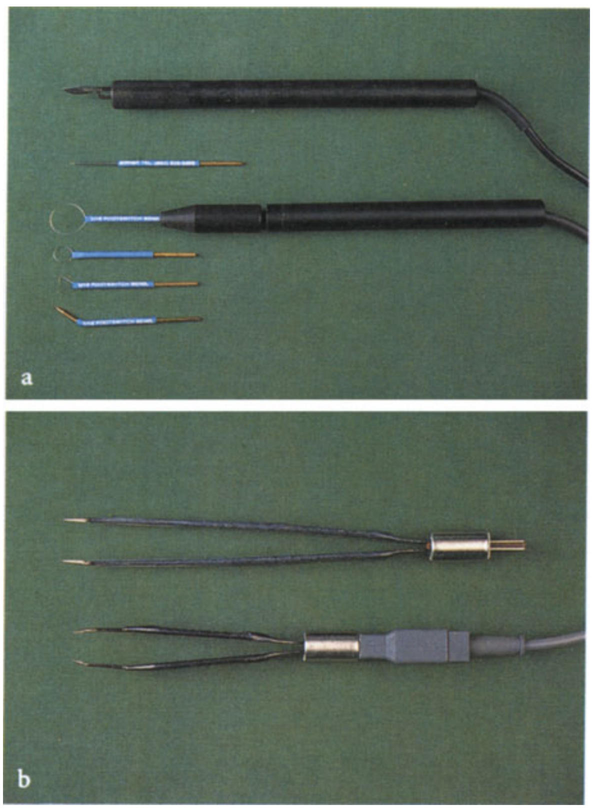
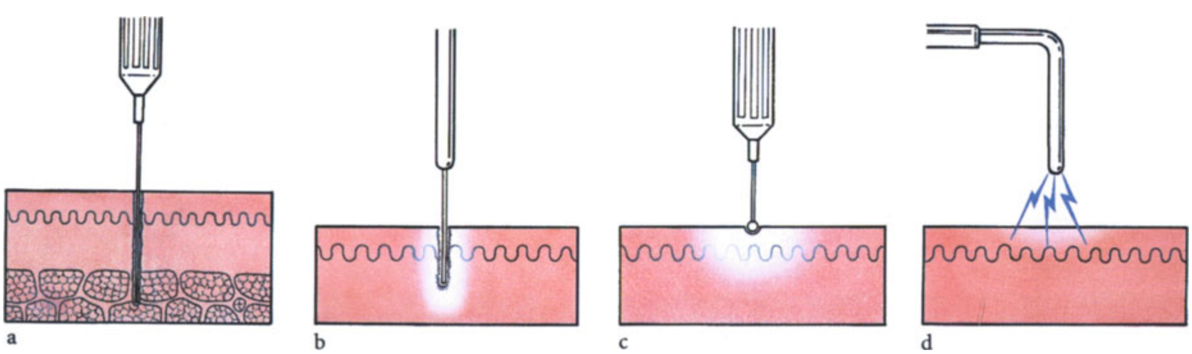


Fig. 83. Instruments for electrosurgery
a Handpiece and various needles and hot loops
b Bipolar forceps, useful for hemostasis

Abb. 84. Types of electrosurgery
a Electrosection, or electrocutting
b Electrocoagulation
c Electrodesiccation
d Electrofulguration
▽



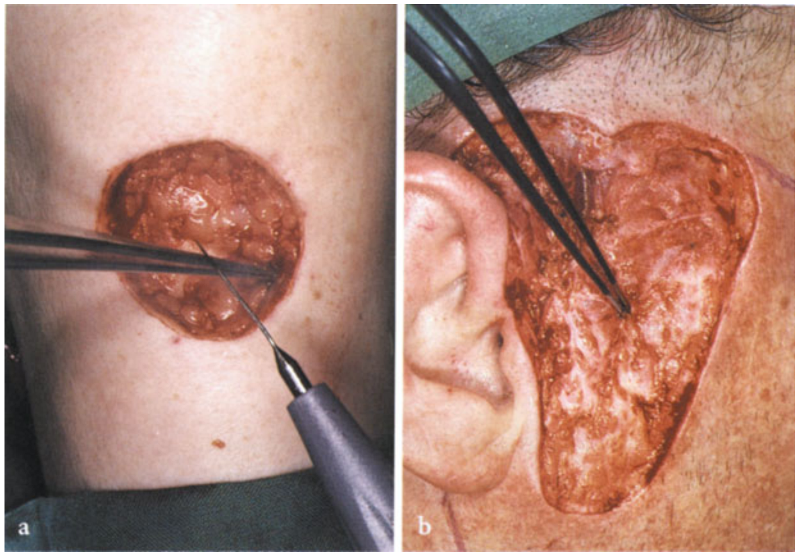


Fig. 85. Electrocoagulation
a Using the surgical forceps to seal vessels
b Using a bipolar forceps

Abb. 86. Wire loop electrocutting
a Multiple perianal condylomata acuminata. The lesions are being removed by passing hot cautery loop across the base
b Appearance after treatment has been completed. Hemostasis is obtained by the use of the cautery loop, as well as by tying off more persistent bleeders

and then switch to electrosection for the deeper, bloodier surgery, such as in the removal of a large tumor. When electrocutting is used to perform shave excisions of seborrheic keratosis or warts, one must be careful not to cut deep into the dermis as this produces unsatisfactory scars. Wire loop or sling electrocutting is frequently used to treat perianal condylomata (Fig. 86). Because of the large amount of current used particular attention must be paid to properly grounding the patient.

11.2 Electrocoagulation

Electrocoagulation uses a low-voltage, high-amperage bipolar current to thermally damage relatively deep tissue, especially vessels (Fig. 84b). One can employ bipolar forceps when coagulating vessels or clamp the bleeding vessel with a forceps which is then touched with the electrocoagulation needle. This technique works poorly with electrodesiccation/electrofulguration devices. The higher energy of electrocoagulation is more effective when working in a bloody field (Fig. 85). A variety of active electrodes are available, including needles, ball-shaped electrodes, and flat blades. One must be sure to keep the electrode clean because a crust formed from blood and tissue fragments interferes with the transfer of current and leads to the formation of sparks.

11.3 Electrodesiccation

Electrodesiccation and electrofulguration differ only in degree. Each involves a monoterminal active electrode which transfers current to the skin where it is converted into heat. The low energy involved limits tissue damage. In electrodesiccation the electrode, usually a needle or a ball-shaped electrode, comes into contact with the tissue (Fig. 84c). Disposable needles are available as well as adaptors to allow the use of metal hypodermic needles.

In North America electrodesiccation is often combined with curettage in the treatment of seborrheic keratoses, verrucae, molluscum contagiosum, actinic keratoses, small basal cell carcinomas, and occasionally other tumors. When basal cell carcinomas are treated, three cycles of curettage and electrodesiccation (or electrofulguration) are traditionally performed. The disadvantages of this technique are a lack of histologic control of the surgical margins and unsatisfactory scarring. Small vascular lesions, skin tags, and other tiny lesions may also be treated effectively.

11.4 Electrofulguration

Here the electrode does not come into contact with the skin; instead high-energy sparks jump from the electrode to burn the tissue (Fig. 84d). Otherwise it is identical to electrodesiccation. In fact, most surgeons employ both techniques in any given case, sometimes touching the tissue and sometimes letting a spark jump. Electrofulguration is slightly less easy to control precisely and, of course, produces even more superficial damage.

12 Laser Therapy

The laser is an essential part of the dermatologic armamentarium today, with a wide variety of instruments available for an expanding list of indications. The first industrial laser was developed in 1960, and the first use of the laser in dermatology was described by Goldman in 1967. If the correct laser is chosen and used appropriately, one can achieve highly selective tissue destruction with excellent cosmetic results.

12.1 Basic Principles

The term laser is an acronym for "light amplification by stimulated emission of radiation." Thus, while the basic principle in all lasers is the stimulated emission of electromagnetic radiation, each of the components of the laser plays a role in determining exactly what type of radiation is emitted. In turn, the physical properties of the radiation dictate the uses, whether they be medical or industrial.

- The gain medium (e.g., argon ions, yttrium-aluminum-garnet (YAG) crystals, dye molecules) is stimulated when some sort of energy raises electrons to a higher energy level. As these electrons then return to a resting state, photons or packets of energy are released. The further application of energy to the medium creates a chain reaction producing more photons. The medium determines the wavelength of the laser.
- The energy source (electrical discharge from gas or optical rays) produces a steady input of energy, ensuring that the molecules of the medium are regularly stimulated to higher energy levels. This approach is known as "pumping."
- The optical resonator consists of two coaxial mirrors which produce a cascadelike increase in the strength of the waves and forces them into a compact parallel beam.

A laser beam is characterized by the following features: (a) monochromatic: contains a single wavelength or a limited number of discrete wavelengths, (b) high intensity, (c) collimated: all beams are parallel, and (d) coherent: the waves are emitted in phase with one another.

A laser can also be distinguished by the intervals into which energy production are divided. The continuous wave laser is pumped by a continuous supply of energy and produces a steady emission beam which is manipulated by the surgeon to produce a beam for a defined interval. A pulsed laser is pumped with energy over small periods of time and produces brief high-energy impulses. In the quality (Q) switched instruments the pumped energy is collected for milliseconds in the laser medium and then released over nanoseconds as a giant impulse. A superpulsed laser gives off a series of giant impulses in intervals similar to a continuous wave laser.

The tissue damage produced by a laser is determined by the energy of the beam (in W/cm^2) and the duration of exposure. Thermal damage can range from edema to tissue coagulation (60°C) and carbonization (150°C) to vaporization (300°C). Vaporization can be very focused, in order to cut, or defocused, allowing more widespread superficial tissue removal. Impulses of a very short duration such as the millisecond emissions of a pulsed laser or the nanosecond releases of a Q-switched laser produce primarily mechanical damage without significant thermal effects.

Finally, the wavelength of the laser beam is crucial. Selective absorption in tissue, for example, hemoglobin, melanin, and tattoo pigment, is possible if the beam wavelength coincides with an absorption band of the target tissue. The medium determines the wavelength of the laser.

12.2 Argon Laser

The argon laser (Fig. 87) has a gain medium of argon gas ions which produces radiation in a continuous fashion. The wavelengths are 514 nm (green) and 488 nm (blue); both are relatively well absorbed by melanin and hemoglobin. The argon laser is therefore best suited for treating superficial pigmented and vascular lesions (Fig. 88). The depth of coagulation is usually about 1 mm, but special techniques such as cooling the skin surface and sharp focusing of the beam permit a depth of 3–4 mm to be obtained. The principal indications for the argon laser are nevus flammeus, telangiectases, spider nevi, hemangiomas, and venous lakes (Figs. 89–91). Less common indications include lymphangiomas, eruptive angiomas, angiokeratomas, angiofibromas, and a variety of other vascular proliferations. The treatment generally requires a number of sessions, during which the entire lesion is completely destroyed by the random application of laser beams. The individual impulses must be spaced far enough apart to avoid cumulative thermal damage to the tissue. "Random" here does not mean erratic or casual but instead indicates that the surgeon carefully covers the entire lesion without the aid of a mechanical grid. New developments employ a mechanical system (e.g. hexascan) to speed the procedure and to achieve a standardized grid.

The argon laser can be used in a defocused mode to vaporize superficial benign or premalignant tumors. Although it is possible to treat both seborrheic keratoses and verrucae with the argon laser, other methods are generally preferable.

Fig. 87. Argon laser
a Handpiece
b Complete unit with control panel and foot control

The major complications of the argon laser are hypo- and hyperpigmentation, which develop in 10–15% of cases. Generally the pigmentary changes are transient and improve with time. Much less often hypertrophic scars or even atrophic scars are produced. The crusts which appear shortly after the treatment as a result of thermal damage heal rapidly. While they are present, even minor mechanical irritation may lead to bleeding, but this can readily be stopped with simple pressure.

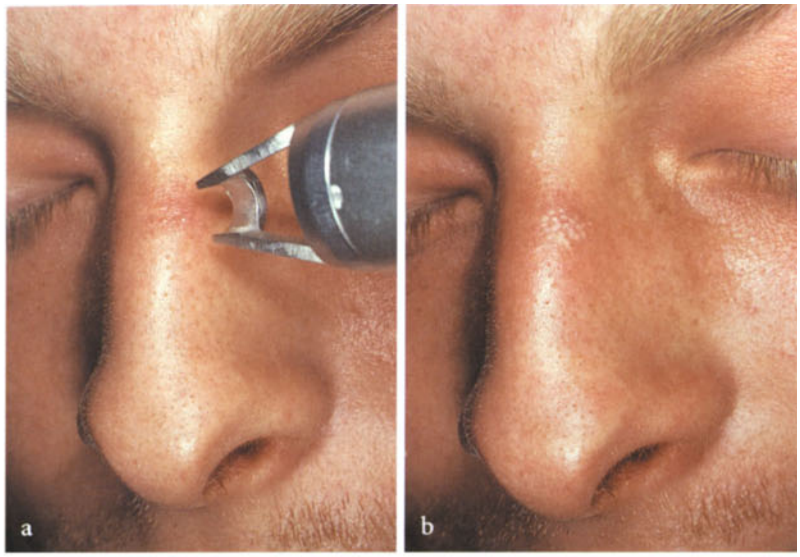


Fig. 88. Coagulation with the argon laser
a Unit is applied to skin
b Blanching effect

Fig. 89. Nevus flammeus: treatment with argon laser
a Preoperative appearance
b Appearance after multiple treatments

Fig. 90. Capillary hemangioma: treatment with argon laser
a Preoperative appearance
b Appearance after multiple treatments

Fig. 91. Venous lake: treatment with argon laser
a Preoperative appearance
b Appearance after 2 treatments

12.3 Neodymium-YAG Laser

The neodymium-YAG laser (Fig. 92) consists of a YAG crystal in which neodymium ions are set as the active medium. The wavelength produced is 1060 nm, in the invisible infrared region. In contrast to the argon laser, these emissions penetrate relatively deeply into the skin, reaching a depth of 5–6 mm. The neodymium-YAG laser is therefore used primarily for deep coagulation and destruction. Because of its intense thermal effects the skin surface must be cooled (Fig. 93). Large, deep vascular lesions such as large hemangiomas, the deep component of a nevus flammeus, and venous lakes are the principal indications for this laser (Fig. 94). In addition, it can be used to vaporize a variety of exophytic lesions such as verrucae (Fig. 95).

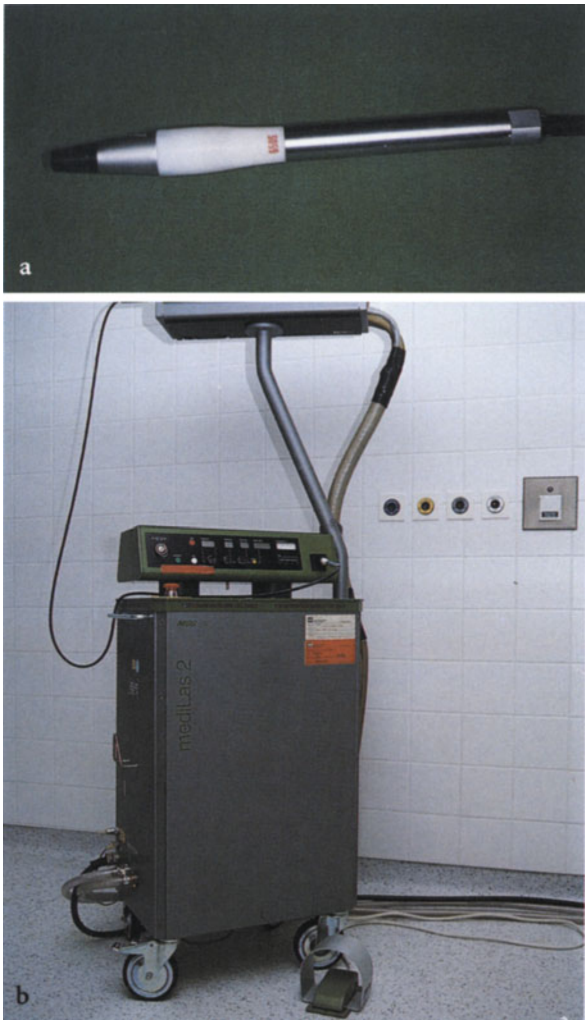


Fig. 92. Neodymium-YAG laser
a Handpiece
b Complete unit

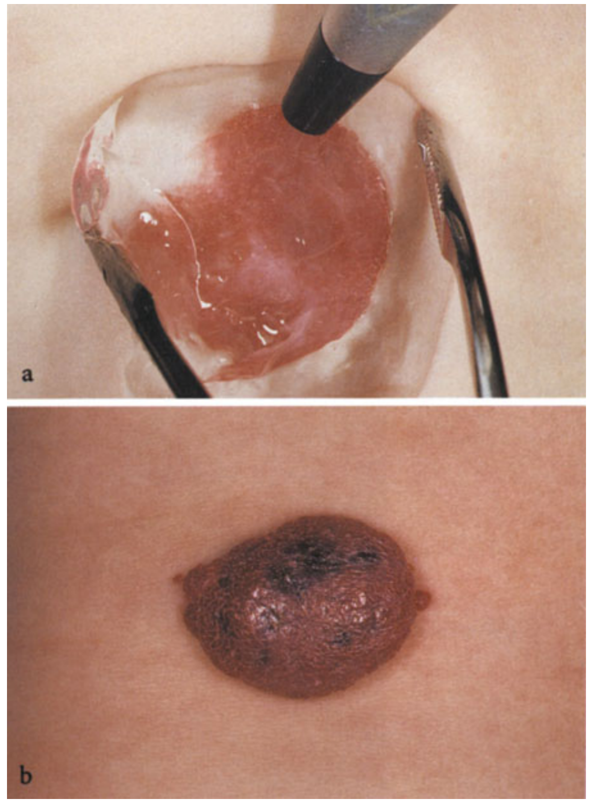


Fig. 93. Cooling the skin surface when using a neodymium-YAG laser
a Lesion is covered with ice cube through which the beam is directed
b *Dark* points, areas of deep coagulation in the hemangioma

Fig. 94. Cavernous hemangioma: treatment with neodymium-YAG laser
a Preoperative appearance
b Marked regression after many years of treatment

Fig. 95. Verruca vulgaris: vaporization with neodymium-YAG laser
a Preoperative appearance
b Appearance immediately after vaporization
c After 1 week
d Scar-free healing

12.4 CO_2 Laser

The gain medium of the CO_2 laser is carbon dioxide gas (Fig. 96). The output of the CO_2 laser is more variable than that of the argon or the neodymium-YAG laser. Generally impulses with a wavelength of 10,600 nm are used. This invisible wavelength is strongly absorbed by water, and regardless of the nature of the lesion therefore tissue steams when treated with this laser. When the beam is highly focused to 0.2 mm, the instrument can be used as a very fine cutting device with minimal thermal damage. This allows great precision with minimal blood loss and maximum tissue preservation. In the defocused mode with a 2–3 mm spot the CO_2 laser is used to remove superficial larger lesions. Here the major indications are in treating verrucae, condylomata, leukoplakia (Fig. 97), epidermal nevi, and rhinophyma, as well as superficial tattoos. Unfortunately the CO_2 laser produces considerable scarring, which limits its use, especially in removing tattoos.

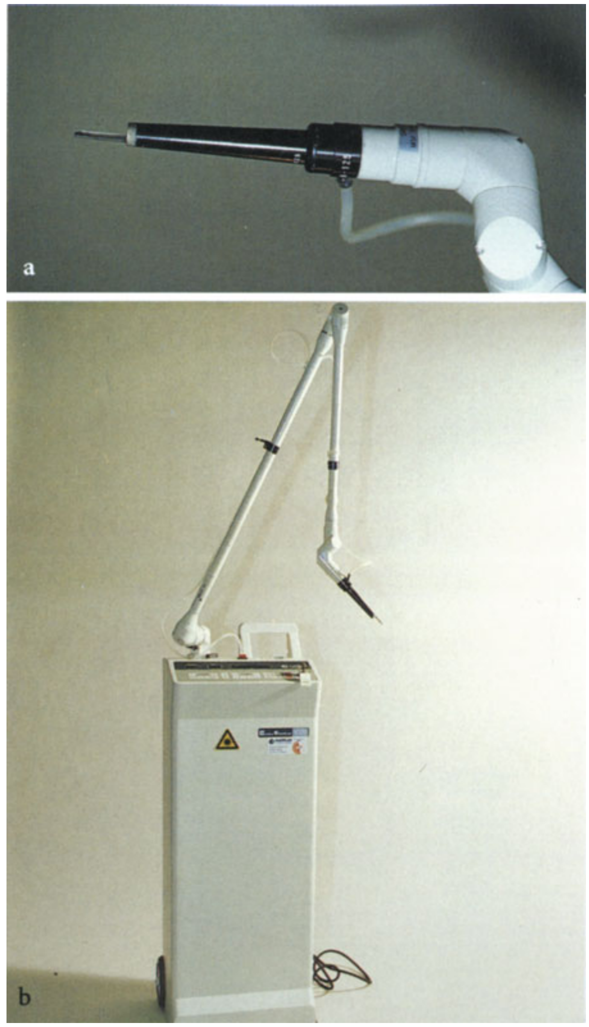


Fig. 96. CO_2 laser
a Handpiece. Note that it is articulated and somewhat bulkier than the handpieces shown in Figs. 87 and 92
b Complete unit

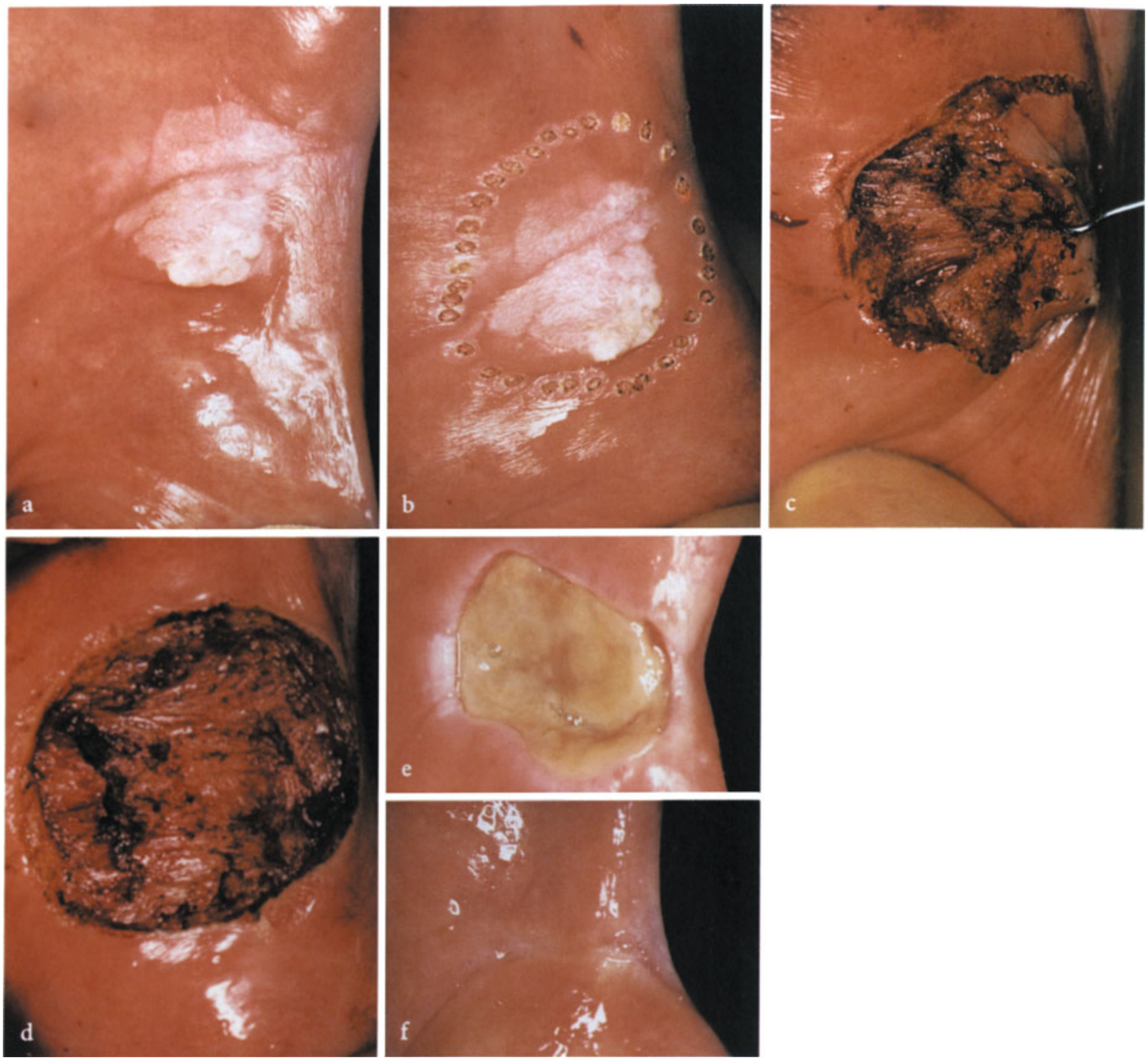


Fig. 97. Excision with the CO_2 laser
a Leukoplakia of buccal mucosa
b Borders of excision
c Note the bloodless operative field
d Final defect
e Appearance after 12 days
f After 2 months

12.5 Tunable Dye Laser

The gain medium for tunable dye lasers are large dye molecules which are dissolved in the appropriate medium. The type of dye determines the wavelength of the resultant beam. However, the complex dye molecules have a wide range of excitation states and produce a wide, almost continuous emission band. Depending on the dye, a range between 380–1000 nm can be covered. To restrict or tune this band (hence the term "tunable dye" laser) a prism in the laser resonator is used to selectively transmit a region of about 50 nm. By varying the dye and adjusting the prism one can therefore tune the laser to some extent, but this is a laborious and expensive process. Finally, a tunable dye laser produces almost no thermal damage.

Tunable dye lasers have found their greatest use in treating vascular lesions. They are set at 577 or 588 nm, where there is excellent absorption by hemoglobin and relatively little by melanin, thus maximizing vascular destruction. Even pale nevi flammei, which are hard to treat with an argon laser, respond well to the tunable dye laser. This device can be used to treat port-wine stains and other vascular malformations very early in life when the lesions are small and light colored, rather than waiting for them to enlarge and darken. The risk of scarring is minimal, making the tunable dye laser better for periorificial vascular lesions. Hemangiomas have also been treated effectively with tunable dye lasers. Only the high initial cost and expensive, time-consuming maintenance (up to 1 h of maintenance per hour of use) have limited the acceptance and widespread availability of tunable dye lasers.

12.6 Other Lasers

A host of other laser types are also available, various types being introduced into the dermatology at a rate which exceeds the publication deadlines of any text. We consider here only three of the newest lasers. The ruby laser at 694 nm is absorbed selectively by melanin and pigmented materials. Traumatic and cosmetic tattoos are easily treated, virtually without scarring, as the pigment particles almost explode. Dermal melanocytic proliferations such as the nevus of Ota, the nevus of Ito, and similar lesions can also be treated. Solitary dermal pigmented lesions, such as blue nevi, are still best treated by excision in order to provide material for histologic evaluation.

The copper vapor laser is pulsed to produce impulses at 510 nm and 578 nm which are repeated so rapidly that they approach a continuous-wave laser. As the radiation is better absorbed by hemoglobin than melanin, vascular lesions are best treated.

Finally, the emissions of the erbium-YAG laser are absorbed primarily by water, producing very exact tissue destruction with little thermal damage. Both epidermal nevi and tattoos seem to respond well to this approach.

13 Cryosurgery

Cryosurgery has a wide range of indications in treating benign, premalignant and malignant lesions.

Possible Indications for Cryosurgery

- Actinic keratosis
- Verruca
- Keloid
- Granuloma annulare
- Hemangioma
- Keratoacanthoma
- Bowen's disease
- Basal cell carcinoma
- Squamous cell carcinoma
- Kaposi's sarcoma (early lesions)
- Cutaneous metastases from malignant melanoma (palliative)

Cryotherapy is the treatment of choice in most cases of verrucae and actinic keratoses. The cryosurgical treatment of cutaneous malignancies must be regarded as an alternative method, since surgical excision provides histologic control and a more rapidly healing wound. In addition, cryosurgery of tumors requires additional surgical experience and appropriate equipment even to be considered as an approach. Larger benign lesions such as keloids and hemangiomas usually heal with unsatisfactory scars. Granuloma annulare responds to many types of minor trauma including light freezing. The early flat lesions of Kaposi's sarcoma in AIDS can often be treated simply with cryotherapy.

On the other hand there are certain conditions in which cryosurgery is contraindicated.

Contraindications to Cryosurgery

- Sclerosing basal cell carcinoma
- Tumors of the scalp
- Tumors of the nasal region in young patients
- Invasive and tumors of the periorbital region
- Invasive tumors of the external ear
- Connective tissue disorders
- Raynaud syndrome or disease
- Cold urticaria
- Cryoglobulinemia

13.1 Principles of Cryobiology

The destruction of tissue by cryogens is a complex, poorly understood event. Water clearly plays a central role. As ice crystals are formed, the electrolyte concentration within the cell changes, and the membrane structure is altered. Both the rate of freezing and the rate of thawing contribute to the degree of tissue damage. When freezing is very rapid, crystals form both within and outside the cells simultaneously; this phenomenon is known as homogenous nucleation. It results in collapsed dehydrated cells with a toxic increase in electrolyte concentrations. As the tissue is allowed slowly to thaw, multiple cycles of crystal formation and destruction occur, coupled with electrolyte changes, which all combine to cause cell death. Since not all cells die after the first freeze-thaw cycle, it is generally repeated.

The practical requirements for effective cell killing by cryotherapy are: (a) rapid freezing at a rate higher than 100°C/min, (b) tissue temperature below −25°C, (c) slow thawing at a rate of 10 °C/min or less, and (d) two freeze-thaw cycles.

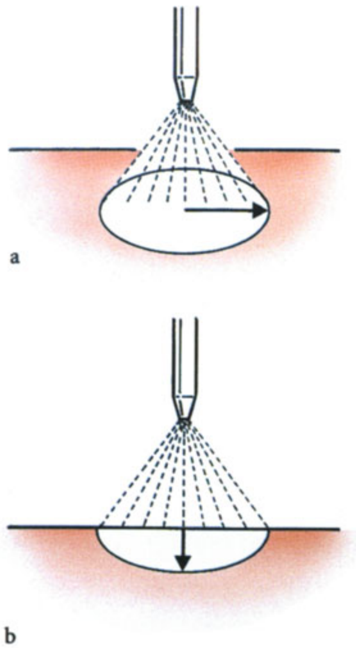


Fig. 98. Cryosurgery using an open spray
a Circular field of spray
b Penetration is roughly half of the radius seen on the surface

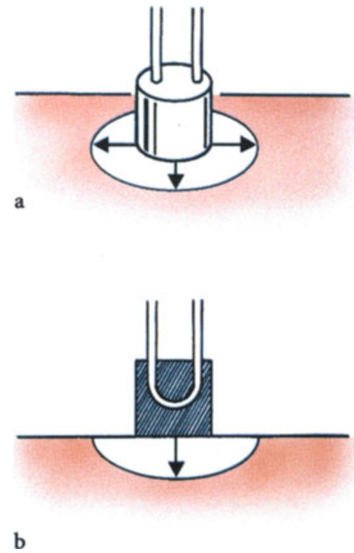


Fig. 99. Cryosurgery using a thermocouple
a Placing the thermocouple
b Width and depth of freezing

13.2 Methods of Cryosurgery

Both carbon dioxide ice (–78.9°C) and liquid nitrous oxide (laughing gas; –89.7°C) were used in the past for cryosurgery. However, they do not achieve a sufficiently rapid freezing rate and are no longer used. Liquid nitrogen with a temperature of –195.8°C has become the standard agent. Liquid oxygen and liquid air reach comparable temperatures but carry too high a risk of explosion.

While only one product is widely used, a multitude of devices are available to deliver it to the skin surface. The traditional method of dipping a cotton-tipped applicator into a cup of liquid nitrogen and then applying it rapidly to the skin is generally inadequate; too little liquid is transferred, and freezing is therefore slow and superficial. This traditional technique is applicable only for small verrucae or similar lesions. One must choose between a spray device (Fig. 98) and contact probes or sounds (Fig. 99). Spray units freeze the tumor rapidly, even when it has an irregular surface, in which case a probe is ineffective. We rarely use copper sounds and then only in treating mucosal lesions, such as in the mouth or vagina.

When treating tumors, histologic control of margins is not possible. One must have a biopsy diagnosis prior to embarking on the case. We request that the pathologist measure the tumor depth. After completing a case and allowing healing to occur we often perform a second biopsy as a follow-up to confirm that a cure has been obtained.

Thermal probes placed at the base of the lesion help to ensure that an adequate killing temperature has been achieved throughout the tumor. However, their placement is difficult to standardize. In addition, in some body sites it is possible simply to freeze through the tissue, such as on the ear or nose. On the forehead and scalp one can also freeze until the tumor is fixed to the underlying tissue. With spray devices one can obtain a temperature of –40°C to a depth of

Fig. 100. Cryosurgical treatment of a large area with multiple actinic keratoses
a Preoperative appearance, with extent marked
b Freezing with spray application
c Tumor and peritumoral region are frozen. To achieve the desired margin of safety one must freeze beyond the clinical border
d Appearance after 1 year

about 12 mm; contact freezing achieves this temperature at a depth of only about 4 mm.

The rapid rate of freezing (−100°C/min) which is required is best obtained with the open spray technique. Initially one sprays continuously until a white pearly surface is obtained. Thereafter intermittent spraying is sufficient to maintain the effect for the duration of the freezing time. We freeze actinic keratoses for 1–2 x 15–20 s; basal cell carcinomas require 2 x 40–60 s. These recommendations are of course not absolute; they must be adjusted depending on the size and depth of the tumor and on individual differences. Sometimes a third freeze-thaw cycle is needed.

The neighboring tissue can be protected by forms or molds. These are needed only

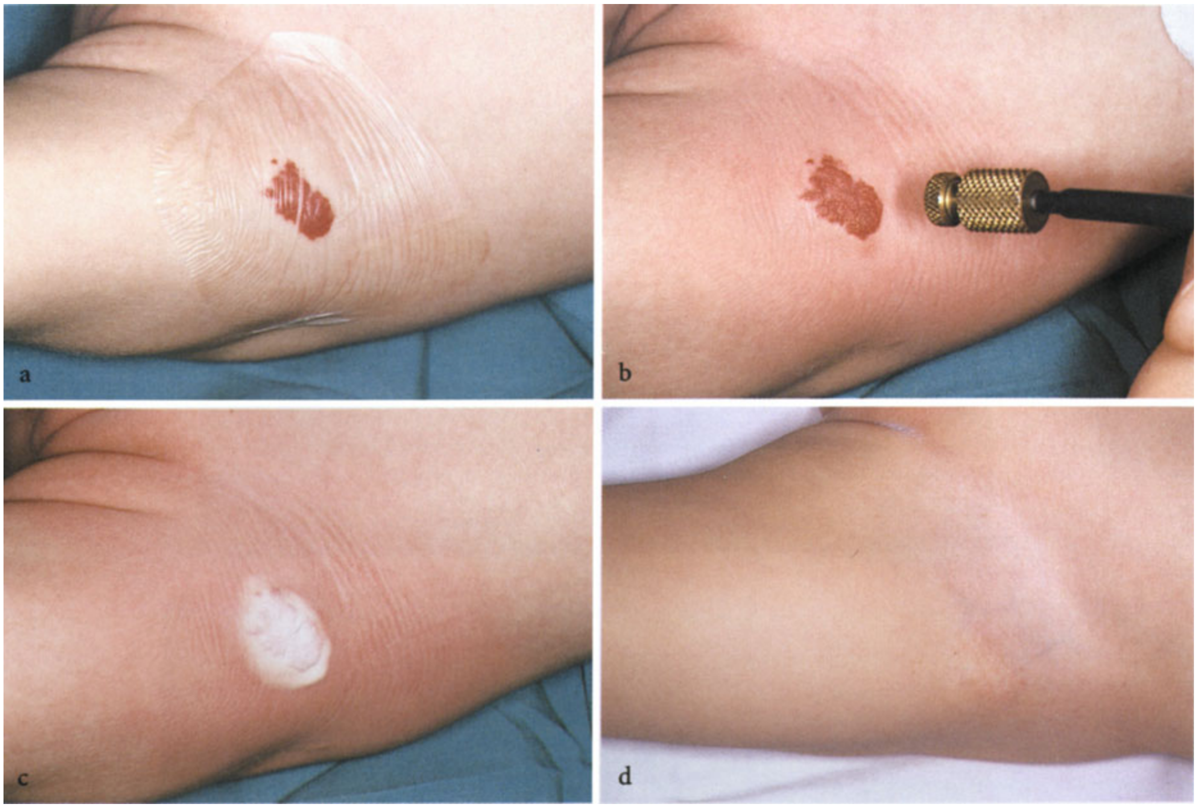


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Fig. 101. Cryosurgical treatment of childhood hemangioma
a Preoperative appearance
b Spray cryotherapy
c Entire area is frozen
d 6 months after the procedure

Fig. 102. Cryosurgical treatment of a basal cell carcinoma
a Deep freeze with long thaw time
b Appearance after 3 months; a depressed, hypopigmented scar is present
▽

when critical structures such as the eye must be shielded. Otherwise it is sufficient to freeze with the open spray technique up to marked borders. This leads to the border of the scar being more diffuse, rather than sharply delineated by the form.

13.3 Tissue Reactions to Cryosurgery

The above method allow a relatively exact application of cryogen with predictable tissue damage ranging from a blister healing without a scar to total tissue destruction with scarring. A short superficial freeze produces a subepidermal blister; this allows actinic keratoses to be removed with excellent, almost scar-free cosmetic results (Figs. 100, 101). Necrosis and loss of tissue are the goals in treating basal cell carcinoma (Fig. 102); here a scar is inevitable. Multiple freeze-thaw cycles are employed to protect adjacent and deeper structures.

In granulomatous skin diseases, lymphocytic infiltrates, and keloids, the goal of treatment is to influence the tissue reaction without producing necrosis. The mechanism of this is unclear. Again, the intensity, depth, and number of freeze-thaw cycles are important in determining the tissue reaction. In general, one must freeze less aggressively and more frequently. When dealing with keloids, one must try to freeze early lesions, which respond much better. Freezing can also be combined effectively with intralesional injection of corticosteroids.

13.4 Clinical Effects and Complications

The healing process following cryosurgery usually entails the following five stages: (a) erythema, (b) edema, (c) blisters and exudates, (d) scale crusts, and (e) scar formation. The time sequence is highly variable depending on the patient, site, and characteristics of the cryosurgery.

Fig. 103. Side effects of cryotherapy include blister formation and edema of adjacent tissue

Erythema is usually present immediately after treatment, followed by edema only minutes later. Blisters begin to develop after 24–36 h. In some regions this is associated with perilesional edema. For example, when working around the eye, eyelid edema may be quite prominent (Fig. 103). Exudation begins after 1–2 days and can last for days (superficial lesions) to weeks (deeper lesions) before crusting begins. After another lengthy period, often 1–2 weeks, the crust is shed, leaving behind a scar. The healing process following cryosurgery is thus far longer than that following cold steel surgery, and this must be carefully explained to the patient prior to the procedure.

The actual freezing process can be quite painful. For larger lesions and if multiple freeze-thaw cycles are required, it is often wise to administer local anesthesia prior to treatment. The prolonged exudative phase is generally most bothersome to the patient. The resultant scar is generally hypopigmented and repigments only slowly; patchy hyperpigmented scars develop occasionally.

14 Operative Treatment of Venous Disease

In Germany the surgical treatment of varicosities and other venous abnormalities has traditionally been part of the specialty of dermatology. Today is possible to obtain specialty certification in the area of phlebology. In the United States dermatologists are becoming more involved in the treatment of venous abnormalities, using sclerotherapy and laser therapy. We therefore feel it important that one be aware of the more aggressive surgical possibilities so that they ensure that their patients obtain the appropriate treatment, tailored to their individual needs.

14.1 Anatomy

The superficial veins of the leg include primarily the two main trunks, the great (or long) saphenous (vena saphena magna) and small (or short) saphenous veins (vena saphena parva), as well as their branches. The small saphenous vein drains into the popliteal vein through the popliteal fossa, while the great saphenous vein drains into the femoral vein after passing through the saphenous opening. While these are the major connections between the superficial and deep veins of the lower limb, there are also a number of perforating veins which connect both major and contribute superficial veins with the deeper system.

The great saphenous vein drains the medial part of the dorsal venous plexus and then passes anteriorly to the medial malleolus before moving upward along the medial side of the limb, curving gently posteriorly about the knee, and dipping through the deep fascia at the saphenous opening about 2–3 cm below the inguinal ligament. The anterior and posterior arch veins (venae arcuatae) and the lateral and medial accessory veins (venae accessoriae) are the most important superficial contributing veins. The distal perforating veins, including the three Cockett's veins and Sherman's vein, extend from the posterior arch vein into the tibial vein. Along with Boyd's perforating vein from the saphenous vein itself, these form Linton's line. In the thigh Dodd's and Hunter's veins connect the saphenous vein to the femoral vein. Just before the saphenous vein joins the femoral vein, it is entered by a number of tributary veins, producing a starlike pattern (Fig. 104).

The small saphenous vein begins posterior to the lateral malleolus and runs the posterior aspect of the calf, passing subfascially in its proximal one-third. It is also connected to the deep veins by perforators: those of Bassi and May. The small saphenous vein joins the deep popliteal vein with a sharp curve; this is known in German as the "J-shaped crook." It is located lateral in the popliteal fossa, usually just above the popliteal crease (Fig. 105).

14.2 Anesthesia

Only limited operations at the main saphenous junctions or for single perforating veins can be performed under local anesthesia. More extensive operations should be carried out under spinal or general anesthesia.

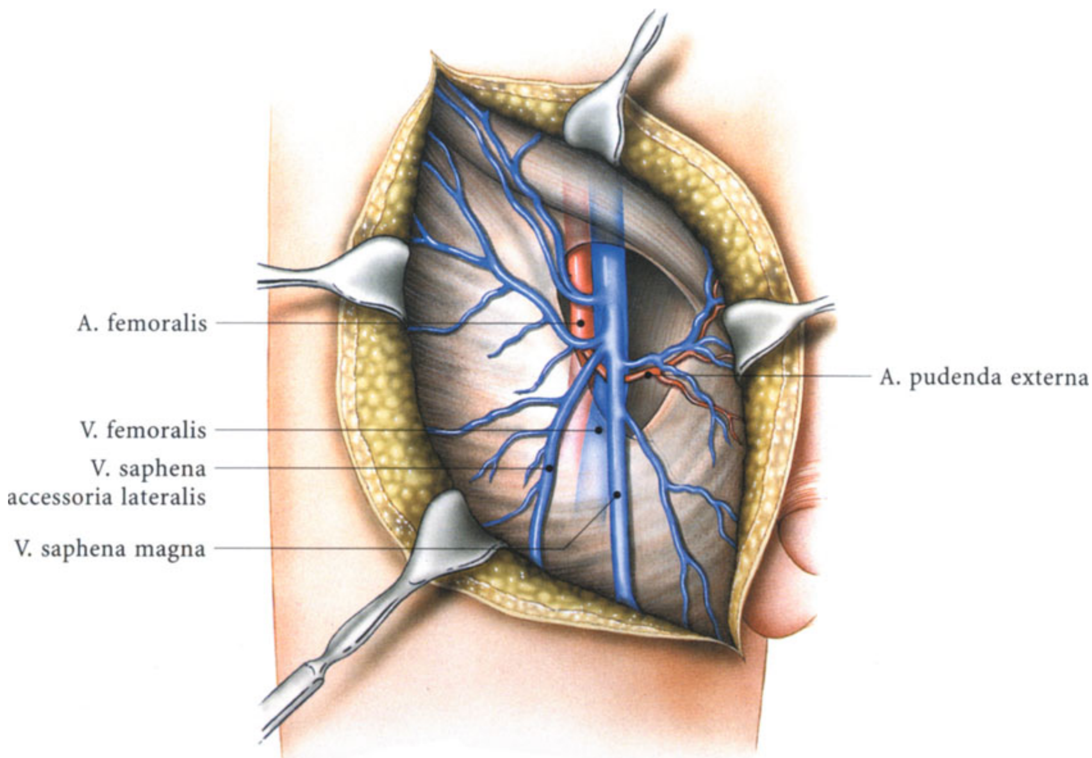


Fig. 104. Anatomy of the femoral canal

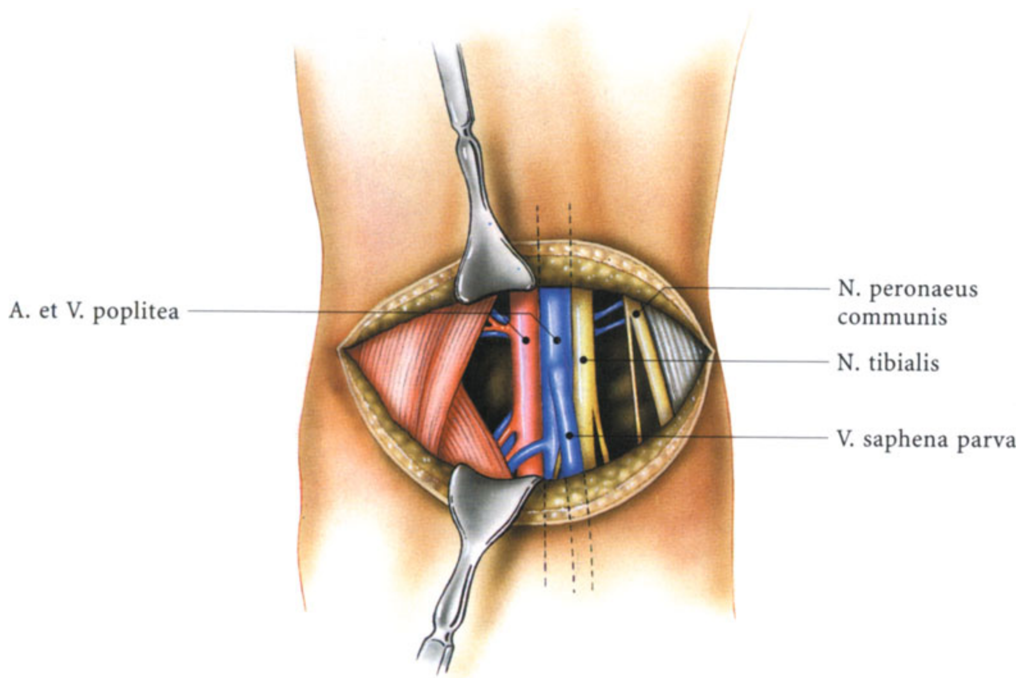


Fig. 105. Anatomy of the popliteal fossa

14.3 Planning the Operation

The functional anatomy and pathology of the venous system determines the optimal surgical approach. This means that the patient must be extensively evaluated prior to surgery. Included are a complete history, clinical function tests (e.g., Perthes, Trendelenburg), Doppler sonographic evaluation, phlebodynamometry, photopletysmography, and other specialized tests. If noninvasive procedures do not provide a clear diagnosis, ascending press-phlebography (angioscopy) is required to localize the varicosity exactly and exclude a postthrombotic syndrome.

Indications for Press-Phlebography

- Suspicion of postthrombotic syndrome
- Exclusion of anomalies in the subfascial venous system
- Suspicion of anomalies in the saphenofemoral or saphenopopliteal junctions
- Reflux with varicosities of the major veins
- "Pseudo" recurrent varicosity

With Doppler ultrasound it is usually possible to identify both the incompetent connections between the superficial and deep systems and the parts of the superficial system that are no longer competent. This information allows one to design an optimal surgical approach to remove or repair damaged parts of the venous system while retaining all the functionally effective parts.

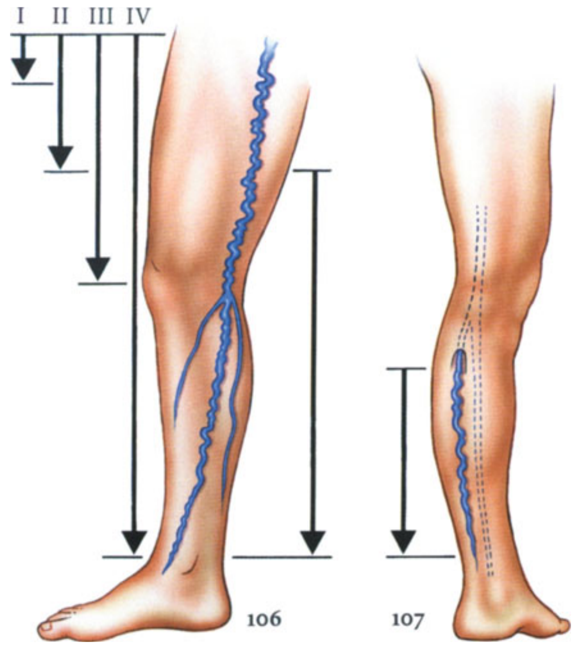


Fig. 106. Varicosities of the great saphenous vein, stages I–IV, and incomplete varicosity

Fig. 107. Varicosity of the small saphenous vein, showing epifascial location distally and subfascial location proximally

The modern division of primary varicosities is based on the level at which one of the saphenous veins becomes incompetent (Tables 11, 12). There are a number of levels at which perforating veins enter the system, and below which then the major vein may be incompetent.

Table 11. Types of superficial trunk varicosity

Vein	Proximal point of insufficiency	Type
Great saphenous	Saphenofemoral junction	Complete
Great saphenous	Boyd's or Hunter's perforating veins	Incomplete
Small saphenous	saphenopopliteal junction	Complete
Small saphenous	May's perforating vein	Incomplete

Table 12. Stages of great saphenous vein varicosities (after Hach et al.)

Stage	Reflux from saphenofemoral junction
I	Only at junction
II	To midthigh
III	To knee
IV	To distal calf

Characteristic Levels of Dysfunction

- Great saphenous vein
  Saphenofemoral junction (saphenous opening)
  Hunter's perforating vein
  Dodd's perforating vein
  Boyd's perforating vein
  Sherman's perforating vein (24-cm perforating vein)
  Cockett's perforating veins (I, II, III)
- Small saphenous vein
  Saphenopopliteal junction
  May's perforating vein
- Posterior thigh
  Vena perforans profunda, or Hach's perforating vein

One can also identify different types of varicosities based on the veins involved and the degree of venous reflux.

Types of Primary Varicosities

- Major superficial veins
  Great and small saphenous veins
- Isolated superficial branch veins (e.g., medial and lateral accessory saphenous veins)
- Isolated perforating veins
- "Spider veins" or venulectasias

If the reflux occurs in the major superficial veins, one is dealing with a varicosity of either the great or small saphenous vein (Figs. 106, 107). If the reflux occurs at the saphenofemoral or saphenopopliteal junction, a complete superficial varicosity is present. If the reflux lies distal to a perforator, such as Dodd's perforating vein or Hunter's perforating vein, one speaks of an incomplete superficial trunk varicosity. Even when the valves of the major superficial veins are competent, other components such as feeder veins and reticular veins can become dilated and incompetent, requiring treatment.

The goal of modern surgical therapy of varicosities is to remove only the functionally damaged parts of veins, retaining as far as possible the normal anatomic structures. Thus each patient's legs must be carefully evaluated prior to the operation to determine the ideal operative approach. The flexible use of a wide variety of standard operative approaches (Table 13) should make possible selectively to remove the hemodynamically relevant areas, such as at the openings of the great and small saphenous veins and along their course, and then to remove the accessory veins and reticular varicosities with a good cosmetic result.

Table 13. Operative approach to various forms of varicosities

Type of varicosity	Operative procedure
Superficial trunk varicosity, stage I, II	High ligation-avulsion of saphenofemoral junction
Superficial trunk varicosity, stage III, IV	High ligation-avulsion and stripping of great saphenous vein to distal insufficiency point
Incomplete varicosity of great saphenous vein	Stripping to proximal insufficiency point (Boyd's or Hunter's perforating vein) with ligation of perforating vein
Complete superficial trunk varicosity of small saphenous vein	High ligation-avulsion of sapheno-popliteal junction (high ligation of the lesser saphenous vein) with stripping
Incomplete superficial trunk varicosity of small saphenous vein	Stripping of the lesser saphenous vein to proximal insufficiency point (Sherman's perforating vein) with ligation of perforating vein
Isolated side branch varicosity	High ligation-avulsion (with supravalvular junction, additional ligation need), stripping of side branches, phlebectomy
Isolated insufficiency of perforating vein	Ligation, phlebectomy
Reticular varicosity	Phlebectomy, sclerosing injections
"Spider-vein" varicosity	Sclerosing injections

14.4 Surgical Techniques

In all operations for varicosities the course of the veins and the points of insufficiency must be marked with indelible surgical markers in the standing patient. We use Doppler sonography to identify the critical sites preoperatively. Since blood loss may be considerable in venous surgery, one should well in advance discuss the option of preoperative collection of the patient's own blood for an eventual transfusion. Regardless of the source, typed and cross-matched blood should be available prior to the operation. Operations in the saphenofemoral region are carried out best with patients on their back and with the involved leg slightly elevated. On the other hand, when operating in the saphenopopliteal area, we prefer to have the patients on their abdomen.

The surgeon must not only know the normal anatomy of the leg veins but must also be aware of the many possible variations (Figs. 105, 106). A great deal of experience is required to deal correctly with atypical connections, especially when they are unexpected. This problem is most critical when dealing with the entry of the great or small saphenous vein into the deep venous system. In addition, secondary veins can be overlooked when not in their usual location, leading to pseudorecurrence. Of course, if a vein in an unexpected location is damaged and not identified, bleeding is a likely problem. Below we review the most important operations that we perform, starting with the normal anatomic structures. Only by mastering these techniques can one be prepared to deal with the frequently encountered aberrant patterns.

14.4.1 High Ligation–Avulsion of Saphenofemoral Junction

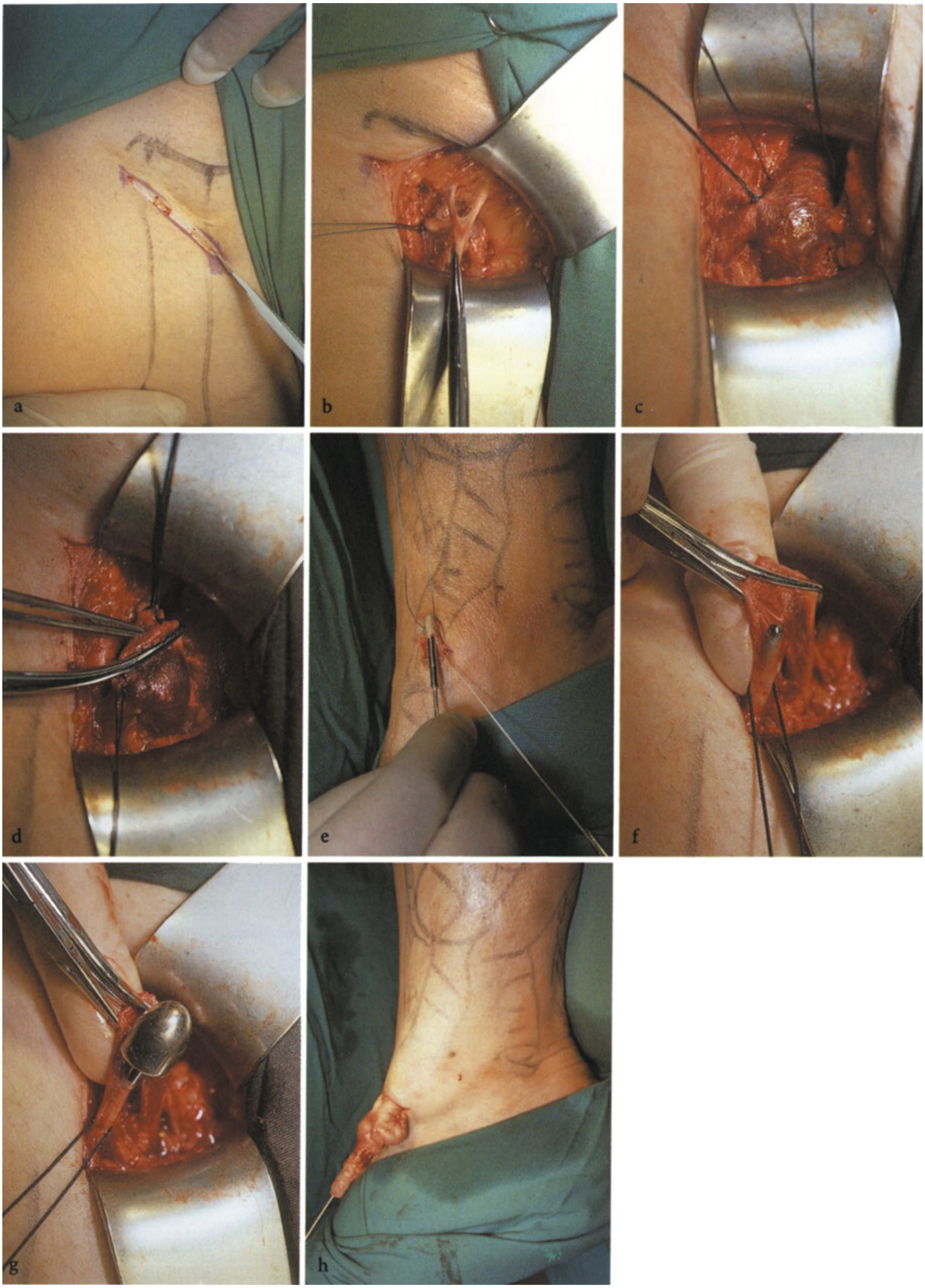
The great saphenous vein is exposed in the saphenous opening by making an incision of 4–6 cm, about 1 cm above the inguinal fold and bordered laterally by the femoral pulse. The vein is then exposed by blunt dissection. The feeder vessels of the great saphenous vein are systematically exposed, clamped, and tied off until one reaches the junction with the femoral vein (Fig. 108). This is easier if the vein is lifted with a sling; this makes it easier to exclude the presence of a dorsal vein, which may otherwise be missed and lead to pseudorecurrence. Next, the great saphenous vein is clamped with a Pean clamp and then ligated twice at the junction with the femoral vein. The great saphenous vein is separated between the ligatures and the clamp. We then sew another ligature through the stump to prevent loosening of the primary ligatures. A small wound drain (size 10–12) is inserted, and the wound closed in a stepwise fashion. We use a running intracutaneous suture and remove the drain after 2–3 days and the suture after 7 days. The patient should ambulate on the day of the operation.

In this operation one must be very careful to ensure that sutures placed at the junction do not restrict the popliteal vein and that no dead-end tube or stump is left behind. Both structural changes can radically alter the hemodynamics in this critical area and increase the risk of thrombosis. Another difficult problem arises when the greater saphenous vein displays a pseudoaneurysm at its point of entry into the femoral vein. A tear at this point during the procedure costs a great deal of time to repair and may lead to a variety of complications.

If it is planned to strip the saphenous vein during the same operation, the high ligation–avulsion should be performed first.

14.4.2 High Ligation–Avulsion of Saphenopopliteal Junction

The small saphenous vein joins the popliteal vein in the vicinity of the popliteal fold, but many anatomic variations are possible. It is estimated that in over 80% of cases the junction is situated proximal to the popliteal fossa, and at least ten variations have been described. In addition, the small saphenous vein lies in an epifascial position in the lower two-thirds of


a
b
c
d
e
f
g
h

the calf but is subfascial in the proximal one-third. To ensure that the procedure goes smoothly, the highly variable vein pattern must be accurately mapped either with ultrasound Doppler or phlebography.

The surgical approach to the popliteal space requires a generous horizontal incision of 5–7 cm; to ensure maximum visibility and access one should not attempt to get by with a smaller incision. The fascia must be then opened, generally also with a horizontal incision. With blunt dissection the vein is exposed and then separated between proximal and distal ligatures. One moves proximally towards the junction with the popliteal vein, using a "ladder climbing" technique of blunt exposure and ligature until the junction is exposed (Fig. 109). During this process all of the branches should also be ligated and separated. Finally, the junction of the small saphenous vein is double tied, taking care not to comprise the diameter of the popliteal vein. The small saphenous vein is cut through between ligatures, and the popliteal vein is then allowed to slide back under its protective fascia. One must make sure to avoid the sural nerve. A suction drain is then inserted, the fascia closed with a running resorbable suture, and the subcutaneous tissue and skin closed in the usual way.

◁ **Fig. 108.** High ligation–avulsion and stripping of the great saphenous vein
a Skin incision, about 4 cm long
b Tying off the branches in the saphenous opening
c Elevating the great saphenous vein and exposing it where it joins the femoral vein
d Tying off and clamping the saphenous vein at the level of entry into the femoral vein
e Introducing the stripper in the great saphenous vein in the region of the medial malleolus
f Stripper at the proximal end of the vein
g The olive is attached to the stripper and the vein bound to the stripper below the attachment
h Stripping the vein

14.4.3 Operations for Perforating Veins

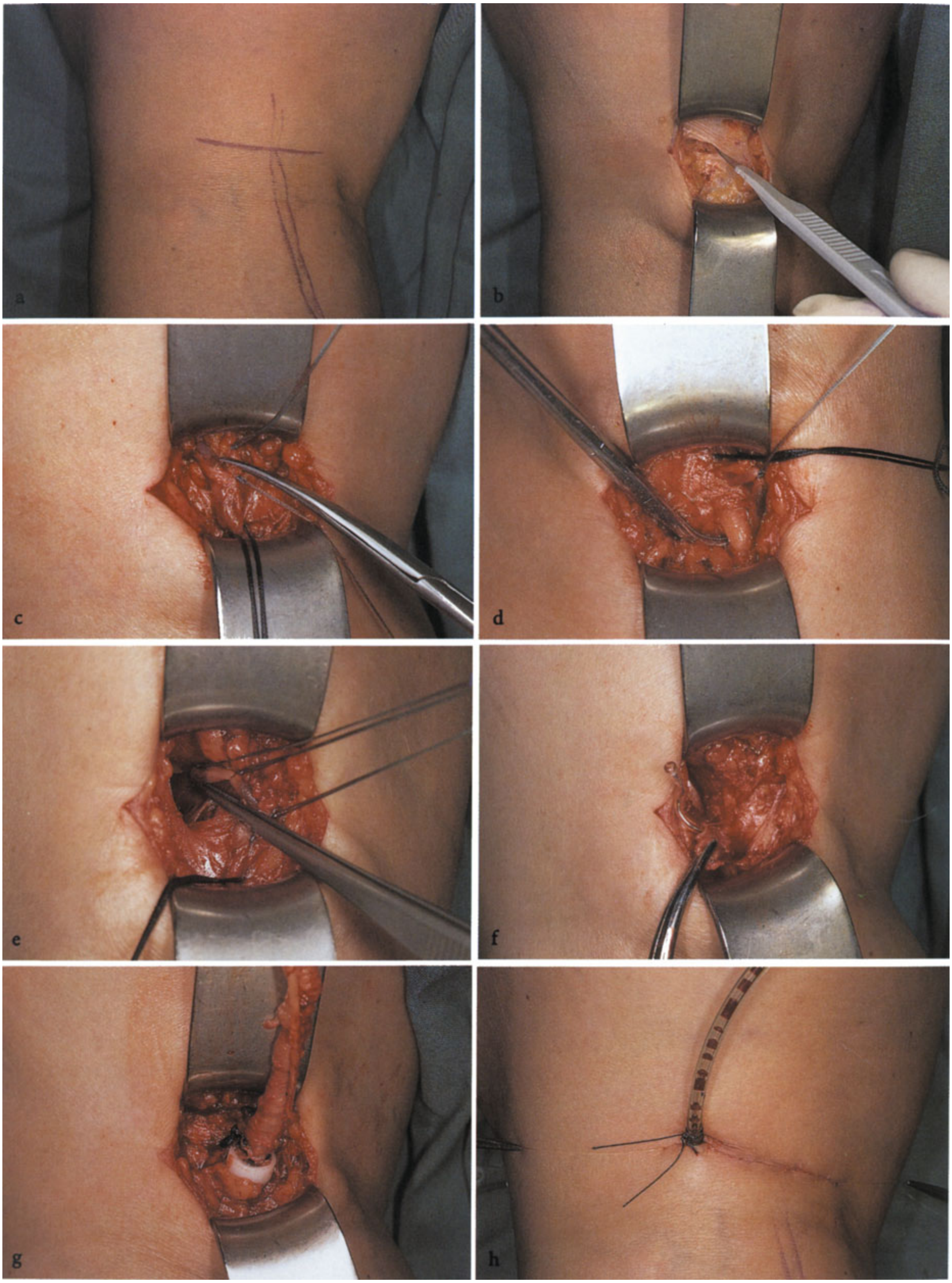
We feel that, when possible, one should control and accurately tie off each perforating vein. In the past the great or the small saphenous veins were often stripped and pressure dressings relied upon to seal off the perforating veins. When each perforating vein is treated, not only are the immediate results better, but a further operation is much less likely. Perforating veins can be found in a variety of clinical settings – isolated, accompanying varicosities of the major veins, reticular varicosities, and pseudo-recurrent varicosities. For this reason one must be in command of a variety of surgical approaches to the problem.

Selective Ligation

The perforating vein is exposed through a 1 cm superficial incision down to its junction with the deep vein system. It is then lifted with a vascular clamp. Slowly resorbable sutures are used to tie off the perforating vein and then to close the fascial slit. Removing the epifascial varicosities that accompany the perforating vein creates the so-called venous T-piece, for example, in incomplete trunk varicosity arising from Dodd's or Hunter's perforating veins (Fig. 110).

Blunt Dissection (Bassi and Feuerstein)

The insufficient perforating vein is exposed through a small skin incision and then elevated with a small hook or vascular clamp. After blunt dissection the vein is simply torn off at the level of the fascia; the superficial branches are removed simultaneously. Initially there is brisk bleeding, but this generally stops spontaneously. Then the wound is closed in layers and a pressure dressing applied. The patient is encouraged to ambulate immediately. This technique is especially effective in treating Boyd's and Cockett's perforating veins.



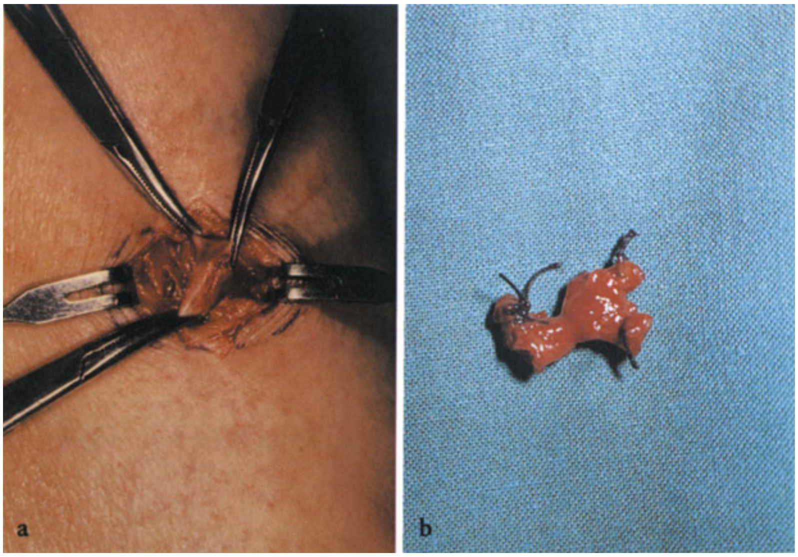


Fig. 110. Ligation of perforating vein
a Exposing and tying off a perforating vein
b Excised "T-piece"

Endoscopic Excision

The endoscopic approach to perforating veins remains a difficult procedure and is only employed by a few specialized centers. It cannot be routinely recommended at the present time.

◁ Fig. 109. High ligation–avulsion and stripping of the small saphenous vein
a The course of the small saphenous vein is marked; skin incision is made above the popliteal crease
b Horizontal division of the fascia
c Elevating the small saphenous vein and tying off small branches in the fossa
d Carefully avoiding the tibial nerve
e The veins tied off in a climbing fashion, moving up to the junction with the popliteal vein
f If a vein stripping is being performed simultaneously, the stripper is passed up to the saphenous stump
g Stripping the saphenous vein, which is here pulled up and out proximally
h After a suction drain is placed, the wound is closed

14.4.4 Phlebectomy

Stripping

Stripping involves passing a sound on a flexible wire through the vein and then removing the entire vein with this equipment. The damaged vein may be approached either distally or proximally. After making a small incision the vein is exposed by blunt dissection. Generally the vein is then clamped or ligated and elevated with a thick suture before being incised either with a transverse or longitudinal incision. The stripping instrument is then passed through the vein up to the desired level. Modern strippers generally have 150 cm of stiff surgical braided wire with a head which either resembles a cork screw or an olive. The head is usually coated with Teflon or a similarly slippery material so that it slides smoothly through the damaged vein. When the desired level has been reached, or when the stripper cannot be advanced further, a second incision is made and the vein ligated or clamped proximally. The stripper head is then exposed between two ligatures, and the freed vein is firmly ligated just behind the head of the stripper. The entire vein usually can be removed without any problems. Suction drains are inserted to avoid the development of hematomas in the long wound canals, and the incision is closed primarily with subcutaneous buried sutures, as well as routine skin closure.

Stripping the Great Saphenous Vein

In the classical operation of Babcock the great saphenous vein is stripped from the saphenofemoral junction to the supramalleolar level, while in the Mayo variation the procedure stops at Boyd's perforating vein. After performing the high ligation–avulsion the greater saphenous vein is approached distally through an approximately 2-cm incision, exposed via blunt dissection, and then ligated distally. The vein is elevated between the ligature and a heavy suture and incised so that the stripper can be inserted. Under careful control via palpation, the stripper is advanced to the already freed up stump of the great saphenous vein (Fig. 108e-h). One must be very cautious about aberrant anatomic patterns by which the stripper can pass into the subfascial space and the femoral vein, for stripping the femoral vein leads to irreparable circulatory consequences. The stripper is then passed through the stump, which has already been tied off and must be once again opened so that the vein can then be firmly attached behind the stripper head. The distal vein is separated proximal to the ligature, and the vein can then be removed.

In an alternative method the stripper is entered in the proximal stump of the vein and cautiously passed in a distal way. Here one is working against the valves of the vein, but these are generally so damaged that it is of little consequence. Again, the extraction of the stripper with the attached venous convolute is carried out proximally, which is thought to reduce the risk of pressure-related damage to the saphenous nerve about the ankle.

The procedure must sometimes be performed in two or more parts, either because the stripper cannot be further advanced, or because the vein is damaged. Here a second incision is made, the vein attached to the first stripper, and a second stripper advanced to complete the surgical task.

At the end of the operation the leg is elevated, and the blood coagulum is expressed out of the wound canal, moving proximally. A long suction drain is inserted, the incisions are closed, and a pressure dressing is applied. We frequently attach a suction drain to the stripper end. Thus, as we remove the stripper, we simultaneously insert the drain.

The Mayo procedure is slightly different. The high ligation–avulsion is performed, and the stripper is then passed from the femoral canal to the level of Boyd's perforating vein where it is brought externally through a simple incision. Before this can be done, of course, the vein must be exposed and ligated distally. The vein is then attached to the stripper wire, and the vein is then removed, moving distally as in the Babcock procedure.

Stripping the Small Saphenous Vein

Here it is advisable to perform the stripping procedure prior to the high ligation–avulsion (Fig. 109). The procedure can be carried out in either direction. One can make an incision just above the lateral malleolus and bring the stripper out in the popliteal fossa, after which the head is attached to the distal segment which is then brought out behind the knee. Alternatively, the stripper can be passed distally, the head then attached proximally, and the stripper pulled out in the ankle area. The rest of the procedure is identical to that described above for the greater saphenous vein.

Phlebectomy of Side Branches

As the stripper is advanced, one can make multiple incisions of 1–2 cm over larger side branches and expose the veins, which are then grasped with a vascular clamp, carefully loosened, and removed with a tug (Fig. 111). The wounds are closed with resorbable subcutaneous sutures and butterfly bandages. If one removes the side branches too forcefully, subcutaneous fat is also removed, and the incisions heal as depressions that are cosmetically unattractive. The procedure must therefore be carried out carefully with attention paid to sparing tissue.

Miniphlebectomy (Muller)

This operation is performed with the leg slightly elevated, as with most venous surgery. Multiple small incisions are made over the varicosities, which are then exposed and clamped off with a mosquito clamp. Working carefully, one can then extract the vein, moving from one incision site to the next (Fig. 112). One does not need to tie off all the veins. The wounds are closed with butterfly bandages, and a compression dressing is applied, which should be worn for 2 weeks.

14.4.5 Removal of Thrombosed Varicosity

In acute thrombophlebitis the thrombosed varicosity may be palpated as a nodule or linear band. One or more superficial incisions are made along the course of the clot, which is then expressed manually (Fig. 113). The wound edges can be closed with a subcutaneous suture or butterfly bandages. After a compression dressing is applied, the patient must ambulate immediately. Nonsteroidal anti-inflammatory agents are prescribed to relieve pain. In superficial thrombophlebitis systemic anticoagulation is generally not needed.

Fig. 111. Removal of many side branches using clamps
a Utilizing many tiny skin incisions, the various branches are grasped with clamps
b After careful subcutaneous tugging and other loosening maneuvers, the veins are extracted

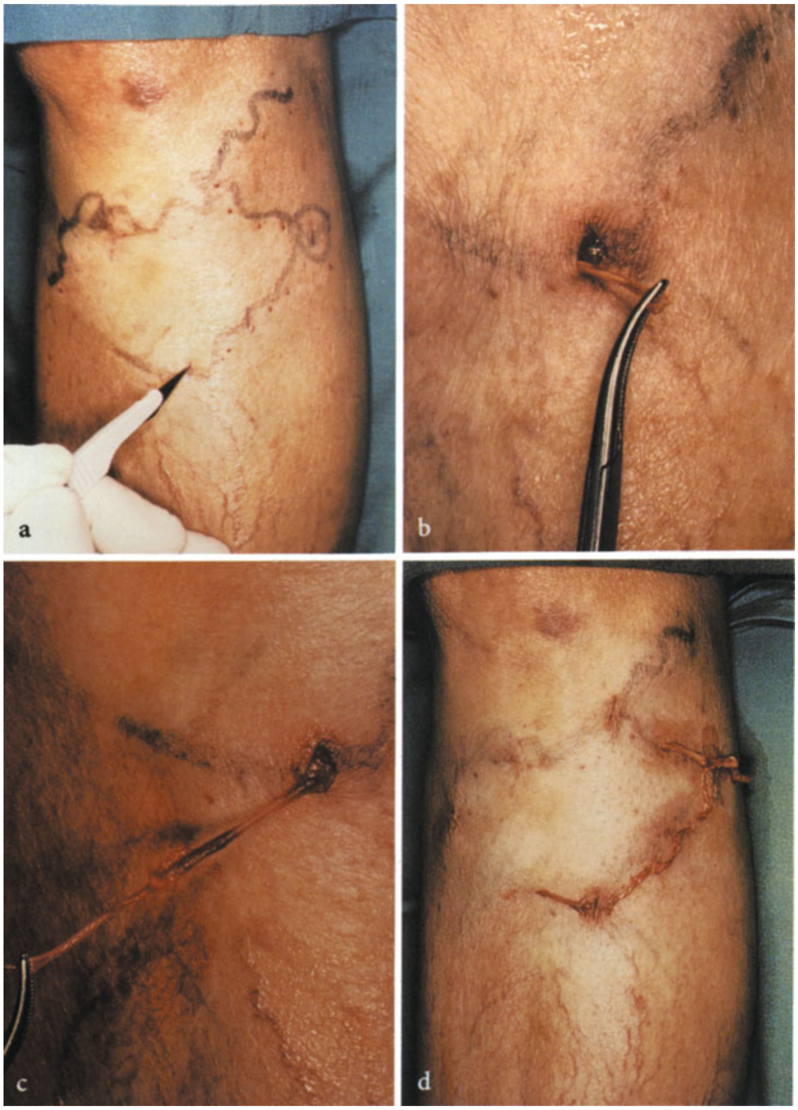


Fig. 112. Miniphlebectomy (after Muller)
a Small incision
b Vein is grasped with mosquito clamp
c Careful extraction of vein
d The finished product

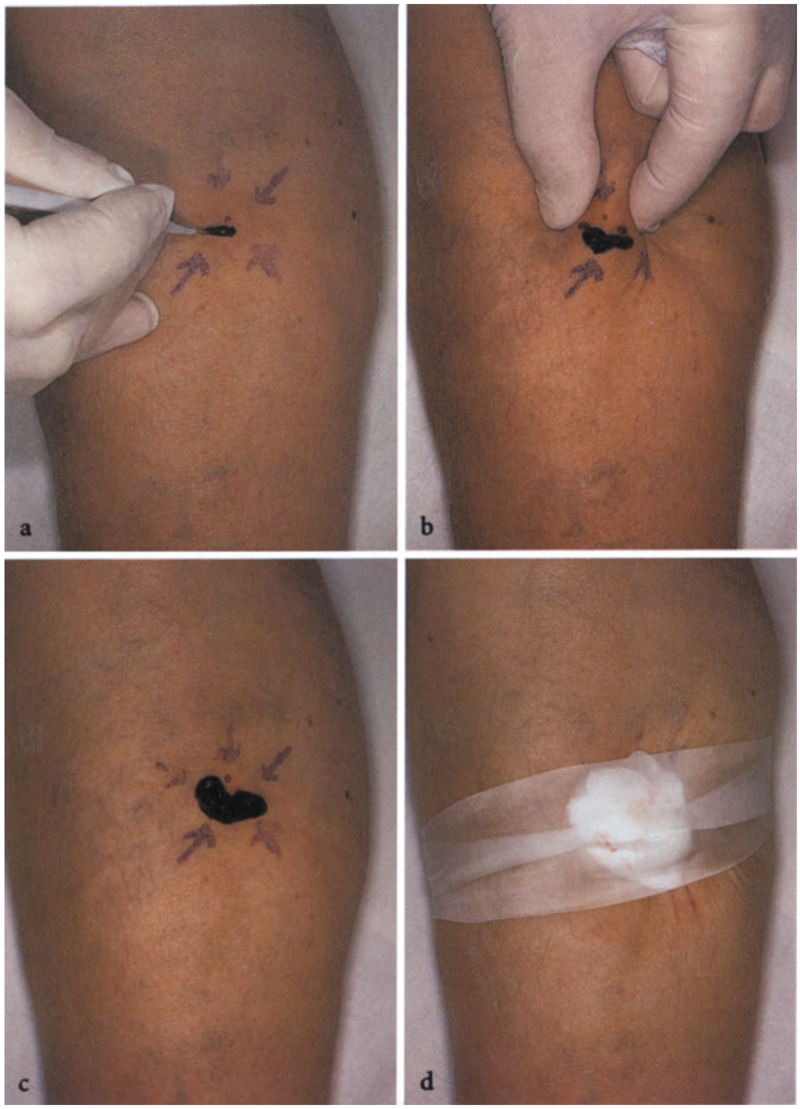


Fig. 113. Removal of superficial thrombophlebitis
a Tiny puncture incision into venous nodule
b Manually expressing clot
c Removed clot
d Pressure dressing

15 Surgical Treatment of Venous Leg Ulcers

Acute and chronic complications of varicose veins and thrombophlebitis frequently require surgical intervention. The most common problem is of course venous leg ulcers, which afflict about 0.3%–1.0% of the population in Western countries.

15.1 Pathogenesis

The crucial step appears to be the deposition of fibrin around the vessels as a result of local hypertension caused by stasis. The fibrin deposits interfere with oxygen diffusion into the local tissue, which then becomes more hypoxic, leading to clinical patterns such as atrophie blanche and lipodermatosclerosis. The skin is both easily damaged and slow to heal. Thus even minor trauma may lead to an ulcer that heals slowly and is progressive.

An important iatrogenic complication is the development of allergic contact dermatitis to topical antibiotics, preservatives, and a variety of other materials, as patients apply a wide range of topical agents over many years to damaged skin.

15.2 Anesthesia

Local, regional, or even general anesthesia may be needed, depending on the size of the defect and the planned surgical approach.

15.3 Planning the Operation

Radial incisions through the wound edge are sometimes felt to improve the vascular supply to the ulcer and thus speed healing. In contrast, the circumferential incision about the ulcer designed to increase vascular supply by stimulating the growth of new capillaries often backfires, leading to additional therapy-resistant ulcers. Thus most operations involve some approach to covering the ulcer.

Surgical Approaches to Venous Ulcers

- Primary transplantation
  Pinch grafts
  Split-thickness skin grafts
  Mesh grafts
  Cultured autologous epidermal cells
- Combined techniques
  Transplantation after ulcer excision and wound conditioning
  Transplantation after surgical removal of perforating veins around the ulcer
  Transplantation after other vascular procedures

Helpful Procedures Prior to Surgical Repair

- Conservative wound preparation (topical antimicrobials, enzymatic preparations, and many others)
- Sclerotherapy both above and below the ulcer
- Venous surgery
- Compression bandages
- Débridement
- Radial or circumferential incision of the ulcer wall

We feel that it is especially important to correct adjacent venous abnormalities such as perforating veins (Fig. 114). Of course, an ulcer can be effectively treated only when the predisposing factors have been corrected; however, this is generally easier said than done.

Fig. 114. Selective ligation of perforating vein and destruction of branches around a stasis ulcer
a Stasis or venous ulcer, with perforating veins and branches marked
b Distal ligature
c Proximal ligature
d Destruction of the branches
e Suction drain in place
f Appearance after 3 months with complete healing

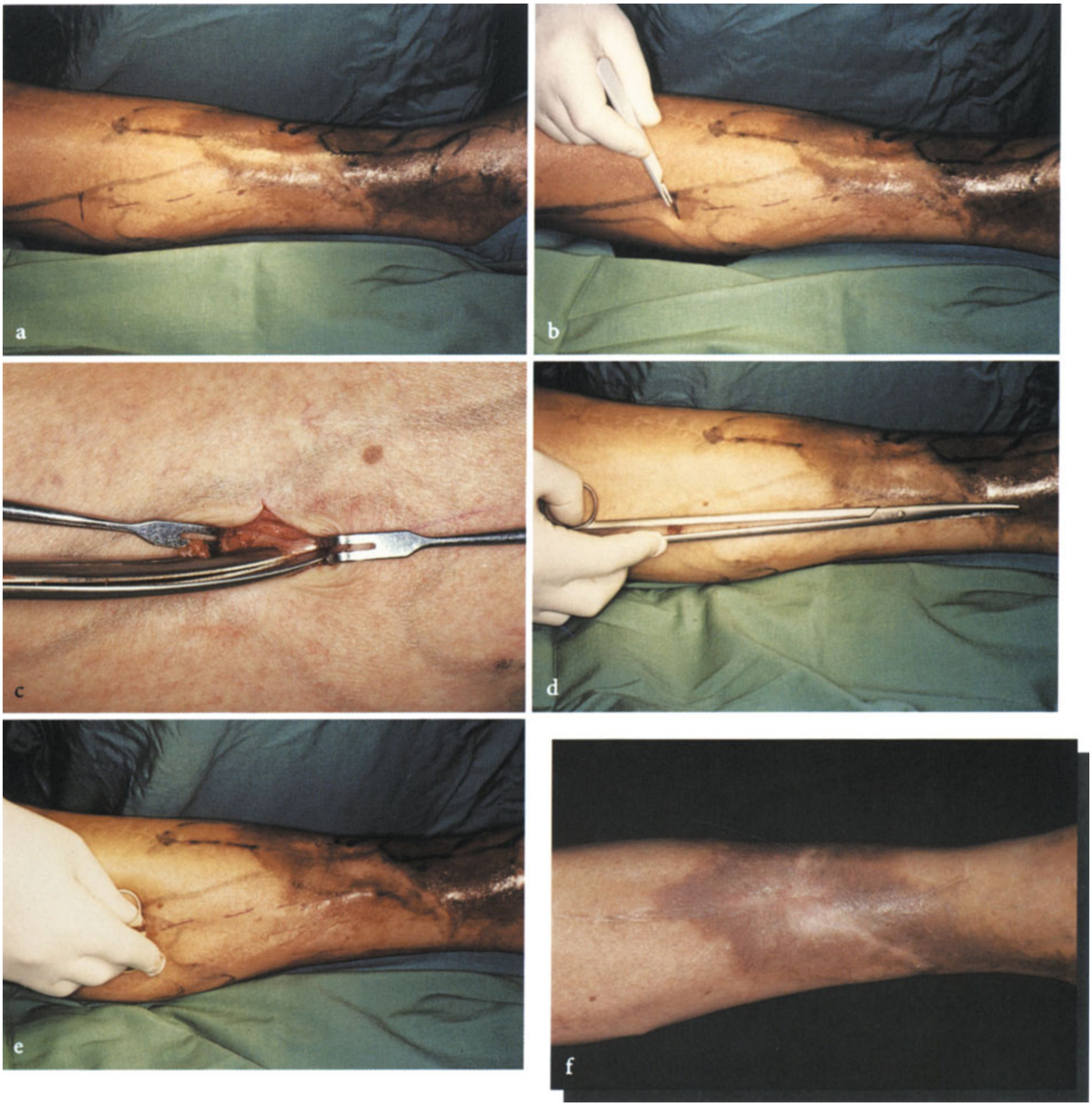
Fig. 115. Mesh grafting of stasis ulcer ▷
a Curettage débridement of ulcer base
b Fitting a mesh graft
c Multiple pieces of a mesh graft tacked in place
d Appearance after 6 months with no residual ulcer

15.4 Surgical Techniques

Primarily covering the wound with pinch, split-thickness, or mesh grafts is technically easy, while the use of cultured autologous epidermal cells is time consuming, expensive, and limited to a few specialized centers. Pinch grafts are simply placed on the prepared ulcer surface; split and mesh grafts, on the other hand, are sewed into place with simple sutures (Fig. 115). We then recommend moist wound dressings. The compression dressings must be worn for about 10 days. If there is clinical evidence of wound infection, the dressing must be changed earlier. The patient should remain nonambulatory, with the leg elevated and appropriate systemic thrombosis prophylaxis prescribed.

For treating resistant ulcers about the medial malleolus we use the operative approach described by Linton. A longitudinal incision is made over the posterior arch vein, which is removed after ligating all of the Cockett's perforating veins. The ulcer itself is débrided down to the fascia and covered with a split or mesh graft.

Another approach is the paratibial fasciotomy as advanced by Hach and coworkers. This is best employed with resistant ulcers in which insufficiency of the Cockett's perforating veins has been demonstrated; we also use it for severe sclerotic stasis dermatitis without an ulcer. A 2-cm-long horizontal incision is made about 2 cm above the Cockett group of perforating veins just medial to the edge of the tibia. The muscle fascia is exposed by blunt dissection and then split in the direction of the ankle using a large Metzenbaum scissors (Fig. 116). The remaining perforating veins are also removed, moving distally. Because of marked bleeding, a long suction drain is placed, the wound is closed in layers, and compression dressings are applied. The patient is encouraged to ambulate



immediately. It is unclear whether this procedure speeds ulcer healing more than simple ligation of perforating veins. There are a number of possible complications, including wound infections, hematomas, skin necrosis (with new ulcers), and damage to the posterior tibial artery. Thus only experienced surgeons should attempt this procedure in carefully selected patients.

Fig. 116. Paratibial fasciotomy
a Chronic venous insufficiency with atrophie blanche and hyperpigmentation
b Paratibial incision
c Proximal incision of fascia
d Scissors to demonstrate the length of the fasciotomy
e Scissors in place after fasciotomy
f Appearance after 3 months with improved microcirculation

16 Scar Revision

16.1 General Principles

Every injury to the skin heals with a scar. The nature of the scar is determined by the nature of the injury (size, cause, treatment), the site of the injury, and the individual predisposition of the patient. The scar is often of a different color, may be elevated or depressed, and frequently lacks skin appendages. In such cases it may reflect continued fibroblast proliferation producing a hyperplastic scar (within in the borders of the initial incision or injury) or keloid (growing beyond the boundaries of the initial insult). It is therefore common for patients to request a scar revision to produce a second but cosmetically more acceptable scar. Such a procedure is usually cosmetic in nature, but it may also be medically necessary. For example, a hypertrophic scar or keloid near a joint may restrict motion. In addition, radiation dermatitis, osteomyelitis, and tuberculosis scars are known to undergo malignant change, and scar removal is therefore best viewed as cancer prophylaxis. Similarly, chronic acne scars such as in the acne tetrade and acne inversa become repeatedly infected well into adult life, thus making the surgical removal also of these lesions medically necessary. Of course, there are generally both cosmetic and medical reasons to treat a given scar.

16.2 Planning the Operation

The operative strategy is of course based on the nature of the individual scar, with special attention paid to previous factors which may have led to scar formation, and which can be avoided during the revision. Each region of the body can be expected to react differently. For example, revising a rapidly growing acne keloid from between the breasts of a 25-year-old black woman is quite different from reexcising a curettage scar on the side of the neck of an octogenarian.

We distinguish between posttraumatic and postinflammatory scars. Posttraumatic wounds following an accident or burn often lead to functional as well as cosmetic problems. Often the initial wound care was inadequate, and one can expect to produce an improvement under more ideal circumstances. Postinflammatory scarring, such as that following a burned-out case of acne or panniculitis, generally presents more of a cosmetic problem.

Scar revision may involve several steps; each should be carefully considered and explained to the patient prior to embarking upon the procedure. The patient must also understand that the final benefits of the scar revision may be not adequately assessed for up to 1 year or longer.

16.3 Surgical Techniques

The revision of unacceptable linear or dehiscent scars should aim at placing the new scar in the skin folds. If the scar fails to follow the skin lines, it can often be broken up so that at least part of it lies in the desired direction. In other instances this goal is simply not obtainable (Figs. 117, 118).

Multiple Z-plasties are especially helpful in modifying contracted scars that are perpendicular to the skin lines. The Z's allow one to

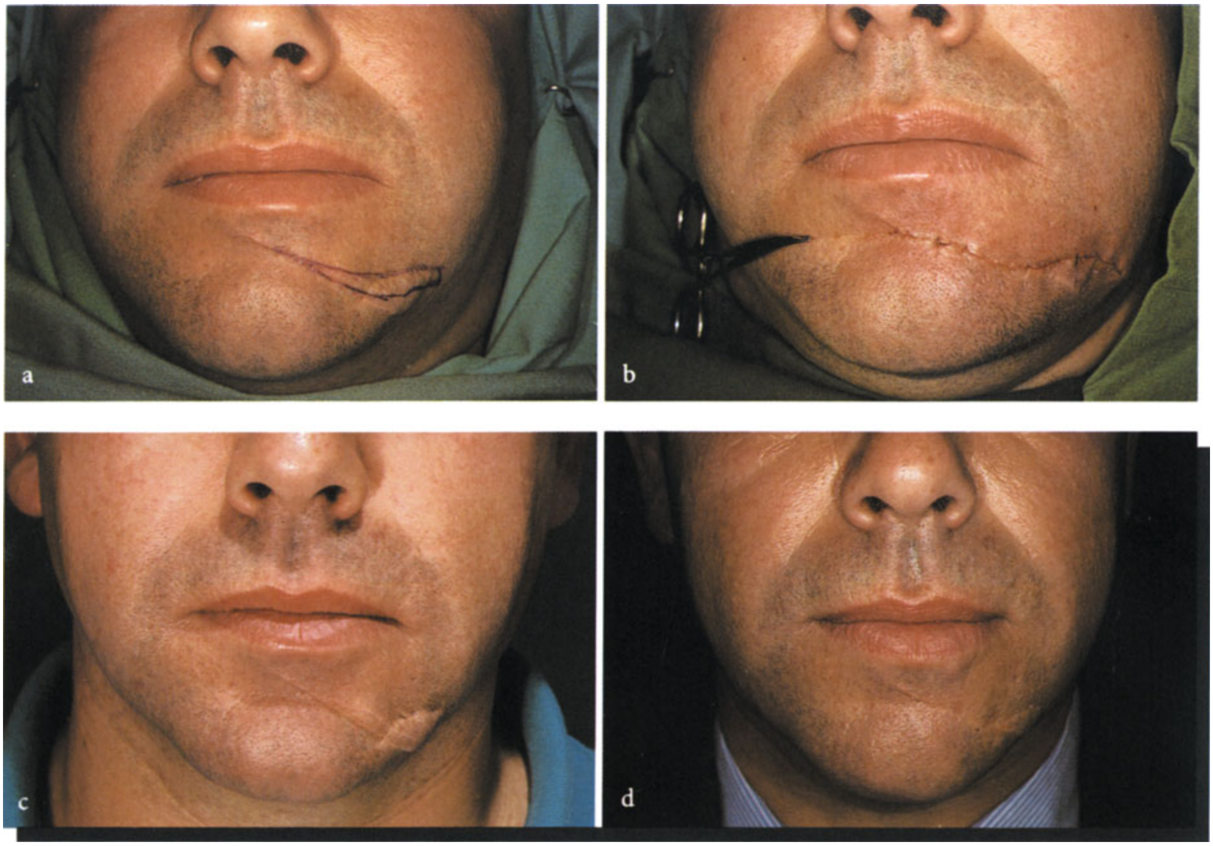


Fig. 117. Revision of an elevated irregular scar secondary to trauma
a Operative plan with spindle-shaped excision drawn in place
b Reapproximation of wound edges and closure with intracutaneous suture
c Preoperative appearance
d Appearance after 4 years

break up a linear scar, lengthen it, and place much of the new scar in the skin lines. The old scar is initially excised in toto. The free arms of the new multiple Z incisions are placed at an angle of 45°–60°. The resulting triangles tend to slide into the new positions spontaneously as they are freed. The scar is lengthened, and the tissue is placed under less tension so that cosmetically more acceptable healing can be anticipated.

Local flaps are often used to repair postinflammatory scars. It is crucial entirely to remove an old acne scar to prevent the recurrence of sinus tracts in the periphery. During the operation it is helpful to mark the sinus tracts with methylene blue and to trace them with sounds or probes. If large areas are exposed during the procedure, these are best covered with full-thickness skin grafts after appropriately preparing the base (Fig. 119). Others have recommended letting such defects on the neck, axilla, or inguinal region heal by secondary intention, but we avoid this because of the considerable risk of contractures.

High-speed dermabrasion is an effective way to deal with facial acne scars. A series of raised and depressed scars are leveled, creating one diffuse scar which is generally more acceptable (Fig. 120). However, the dermabrasion must not extend too deeply, for the new resultant scar may be even more noticeable than the original condition. Sometimes it is helpful to perform the procedure in several steps. Deep ice-pick scars are generally removed separately through punch excision and then simply sutured.

Dermabrasion is also useful in planing down posttraumatic and surgical scars (Fig. 121). The use of such spot dermabrading has become increasingly popular. Of course the surgeon must rely on those techniques with which he has the most experience in order to produce to best cosmetic result.

Fig. 118. Revision of a depressed postinflammatory and pretreated scar
a Depressed scars following panniculitis which were severe enough to restrict motion
b Planning the operation; as the skin is moved, the depth of the depressed scar is better appreciated
c Excision of the entire scar
d Closure
e Preoperative appearance
f Appearance after 5 months

Fig. 119. Excision of a keloidal scar with grafting
a Wide excision of a contracted but keloidal scar following a burn
b Coverage with split-thickness skin graft
c Preoperative appearance
d Appearance after 1 year

Fig. 120. Dermabrasion
a High-speed dermabrasion of acne scars on forehead
b Condition immediately after dermabrasion
c–d Condition after full face dermabrasion showing both sides of face
e Preoperative appearance
f Appearance after 2 months

Fig. 121. Dermabrasion
a Dermabrading scars as a result of trauma on forehead
b Fine modeling with small fraize
c Preoperative appearance
d Appearance after 5 years

17 Collagen Injection

The injection of highly purified bovine collagen makes it possible to replace damaged or missing dermis. The currently available products are relatively stable after injection and serve as a matrix over which the host fibroblasts can grow. Earlier preparations tended more to elicit foreign body reactions and to migrate. The reduced antigenicity of current products results from the enzymatic splitting of the N- and C-terminal peptide chains.

17.1 Indications

In general, collagen injections should be used for treating small areas such as depressed lines or furrows. These are not suited to repair large defects. One widely accepted indication is depressed scars from chickenpox and acne. Posttraumatic and even postoperative tissue defects can also be corrected. An atrophic scar can be elevated, or one can inject beneath a skin graft. Atrophic sclerotic changes such as morphea, especially linear morphea, and hemifacial atrophy can also be treated. Today most collagen injections are used in cosmetic procedures to flatten glabellar and nasolabial folds and to improve periorbital and perioral wrinkles.

17.2 Materials

Three different collagen preparations are currently available, each with slightly different biologic properties.

Available Collagen Products

- Zyderm I: 35 mg collagen per milliliter
- Zyderm II: 65 mg collagen per milliliter
- Zyplast: 35 mg glutaraldehyde cross-linked collagen per milliliter

While Zyderm I and Zyderm II differ only in the available concentration of collagen, Zyplast is a somewhat more stable product, resistant to the action of host collagenases. It is therefore better suited for repairing deeper and larger defects.

17.3 Prerequisites for Treatment

Patient selection, education, and testing are all essential to obtaining an optimal result. The patient must be aware of exactly what can be achieved by collagen injection; pre- and post-injection photographs are often helpful. A patient who wishes "normal skin," either wrinkle-free or free of any sign of scarring, is bound to be disappointed. Preoperative intracutaneous allergy testing is mandatory. A test injection should be observed for at least 4 weeks to rule out a delayed hypersensitivity reaction, foreign body reaction, hyperpigmentation, and other complications. In 2%–3% of cases a positive reaction occurs which excludes the patient from further collagen treatment. In addition, patients with collagen vascular diseases, other forms of inflammatory arthritis, or any hint of autoimmune disease should not be treated. Their condition may potentially be exacerbated by exposure to exogenous collagen, and medical-legally, if their condition worsenes, the surgeon is very likely to be blamed.

Fig. 122. Technique for injection of collagen
a Intradermal injection with blanching effect
b Linear arrangement of deposits along fold line
c Preoperative appearance
d Appearance after two treatments with Zyderm II

17.4 Injection Techniques

Achieving a satisfactory result usually requires multiple injections. Often, even after an acceptable appearance has been produced, with time atrophy redevelops, or folds and wrinkles again become more prominent. This makes a "freshening-up" necessary. The patient must be informed prior to the first procedure that improvements are rarely permanent; this explicit statement can avoid later misunderstandings. For example, injections in relaxed skin tension lines are especially likely to be transitory and require an early reinjection.

Zyderm I and Zyderm II are injected only in an intradermal fashion. Multiple tiny injections are made along a linear scar or fold. Each injection should produce a tiny wheal with blanching (Fig. 122). Initially one should overcorrect slightly, for in every case there is some shrinkage or regression. After multiple injections a level appearance can generally be obtained. When dealing with deeper defects, Zyplast can be injected subcutaneously or at the junction between the dermis and fat layers. Experienced dermatologists are also able to inject Zyplast intradermally.

Inadvertent intravascular injection can lead to ulcerations which may heal with unacceptable scars. This problem is particularly common in the glabellar region. Intravascular injections are more common when attempting to inject subdermally. Other complications include abscess formation and foreign body reactions, even after negative intracutaneous testing.

Zyderm I, with its low concentration of collagen, is degraded relatively quickly, and its use is therefore limited principally to small periorbital and perioral wrinkles. Deeper nasolabial and forehead wrinkles as well as depressed acne scars are best treated with Zyderm II. When Zyplast is simultaneously injected subcutaneously, the effect can be noticeably prolonged (Figs. 123, 124).

Fig. 123. Correcting a scar through deeper injection of collagen
a Depressed scar at corner of mouth
b Subdermal injection of Zyplast
c Manual control and modeling of injection
d Appearance immediately after procedure
e Preoperative appearance
f Appearance after two injections of Zyplast

Fig. 124. Scar revision combined with collagen injection
a Nasal defect repaired through tubed graft tunneled from nasolabial fold
b Correction of minor depressions with collagen injections
c Preoperative appearance
d Appearance after combined correction

18 Complications in Dermatologic Surgery

18.1 Causes of Complications

Incorrect clinical or histologic diagnoses can lead to inappropriate under- or overtreatment. For example, lymph node dissection performed for a large inflamed nevus rather than a nodular melanoma subjects the patient to unnecessary risk and long-term complications. However, overtreatment rarely if ever causes as much trouble as an undertreatment. If surgical margins are incorrectly assessed by the pathologist, or if a melanoma is misdiagnosed as a nevus, inadequate surgical treatment may be provided. Only when a local recurrence or metastasis occurs are the surgeon and the patient (and perhaps the lawyer) aware of the dilemma.

The most important step in avoiding intraoperative complications is to choose the least complicated procedure to produce the needed results. In addition, the surgeon is morally obliged to undertake only those operations in which he is facile. In trying a new approach one must inform the patient to the effect that, "I have never done the procedure exactly this way, but others have had great success, and I believe it is the best choice for your problem for the following reason(s)."

During the operation complications can arise either because of the surgeon's inexperience and lack of skill, inattention, frank sloppiness, or simple bad luck. In our practice, the most common complications are the latter, such as postoperative bleeding, scar formation, keloids, and wound infections. In addition, the patient may have an underlying disease, such as diabetes mellitus or a collagen vascular disorder, the potential effects of which had been overlooked or underestimated. Only when wound healing is dismal does the surgeon become fully aware of the severity of the patient's underlying condition. In this era of quality assurance, every surgical operation has a threshold of acceptable complications, supporting the simple fact that problems may arise even under the best of circumstances. Unfortunately, this reality is not widely accepted by patients and attorneys.

18.1.1 Intraoperative Changes in the Operative Plan

This awkward title reflects an awkward situation. Often the patient has been counseled in great detail about an operative plan, which must then be changed, resulting in a longer operation, bigger scar, longer hospital stay, or larger bill. The preoperative discussion and operative consent should include the possibility of a larger procedure based on intraoperative clinical or histologic findings, such as a basal cell carcinoma invading bone; or if the temporal artery is cut during a procedure on the forehead, it may be necessary to enlarge the excision to adequately control bleeding. Similarly, cutting the facial nerve or parotid duct when excising a cyst just anterior to the ear would also produce a much different postoperative result than the patient expected.

If the patient has previously expressed opposition to a specific aspect of a procedure, only the previously planned procedure should be completed. The patient must then be recounseled and a second procedure performed if the patient consents. For example, when operating on the thumb to rule out a potential malignant melanoma, the surgeon

Fig. 125. Postoperative hematoma following lower eyelid blepharoplasty

Fig. 129. Necrosis following collagen implantation
a Superficial necrosis probably following intravascular injection of collagen. The glabella region is especially prone to this complication
b Appearance after 8 months

Fig. 126. Milia following dermabrasion

Fig. 127. Hypo- and hyperpigmentation following facial dermabrasion

Fig. 128. Hyperpigmentation following dermabrasion in a darker skin type

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Fig. 130. Dehiscence following wound infection

Fig. 131. Partial necrosis of a lobed flap as part of a complex flap procedure

may notice that a subungual tumor extends deeply into the tissue and determine that amputation of the distal phalanx is appropriate. If the patient, however, has expressed opposition to amputation, it cannot be justified under the grounds of medical necessity. Instead the situation must be reexplored with the patient and appropriate consent obtained.

18.2 Complications of Cosmetic Procedures

When planning procedures that are entirely cosmetic, the preoperative discussion should include all possible complications, even those which are quite uncommon. The patient must realize that the operative scar may be more disturbing than the preoperative problem, and that a hypertrophic scar or keloid is possible in every case, despite excellent technical efforts. Postoperative bleeding, wound infections, and necrosis all delay healing and lead to a less acceptable result (Fig. 125). Dermabrasion of acne scars may produce secondary scarring, especially if it is performed too aggressively. In addition, hyperpigmentation and milia formation are common complications (Figs. 126–128). Necrosis and ulceration may follow collagen injections especially if accidental intravenous injection occurs (Fig. 129). Even following a negative skin test a delayed hypersensitivity reaction may occur with inflammation, erythema, and foreign body granulomas, as well as postinflammatory hypo- and hyperpigmentation. In addition, the patient may be disappointed by the lack of correction or complain because of overcorrection of a depression or crease.

18.3 Complications of Minor Procedures

Even relatively minor excisions can lead to cosmetically unacceptable scars. This is particularly true when operating on the back, especially over the scapula, shoulder, and extensor surfaces of the arms. On the extremities, where there is often marked tension perpendicular to the scar, dehiscence may occur (Fig. 130). Certain areas such as the ear lobe and décolletage are particularly prone to keloid formation. Failure to consider the skin tension lines can lead to a spread scar or to a distortion of normal structures, such as an

Fig. 132. Facial paralysis following surgery
a Rotation flap on forehead
b Paralysis because of damage to the superficial temporal branch of the facial nerve

ectropion of the lower eyelid by a minor but poorly planned infraorbital procedure.

18.4 Complications of Flaps

Ensuring adequate vascular supply is the key to avoiding complications of flaps and grafts. Seldom do local flaps contain a single crucial vessel; rather, they are generally served randomly by diffusion through the dermal-subcutaneous vascular plexus. If the base of the flap is too narrow with regard to its length, tip necrosis may occur (Fig. 131). One must also have a thorough knowledge of the vascular and nerve supply of the operative field. Fortunately, only few crucial nerves are so superficial that they are routinely in jeopardy. For example, the facial nerve can easily be damaged during a procedure anterior to the ear.

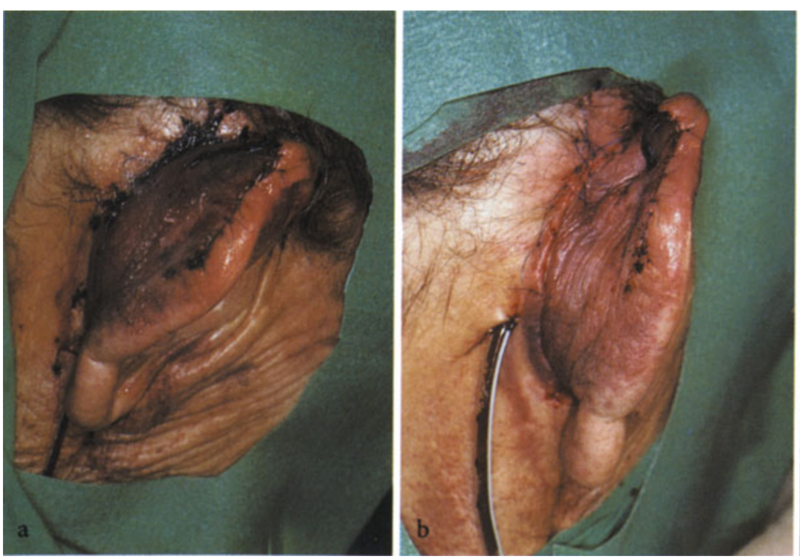

Fig. 133. Postoperative hematoma following flap placement
a Hematoma following postauricular rotation flap
b Appearance after revision and insertion of a suction drain

Fig. 134. Ectropion of the lower eyelid following rotation flap on cheek combined with skin graft

Fig. 135. Dehiscence following flap procedure on skull
a Simple rotation flap followed by dehiscence
b Rotation flap from contralateral side for correction
c Skin closure after second procedure
d Appearance after 3 months

Similarly, one does not want to compromise or damage a major blood vessel supplying the operative site, for this increases the likelihood of delayed healing and necrosis (Fig. 132).

Meticulous control of bleeding is essential during the procedure. Locating bleeders with a small clamp and then tying them off is more certain and less traumatic than using cautery. Of course, slightly more suture material is left in the wound, but we are willing to accept this risk. In our experience, postoperative bleeding and necrosis are more common when cautery is used to control bleeding as flaps are developed (Fig. 133). If the flap covers a relatively large wound, a suction drain is very helpful to help ensure that the flap takes, and that bleeding causes minimal problems.

Again, careful planning is critical to avoiding problems. When working around the eyes and mouth, one must consider the possibility that the wound may tug on the eyebrow, eye-

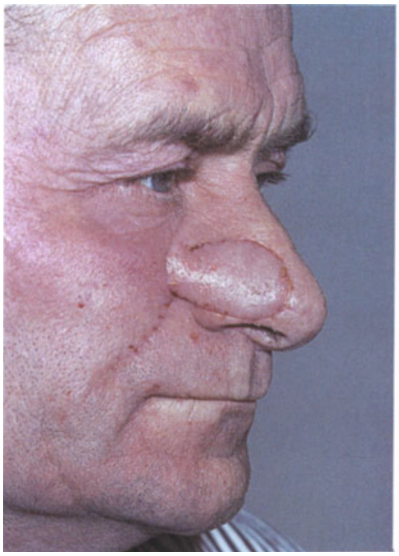

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Fig. 136. Trapdoor effect because a flap was not adequately defatted

Fig. 137. Depressed scar following split-thickness skin graft over wound bed which has not been conditioned long enough

Fig. 138. Partial failure of a split-thickness mesh graft

lid, or lip, producing an asymmetry which is invariably noticeable (Fig. 134). Thus the operation should be planned so that the flap can be suspended from a relatively firm region such as the temple or lateral nose, rather than to the lip or near the eyelid. Dehiscence is a potential problem when flaps are used in areas with little additional skin, such as the extensor surfaces of the extremities or scalp. If it occurs, yet another flap can be employed or a graft used (Fig. 135).

The trapdoor effect occurs when the two edges of the wound are not at the same level (Fig. 136). This may occur when the flap is not trimmed properly so that it remains thicker than the adjacent skin. This often occurs when nasolabial flaps are used to cover nasal defects.

18.5 Complications of Grafts

The most important issue involving a graft is obviously whether or not it takes. Many factors are important in this, including where and how it is obtained, how well the recipient site is prepared, and how good its vascular supply is (Fig. 137). All grafts should be taken from healthy, well-vascularized sites in as gentle and atraumatic manner as possible. Full-thickness skin grafts must be defatted to avoid uneven edges and to allow more rapid diffusion of nutrients. The graft should be carefully fitted to the host site, avoiding any tension, pressure, or excessive suturing in order to minimize the chance of wound edge necrosis, which may serve as the nidus for more severe problems with wound healing (Fig. 138). Split-thickness skin grafts, even after they have apparently healed well, may undergo shrinkage despite the best efforts of the surgeon and patient (Fig. 139).

18.6 Medical-Legal Aspects

Complications may arise in dermatologic surgery not only through problems during the surgery but also because of inadequate preope-

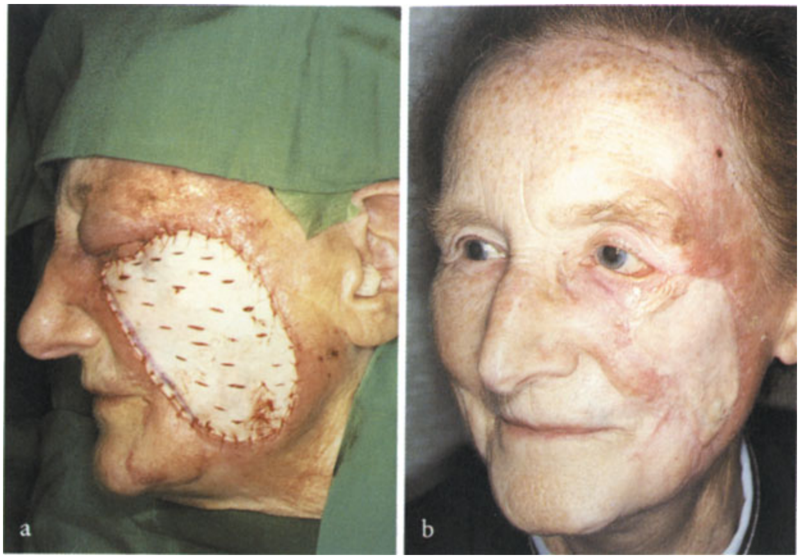


Fig. 139. Shrinkage of a split-thickness skin graft
a Split-thickness graft stretched out on cheek to provide adequate coverage
b After contraction of graft, ectropion of lower eyelid occurred

rative evaluation and planning or because of less than ideal postoperative care. In addition, underlying diseases may contribute to inadequate healing, bleeding, or wound infections. In the eyes of the patient, the surgeon is responsible for all these problems, and in most instances the law also takes this viewpoint.

Once a contract between the physician and patient has been established, usually in the form of a patient visit, and once counseling and agreement to perform an operation have taken place, the doctor is held responsible for adequately informing the patient about the benefits and risks of the procedure, for performing it according to the standards of care appropriate for his specialty and place of practice, and for being available for all postoperative care. Obviously many of these tasks may be delegated to assistants, but the surgeon is still ultimately responsible. Even when a physician is consulted outside his specialty, such as an internist who is asked to help with prevention of thrombosis, if a thrombus occurs, both physicians are probably at risk.

Part B
Regional Operative Techniques

The fundamental techniques of skin surgery have been well established for over 100 years, but they continue to undergo continuous modification and improvement. These techniques are discussed in detail in Part A. However, one of the major tasks of the cutaneous surgeon is to know which techniques are best suited for various anatomic units (and even subunits). To make this crucial decision the surgeon must be well versed both in the details of regional anatomy and in the myriad of possible surgical approaches. The following operative approaches for different body regions are based principally on our personal experience and preference; we have no doubt omitted many equally useful techniques. Nonetheless, the operations described below should enable the surgeon to provide a curative and cosmetically elegant approach to most surgically amenable skin diseases.

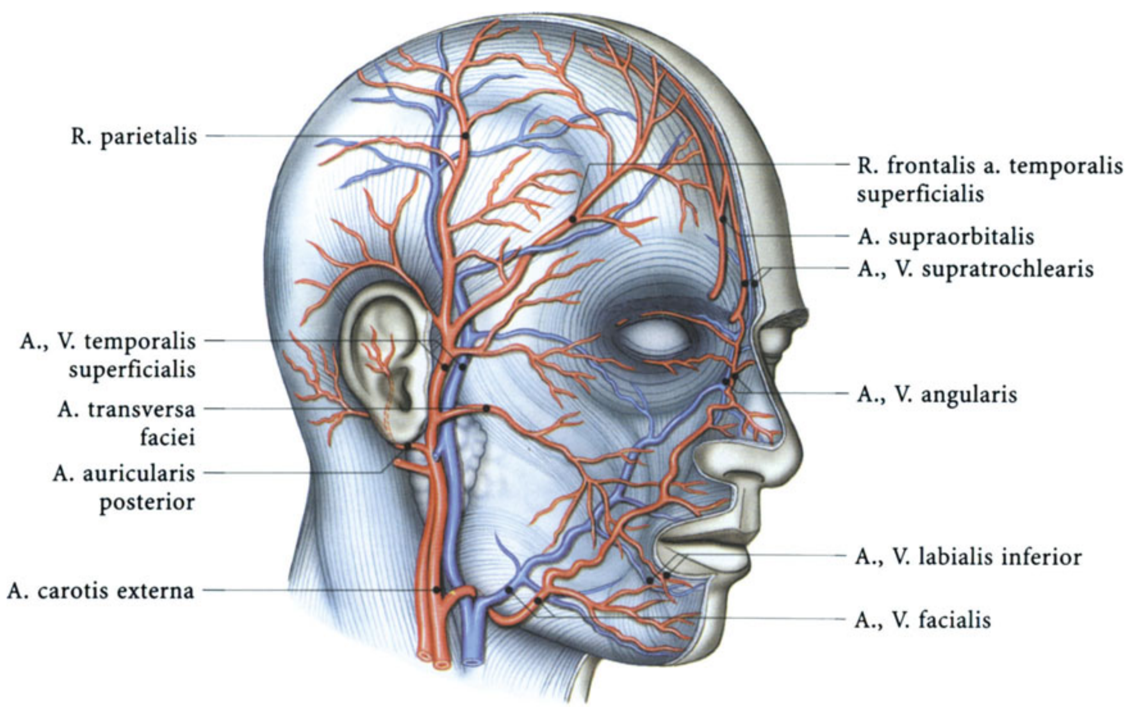
19 Head and Neck

Operations of the head and neck region pose a great challenge to all surgeons because they require an extensive knowledge of anatomy, including vascular and nerve supply, and because the patient is always concerned about acceptable cosmetic results. The overwhelming majority of malignant and premalignant skin tumors occur in the head and neck region. In addition, the classic problem areas for the cutaneous surgeon, such as the eyelids, nose, lips, and ears, are often the site of tumors.

An exact appreciation of the anatomic relationships of the individual subregions is critical (Figs. 140–142). One must avoid accidental injury to major nerves (such as the facial nerve) and arteries (facial and temporal arteries) while preserving an adequate vascular supply required for the satisfactory healing of flaps. The relationships between the muscles of facial expression, fascia, cartilage, and connective tissue, especially as they combine to give form to the face through the shape of the mouth, nose, ears, and eyes, must be considered in planning each operation. These are considered in detail in the following chapters.

Two different sets of lines must be considered when planning the line of excision in the head and neck region. In children and younger adults the skin tension lines are most important. Older facial skin, on the

Fig. 140. Vessels of the face and scalp



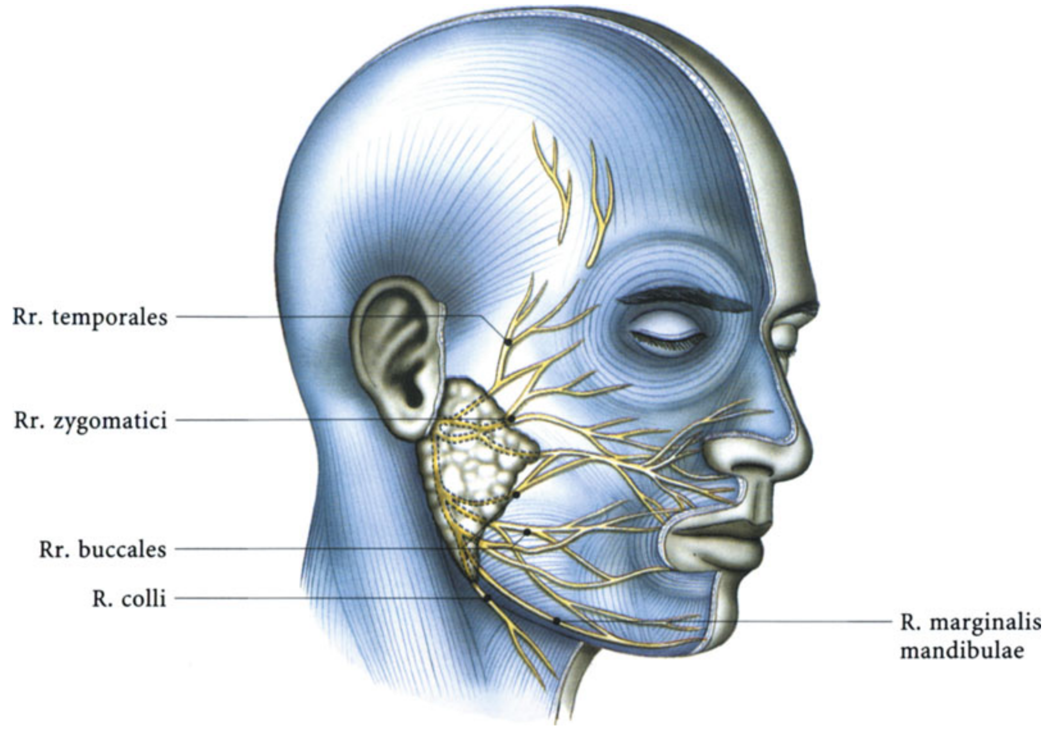


Fig. 141. Branches of the facial nerve

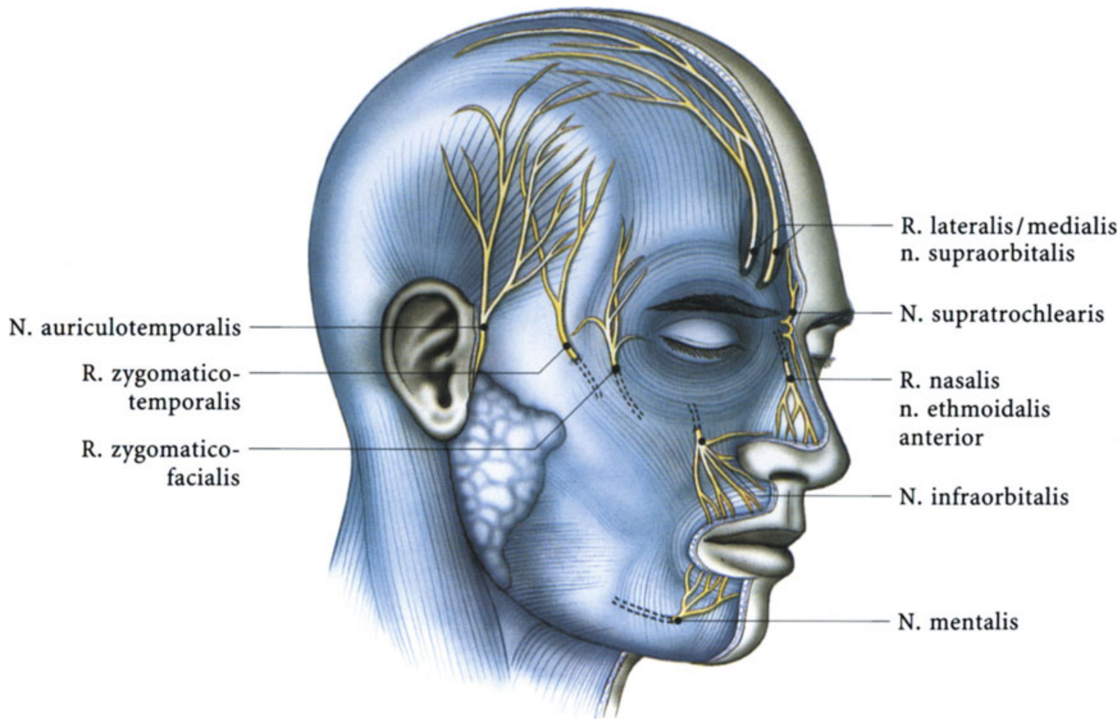


Fig. 142. Branches of the trigeminal nerve

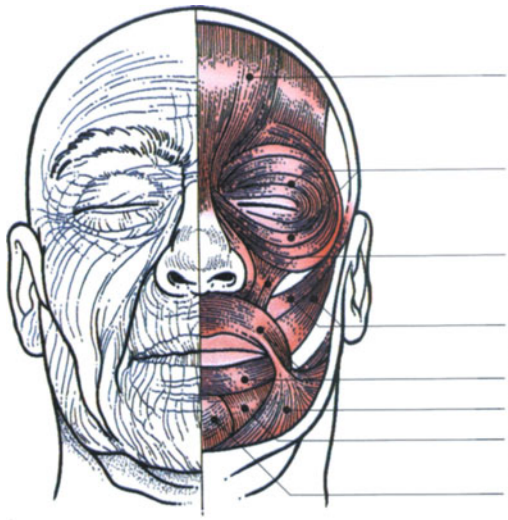


Fig. 143. *Right*, muscles of facial expression; *left*, the wrinkle lines in an elderly person are generally perpendicular to the muscles

other hand, shows numerous folds and wrinkles, usually perpendicular to the muscles of facial expression. These are generally not identical to the skin tension lines. Wrinkled skin provides a convenient place to hide scars and therefore serve as a source of tissue for flaps (Fig. 143). We divide the head and neck region into various subregions (Fig. 144) and deal separately with the unique features of each.

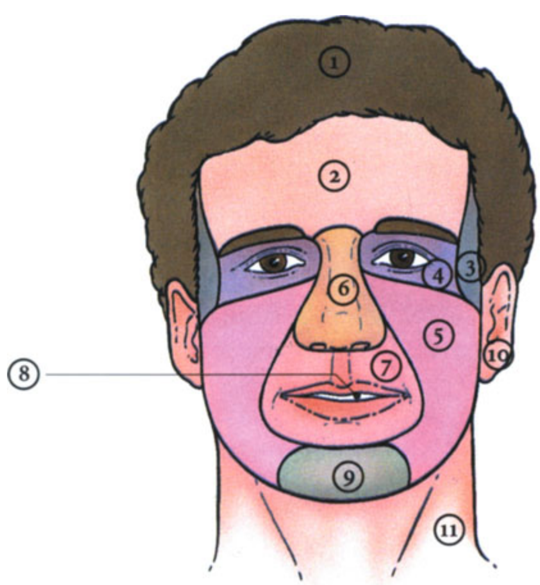


Fig. 144. Anatomic subregions of the head and neck:
1, scalp
2, forehead
3, temple
4, eyelids, eyebrows
5, cheek
6, nose
7, lips, perioral region
8, mouth
9, chin
10, ear
11, neck

19.1 Scalp

Closing wounds primarily, even after generous lateral undermining, is often difficult on the scalp. Wounds are created under great tension, and the scars tend to expand over time. The problems for surgeons arise from thickness and lack of distensability of the skin, coupled with its close attachment to the skull. In recent years tissue expanders have been used both pre- and intraoperatively on the scalp to facilitate wound closure. In addition, skillful use of flaps also makes the process more successful.

19.1.1 Anatomy

The skin, subcutaneous tissue, galea aponeurotica, and epicranial muscles combine to form a relatively homogenous anatomic unit. The galea is a firm, strong, tendonlike structure which covers the skull much as a skullcap. The epicranial muscles attach to the galea in symmetrical pairs, frontally, temporally, and occipitally. The galea is firmly attached to the subcutaneous tissue but is easily movable over the periosteum. The skull is highly vascularized; the main vessels are the occipital, posterior auricular, frontal, and especially temporal arteries. Multiple anastomoses connect the various arterial beds, which explains the excellent vascular supply and also the difficulties with hemostasis. Innervation of the scalp is also achieved through a rich network of nerves involving the three branches of the trigeminal nerve, the occipital nerves, and a variety of nerves from the cervical plexus. This makes a nerve block for the scalp impossible. The combination of a rich vascular supply and interconnected nerve supply helps to explain why local anesthesia often takes longer to become effective than in other areas.

19.1.2 Anesthesia

Local infiltration anesthesia is sufficient for minor procedures. Larger flaps can be performed after circumferential or ring-shaped infiltration has been performed. General anesthesia may be necessary for more major procedures.

19.1.3 Planning the Operation

The use of local flaps is generally recommended on the scalp, as this approach most often eliminates the need to create areas of hair loss which are cosmetically unacceptable. Excisions that involve lesions larger than 1 cm should be carried out to the depth of the periosteum. This allows for easier closure with less wound tension. Because of the risk of blood loss any major scalp procedure should be preceded by blood typing and cross-matching. If there is a history of a bleeding disorder, consultation with an internist should be sought.

19.1.4 Surgical Techniques

Areas of scalp that are to be mobilized should be freed at the level of the galea. The entire scalp is then slid or rotated. Bleeding is profuse, but hemostasis is easier to obtain when the scalp is mobilized in this way. To close the wound we use single stitches with sutures between 0-0 and 2-0.

The best flap on the skull is a rotation flap, usually a fairly large one since the thick skin unit creates problems with small or delicate flaps. Other forms of flaps are less successful on the scalp.

Free skin grafts can also be applied to the scalp. These are used to close large or even medium-sized defects in patients who are at operative risks. In general, they are used only with bald patients because of the obvious cosmetic problem, although they are sometimes unavoidable in patients with a full head of hair who must undergo major surgery for a tumor. Skin grafts do not survive on exposed bone, and therefore a bed of granulation tissue must be prepared for them. An artificial

area of granulation tissue is induced by drilling 3- to 4-mm holes, separated by a distance of 1 cm, through the external table of the skull into the spongy bone. A fresh bed of granulation tissue arises through these holes over a period of 2–4 weeks; in our experience, it is more than adequate to nurture free skin grafts. If the periosteum is preserved for the most part, a full- or split-thickness skin graft generally takes directly to this vascularized tissue.

Fig. 145. VY-plasty
a Partially necrotic hemangioma on scalp of infant
b VY excision
c Extensive undermining
d Closure with single skin sutures
e Preoperative appearance
f Appearance after 1 year

Fig. 146. Advancement flap
a Triangular excision of a basal cell carcinoma with advancement flap created in a caudal and lateral direction
b Mobilization of flap at level of fascia
c Moving the flap into place
d Closure with Burow's triangle at upper sulcus of the ear and suction drain in place
e Preoperative appearance
f Appearance after 6 months

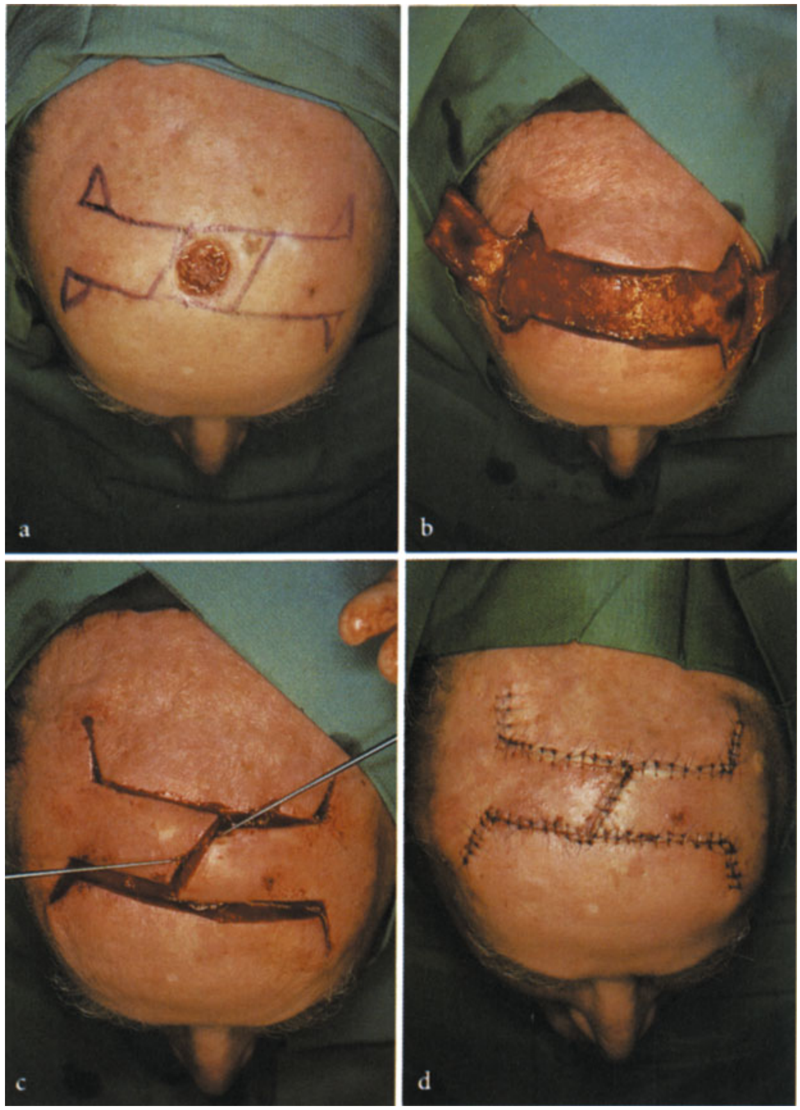


Fig. 147. H-plasty or bilateral advancement flap
a H-plasty planned on forehead after removal of a squamous cell carcinoma
b Wide mobilization of the flaps and excision of Burow's triangles
c Approximation of flaps
d Closure

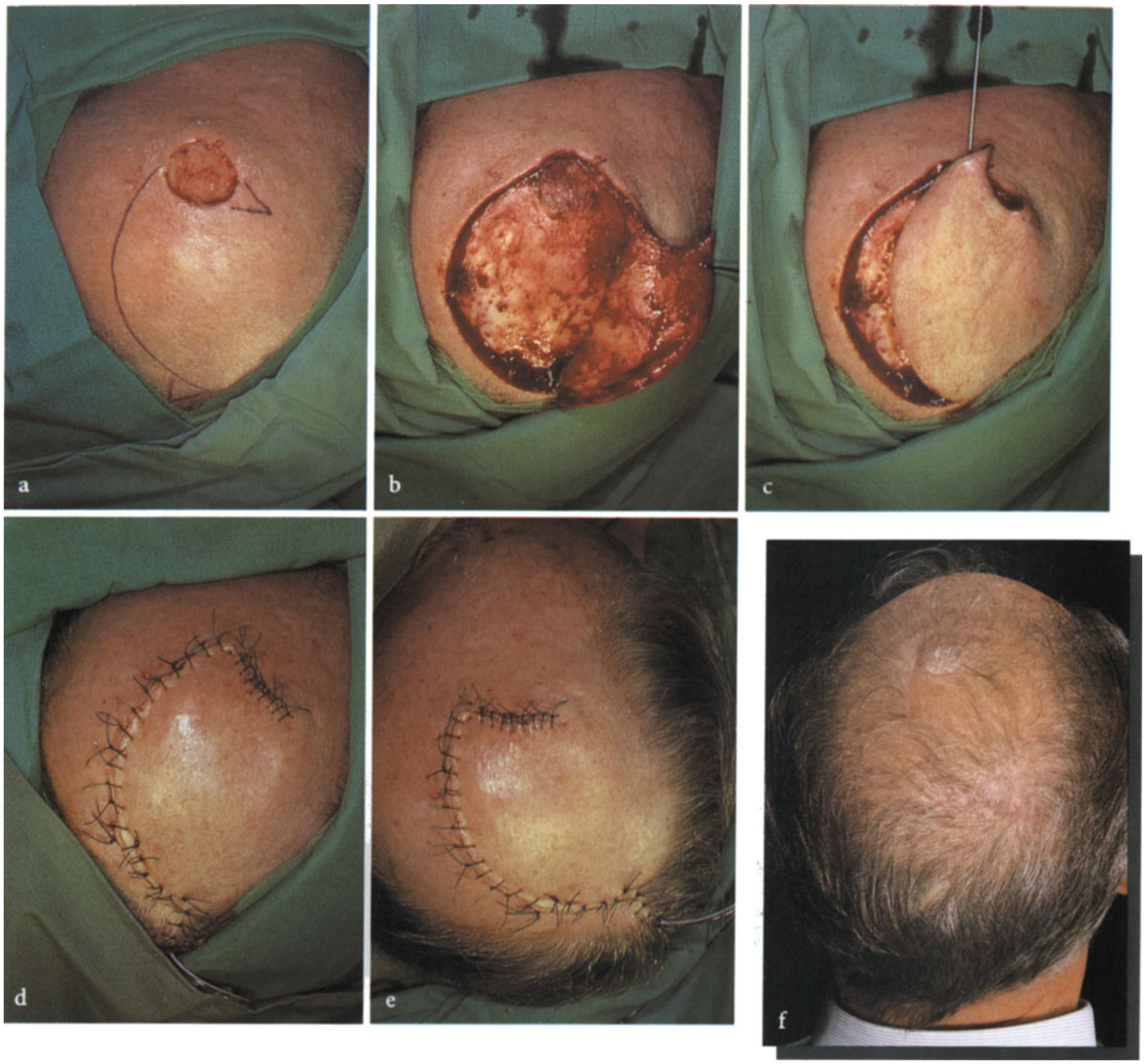


Fig. 148. Simple rotation flap
a Defect after excision of basal cell carcinoma, with operative plan
b Complete mobilization of flap
c Rotation into defect
d Closure with deep skin sutures
e Appearance after closure with insertion of suction drain
f Appearance after 6 months

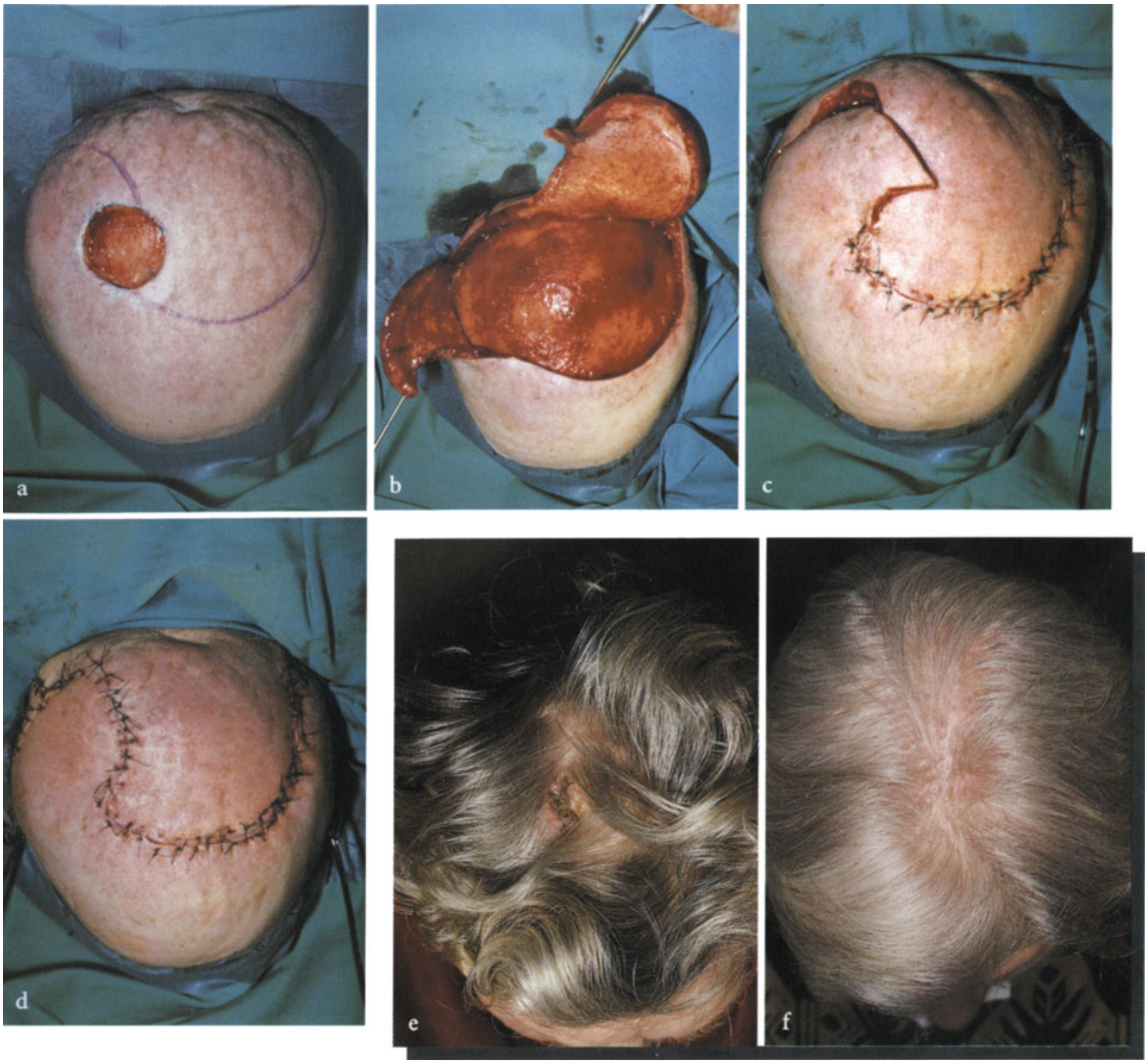


Fig. 149. Double rotation flap
a Defect after removal of basal cell carcinoma, with operative plan
b Preparation of both flaps, avoiding damage to the periosteum
c Wound partially closed
d Skin closure completed
e Preoperative appearance
f Appearance after 8 years

Fig. 150. Rotation flap in combination with WY-plasty
a Operative plan for excision of nevus sebaceus
b Defect excised in W shape at base
c Flap mobilized
d Flap rotated in place
e Preoperative appearance
f Appearance after 1 year

Fig. 151. Rotation flap combined with advancement flap with back cut

a Defect after removal of large ulcerated pigmented basal cell carcinoma and operative plan sketched
b Rotation flap placed and two Burow's triangles marked
c Advancement flap with back cut used to close defect left by rotation flap
d Final closure
e Preoperative appearance
f Appearance after 6 months

Fig. 152. Split-thickness skin graft
a Defect after wide excision of malignant melanoma with satellites
b Freshening the edges of the wound after conditioning
c Carefully placed split-thickness graft
d Appearance after 6 months

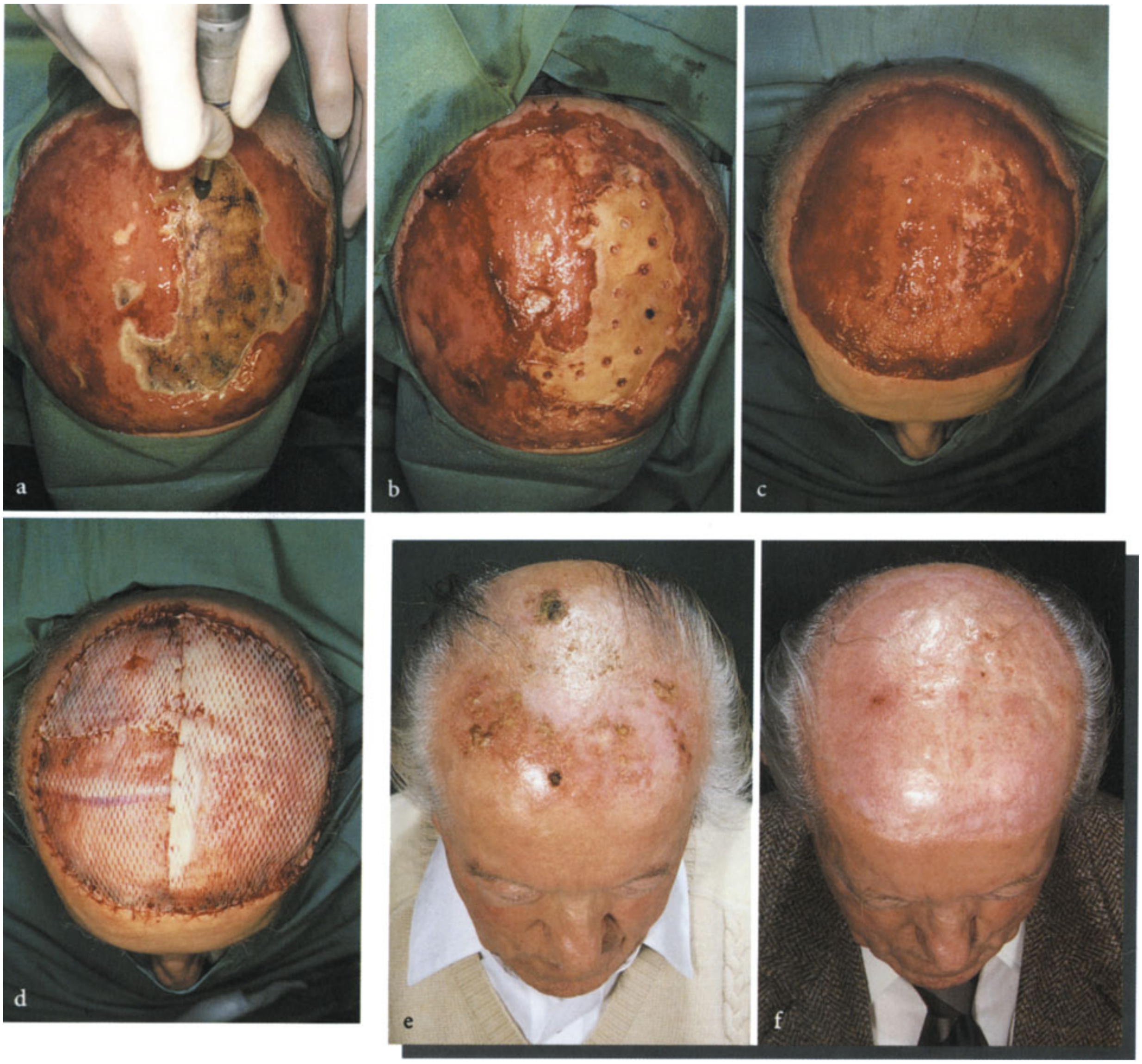


Fig. 153. Mesh split-thickness skin graft
a Huge defect after excision of multifocal squamous cell carcinoma with intervening areas of carcinoma in situ. The skull is exposed
b The external table of the skull has been fenestrated to allow granulation tissue to grow up
c Complete coverage after 6 weeks
d Mesh split-thickness grafts in place
e Preoperative appearance
f Appearance after 1 year

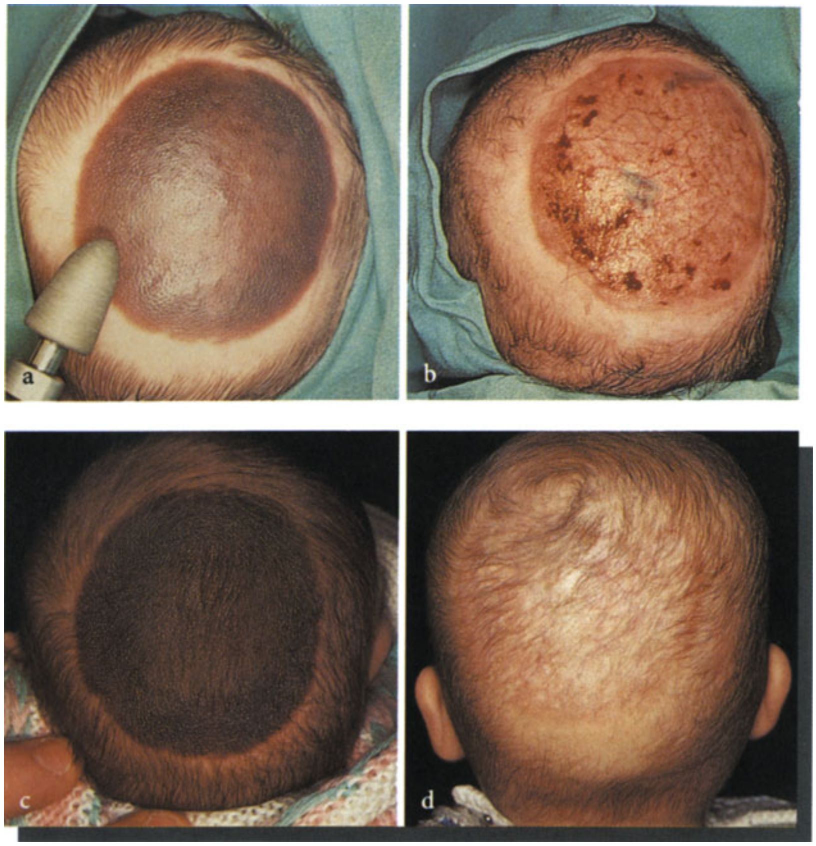


Fig. 154. Dermabrasion
a Dermabrasion of a congenital nevus in an infant
b Appearance after procedure, with almost all pigment removed
c Preoperative appearance
d Appearance after 6 months

19.2 Forehead

Just as on the skull, the skin of the forehead is difficult to close with flaps, and larger defects are hard to close primarily. However, since the forehead skin is looser and rich in folds, in many smaller procedures the suture line can be buried in a crease. If flaps are planned carefully, with attention to wrinkle lines, these usually also produce acceptable cosmetic results. Finally, the forehead is the best place on the head for free skin grafts; because of the relative lack of motion, especially laterally, structural differences between the donor and host skin are less noticeable than in other areas.

19.2.1 Anatomy

The forehead marks the transition from the skull unit to the muscles of facial expression. The fibers of the frontalis and orbicularis oculi muscles insert in the base of the skin and help in facial expression, such as elevating the skin of the forehead in the stereotypic look of surprise. The major arteries are the superficial temporal, supraorbital, and supratrochlear vessels. The latter run parallel to the branches of the supraorbital nerve after it leaves the supraorbital foramen and branches across the forehead.

19.2.2 Anesthesia

The forehead can be anesthetized using infiltration techniques or with a nerve block. The first branch of the trigeminal nerve can easily be identified as it exits the orbital foramen. Therefore general anesthesia is rarely needed, even for major procedures.

19.2.3 Planning the Operation

When considering local flaps, the surgeon must be certain not to drastically alter the hairline, particularly by moving the scalp anteriorly. Of course, for some patients this presents no problem, while for others, requiring cosmetic hair replacement, it is the goal. Another concern is elevating an eyebrow and thus destroying the facial symmetry. Minor elevation of the eyebrow is acceptable, as the eyebrow generally relaxes to its original position over a period of time.

19.2.4 Surgical Techniques

Many different procedures have proven valuable on the forehead. In addition to simple excision with undermining, we usually employ VY-, H-, U-shaped and rotation flaps. The individual flaps must of course be planned to best fit the particular part of the forehead where the lesion is found. In the preparation of flaps one must be aware of the paths of the frontal and temporal arteries. In the lateral part of the forehead one must avoid the superficial temporal branch of the facial nerve, while in the midforehead one must avoid the supratrochlear and supraorbital nerves if possible.

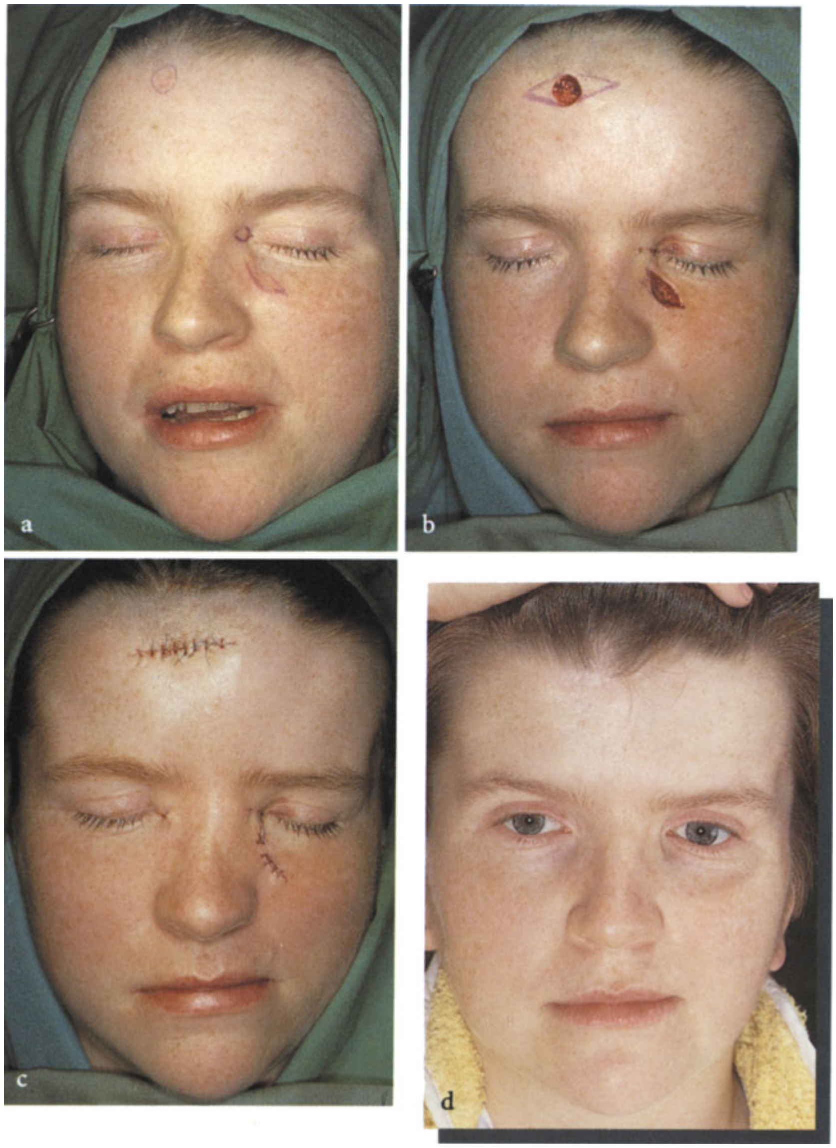


Fig. 155. Simple excisions
a Patient with nevoid basal cell carcinoma syndrome (Gorlin-Goltz syndrome) with basal cell carcinomas on forehead and about left eye
b After excision of forehead basal cell carcinoma, conversion of defect into horizontal ellipse which was then extensively undermined. The two lesions about the eye were excised with regard to skin tension lines
c Simple closure
d Appearance after 2 years

Fig. 156. VY-plasty
a After excision of a basal cell carcinoma, planning for a VY-plasty in a vertical fashion, but with attention to the horizontal forehead folds
b Undermining laterally
c End of operation
d Appearance after 3 months

Fig. 157. Advancement flap
a Excision of a congenital melanocytic nevus using classical advancement flap with Burow's triangle with orientation along forehead and glabellar lines
b End of operation
c Preoperative appearance
d Appearance after 3 months

Fig. 158. U-plasty (advancement flap)
a Excision of a keratoacanthoma and advancement of a lateral U-shaped flap with Burow's triangles. Long arms of U follow forehead lines
b Complete mobilization of flap and excision of triangles
c Moving the flap into place
d End of operation
e Preoperative appearance
f Appearance after 1 year

Fig. 159. H-plasty (bilateral advancement flap)
a Defect after excision of basal cell carcinoma. Plan for an H-plasty with long arms following forehead lines
b Mobilization of flaps and excision of Burow's triangles
c Advancing the two flaps together
d End of operation
e Preoperative appearance
f Appearance after 3 months

Fig. 160. Rotation flap with back cut
a Defect after excision of basal cell carcinoma with plan for rotation flap oriented horizontally
b Mobilization of flap
c Rotation of flap. The use of the back cut avoided the need for a Burow's triangle
d End of operation
e Preoperative appearance
f Appearance after 1.5 years

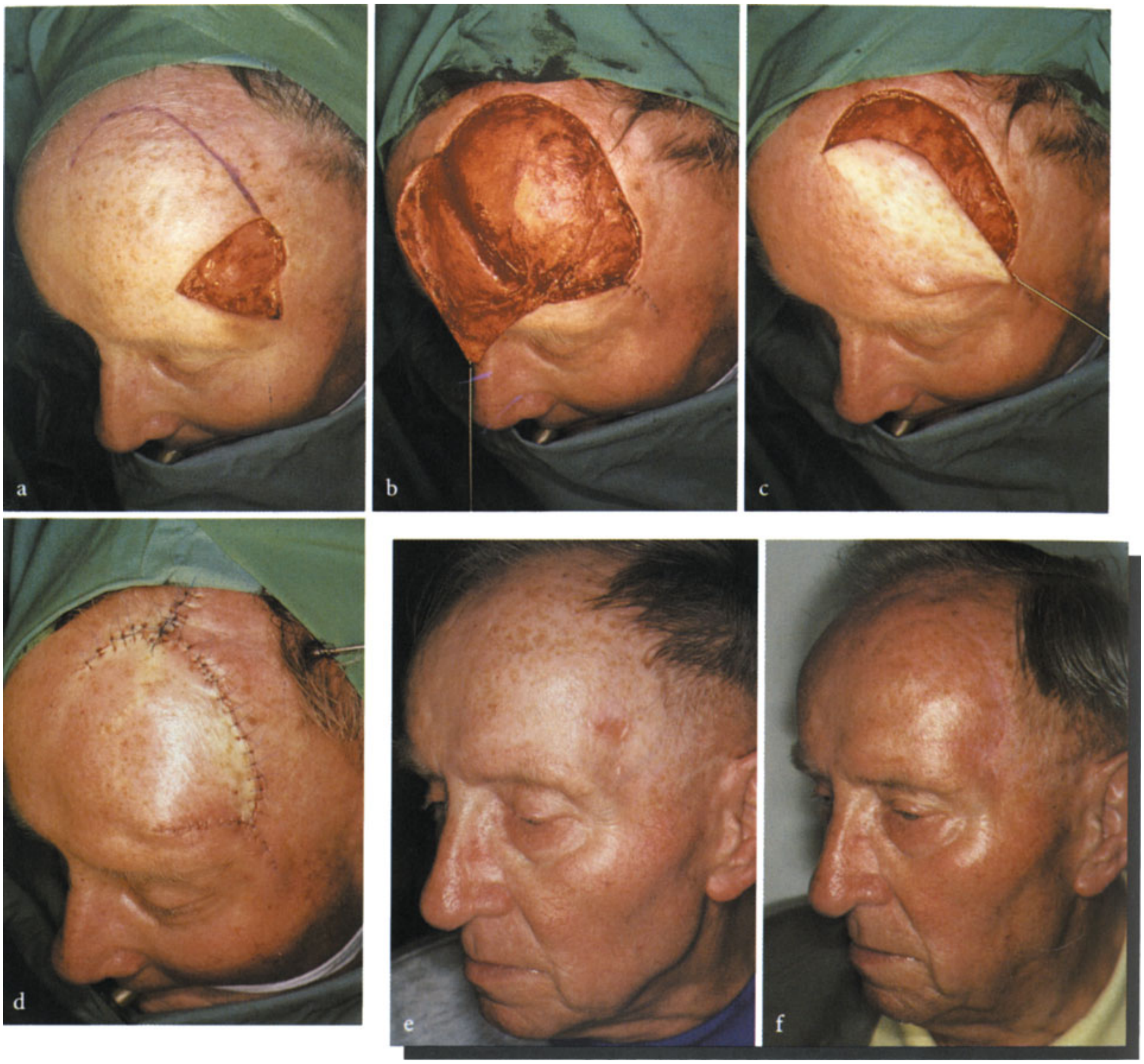


Fig. 161. Rotation flap
a Triangular defect after excision of a basal cell carcinoma
b Undermining and partial closure in temporal region with mobilization of flap
c Rotating the flap
d End of operation
e Preoperative appearance
f Appearance after 3 months

Fig. 162. Rotation flap combined with a small subcutaneous pedicle flap

a Defect after excision of basal cell carcinoma, with operative plan
b Preparation of a pedicle flap laterally
c Moving the pedicle flap medially
d Mobilization of rotation flap. Pedicle flap already partially tacked in place
e End of operation
f Appearance after 6 months. The use of the pedicle flap was important in this case to prevent the rotation flap from elevating the eyebrow

Fig. 163. Double rotation flap
a Recurrent basal cell carcinoma with two opposing rotation flaps planned
b Triangular defect
c Preparation and rotation of flaps
d End of operation
e Preoperative appearance
f Appearance after 6 months

Fig. 164. Bilateral subcutaneous pedicle flaps
a Operative plan for excision of a basal cell carcinoma with flap closure
b Defect is rectangular
c Two pedicle flaps are moved medially
d Laterally a small Burow's triangle is needed. End of operation
e Preoperative appearance
f Appearance after 1 year

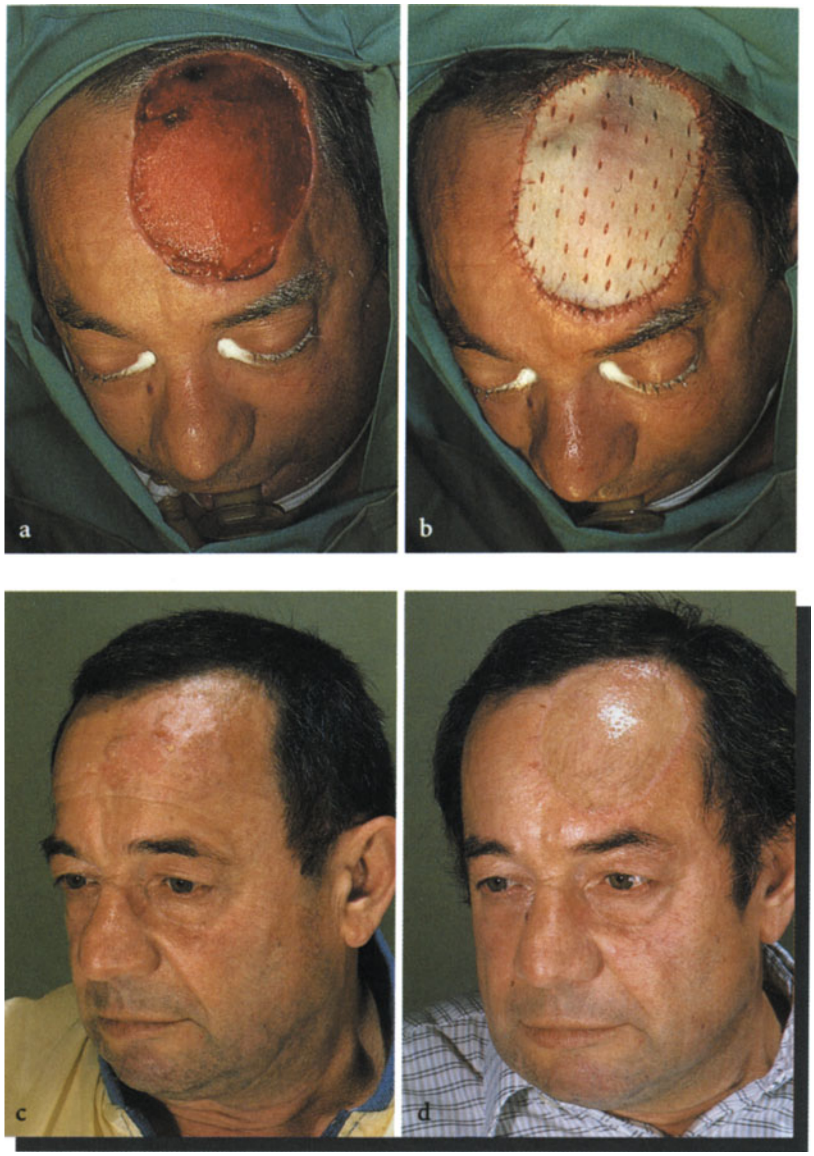


Fig. 165. Split-thickness skin graft
a Defect after removal of superficial basal cell carcinoma and granulation of wound base
b Split-thickness skin graft in place. Slits used to reduce risk of hematoma formation
c Preoperative appearance
d Appearance after 1 year

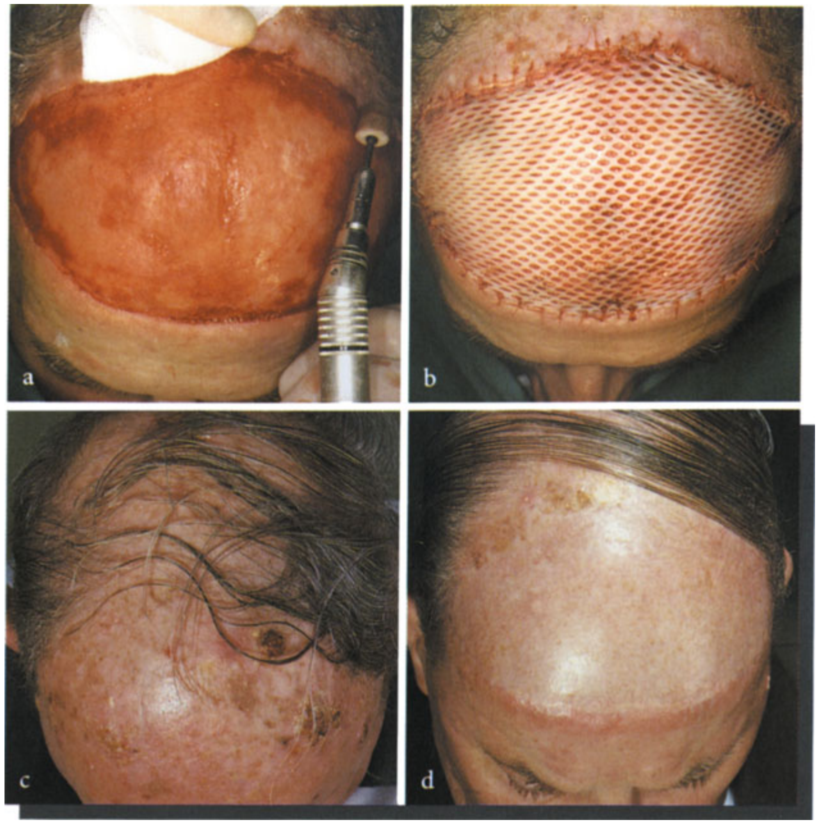


Fig. 166. Mesh split-thickness skin graft
a Defect after removal of large squamous cell carcinoma with many associated actinic keratoses. Wound has been conditioned, and it is now being freshened
b Mesh graft in place
c Preoperative appearance
d Appearance after 2 years

19.3 Temples

The skin in the region of the temples is relatively easy to stretch and to move. Therefore it is relatively simple to close fairly large defects with simple closure or a VY-flap, after extensive undermining in each case. The superficial temporal branch of the facial nerve lies superficial to the temporalis muscle and just lateral to the eyebrow; this must be avoided. The vascular supply to this region is so good that healing is almost never a problem.

19.3.1 Anatomy

In this area the skin lies directly over the fascia of the temporalis muscle. The temporal artery can be easily palpated; beneath it is the temporal branch of the facial nerve. Anteriorly, many small branches of the facial nerve splay out to serve the periorbital muscles of facial expression; these usually cannot be identified and spared.

19.3.2 Anesthesia

Local infiltration usually suffices in this region.

19.3.3 Planning the Operation

The major problem to take care of is displacing the lateral eyelid or eyebrow. New dangers present themselves when undermining or working in the preauricular region. One must preserve not only the temporal branch of the facial nerve but also the zygomatic branch as well as the temporal artery and vein. If one is aware of anatomic landmarks, a facial nerve paralysis can usually be avoided. Nonetheless, it is wise to counsel the patient about this possibility prior to the operation.

19.3.4 Surgical Techniques

If the defect is too large for closure with a flap, a full-thickness skin graft can be taken from the inner aspect of the upper arm. The skin here is a surprisingly good match for the temple. One can attempt to modify other standard flaps, for the blood supply in this region is superb and provides one considerable flexibility.

Fig. 167. Two advancement flaps
a Plan to remove two basal cell carcinomas (*enclosed in the two triangles*) and then advance two flaps
b Mobilization of flaps
c Placement of flaps
d Closure under almost no tension
e Preoperative appearance
f Appearance after 3 months

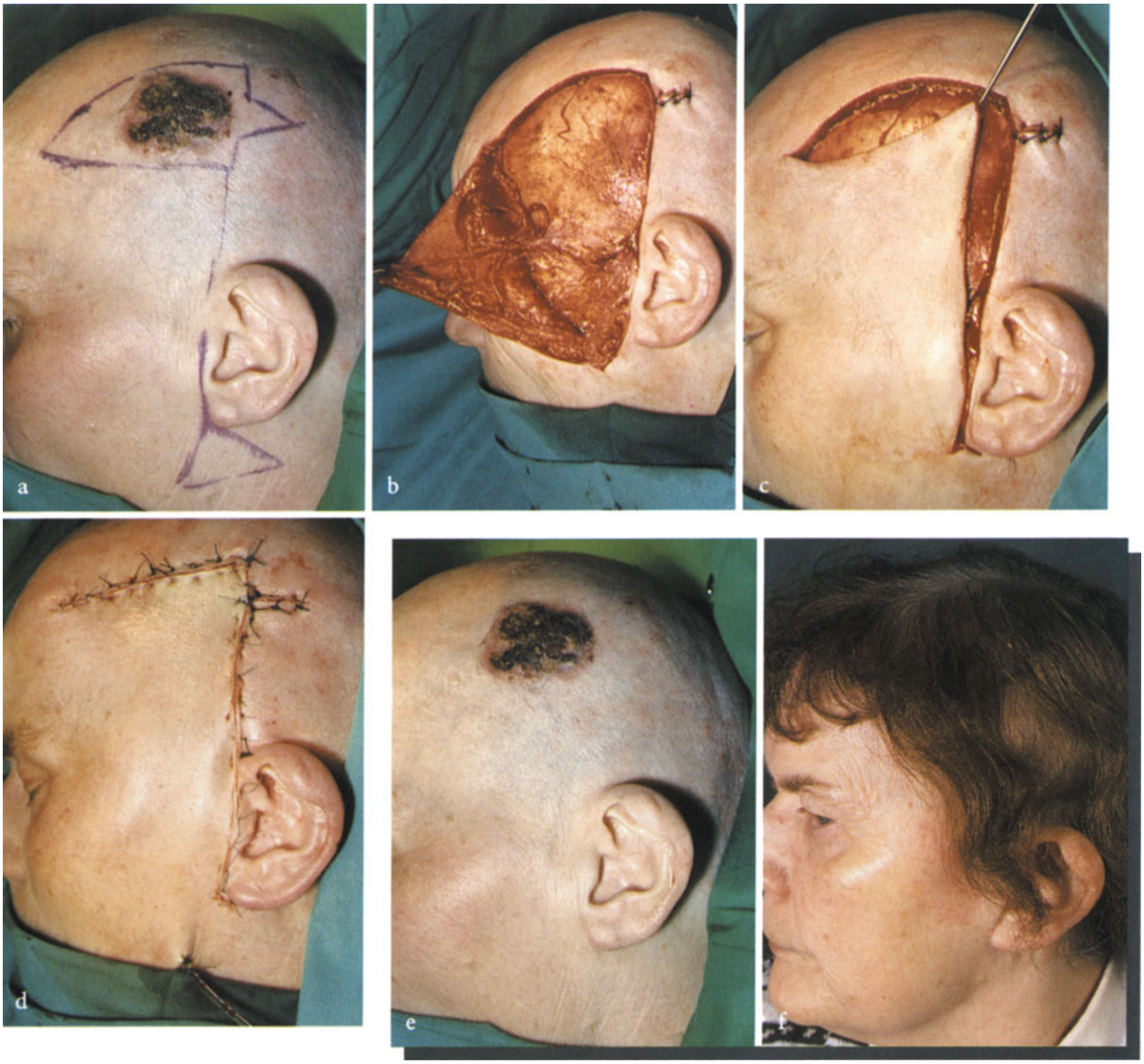


Fig. 168. Advancement flap
a Removal of ulcerated basal cell carcinoma, with operative plan showing a relatively long advancement flap using preauricular crease
b Closure of superior Burow's triangle and mobilization of flap
c Placement of flap
d Appearance after excision of Burows triangle in the infraauricular fold. End of operation
e Preoperative appearance
f Appearance after 5 years

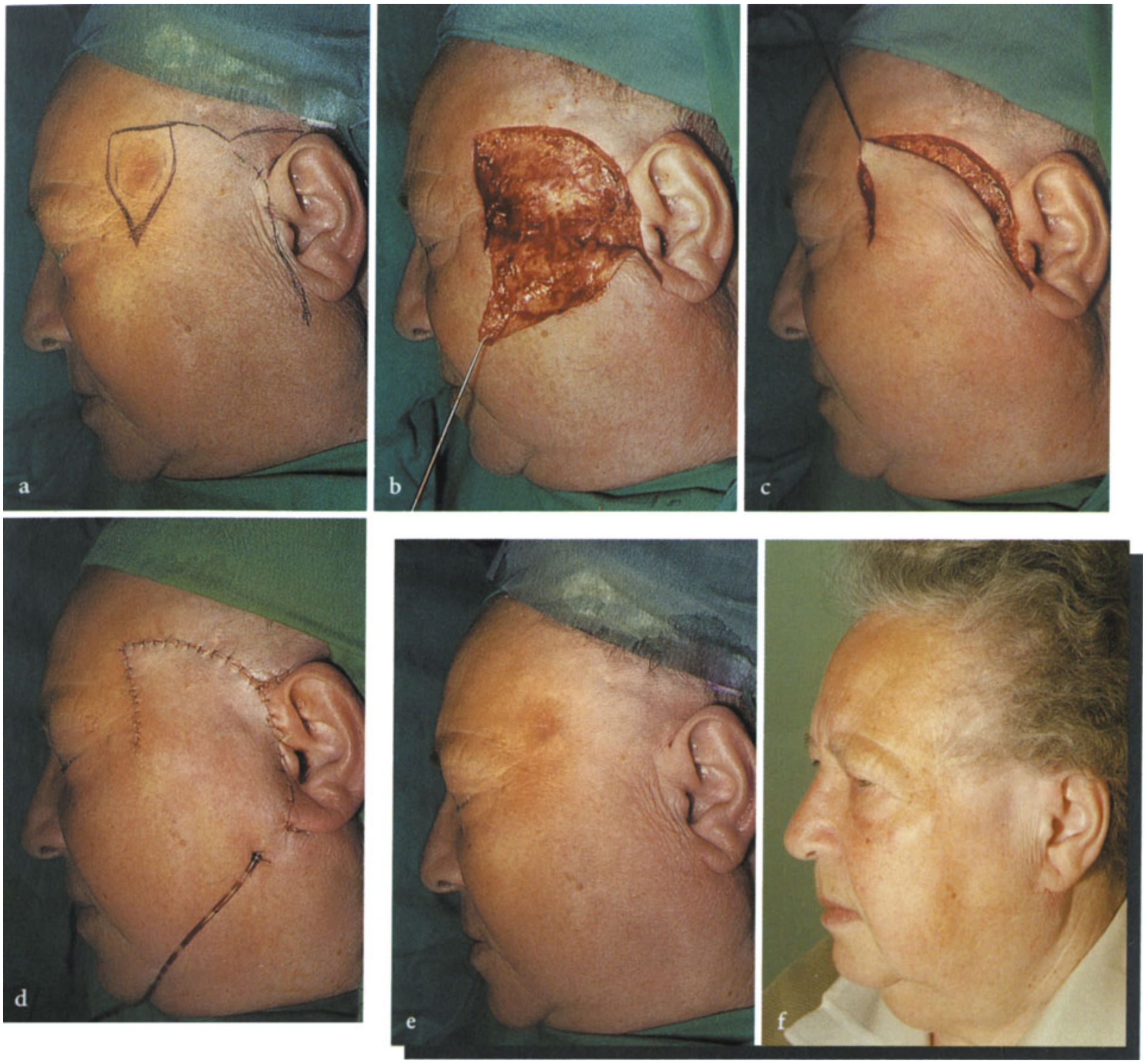


Fig. 169. Rotation flap
- **a** Plan for excision of basal cell carcinoma and large rotation flap with longest arm in preauricular crease
- **b** Mobilization of flap
- **c** Placement of flap
- **d** Skin closure and suction drain in place. Two Burow's triangles, above and below ear
- **e** Preoperative appearance
- **f** Appearance after 1 year

Fig. 170. Rotation flap combined with subcutaneous pedicle flap
a Defect after removal of basal cell carcinoma, with operative plan
b Mobilization of rotation flap
c Preparation of pedicle flap
d Skin closure utilizing both an intracutaneous suture and simple sutures
e Preoperative appearance
f Appearance after 6 years

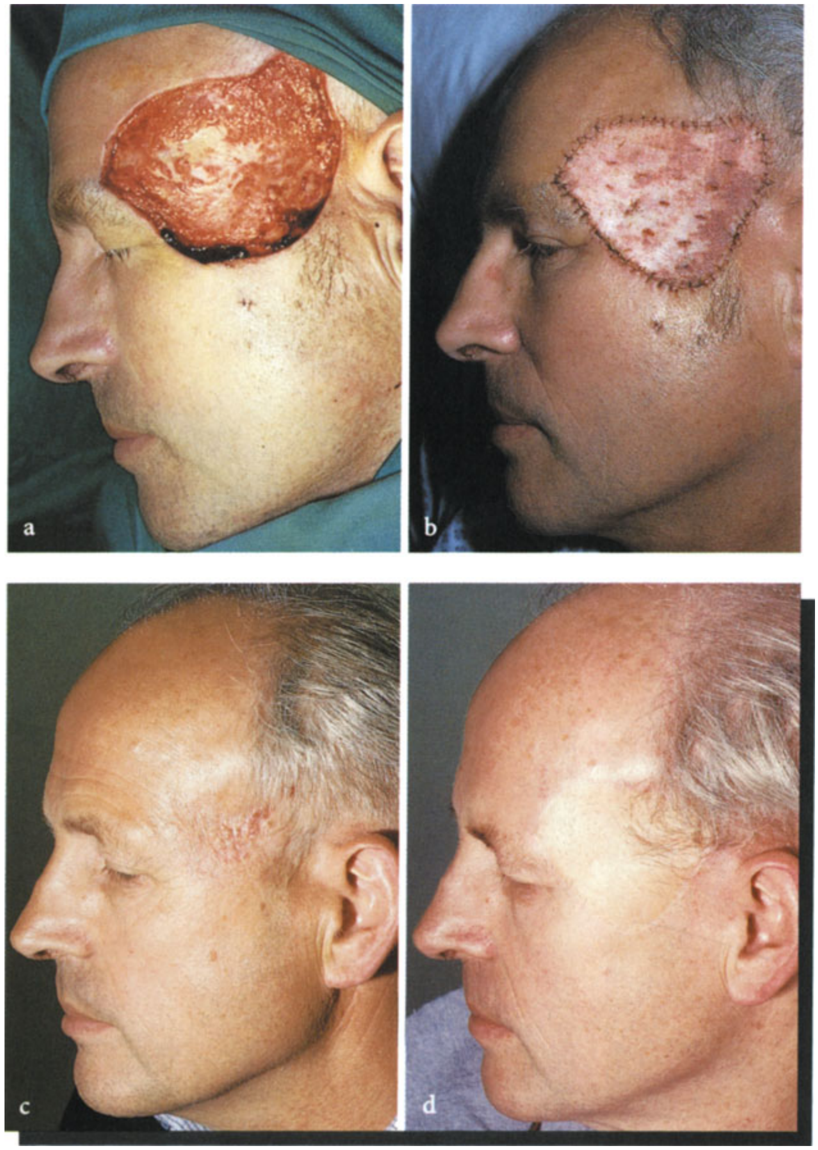


Fig. 171. Split-thickness skin graft
a Large defect after excision of a superficial basal cell carcinoma
b After wound conditioning, a split-thickness skin graft is fitted in place
c Preoperative appearance
d Appearance after 6 years

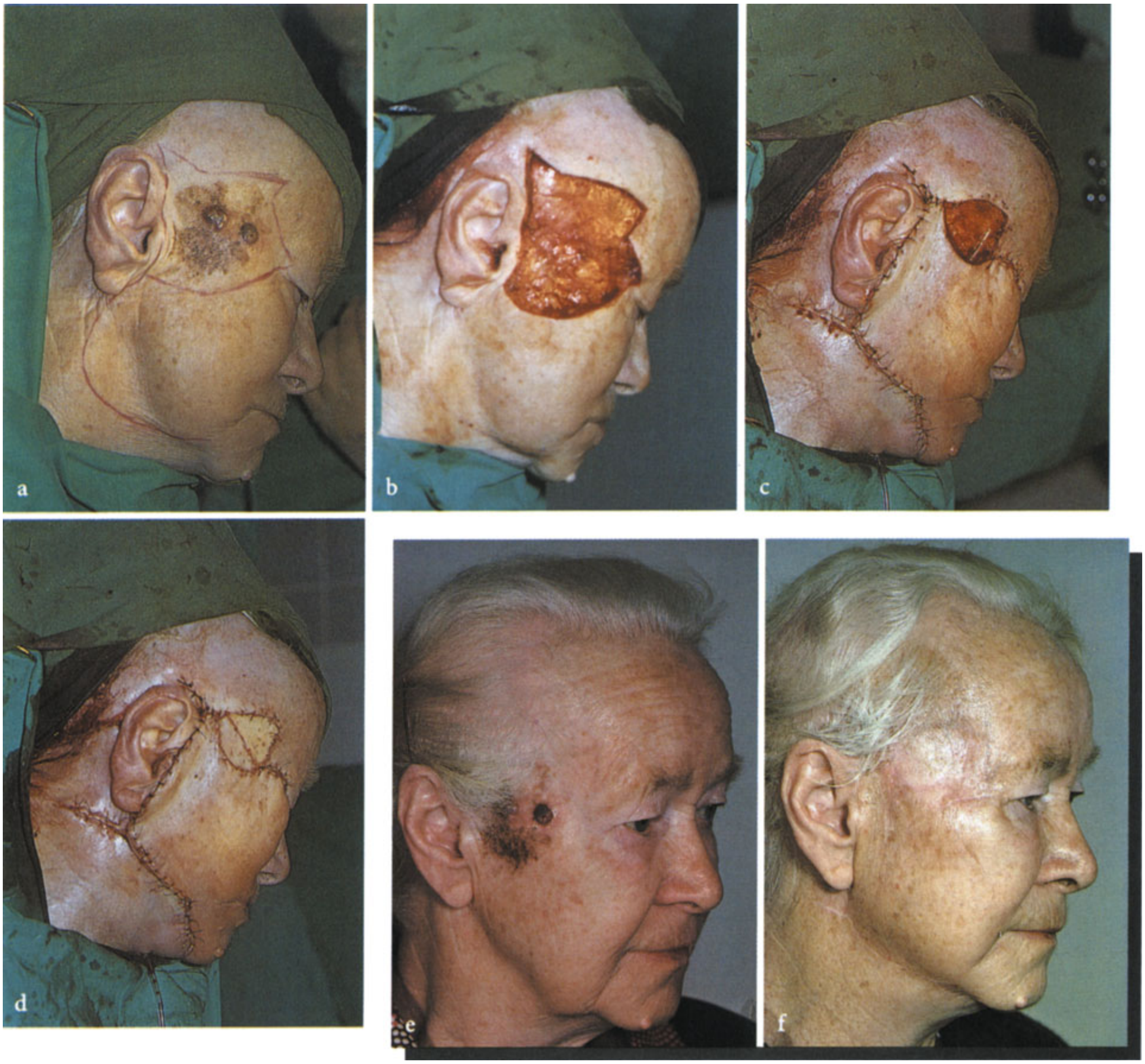


Fig. 172. Rotation flap combined with full-thickness skin graft
a Operative plan for removal of a lentigo maligna melanoma with subsequent reconstruction
b Defect after excision
c Rotation flap in place
d Residual defect closed with full-thickness skin graft
e Preoperative appearance
f Appearance after 6 months

19.4 Eyelids and Eyebrows

The eyelids and the immediately adjacent skin at the corners of the eye form an anatomic unit. A thorough understanding of the unique anatomic features of these structures is a prerequisite for acceptable functional and cosmetic results. The eyebrows are not only the upper border of the eyelid unit but also a very important structure in giving individuality to the face. They are essential in facial expression (for example, "with raised eyebrows" means a look of surprise) and in many cultures are regarded as a sign of beauty. Thus every operation must ensure that their symmetry is preserved, and that no gaps are created in the hair pattern.

19.4.1 Anatomy

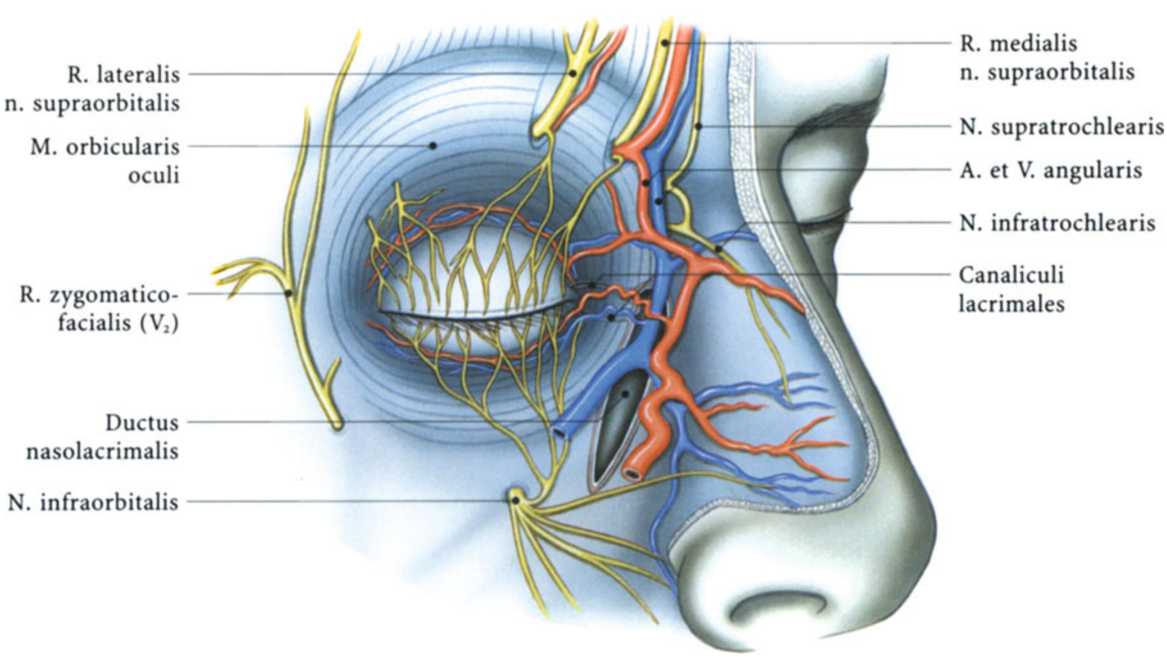
The eyelids are divided into two layers by a sheet of connective tissue. The outer layer consists of the skin and orbicularis muscles while the inner one is made up of the tarsal plate and conjunctiva. A fine gray line on the edge of the eyelid marks the mucocutaneous junction between the conjunctiva and skin. The eyelashes arise in the skin of the edge of the eyelid.

Tiny puncta can be seen at the medial aspects of both the upper and lower eyelids. These represent the openings of the upper and lower lacrimal ducts which run medially to the lacrimal canal. The lacrimal gland is found just beneath the orbital septum, located in the superior-lateral quadrant of the orbit. The arteries and veins run parallel to the eyelid margin. The nerve supply is a network arising from the 1st and 2nd branches of the trigeminal nerve.

19.4.2 Anesthesia

Sensory innervation of the eyelid region is supplied by the 1st and 2nd branches of trigeminal nerve. The 1st branch gives rise to the supraorbital nerve, which also serves the forehead, after exiting the skull through the supraorbital foramen. The supra- and infratrochlear nerves and the lacrimal nerve also arise from the 1st nerve and combine to innervate

Fig. 173. Anatomy of the eyelid region



the upper eyelid, along with the medial and lateral canthi. The lower eyelid is innervated by the 2nd branch of the trigeminal nerve via the zygomaticofacial nerve, which exits the skull about 1 cm below and just lateral to the lateral canthus. The infraorbital nerve which exits the maxilla at the infraorbital foramen also innervates the lower eyelid as well as the lateral aspect of the nose and upper lip. Knowledge of the precise location at which these nerves exit the skull is necessary for effective nerve blocks. In general, even large lesions can be anesthesized using nerve blocks, while small eyelid lesions are best handled with infiltrative techniques.

19.4.3 Planning the Operation

The first rule when working on the eyelids is to ensure that eyelid closure is not hampered, and that the eyelid margins are lined up exactly when they are reapproximated. Other problems arise in the inner and outer canthi and around the orifices of the tear ducts, especially the inferior tear duct.

One must also take into account the striking differences in eyelid texture and elasticity between younger and older patients. The lax upper eyelid of an elderly adult offers far fewer problems than the smooth, taut surface of the same area in a teenager. The orbicularis oculi muscles tend to relax with age, and the connective tissue becomes less elastic.

Following the natural skin lines, it is relatively easy to excise small lesions from the upper eyelid and at the lateral canthus with simple excision or VY flaps. To avoid facial asymmetry it is sometimes necessary to remove a piece of normal skin of the same size from the contralateral eyelid, in the sense of a corrective blepharoplasty. On the other hand, even small procedures on the lower eyelid and the medial canthus can be fraught with problems. Even minor tension placed on the wound may produce an ectropion. Scar formation can cause a delayed ectropion. Ocular mobility can be hampered and lead to severe problems, especially if a nerve or muscle is severed. Finally, if the lacrimal duct or ducts are severed, tearing is a problem. However, entropion is rarely a problem, even with extensive eyelid excisions.

19.4.4 Surgical Techniques

When a lesion is removed from the edge of the eyelid, a full-thickness wedge-shaped excision should be performed. A layered closure is then done, with the conjunctiva and tarsal plate approximated, as well as the muscle and skin. The line of demarcation between skin and mucosa (the gray line) must be matched exactly.

If more than one-third of the eyelid is removed, an even more difficult procedure must be undertaken. On the lower eyelid one can employ the cheek rotation flap of Imre, coupled with the replacement of tarsus and mucosa through a free graft of nasal mucosa and cartilage. Such procedures, however, are properly the domain of oculoplastic surgeons.

On both the upper and lower eyelids one can achieve good results using a lobed flap or the rhomboid flaps of Limberg or Dufourmentel. Possible sources of tissue include the cheek, the paranasal region, and the opposite eyelid (that is, swinging a flap from the upper to the lower eyelid). Larger defects can also be closed with skin grafts, usually taken from the retroauricular region. We sometimes then suture the eyelid shut for 8–10 days to ensure better healing of the graft. On the upper eyelid one can also consider transposing a flap down from the forehead, although this is often not acceptable for cosmetical reasons. On the lower eyelid, in addition to Imre's rotation flap and a flap from the upper eyelid, one can consider other local flaps to use tissue from the cheek.

Unfortunately, the inner canthus is a common site of basal cell carcinomas. The approach in this area is very difficult. Both the complete removal of the tumor and the necessary reconstruction entail surgical challenges. Because of the absolute necessity to obtain a tumor-free plane before beginning reconstruction, Mohs surgery is of great value in this area. While one must attempt to spare the tear apparatus, the ducts or canal must be sacrificed when they are involved by tumor. The tumors often extend quite deep, requiring the surgeon to remove the periosteum of the nasal bone and, rarely, even parts of the bone itself. A small, deep defect can occasionally be closed primarily with a VY flap. To ensure that the inner aspect of the eye is not distorted so as to produce an asymmetry, one can choose from a wide variety of flaps, none of which is ideal, or a skin graft from the retroauricular region. A glabellar rotation flap may be useful.

Reconstruction of the tear apparatus is very difficult and often fails. A thin silicon stent or tube is used to reanastomose the distal end of the duct with the conjunctival sack. The tube is removed after 3–4 weeks. Unfortunately, failures are common.

When operating on the eyebrows, we generally use advancement flaps or U- or H-flaps and occasionally a subcutaneous pedicle flap. Regardless of the procedure one must plan carefully so that the eyebrow remains in alignment, even if it must be shortened.

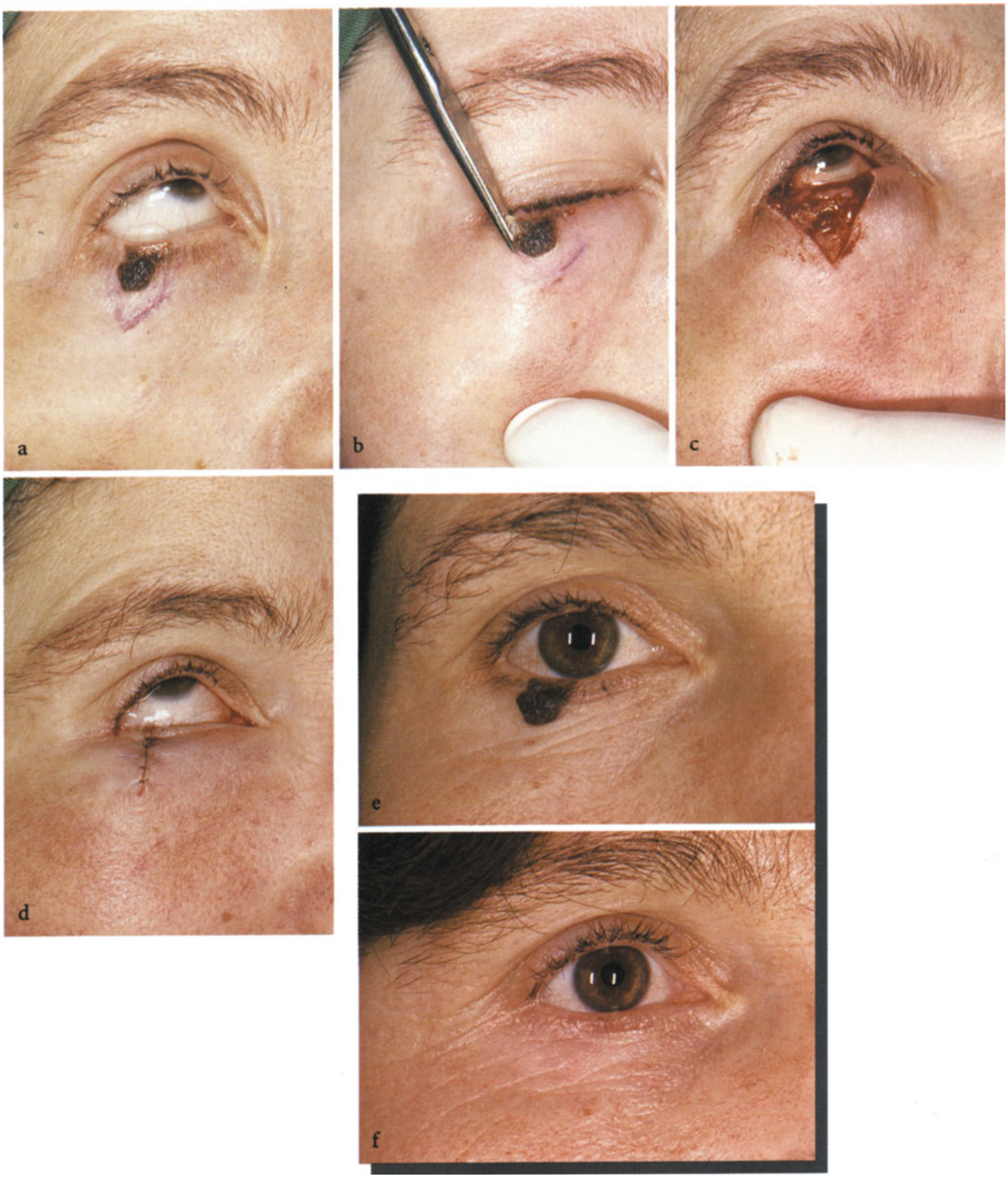


Fig. 174. Wedge excision
a Operative plan for removal of a verrucous dysplastic melanocytic nevus on the lower eyelid
b Full-thickness excision including the conjunctival side of the eyelid
c The conjunctival surface is reapproximated with resorbable buried sutures
d End of operation
e Preoperative appearance
f Appearance after 5 months

Fig. 175. Advancement flap with back cut
a Operative plan for defect created by excision of a basal cell carcinoma
b Raising the flap
c Placing the flap; the triangle left by the back cut can be closed primarily
d End of operation
e Preoperative appearance
f Appearance after 5 months

Fig. 176. Transposition flap or rhomboid flap (after Dufourmentel)
- **a** Defect after excision of a probable basal cell carcinoma, with operative plan. The histologic diagnosis was hidrocystoma
- **b** Mobilizing the flap
- **c** Transposing the flap into the defect
- **d** End of operation
- **e** Preoperative appearance
- **f** Appearance after 3 months

Fig. 177. Two-step transposition flap
a Defect after removal of a recurrent basal cell carcinoma. Defect was covered by polyurethane foam dressing
b Transposing a large flap into the defect
c Flap in place. Laterally it was left attached because of difficult vascular supply
d After 2 weeks, the flap was then totally fitted with partial separation of the pedicle. The long donor defect lies in the normal wrinkle lines of the cheek
e Preoperative appearance
f Appearance after 1 year

Fig. 178. Transposition from upper eyelid to lower eyelid
a Defect in nasolabial region involving lower eyelid after removal of a basal cell carcinoma
b Operative plan
c Raising and moving the upper eyelid flap to the lower eyelid. The nasolabial defect was closed primarily after extensive undermining
d End of operation
e Preoperative appearance
f Appearance after 4 weeks

Fig. 179. Bridge flap or bilateral pedicle flap from upper eyelid

a Operative plan to correct an ectropion of lower eyelid
b Raising a flap from the upper eyelid
c Moving the flap; note that it is attached both medially and laterally
d End of operation; the upper eyelid defect is closed primarily after undermining
e Preoperative appearance
f Appearance after 2 months

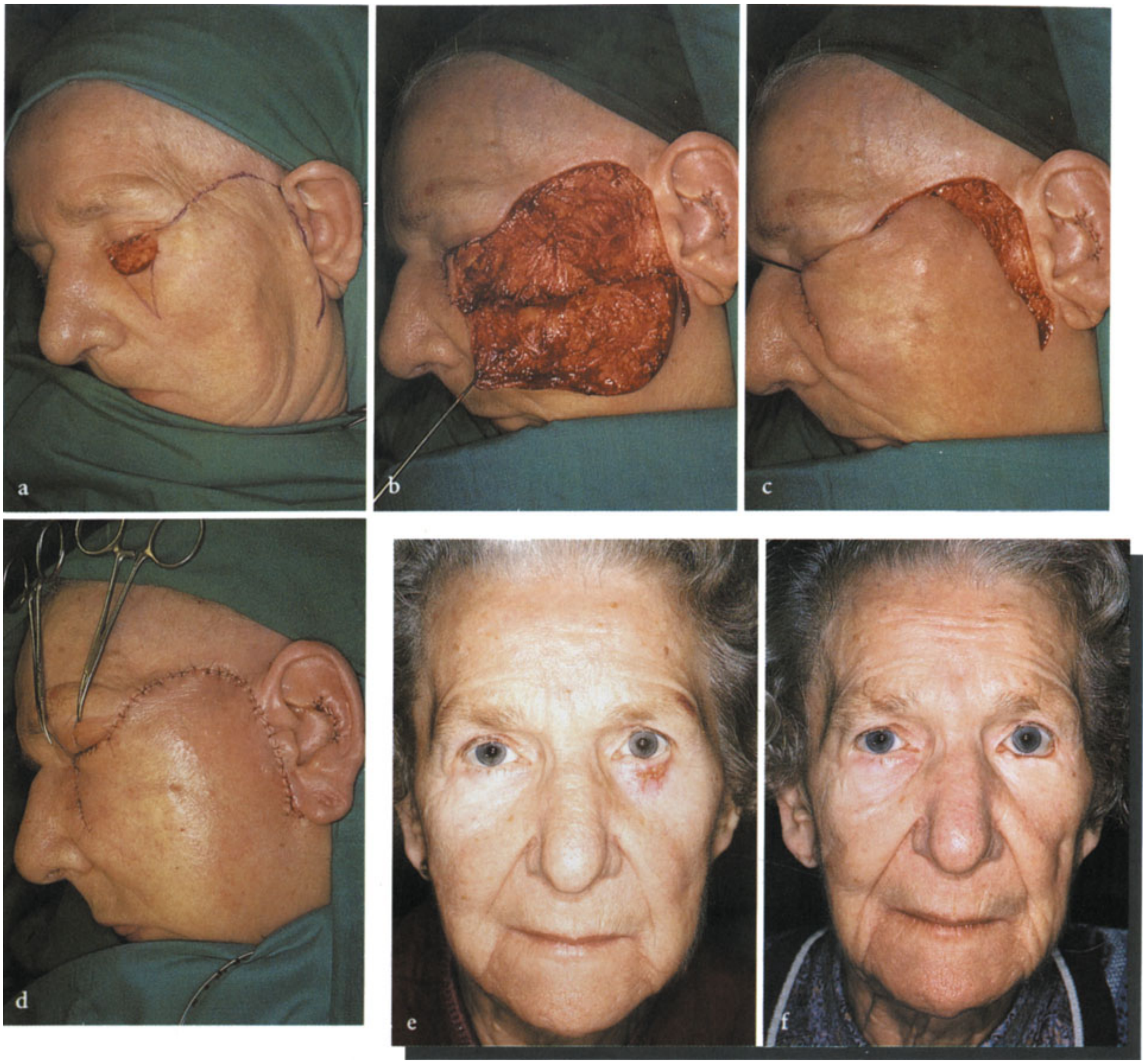


Fig. 180. Rotation flap
a Defect after removing a basal cell carcinoma which recurred after radiation therapy. Operative plan is drawn
b Mobilization of flap, using the technique of Imre
c Placing the flap
d End of operation
e Preoperative appearance
f Appearance after 5 years

Fig. 181. VY-plasty combined with full-thickness skin graft
a Operative plan for removal of the darkest part of a congenital melanocytic nevus
b Y-shaped closure
c After 1.5 years, reexcision on lower eyelid
d Full-thickness skin graft employed to close defect
e Preoperative appearance
f Appearance 4 years after final procedure

Fig. 182. Serial excision
a Congenital melanocyctic nevus on upper eyelid
b First excision with VY-plasty
c Reexcision with undermining
d End of operation
e Preoperative appearance
f Appearance 1 year after final operation

Fig. 183. Advancement flap
a Defect after excision of basal cell carcinoma
b Plan for horizontal advancement flap with lateral Burow's triangle
c Raising the flap
d End of operation
e Preoperative appearance
f Appearance after 3.5 years

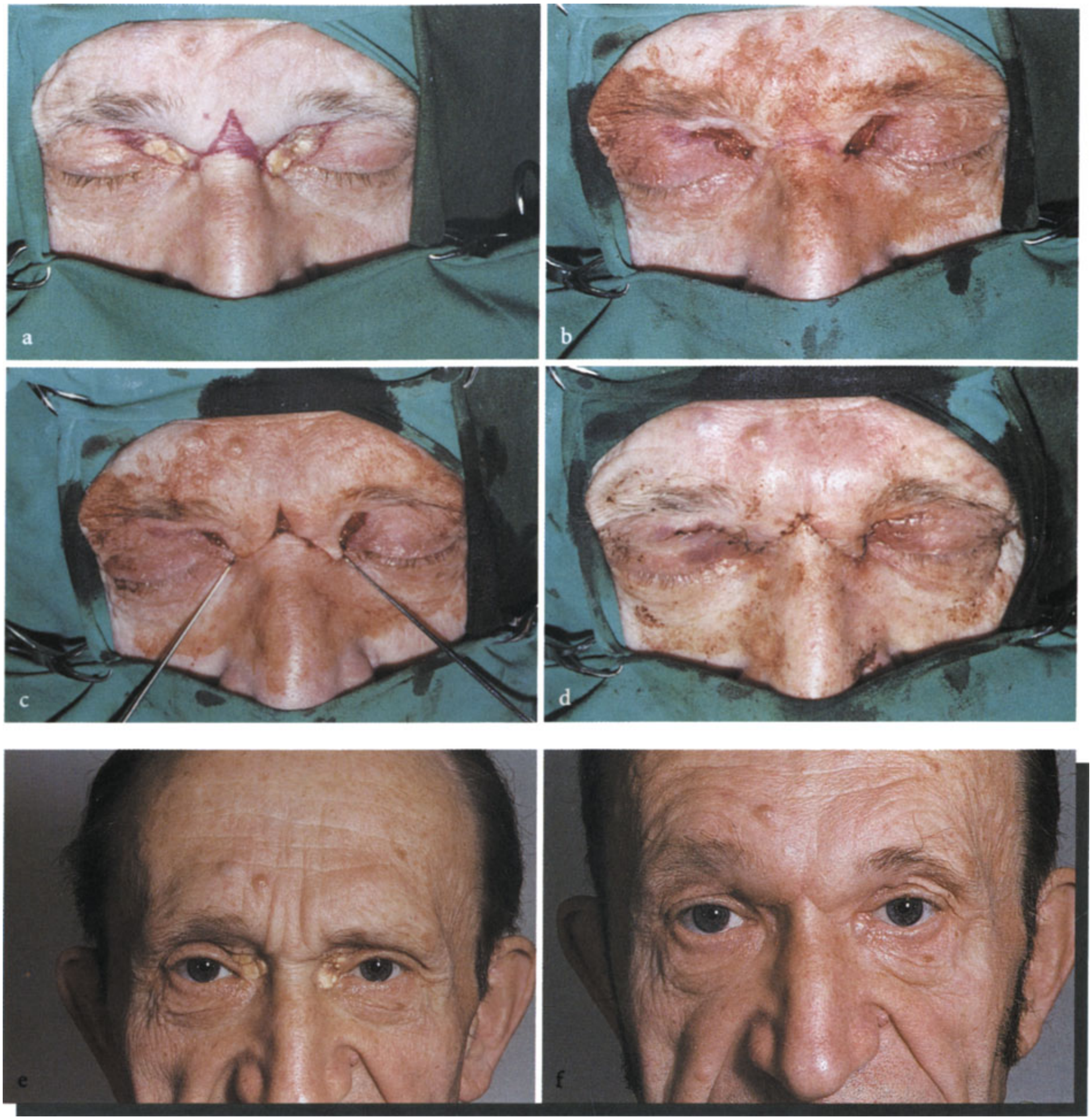


Fig. 184. Bilateral advancement flaps
a Bilateral xanthelasma; operative plan with bilateral advancement flaps and medial Burow's triangle
b Defect after excision
c Moving flaps into place
d End of operation
e Preoperative appearance
f Appearance after 3 months

Fig. 185. Transposition flap (lobed flap)
a Operative plan for removal of ulcerated basal cell carcinoma on upper eyelid
b Defect after excision
c Transposing the flap into place
d End of operation
e Preoperative appearance
f Appearance after 2 years

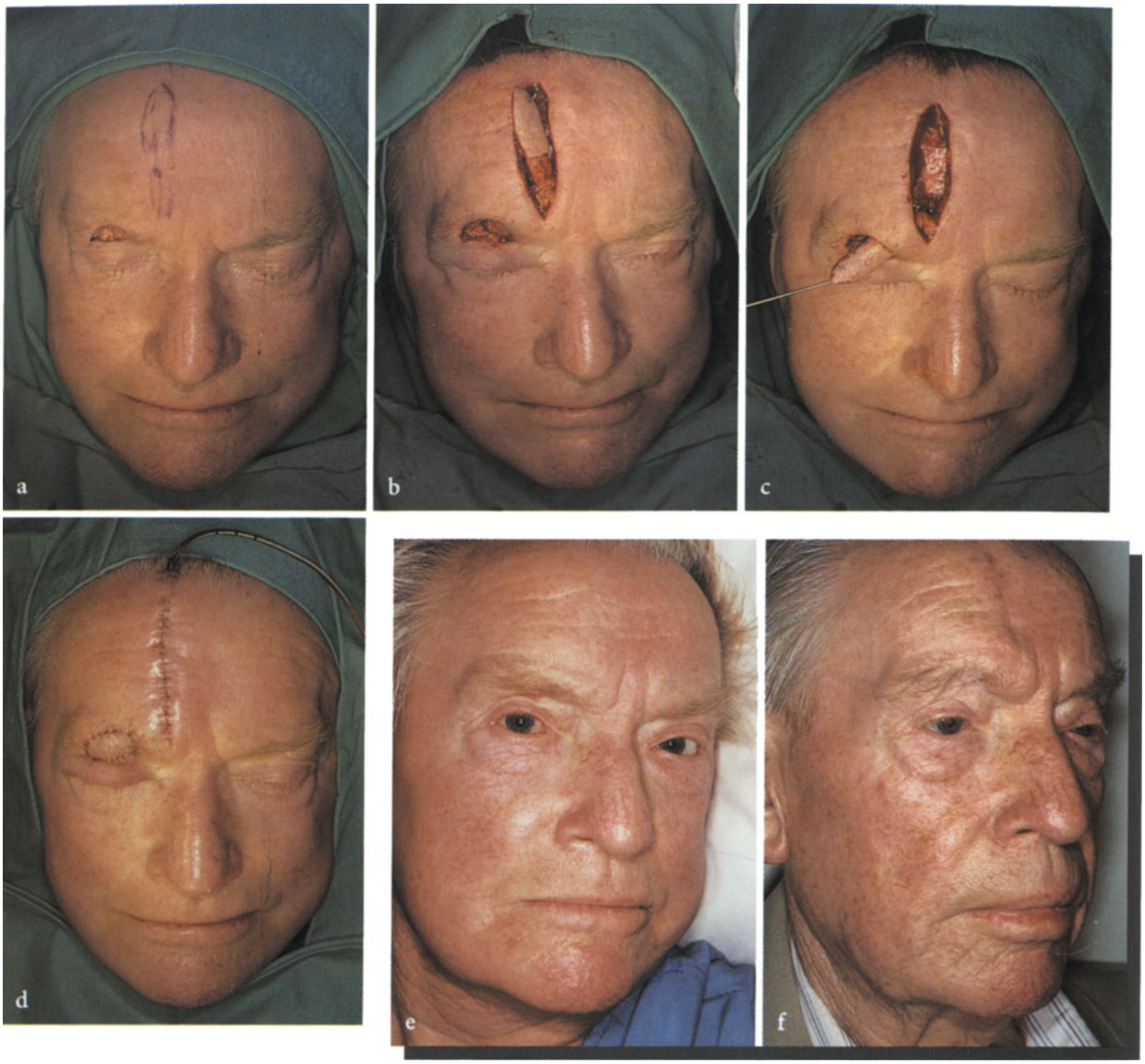


Fig. 186. Tunnel or island flap
a Defect after excision of basal cell carcinoma on upper eyelid
b Preparation of a mediofrontal island flap; the pedicle is deepithelialized with care not to compromise the vascular stalk
c The flap is tunneled beneath the skin to fill the defect
d The flap tip is sewn in place to fill the eyelid defect, while the donor defect is closed primarily after undermining
e Preoperative appearance
f Appearance after 4 years

Fig. 187. Forehead flap
a Defect after removal of basal cell carcinoma
b Development of a forehead flap with its specific vascular supply
c Placing the flap in the defect
d Flap sewn in place. Donor site partially closed. Two weeks later the pedicle was separated and returned to donor site
e Preoperative appearance
f Appearance after 6 months

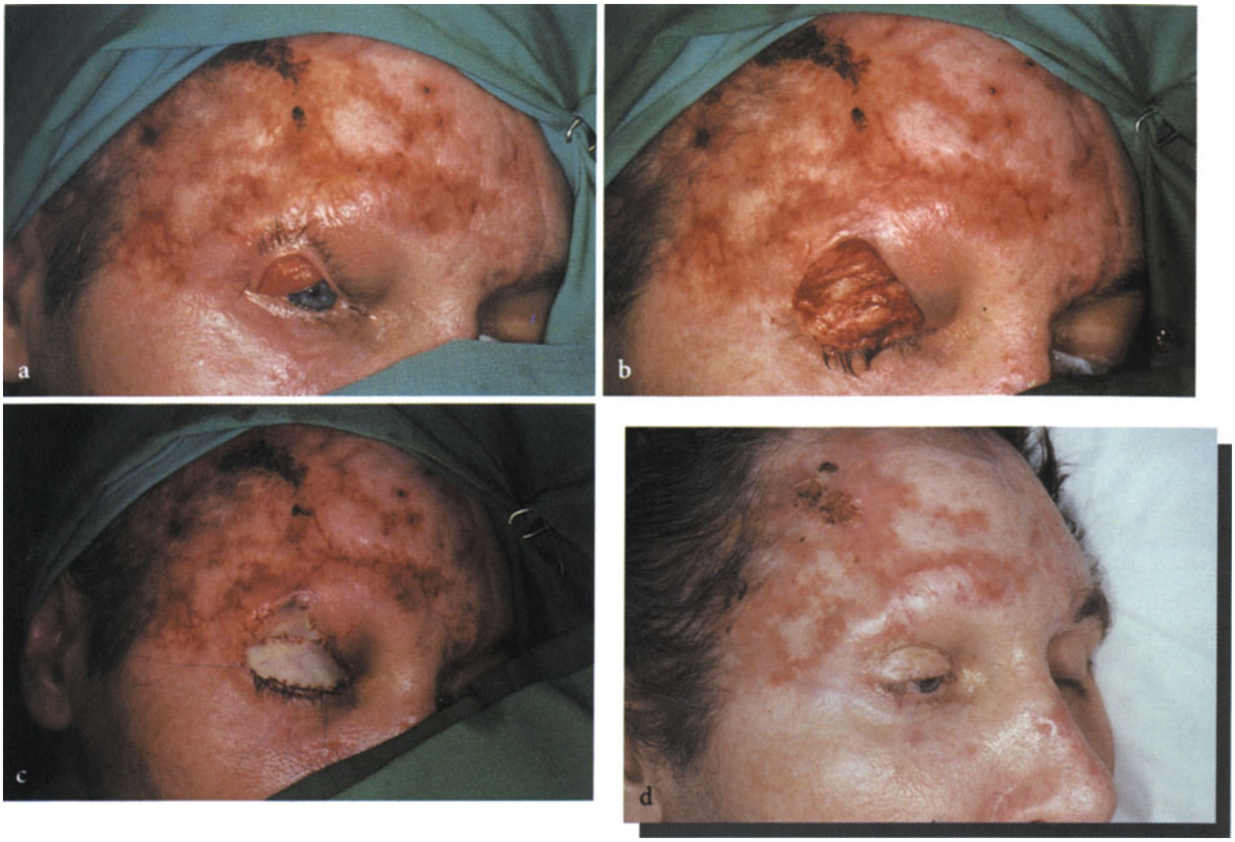


Fig. 188. Ectropion repair with full-thickness skin graft
a Patient with marked ectropion; there is marked discoloration and scarring as a result of a car accident with a burn, all of which was allowed to heal secondarily
b The scarred tissue of the upper eyelid is excised down to the tarsus muscle
c Full-thickness skin graft sewn in place
d Appearance after 2 months. The upper eyelid was functional without any ectropion

Fig. 189. VY-plasty
a Operative plan for removal of basal cell carcinoma
b VY-excision and undermining
c Two-layered closure
d Checking the patency of the tear duct
e Preoperative appearance
f Appearance after 3 months

Fig. 190. Rotation flap with back cut

a Defect after excision of basal cell carcinoma. Operative plan with long edge of flap parallel to eyebrow
b Developing the flap
c Moving the flap in place
d End of operation
e Preoperative appearance
f Appearance after 9 months

Fig. 191. Nasolabial advancement flap with crescentic relaxing excision
a Defect after excision of basal cell carcinoma, with operative plan
b Preparing the flap
c Advancing the flap into place
d End of operation
e Preoperative appearance
f Appearance after 9 months

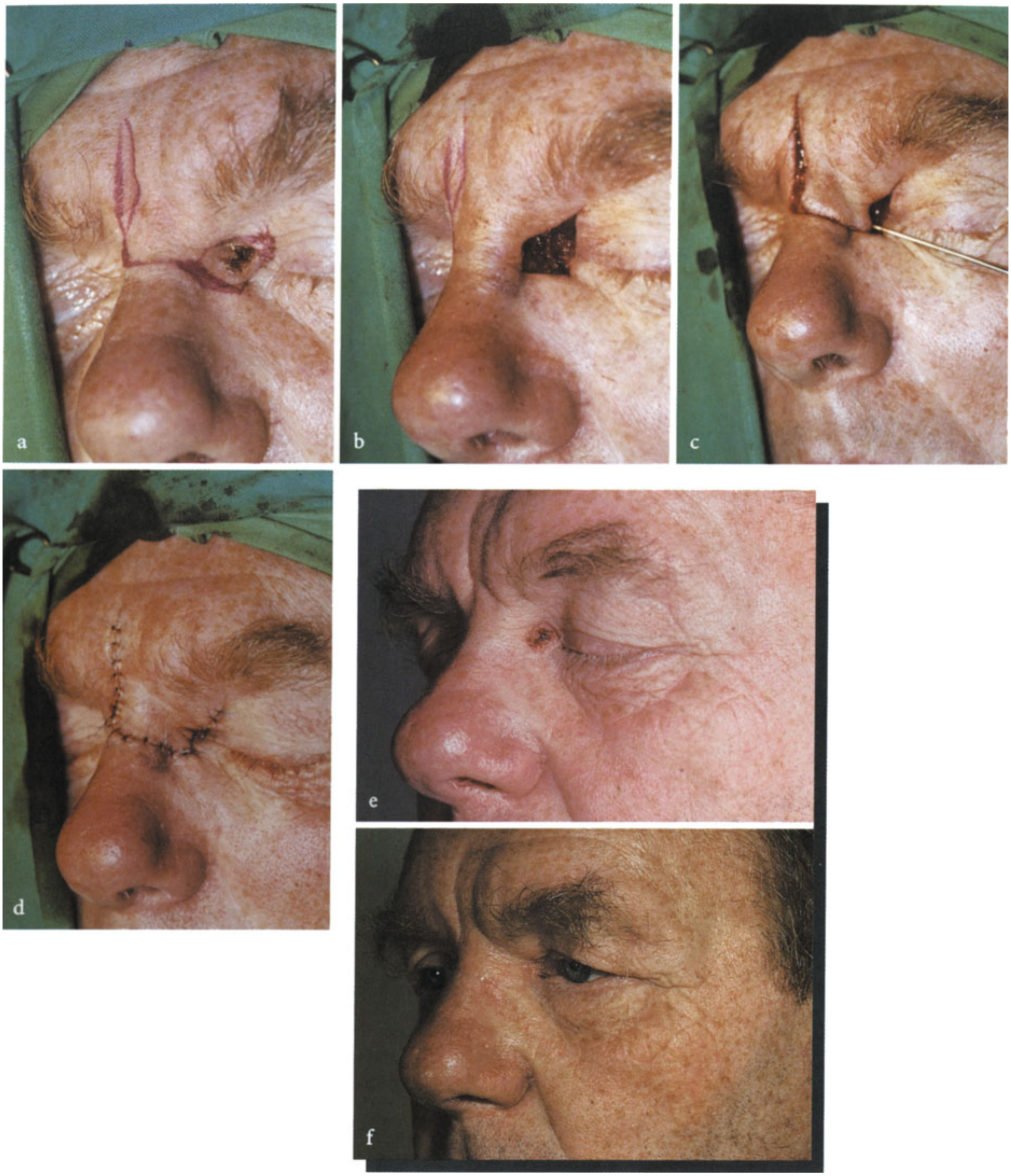


Fig. 192. Glabellar rotation flap
a Operative plan for excision of basal cell carcinoma and reconstruction
b Excision defect
c Halfmoon-shaped relaxing excision followed by movement of flap
d End of operation
e Preoperative appearance
f Appearance after 3 months

Fig. 193. Tunnel flap
a Defect after excision of basal cell carcinoma and operative plan
b Development of pedicle flap
c Pedicle flap tunneled subcutaneously into defect
d End of operation
e Preoperative appearance
f Appearance after 2 years

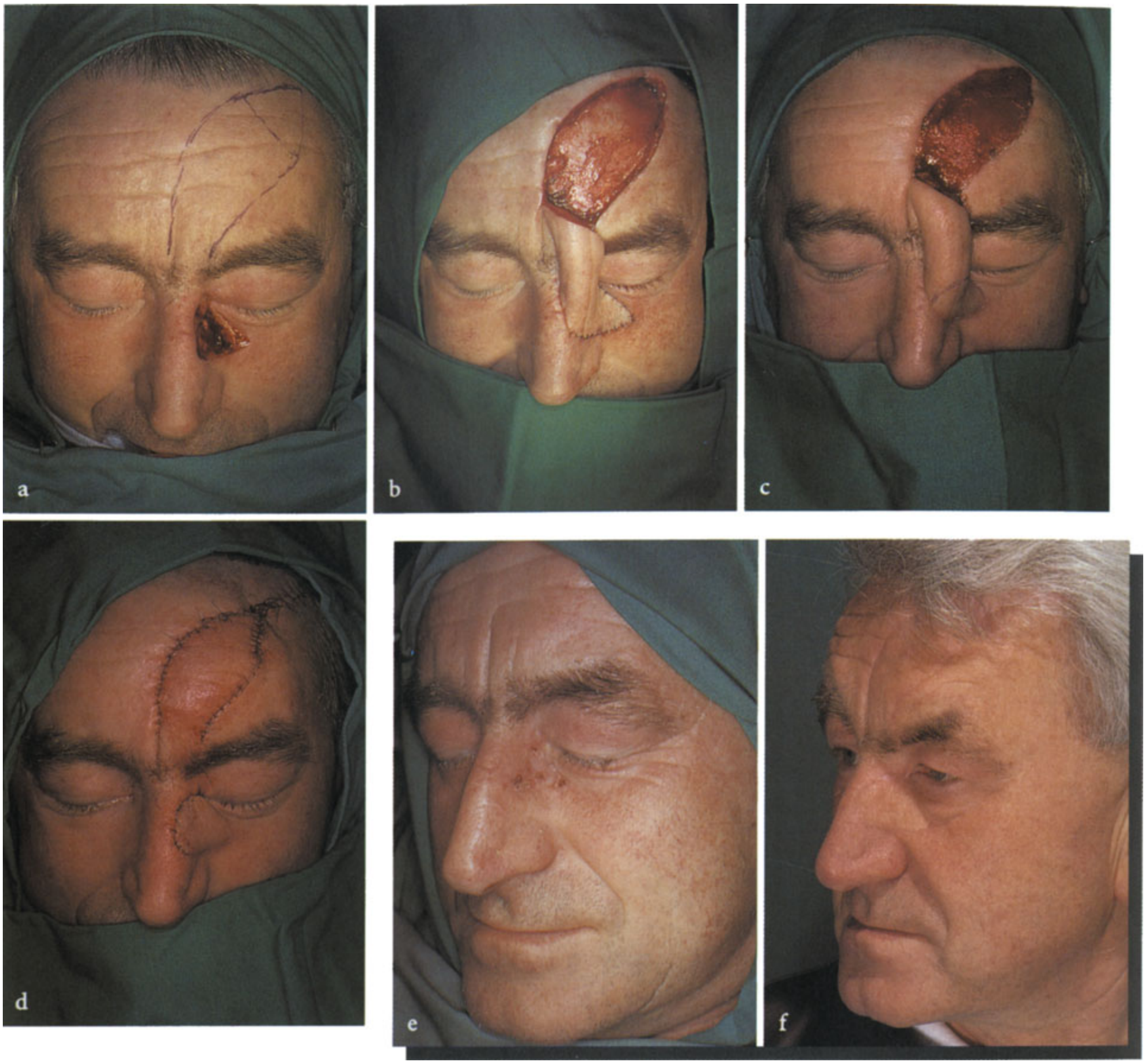


Fig. 194. Paramedian forehead flap
a Defect after excision of a widespread basal cell carcinoma, with operative plan
b Movement of flap into primary defect and then temporary wound dressing for secondary defect
c After 2 weeks, division of stalk with pedicle returned to help close secondary defect
d Final trimming of transferred flap
e Preoperative appearance
f Appearance after 1 year

Fig. 195. Nasolabial advancement flap combined with glabellar rotation flap
a Defect after excision of basal cell carcinoma with combination of two flaps as illustrated in Figs. 191 and 192
b Preparing the nasolabial flap
c Moving both flaps into the defect
d End of operation
e Preoperative appearance
f Appearance after 7 years

Fig. 196. Nasolabial advancement flap combined with U-plasty

a Defect after excision of a recurrent lentigo maligna, with operative plan for forehead U-plasty
b U-plasty finished; development of nasolabial flap
c Moving nasolabial flap in place
d End of operation
e Preoperative appearance
f Appearance after 6 months

Fig. 197. Nasolabial advancement flap combined with a paramedian forehead flap

a Defect after excision of a large nodular basal cell carcinoma, with operative plan for two flaps
b Nasolabial flap completed
c In order to repair the lower eyelid without causing an ectropion, a paramedian forehead flap is developed
d After 2 weeks, the pedicle is severed and the tip of the forehead flap is fitted in place with final skin closure
e Preoperative appearance
f Appearance after 15 months

Fig. 198. Serial excision with undermining
a Congenital melanocytic nevus; first excision faintly marked as vertical ellipse
b Skin closure after undermining
c Final excision, again as vertical ellipse
d Final skin closure with subcutaneous and intracutaneous sutures
e Preoperative appearance
f Appearance 1 year after second procedure

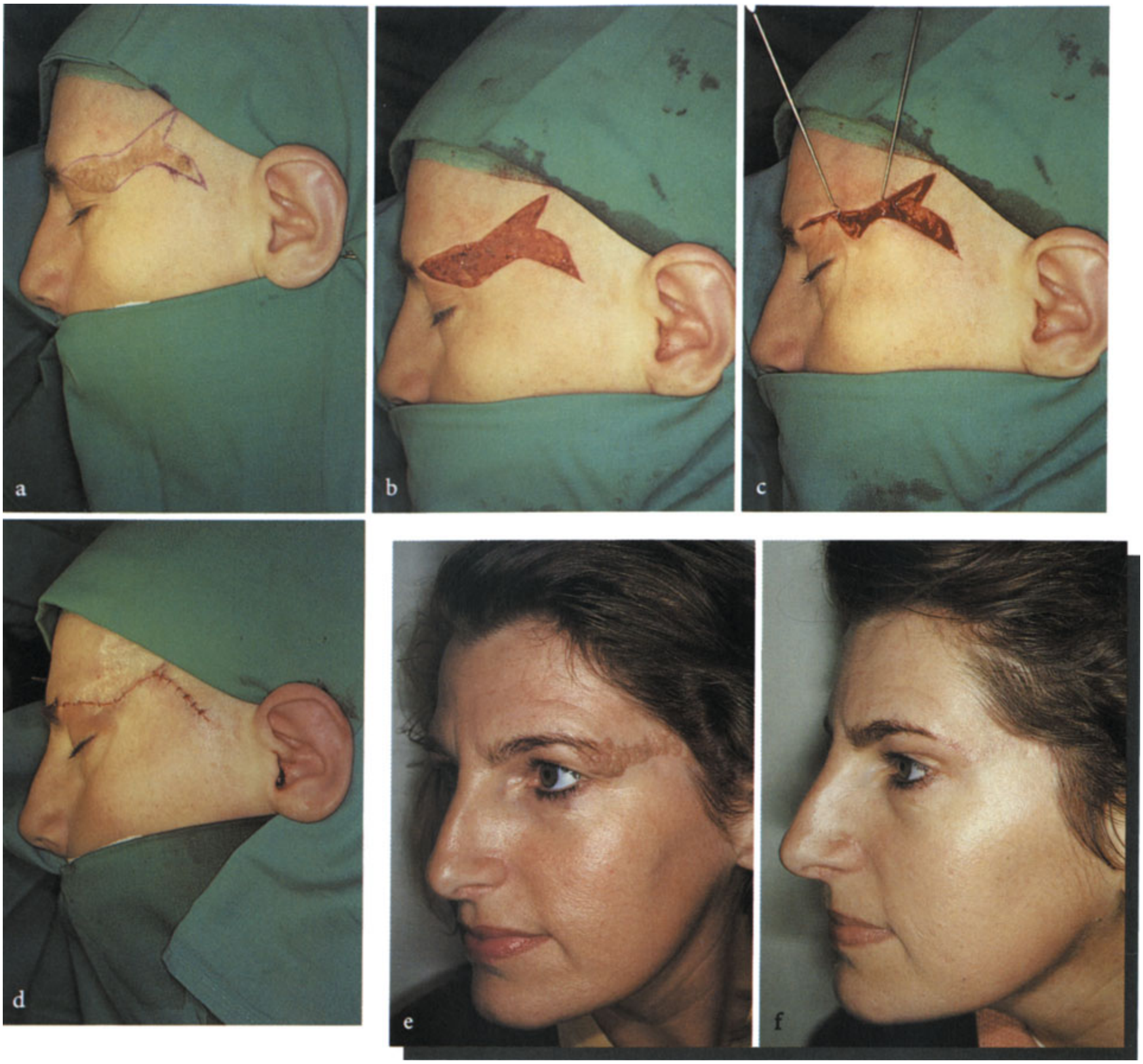


Fig. 199. VY-plasty
a Operative plan for excision of a nevus sebaceus
b VY-shaped defect after excision
c Moving the edges together after undermining
d End of operation
e Preoperative appearance
f Appearance after 3 months

Fig. 200. Advancement flap
a Defect after excision of a hypertrophic actinic keratosis, with operative plan
b Mobilization of flap
c Moving the flap in place with careful attention to eyebrow
d End of operation
e Preoperative appearance
f Appearance after 2 months

Fig. 201. U-plasty
a Defect after excision of basal cell carcinoma, with operative plan
b Excision of Burow's triangles and mobilization of flap
c Placing the flap
d End of operation
e Preoperative appearance
f Appearance after 1.5 years

Fig. 202. Advancement flap with back cut
- **a** Triangular defect after excision of basal cell carcinoma, with operative plan and borders for undermining marked
- **b** Mobilization of flap
- **c** Placing the flap which is under no tension, to avoid raising the eyebrow
- **d** End of operation
- **e** Preoperative appearance
- **f** Appearance after 2 years

Fig. 203. Rotation flap
a Teardrop-shaped defect following excision of basal cell carcinoma. Note that eyebrow was involved. Operative plan is marked
b Mobilization of flap
c Rotation of flap
d Beginning closure with attention to eyebrow line
e Final closure with slight inferior deviation of lateral eyebrow
f Appearance after 6 months with marked improvement

Fig. 204. Rotation flap with double WY-plasties
a Large sclerosing basal cell carcinoma, with operative plan
b Defect with part of double WY-plasty closed and mobilization of rotation flap
c Rotating flap into place
d End of operation
e Preoperative appearance
f Appearance after 1.5 years

19.4.5 Blepharoplasty

Blepharoplasty is a relatively common cosmetic procedure. In general, only an experienced surgeon should undertake blepharoplasties, especially those of the lower eyelid, since the revision of an overly enthusiastic repair which produces an ectropion is often quite difficult. Even other minor procedures on the lower eyelid can produce this unfortunate result; somewhat more leeway is possible on the upper eyelid. One must also be aware of occasional reports in the literature of unilateral or even bilateral blindness following blepharoplasty. Among the causes of blindness are retrobulbar hematoma, pressure atrophy of the optic nerve, inflammation of the nerve, and thromboses of the central artery or vein.

Surgical Techniques

For lower eyelid blepharoplasties an incision is made from the medial to the lateral canthus just below the eyelid margin. At the lateral canthus the excision can be extended slightly and curved downward into one of the lateral periorbital wrinkles. With a small, curved Metzenbaum scissor the surgeon must then free the skin of the eyelid carefully until the orbital rim is reached. The muscles are divided transversely. When light pressure is applied, the submuscular fat then extrudes through the defect and can be excised, usually in three parts: medially, centrally, and laterally. After careful control of bleeding the excess skin along with a lateral Burow's triangle is excised.

Blepharoplasty of the upper eyelid, in contrast, is one of the simplest cosmetic procedures. An excision is performed, removing the skin between a series of folds, usually close to the orbit. After the muscle separated in a blunt fashion, the submuscular fat can be extruded and hemostasis obtained.

In each case the wound is closed with fine 7–0 nonresorbable sutures, either with single stitches or a running intracutaneous suture.

Fig. 205. Bilateral upper eyelid blepharoplasties
a Operative plan
b Excision of skin, subcutaneous tissue, and excision of extruding submuscular fat
c Appearance after undermining
d Skin closure
e Preoperative appearance
f Appearance after 1 year

Fig. 206. Lower eyelid blepharoplasties ▷
a Subcutaneous mobilization after incision just below the ciliary line
b Dissection down to orbicular oculi muscle
c Removal of the extruded submuscular fat
d Lifting the skin to plan the correct excision
e Marking the excision including a lateral Burow's triangle
f Skin closure
g Preoperative appearance
h Appearance after 9 months


a
b
c
d
e
f
g
h

19.5 Cheeks

The cheeks are a large region which begins to loose elasticity by about the 4th decade. Thus major defects can be relatively easily closed with simple undermining or VY flaps. The two crucial structures in this region, the facial nerve and the parotid duct, both lie quite deep; therefore they are not jeopardized even with extensive undermining. Skin grafts on the cheeks are almost always less satisfactory than flaps. Even complicated flaps do very well because of the vascularity. Sometimes, however, when attempting to cover a large defect following the removal of a tumor (for example, a large lentigo maligna melanoma in an elderly patient), a graft may be needed simply because the patient cannot tolerate a more complicated procedure.

19.5.1 Anatomy

The cheeks are marked by a network of many muscles of facial expression, beneath which pass the vascular and nerve tracts. The arteries and veins generally run parallel here (see p. 145). The facial artery is a main branch of the external carotid artery and divides into the submental artery, the labial artery, and the dorsal nasal artery. The latter anastomoses with the angular artery, which runs along the medial orbital wall. The analogous venous connections are of great importance in the spread of infectious processes, such as cellulitis, not only in the skin but also centrally.

In the preauricular region one must pay careful attention to the parotid gland, as this lies just beneath the skin. The parotid duct runs horizontally at about the level of the 2nd upper premolars. Within the parotid gland the facial nerve divides into its many branches, which then fan out from the gland's anterior and posterior borders (see p. 146).

19.5.2 Anesthesia

Most procedures can be performed with infiltrative anesthesia. Large reconstructive efforts, such as combined flaps, require general anesthesia.

19.5.3 Planning the Operation

One should observe the relaxed skin tension lines or the natural skin folds as a site for the suture line. If the defect is larger than 10 mm in a younger patient or 15–20 mm in an older one, one should consider a flap closure. Since dog ears are especially noticeable on the cheeks, one must always avoid or correct them. One should also choose a procedure with minimal risk of either dragging up the corner of the mouth or dragging down the lower eyelid.

If a branch of the facial nerve is cut during the operation, it must be immediately reanastomosed. Prior arrangements must be made to have an appropriate back-up available if the surgeon is not trained to do this procedure.

19.5.4 Surgical Techniques

Advancement and rotation flaps are the classical approaches on the cheek. Subcutaneous pedicle flaps are also very useful; due to the suitable subcutaneous cushion of the cheek such flaps can be developed and moved in virtually all directions. Trapezoid flaps are often valuable when closing defects in the paranasal region. Finally, an advancement flap with a back cut is also useful, for it usually can be sutured without placing a Burow's triangle, thus saving tissue in an area with little tissue reserve.

Fig. 207. Primary closure with undermining
a Defect after excision of lentigo maligna
b Wound converted into spindle-shaped defect parallel to skin tension lines
c Undermining
d End of operation
e Preoperative appearance
f Appearance after 1 year

Fig. 208. VY-plasty
a Operative plan for VY-shaped excision of lentigo maligna
b Excision defect
c Optimally approximated wound edges using a subcutaneous suture
d Skin closure
e Preoperative appearance
f Appearance after 3 months

Fig. 209. Advancement flap

a Defect after excision of lentigo maligna, with operative plan. The long side of the flap is located in the skin folds below the eye. By curving upward laterally, a downward pull on the lower eyelid is avoided
b Excision of the lateral Burow's triangle and mobilization of flap
c Moving the tension-free flap into place
d End of operation
e Preoperative appearance
f Appearance after 15 months

Fig. 210. Trapezoid flap
- **a** Defect after excision of a recurrent basal cell carcinoma. Here a cheek rotation flap is combined with a nasolabial advancement flap
- **b** Mobilization of almost the entire cheek
- **c** Placing the flap into the defect
- **d** End of operation
- **e** Preoperative appearance
- **f** Appearance after 1 year

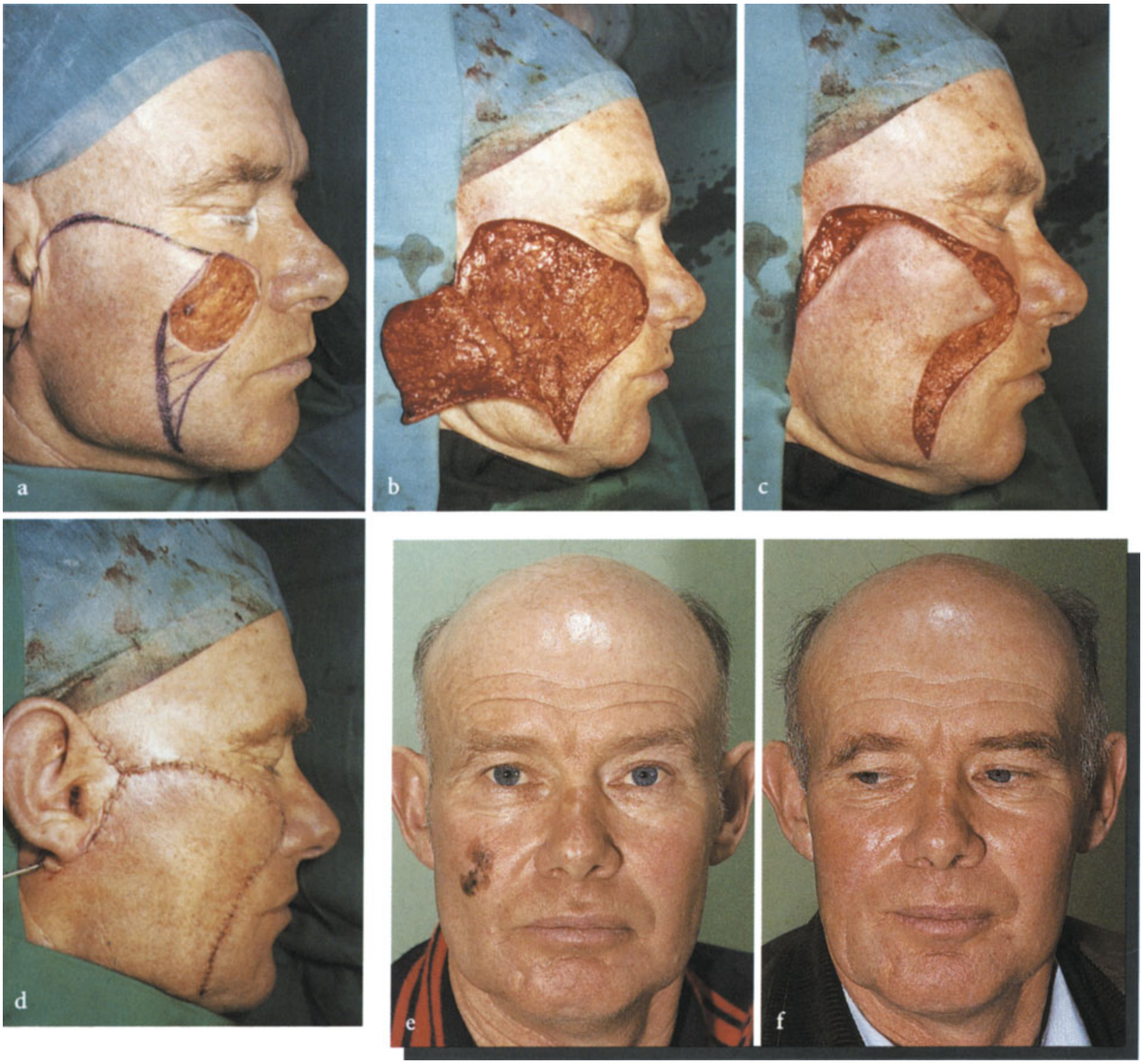


Fig. 211. Cheek rotation flap
a Defect after excision of a lentigo maligna melanoma, with operative plan for a cheek rotation flap (after Imre)
b Mobilization of cheek flap
c Flap rotated in place with little tension
d End of operation
e Preoperative appearance
f Appearance after 1.5 years

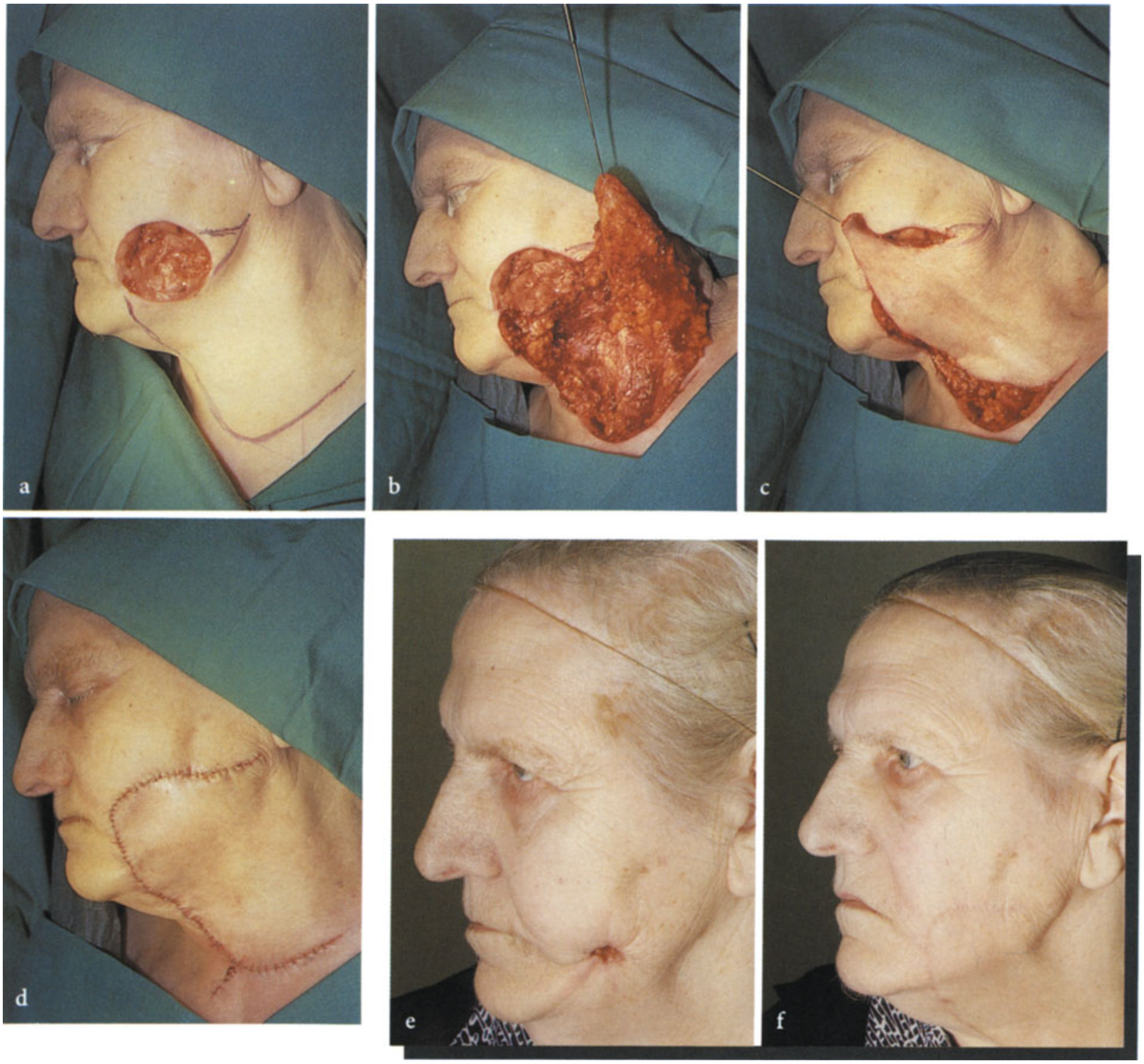


Fig. 212. Rotation flap
a Defect after excision of ulcerated basal cell carcinoma, with operative plan for a rotation flap based laterally
b Development of flap involving the neck region
c Placing the flap with as little tension as possible, inserting a Burow's triangle at the point of maximum tension
d End of operation
e Preoperative appearance
f Appearance after 6 months

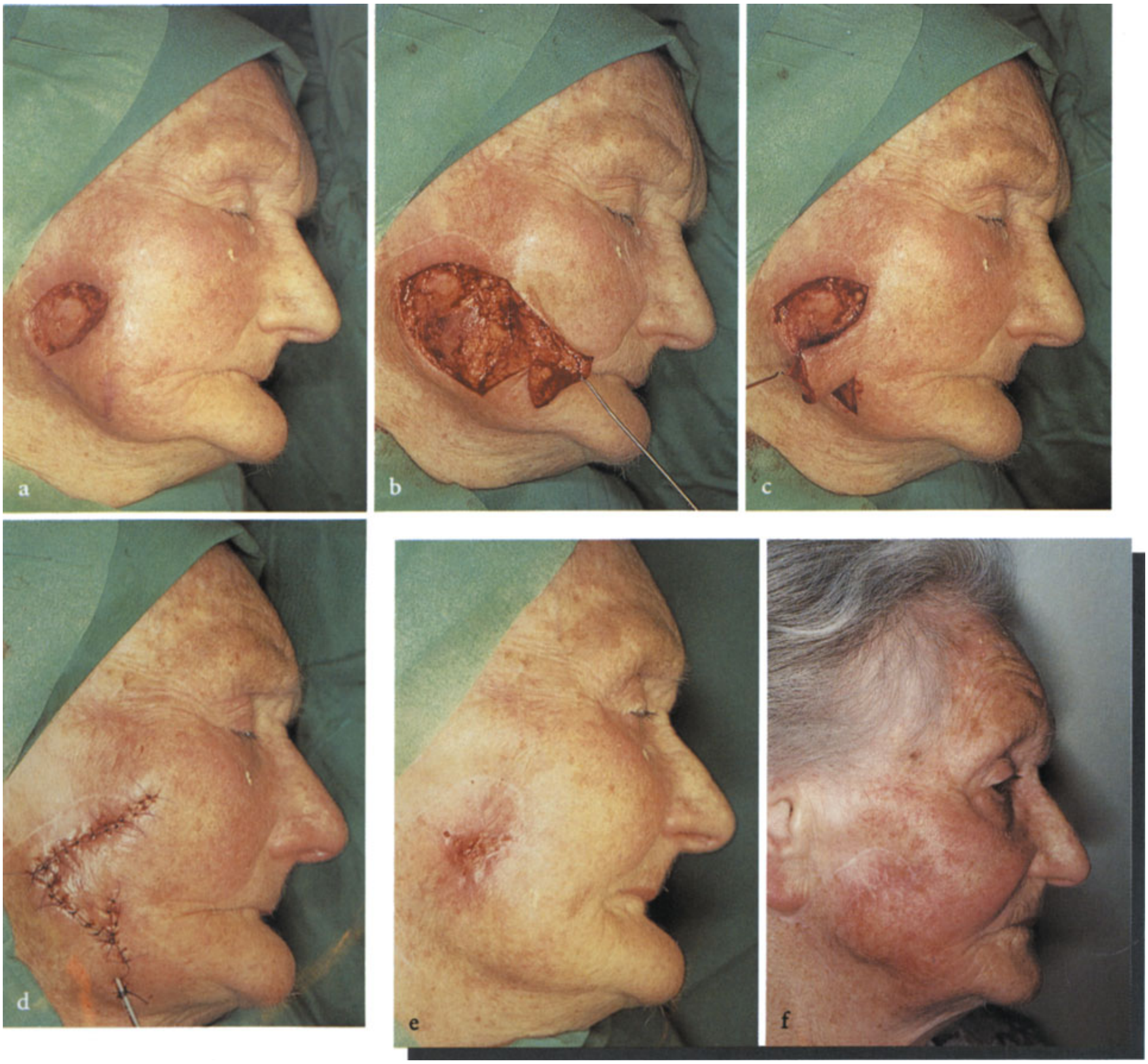


Fig. 213. Advancement flap with back cut
a Defect after excision of a recurrent basal cell carcinoma
b Development of flap
c Moving the tension-free flap
d End of operation
e Preoperative appearance
f Appearance after 8 months

Fig. 214. Subcutaneous pedicle flap
a Defect after excision of a basal cell carcinoma
b Preparing a subcutaneous pedicle flap, oriented along skin tension lines
c Fitting of flap beginning distally
d End of operation
e Preoperative appearance
f Appearance after 15 months

Fig. 215. Subcutaneous pedicle flap
a Defect after excision of lentigo maligna with plan for a subcutaneous pedicle flap to be advanced from the laterocranial aspect
b Preparation of flap
c Moving the flap into place
d End of operation
e Preoperative appearance
f Appearance after 6 months

Fig. 216. Double subcutaneous pedicle flap
a Defect after excision of a basal cell carcinoma, with operative plan
b Pedicle flaps developed, advanced, and attached
c Beginning to close the sides
d End of operation
e Preoperative appearance
f Appearance after 3 years

Fig. 217. Forehead pedicle flap
- **a** Defect after excision of recurrent basal cell carcinoma and operative plan for a paramedian forehead pedicle flap
- **b** The tip of the flap is sewn into the defect
- **c** After 2 weeks, the pedicle is severed and returned to help close the secondary defect
- **d** End of operation after final trimming and fitting of the transferred flap
- **e** Preoperative appearance after unsuccessful cheek rotation flap
- **f** Appearance after 2.5 years

Fig. 218. Split-thickness skin graft
a Operative plan for removal of lentigo maligna melanoma
b Defect
c Appearance after wound conditioning
d Closure with split-thickness skin graft; a relatively thick graft was prepared to minimize shrinkage
e Preoperative appearance
f Appearance after 9 months

Fig. 219. Bilobed flap combined with split-thickness skin graft ▷
a Defect after excision of large basal cell carcinoma, with operative plan
b Development of proximal flap from the lateral neck region
c Residual defect after the first flap is sewn in place
d Closing the neck defect with a second flap from the shoulder
e Temporary covering of shoulder defect with artificial wound dressing for conditioning
f Appearance of shoulder aspect 6 months after coverage with split-thickness skin graft
g Preoperative appearance
h Appearance after 6 months

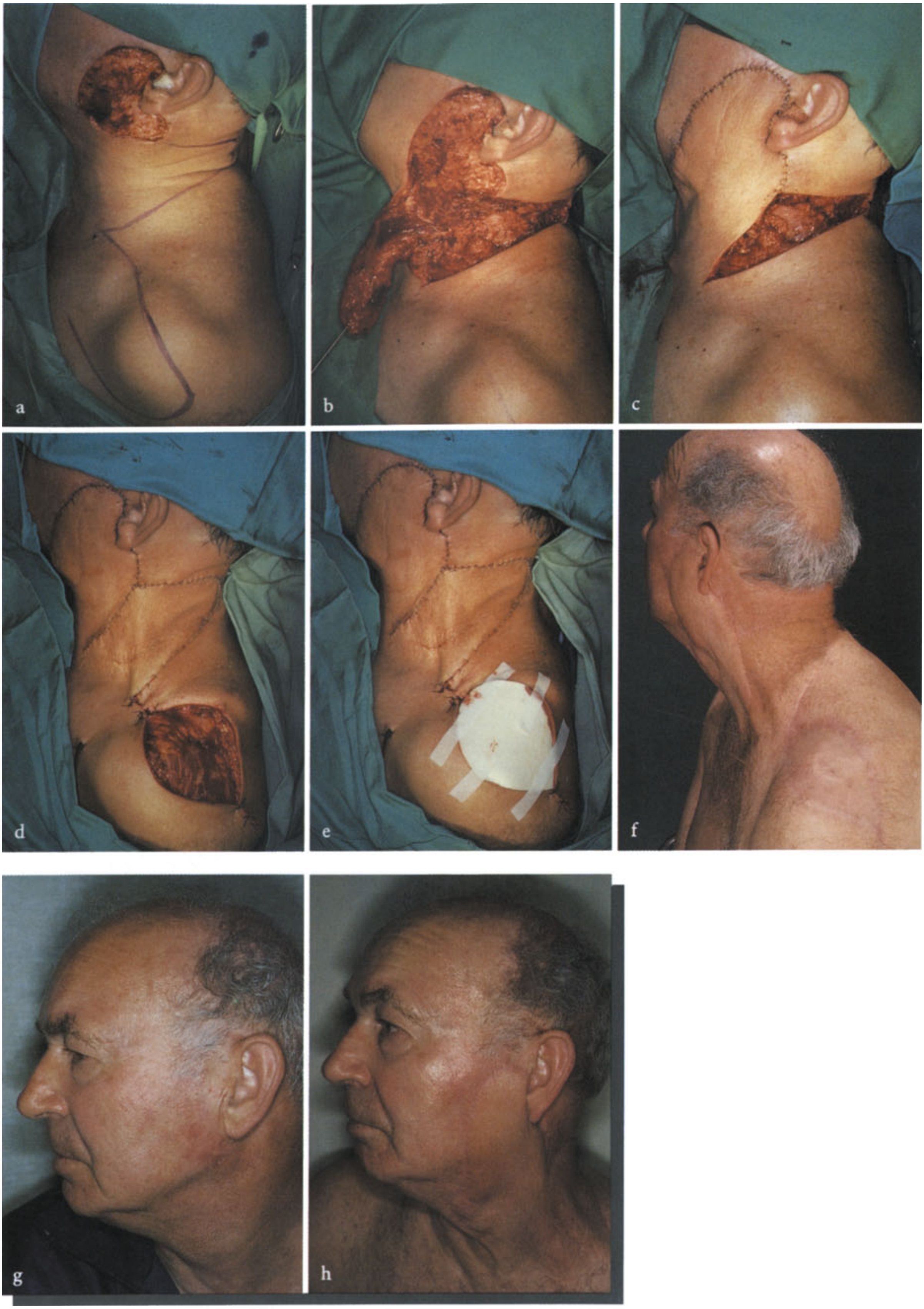


Fig. 220. Cheek rotation flap combined with glabellar rotation flap

- **a** Defect after excision of a sclerosing basal cell carcinoma, with operative plan for a cheek rotation flap (after Imre)
- **b** Rotation flap in place with small residual defect
- **c** Operative plan for glabellar rotation flap with Burow's triangle
- **d** End of operation
- **e** Preoperative appearance
- **f** Appearance after 6 months

19.6 Nose

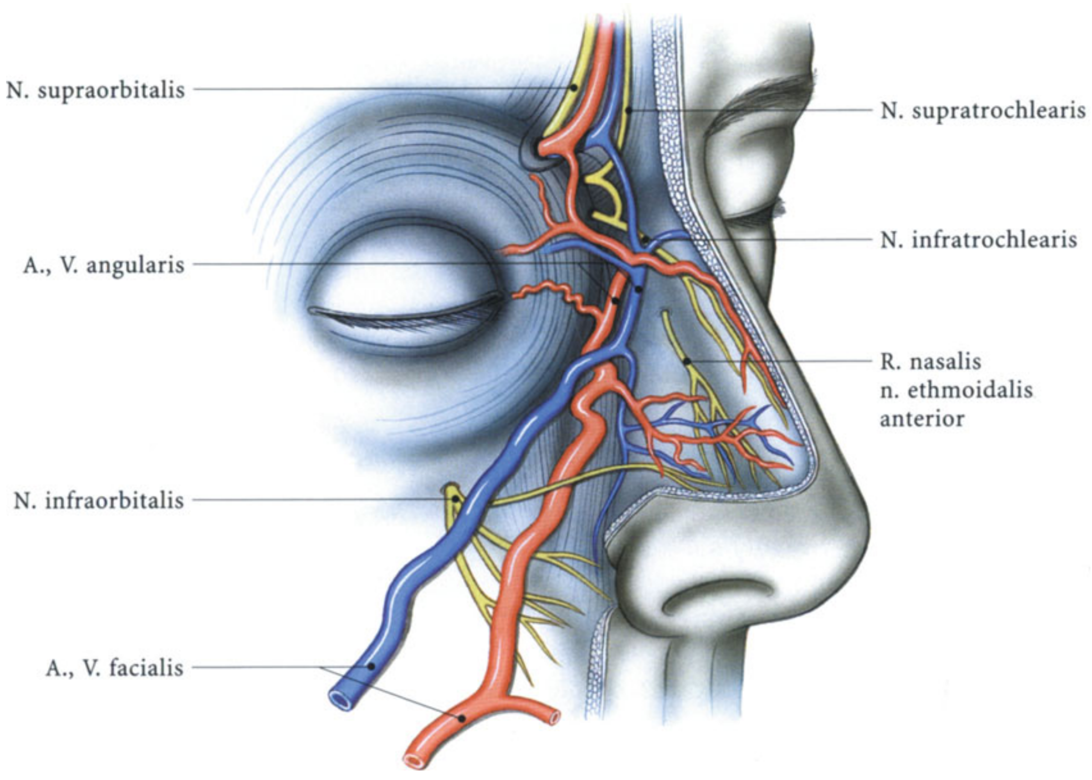
Operations on the nose require an especially careful approach. Particular attention must be paid not only to the profile but to the symmetry of the nose and nostrils as viewed face on. Even a minor deviation to one side or the other can both be cosmetically disturbing and lead to difficulty in breathing. Furthermore, even a small defect on the tip of the nose is invariably worrisome to the patient, as it seems that the nose presents the focal point when someone glances at the face. This problem arises almost daily, for the nose is the site of many cutaneous malignancies. In addition to a knowledge of the superficial and deep structures, the surgeon must be able to view the nose three-dimensionally.

19.6.1 Anatomy

The shape of the nose is determined by the underlying bony and cartilaginous structures. The paired nasal bones lie beneath the skin of the dorsum of the nose. The rest of the nose, including the tip and columella, is supported by cartilage. The latter structure is relatively easily deformed, and minor postoperative tension can lead to deviation. The ala nasi is supported medially by cartilage but laterally only by skin, connective tissue, and muscle; it is highly mobile (for example, "flared nostrils"). These features must be considered in planning the operation.

The vascular supply comes from the facial and angular arteries and veins, which anastomose and send branches medially. Innervation is through the 1st and 2nd branches of the trigeminal nerve: the infraorbital and infratrochlear nerves from the former and the nasal and anterior ethmoid from the latter (Fig. 221).

Fig. 221. Anatomy of nasal region



19.6.2 Anesthesia

Large operations on the nose are possible without general anesthesia, but local infiltration offers little. Only the smallest procedures on the dorsum of the nose are best performed with this technique. Instead, one should become adept at blocking the various branches of the trigeminal nerve. One blocks the infratrochlear nerve by injecting anesthetic at the root of the nose (glabella) in the direction of the lateral nasal sidewalls and the medial canthus. This numbs the root and the proximal lateral sidewalls of the nose. The infraorbital nerve is blocked by injecting anesthetic along the lateral sidewall of the nose cranially and then rotating the needle and, through the same site, infiltrating towards the columella. This anesthetizes the ala nasi, lateral sidewall of the nose, and columella. Finally, branches of the anterior ethmoid nerve are blocked by a fan-shaped injection starting between the nasal bone and the wing-shaped cartilage at the tip; this numbs the distal aspect of nose.

19.6.3 Planning the Operation

Many different operative techniques have been described, depending on the localization, size, and depth of the defect; these produce varying degrees of cosmetically acceptable results. For example, a defect may be excised on the dorsum of the nose over the bony skeleton and closed primarily with acceptable results, while the same approach on a lesion of the same size but on the tip would be doomed to failure. One must therefore be capable of performing a wide variety of procedures and of employing them selectively in the various nasal subregions.

Unfortunately, surgeons often err on the side of tissue conservation rather on that of than adequate margins when working in the different regions of the nose. This tendency leads to many recurrent tumors which are then much harder to treat. Such caution is usually unnecessary as highly successful procedures are available for closing larger defects. One must pay close attention to the different regions of the nose, particularly to the variations in skin texture, and to the borders between the subunits.

We most commonly use flaps, but skin grafts are also very useful. When grafts are placed, hemostasis must be excellent, and the periosteum and perichondrium preserved as much as possible. Postoperative bleeding and a lack of nutrients often lead to graft necrosis. Larger defects often require a combination of tissue movement and grafting. If uneven scars, depressions, or pigmentary changes do develop after the operation, a light dermabrasion is particularly useful on the nose to correct contouring and to improve color.

19.6.4 Surgical Techniques

The following techniques are discussed with particular attention to the most appropriate nasal subregion (Fig. 222). Around the glabella and root of the nose the reservoir of tissue comes from the vertical glabellar folds and the horizontal folds of the nasal bridge. Simple excision with undermining and VY flaps are highly suitable here. The classical glabellar rotation flap also uses these two sets of folds to place suture lines.

On the dorsum of the nose simple excisions with undermining are still useful, especially in older patients. With advancement flaps the tissue is moved from the lateral sidewalls of the nose and the medial cheek. U-flaps are oriented downward from the glabellar region. Transposition flaps must often be bilobed to bridge the distance between the nasal back and the nasolabial fold. The tip of the nose is a difficult spot. In order to free tissue, skin must be mobilized up to the glabella or to nasolabial folds and cheek. We usually use U-flaps, frontonasal flaps, transposition flaps, and median forehead flaps.

The lateral nasal sidewall can generally be closed using primary closures or rotation flaps to move lateral tissue medially. Occasionally transposition flaps from the cheeks or forehead are needed. Special techniques are required to reconstruct the arches of the ala nasi so that breathing remains undisturbed. Various advancement and transposition flaps from the nasolabial fold are often employed. There are only a few approaches to the columella; we usually employ a bilobed flap.

In some operations on the nose a full-thickness or penetrating defect must be closed. This means that not only the skin must be repaired but the mucosal surface also replaced. One can invert a Burow's triangle into the wound, invert the tip of a bilobed flap, or apply a graft to line the defect before using another technique to cover it. In all cases skin comprised of cornified epithelium then lines the nasal airway, replacing mucosa.

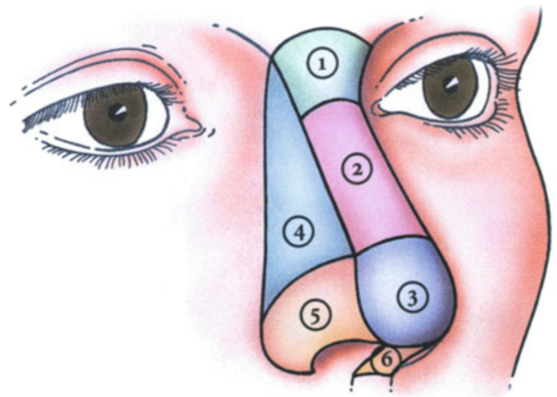


Fig. 222. Anatomic subregions of nose
1, glabella and bridge
2, back
3, tip
4, side
5, ala nasi
6, columella

Fig. 223. Primary closure with undermining
a Operative plan for spindle-shaped excision of a basal cell carcinoma on nasal root
b Operative defect
c Undermining
d End of operation
e Preoperative appearance
f Appearance after 6 months

Fig. 224. Double WY-plasty
a Operative plan for a double WY excision of a congenital melanocytic nevus
b Excision of nevus
c Closure of lower part of wound
d Final closure
e Preoperative appearance
f Appearance after 1 year

Fig. 225. Glabellar rotation flap
a Defect after excision of a basal cell carcinoma, with operative plan
b Preparing the flap
c Final closure
d Appearance after 2 years

Fig. 226. Subcutaneous pedicle flap
a Defect after excision of basal cell carcinoma on nasal root, with operative plan
b Careful preparation of flap avoiding damage to subcutaneous pedicle
c Moving pedicle flap into place
d Appearance after fitting the pedicle flap in place and closing the donor site after undermining
e Preoperative appearance
f Appearance after 4 years

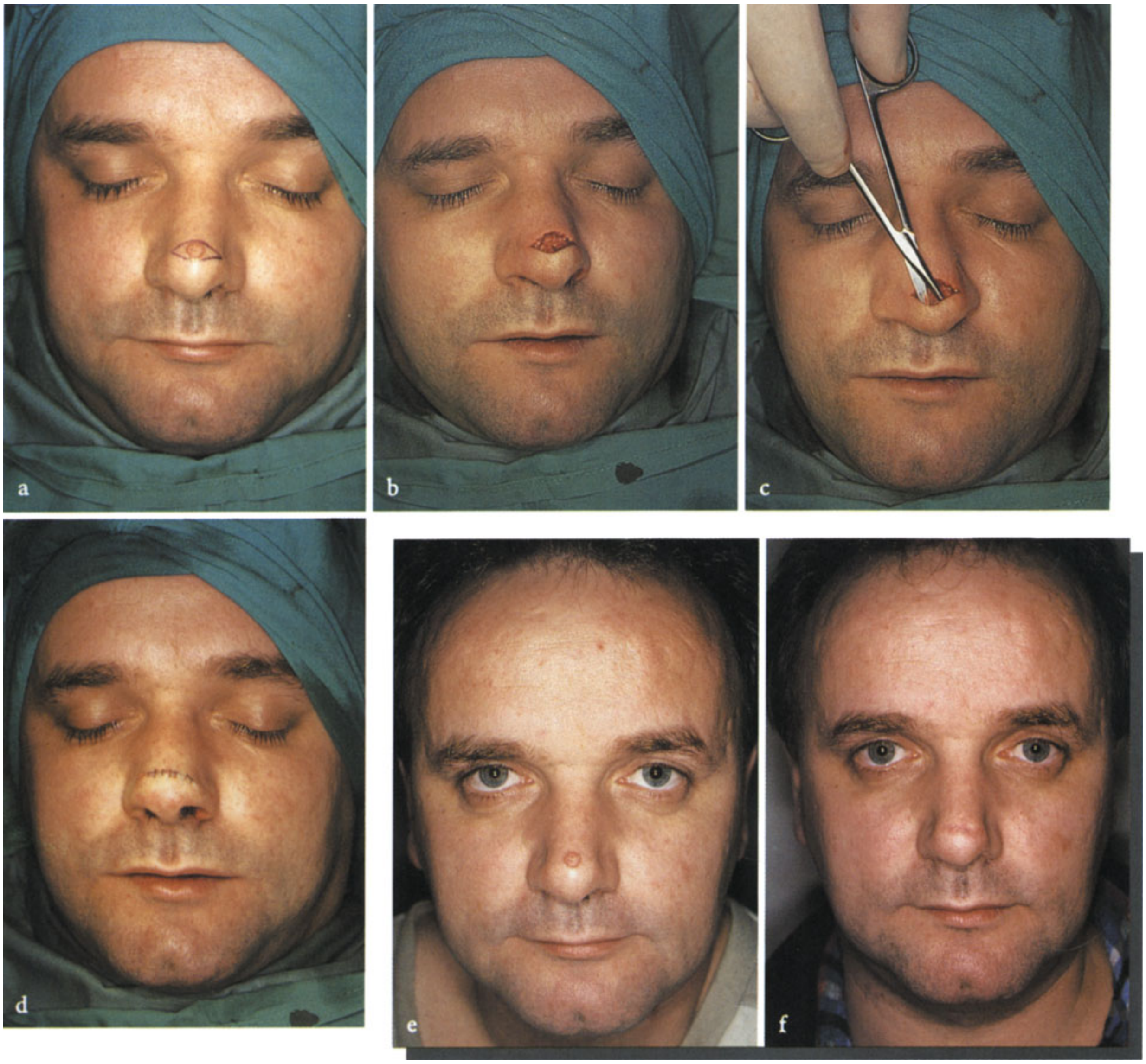


Fig. 227. Primary closure with undermining
a Keratoacanthoma with plan for horizontal excision
b Surgical defect
c Undermining
d Final closure
e Preoperative appearance
f Appearance after 3 months

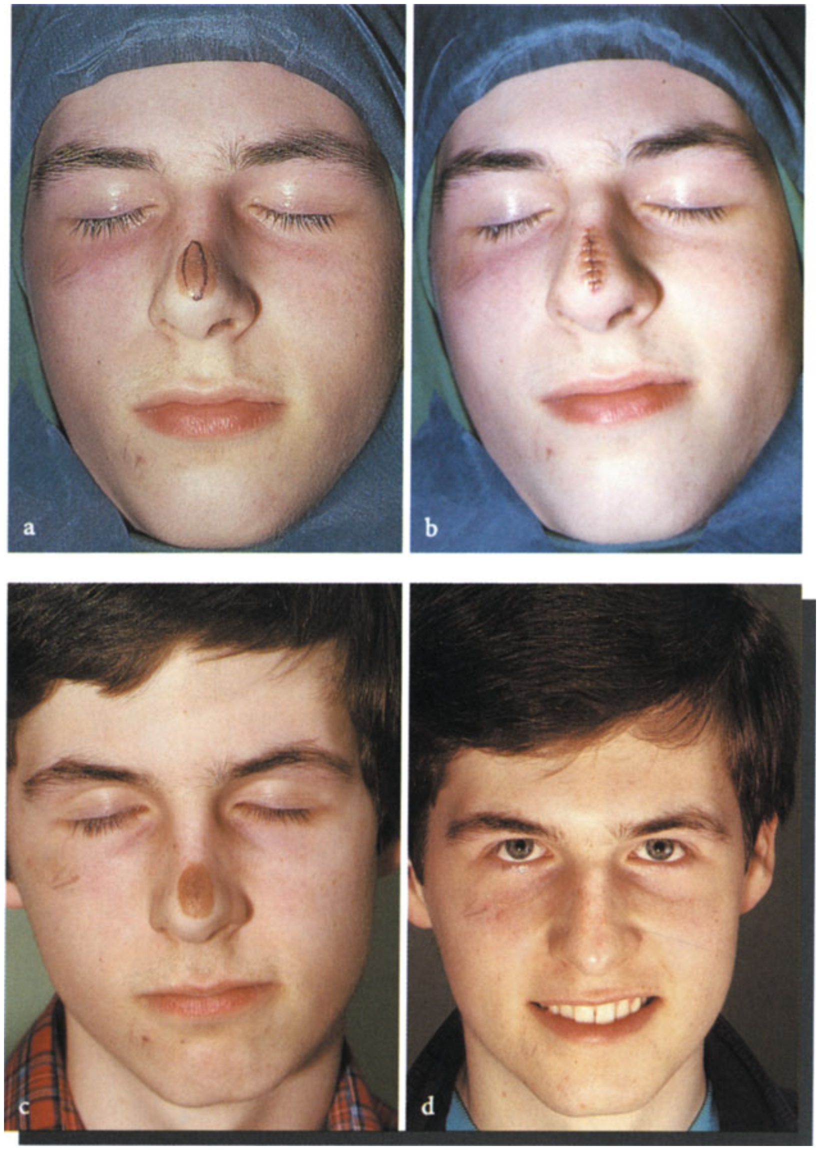


Fig. 228. Serial excision
a Congenital melanocytic nevus, with operative plan for a partial excision using vertical ellipse
b Appearance after first operation
c Preoperative appearance
d Appearance 2 years after a second vertical excision to remove the residual nevus

Fig. 229. U-plasty
a Defect after excision of basal cell carcinoma, with operative plan
b Mobilization of flap
c Placement of flap and intraoperative determination of Burow's triangles
d Closure after placement of Burow's triangles at medial canthi of the eye
e Preoperative appearance
f Appearance after 1 year

Fig. 230. Rotation flap with back cut
a Defect after excision of basal cell carcinoma, with operative plan
b Mobilization of flap
c Rotation of flap into place
d Final closure after lateral Burow's triangle to preserve the axis of the eyebrows
e Preoperative appearance
f Appearance after 1 year

Fig. 231. Bilobed flap
a Defect after excision of basal cell carcinoma, with operative plan
b Moving the first flap into the primary defect
c Primary flap sewn in place; residual defect to be repaired through second flap from nasolabial fold, as marked
d Final closure
e Preoperative appearance
f Appearance after 4 years

Fig. 232. U-plasty combined with subcutaneous pedicle flap
a Wide defect after excision of lentigo maligna, with operative plan
b Following U-plasty, small residual defect on side of nose
c Operative plan for subcutaneous pedicle flap
d Moving the flap into place
e End of operation
f Appearance after 9 months

Fig. 233. Full-thickness skin graft
a Excision of basal cell carcinoma
b Defect after excision
c Wound after conditioning; harvesting of full-thickness skin graft from supraclavicular region
d Closely fitted skin graft; donor site closed primarily after undermining
e Preoperative appearance
f Appearance after 2 years

Fig. 234. Forehead flap combined with full-thickness skin graft to repair penetrating nasal defect

- **a** Full-thickness defect after excision of large basal cell carcinoma; nasal bone is exposed. Operative plan for forehead flap with marked area designed as full-thickness skin graft to line inner aspect of nose
- **b** Fitting a full-thickness skin graft onto the tip of the flap as well as the donor site
- **c** After the full-thickness skin graft has healed (10 days later), the pedicle is developed and flap placed over nasal defect
- **d** After another 2 weeks, the pedicle is severed and used to close the donor site while the transferred flap is finally fitted in place
- **e** Preoperative appearance
- **f** Appearance after 1 year

Fig. 235. U-plasty
a Defect after excision of radiation ulcer following treatment of basal cell carcinoma. Operative plan marked
b Preparation of U-flap and excision of Burow's triangles
c Moving the flap into place
d End of operation
e Preoperative appearance
f Appearance after 15 months

Fig. 236. Advancement flap with back cut
a Defect after excision of basal cell carcinoma, with operative plan for glabellar advancement flap with back cut (after Rieger)
b Mobilization of flap
c Advancing the flap
d Final closure
e Preoperative appearance
f Appearance after 1.5 years

Fig. 237. Advancement flap with sickle-shaped relaxing excision
a Defect after excision of basal cell carcinoma, with operative plan
b Preparation of advancement flap
c Moving the flap into place
d Final closure
e Preoperative appearance
f Appearance after 2 years

Fig. 238. Rotation flap
a Defect after excision of lentigo maligna, with operative plan for simple rotation flap
b Mobilization of flap
c Placement of flap
d End of operation
e Preoperative appearance
f Appearance after 6 months

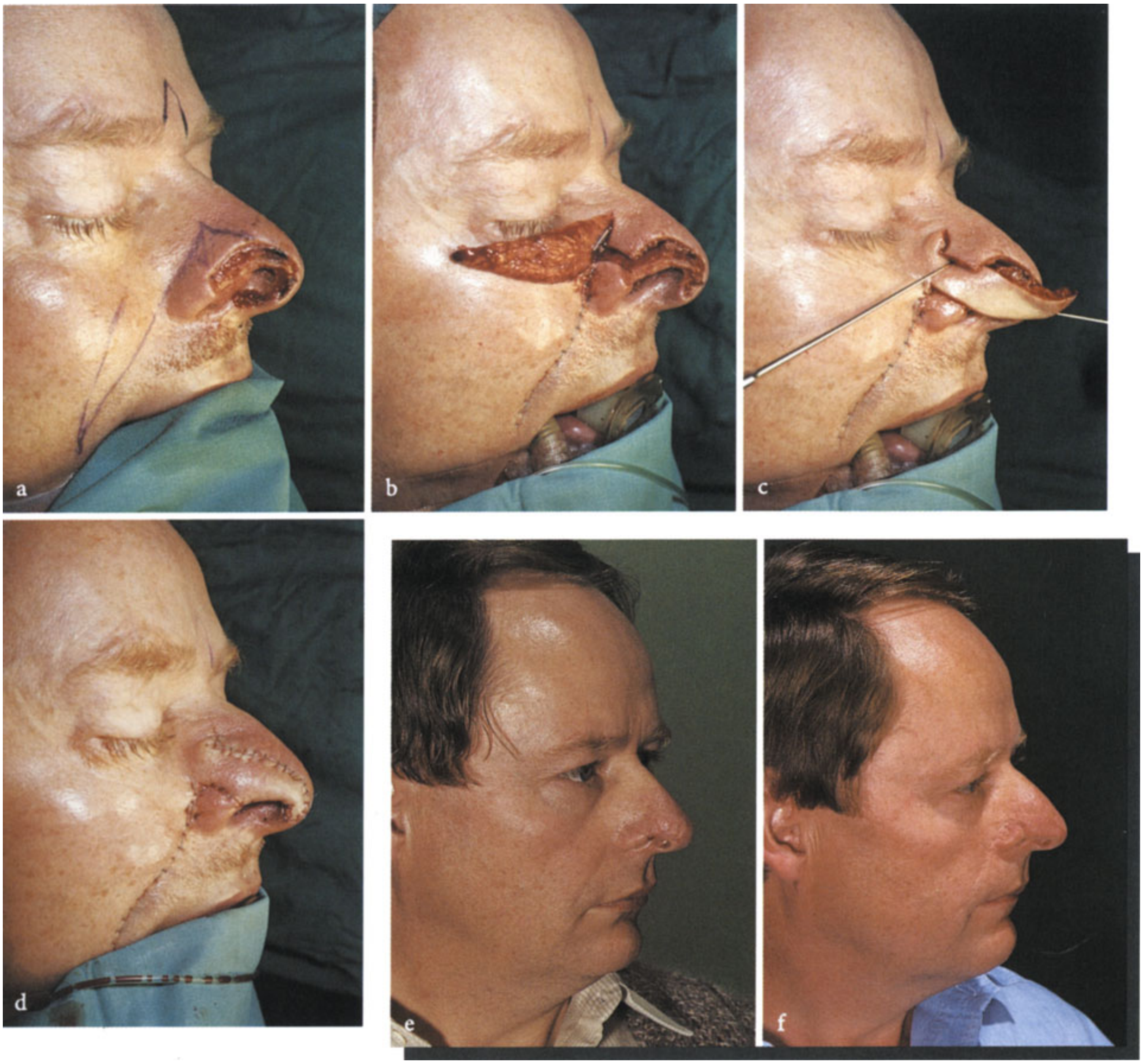


Fig. 239. Transposition flap
a Full-thickness defect involving tip and ala nasi after excision of basal cell carcinoma
b Appearance after preparation of transposition flap and closure of nasolabial donor site
c Placing the flap, including inversion of the distal tip to line the inside of the nostril
d End of operation
e Preoperative appearance
f Appearance after 6 months

Fig. 240. Full-thickness skin graft
a Defect after excision of basal cell carcinoma
b Full-thickness skin graft harvested from retroauricular region and fitted in place
c Preoperative appearance
d Appearance after 1 year

Fig. 241. Paramedian forehead flap
a Large squamous cell carcinoma of nasal tip
b Repair of defect with paramedian forehead flap
c After 2 weeks, final fitting of flap with pedicle returned to donor site
d Donor defect closed with advancement flap from temporal region with Burow's triangle
e Preoperative appearance
f Appearance after 6 months

Fig. 242. Temporal flap combined with full-thickness skin graft
a Defect after excision of basal cell carcinoma. Preparation of axial temporal flap
b Placement of flap
c After 2 weeks, the pedicle is severed and returned to donor site while the graft is fitted
d The residual donor defect is closed with a full-thickness skin graft
e Preoperative appearance
f Appearance after 1 year

Fig. 243. Advancement flap
a Defect after excision of basal cell carcinoma with plan for classical Burow's advancement flap
b Raising the flap; Burow's triangle just lateral to ala nasi
c Placement of flap
d End of operation
e Preoperative appearance
f Appearance after 1 year

Fig. 244. Advancement flap with back cut
a Defect after excision of basal cell carcinoma, with operative plan
b Complete mobilization of flap
c Tension-free advancement
d End of operation
e Preoperative appearance
f Appearance after 1 year

Fig. 245. Nasolabial advancement flap
a Operative plan for excision of basal cell carcinoma and repair using nasolabial advancement flap in single sitting
b Excision defect
c Crescentic relaxing excision along nasolabial fold with preparation of flap
d End of operation
e Preoperative appearance
f Appearance after 1 year

Fig. 246. Trapezoid plasty
a Defect after excision of basal cell carcinoma, with operative plan
b Complete mobilization of flap
c After placing Burow's triangle laterally and crescentic relaxing excision medially, the flap is moved into place
d End of operation
e Preoperative appearance
f Appearance after 1.5 years

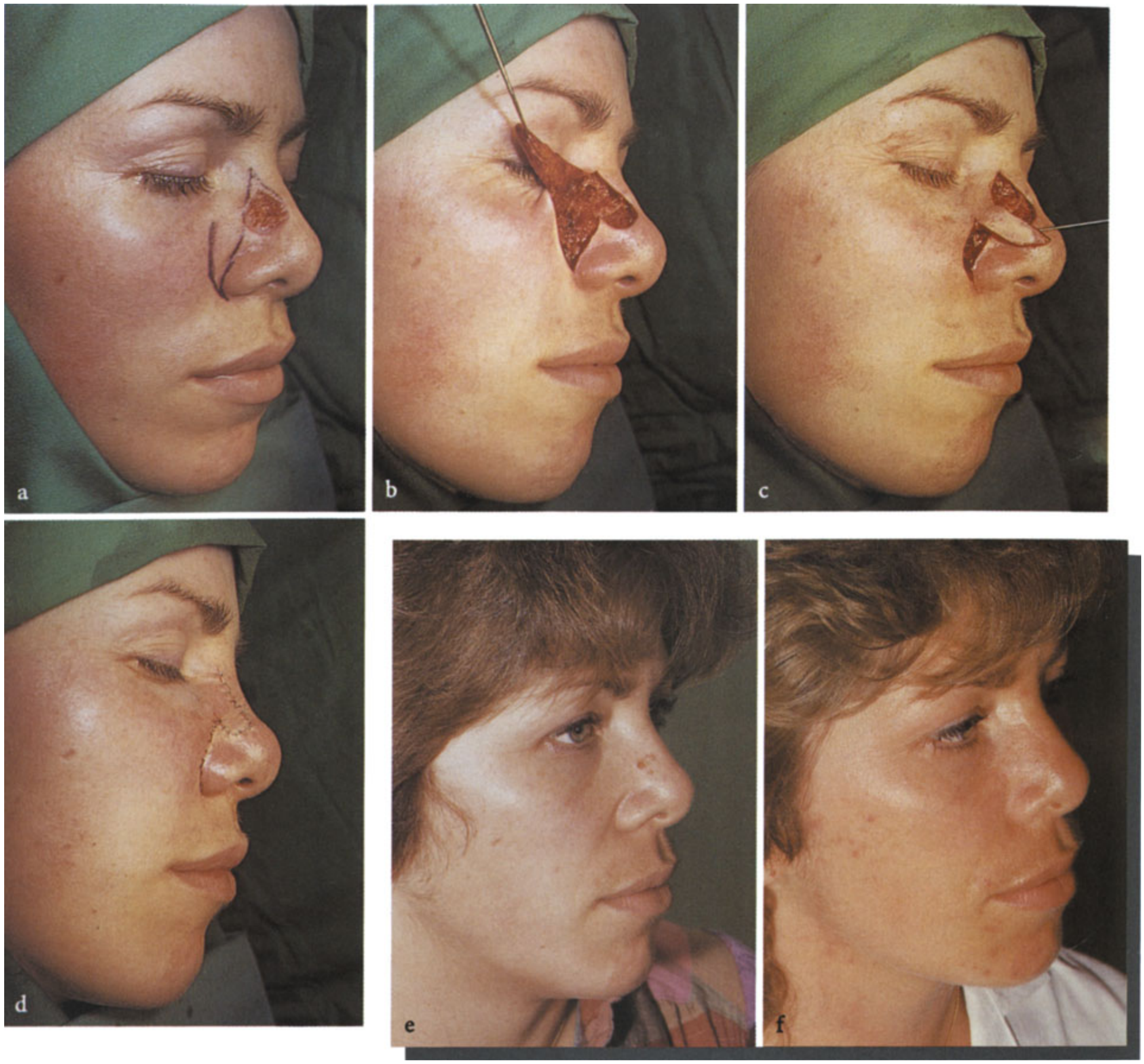


Fig. 247. Transposition flap
a Defect after excision of basal cell carcinoma, with operative plan
b Preparation of flap
c Transposing the flap into place
d End of operation
e Preoperative appearance
f Appearance after 1.5 years

Fig. 248. Paramedian forehead flap
a Large basal cell carcinoma on the lateral nasal sidewall
b Excision defect
c Forehead flap sewn into place
d After the flap has taken, the pedicle is severed and returned to the forehead. The residual donor defect is closed after extensive undermining
e Preoperative appearance
f Appearance after 2 years

Fig. 249. Median forehead flap combined with cheek rotation flap

a Large defect involving lateral nasal wall and ala nasi after excision of recurrent basal cell carcinoma. Operative plan as marked

b Flap placed in the medial aspect of the defect

c After 2 weeks, pedicle is severed and returned to forehead. Sketch of cheek rotation flap to close lateral defect

d End of operation

e Preoperative appearance

f Appearance after 1 year

Fig. 250. Trapezoid plasty combined with inverted subcutaneous pedicle flap to repair full-thickness nasal defect
a Defect after excision of an extensive recurrent basal cell carcinoma, with operative plan
b The subcutaneous pedicle flap from the lateral nasal wall is inverted and used to create the mucosal lining. Preparation of large cheek flap
c Placement of trapezoie flap
d End of operation
e Preoperative appearance
f Appearance after 1 year

Fig. 251. Advancement flap
a Defect after excision of basal cell carcinoma, with operative plan for classic Burow's flap with Burow's triangle at lateral aspect of ala nasi
b Mobilization of the flap
c Advancement of the flap
d End of operation
e Preoperative appearance
f Appearance after 6 months

Fig. 252. Subcutaneous pedicle flap
a Defect after excision of basal cell carcinoma, with operative plan
b Preparation of subcutaneous pedicle flap while sparing the lateral vascular stalk
c Moving the flap into place
d Fitting the flap into the defect and wound closure
e Preoperative appearance
f Appearance after 1 year

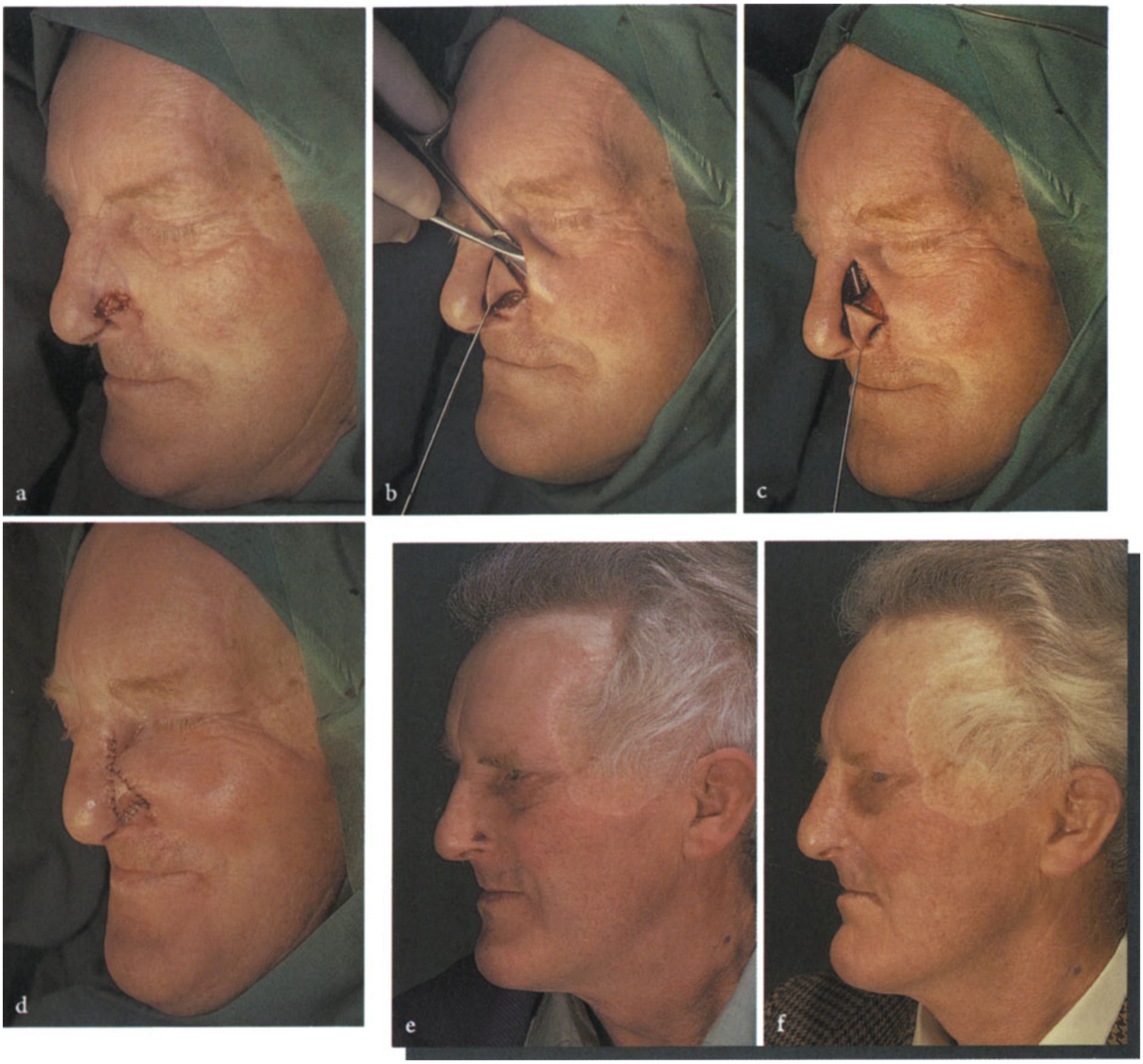


Fig. 253. Subcutaneous pedicle flap
a Defect after excision of basal cell carcinoma, with operative plan for a pedicle flap
b Preparation of flap taking care to ensure that the lateral subcutaneous vascular stalk remains intact
c Moving the flap into place
d End of operation
e Preoperative appearance. Note also that a large defect of the temple, following removal of basal cell carcinoma, has been covered with a full-thickness skin graft
f Appearance after 1 year

Fig. 254. Subcutaneous tunnel or island flap
a Defect after excision of basal cell carcinoma, with operative plan
b Raising the transposition flap in the nasolabial fold region
c Tunneling the flap into place after removing the epithelium from the stalk
d Flap sewn in place; donor defect closed primarily after undermining
e Preoperative appearance
f Appearance after 15 months

Fig. 255. Transposition flap
a Operative plan for excision of lentigo maligna and transposition flap
b Excision defect
c Fitting of transposition flap and step-by-step closure
d End of operation
e Preoperative appearance
f Appearance after 1.5 years

Fig. 256. Bilobed flap
a Defect after excision of basal cell carcinoma, with operative plan
b Preparation of both flaps
c Moving both flaps
d End of operation
e Preoperative appearance
f Appearance after 1 year

Fig. 257. Transposition flap combined with inverted subcutaneous pedicle flap
- **a** After excision of basal cell carcinoma, a defect is left which in some areas involves the mucosal lining of the nose. Secondary healing has occurred. Operative plan shows both the pedicle flap above the defect and the lateral transposition flap
- **b** Preparing the subcutaneous pedicle flap
- **c** Reversing the flap to line the mucosal aspect of the nose
- **d** Preparing the transposition flap
- **e** End of operation
- **f** Appearance after 1 year

Fig. 258. Two-step pedicle flap ▷
- **a** Defect after excision of squamous cell carcinoma, with operative plan
- **b** Developing a pedicle flap after partially closing nasal defect
- **c** Donor site closed primarily after undermining
- **d** Tip of flap sewn into place
- **e** After 2 weeks, the pedicle is severed and the flap fitted
- **f** End of second operation
- **g** Preoperative appearance
- **h** Appearance after 2.5 years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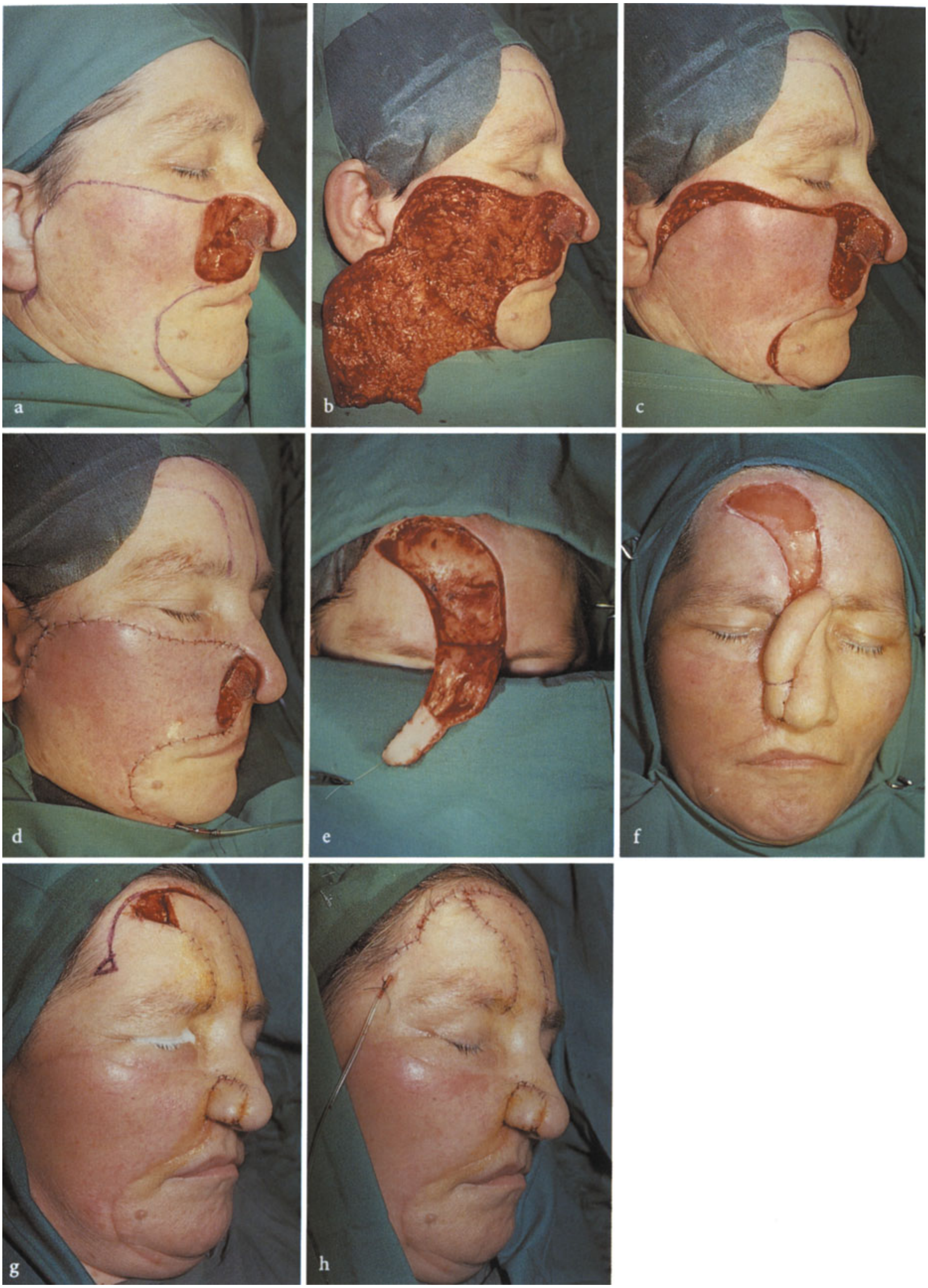
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Fig. 259. Trapezoid flap combined with forehead flap and full-thickness skin graft

- **a** Large defect of nose and adjacent tissue after removal of basal cell carcinoma
- **b** Large trapezoid flap from cheek used to cover the lateral defect
- **c** Moving the trapezoid flap into place
- **d** Residual full-thickness nasal defect
- **e** Preparation of forehead flap, with full-thickness skin graft applied to ventral tip to line the nasal vestibule
- **f** After healing of the flap, it is finally fitted and the pedicle severed and returned to donor site
- **g** Rotation flap planned to cover residual forehead defect
- **h** Rotation flap completed and final closure
- **i** Preoperative appearance, lateral view
- **j** Appearance after 5 years, lateral view
- **k** Preoperative appearance, frontal view
- **l** Appearance after 5 years, lateral view

Fig. 260. Transposition flap with inversion
a Excision of squamous cell carcinoma leaving full-thickness defect, with operative plan
b Preparing the flap
c Inverting the tip of the flap to line the nasal vestibule
d Final closure with evenly fitted flap
e Preoperative appearance
f Appearance after 2 years

Fig. 261. Tunnel or island flap
a Defect at base of nostril after excision of basal cell carcinoma. Operative plan shows the intended flap with cross-hatching
b Preparation of flap
c Tunneling the flap into place
d End of operation
e Preoperative appearance
f Appearance after 6 months

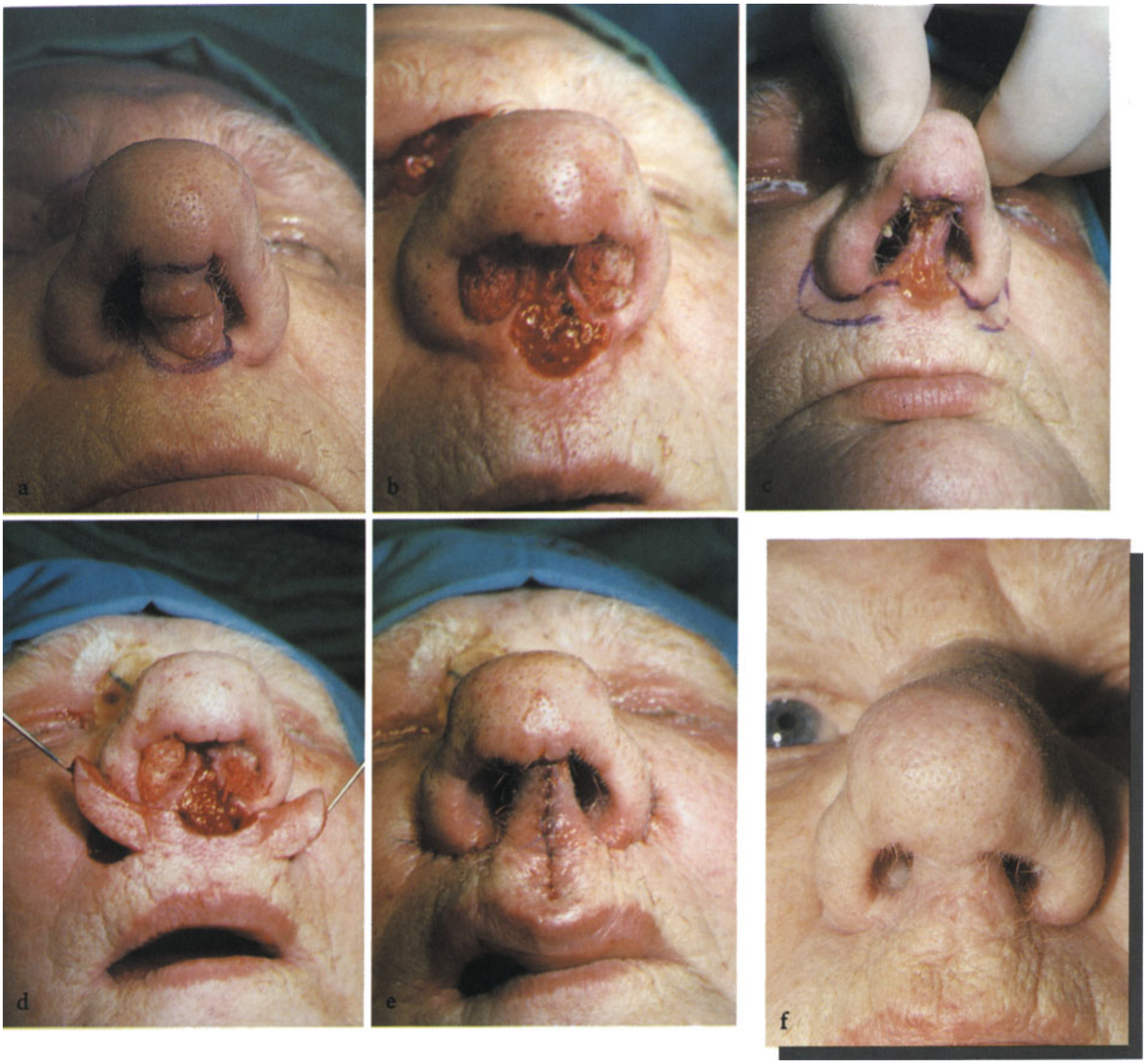


Fig. 262. Double transposition flap
a Nodular basal cell carcinoma on columella
b Excision defect
c Operative plan for two transposition flaps to meet medially
d Transposing the flaps
e End of operation
f Appearance after 1 year

Fig. 263. Methods of treating rhinophyma
a Scalpel excision
b Excision with disposable razor
c Dermabrasion

19.6.5 Rhinophyma Surgery

Rhinophyma can be treated only surgically. We usually employ general anesthesia, but the operation can also be performed under local anesthesia. The two basic operative approaches involve course reshaping of the nose by slicing or cutting off excess tissue and then fine sculpting using dermabrasion. One can be surprisingly aggressive in removing tissue, for healing is generally amazing; if too much tissue is removed, however, netlike scars can result. As a model for the final shape we like to use photographs of the patient that were taken before rhinophyma began to develop.

Two other techniques have not proven themselves valuable in our judgment. Both electrosurgical sculpting and complete excision of all proliferative tissue followed by a skin graft have produced unsatisfactory cosmetic results.

The excised tissue should be submitted for histopathologic examination. Both basal cell and squamous cell carcinomas are occasionally identified histologically, although they have been overlooked clinically. If they are treated inadvertently during rhinophyma repair, additional treatment may not be needed.

Surgical Techniques

Gross removal of the fibrous tissue with sebaceous hyperplasia is accomplished with a scalpel or a disposable razor. We then use a dermabrader with a diamond fraize. It is usually possible to sculpt a nose which is cosmetically satisfactory. Postoperative bleeding can be controlled by the use of a local hemostatic agent or fibrin glue. The wounds reepithelialize rapidly from the remaining deep hair follicles and sebaceous ducts.

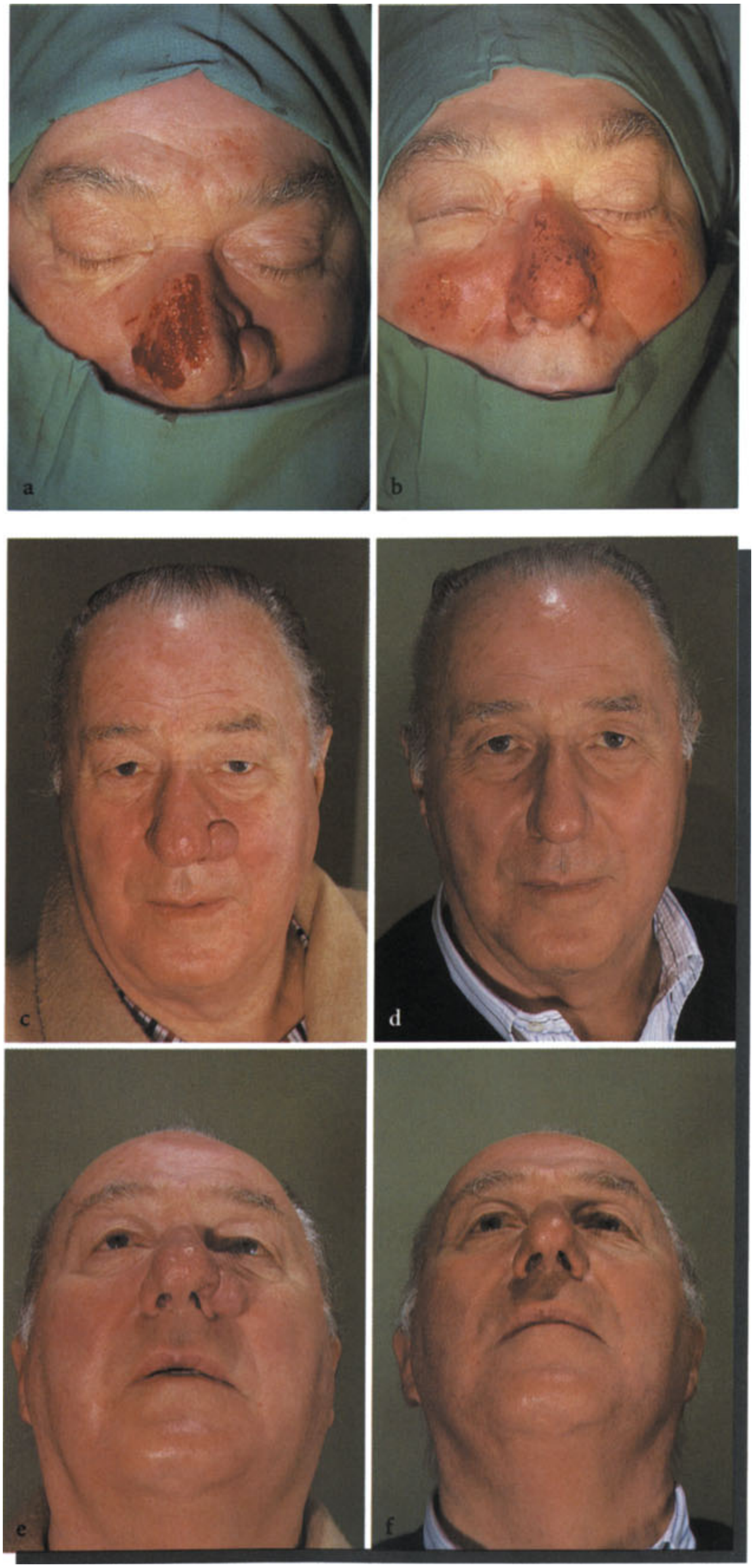


Fig. 264. Treatment of rhinophyma
a Appearance following tangential excision with scalpel
b Dermabrasion is suited for fine modeling
c Preoperative appearance, frontal view
d Appearance after 6 months, frontal view
e Preoperative appearance, inferior view
f Appearance after 6 months, inferior view

19.7 Lips

The upper and lower lips are each symmetrical structures which together form an anatomic unit. Their basic muscular support is provided by the sphincterlike orbicular oris muscle. An elegant interplay between three groups of muscles produces the precise motions, such as raising and lowering the lips and moving the corners of the mouth, which are needed for speaking, for eating, and particularly for facial expression. The surgeon must avoid tension at the corner of the mouth which can lead to distortion of the lip, misalignment of the vermilion, or asymmetry, for each of produces a most disturbing cosmetic result.

The lip region is bordered by the nose, the nasolabial folds, and the mental crease. These lines, along with the relaxed skin tension lines, should be used for the placement of scars.

19.7.1 Anatomy

The labial arteries and veins enter laterally and run parallel to both lips as they branch; both anastomose in the midline with their opposite pair. The vessels run either beneath or through the orbicularis oris muscles. The upper lip is innervated by branches of the infraorbital nerve. The lower lip and chin are innervated by the mental nerve, which reaches the skin through the mental foramen (Fig. 265).

19.7.2 Anesthesia

Most dermatologic operations around the lips can be carried out either with infiltrative anesthesia or local blockade of the infraorbital or mandibular and mental nerve. The nerve block can be accomplished by injecting at the site where the nerves exit the maxilla or mandible intraorally. Extensive procedures such as

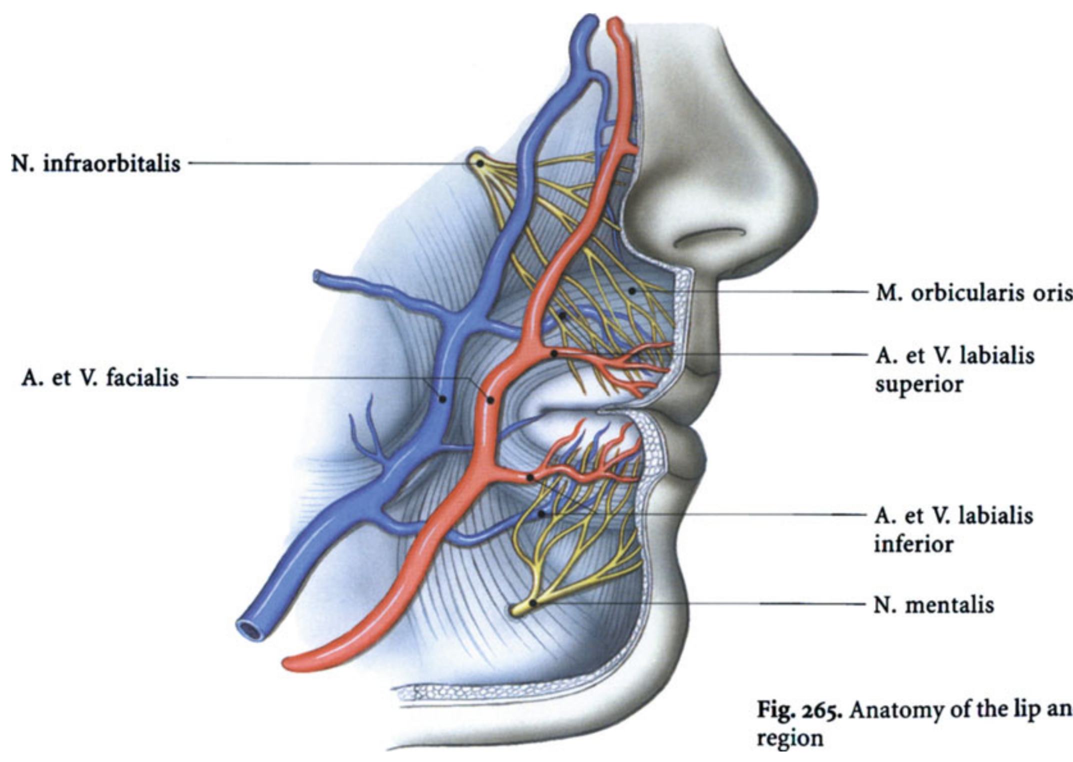


Fig. 265. Anatomy of the lip and chin region

those involving marked reconstructive surgery or cutaneous surgery combined with a lymph node dissection are carried out under general anesthesia.

19.7.3 Planning the Operation

To avoid a narrowed oral aperture one should never attempt to repair a defect comprising more than one-third of the upper or lower lip with a primary closure. A three-layered closure is mandatory when closing a wedge-shaped surgical lip defect; the mucosa, muscles, and skin must be approximated separately. Buried single sutures with slowly resorbable material are used for the mucosa. Larger defects must be closed with local flaps; skin grafts are most unsatisfactory around the lips.

A wide variety of operative approaches to the lips have been described; many are too extensive or lead to major postoperative disabilities. Local radical excision is adequate for treating actinic cheilitis, that is a premalignant or in situ tumor of the lip, or a local squamous cell carcinoma with no indication of regional metastasis. Neither postoperative radiation nor lymph node dissection provides a better prognosis. Of course, close postoperative clinical control is needed. The chances for a cure following a recurrence or inadequate initial procedure are smaller.

Below we discuss only those procedures which are not unnecessarily technically complicated, and which offer the promise of curative and cosmetically acceptable results.

19.7.4 Surgical Techniques

An elliptical vertical excision of the lips should be oriented along the vertical folds and wrinkles. Lateral undermining is essential to avoid a sunken wound. If the excision crosses the vermilion, this area should first be reapproximated exactly to ensure the best possible result. It is sometimes helpful to mark the vermilion border prior to anesthesia, for vascular blanching and surgical trauma may later make its identification difficult.

A full-thickness wedge excision may be needed to remove a malignant tumor of the lip and subcutaneous/subepithelial tissue. Again, the key steps are realigning the vermilion border and performing the three-layered closure. A Z-plasty is useful if the lip is displaced through the wedge-shaped excision, or if the scar is too long. A WY-plasty can also be used to avoid a long vertical scar.

If the vermilion shows precancerous changes, it too should be treated; we often do this in one sitting. The vermilion surface is excised horizontally (the so-called lip shave). The mucosa of the lip can then be undermined and moved anteriorly to cover the denuded surface, as described by Langenbeck and von Bruns. This technique is best suited to in situ carcinomas and small carcinomas confined to the vermilion surface. The operation can be performed either with local anesthesia or nerve blocks. Often we add epinephrine to the infiltrative anesthetic to reduce problems with bleeding. After excising the tumor and the vermilion, the mucosa is undermined with a small Metzenbaum scissor to the point at which it becomes fixed. The freed mucosa is easily stretched and advanced forward to cover the lip surface. It is tacked down with single sutures; the suture line forms the new vermilion border. Generally the lip proves no thinner than previously, once the postoperative swelling has declined. Suction drainage is inserted. After 3 days one half of the sutures are removed; the rest are removed after 7 days. We prefer this technique because it is relatively simple, is very well-tolerated, heals well, and usually produces excellent cosmetic results.

Carcinomas of the lower lip rarely arise as single lesions; almost invariably there is premalignant change on the adjacent terrain. Therefore we almost always combine a lip-shaving operation with treatment of the carcinoma. This reduces the likelihood of a second tumor and makes it easier to follow the patient for possible recurrences. Otherwise one often faces the question of recurrence versus second primary, with their various implications.

Larger tumors are best approached by the advancement flap designed by Burow. After a wedge-shaped excision is performed, a curved incision is made along the vermilion border either towards one or both commissures of the mouth. In the region of the nasolabial fold on the contralateral side a triangle is excised. After extensive undermining of the skin around the mouth and the cheek, the skin is advanced from the cheek and rotated to bridge the defect, thus reconstructing the lip. A major problem with this repair is that functional problems result if the orbicularis oris muscle is damaged.

It is also often necessary to repair the mucosal defect intraorally. Buccal mucosa can be advanced from the cheek to replace the missing mucosa. A horizontal excision is extended 2–3 cm posteriorly from the corner of the mouth, and the mucosa is then undermined down to the base of the mandible. This mucosa can then be advanced forward. If the vermilion must also be replaced, the same mucosa is employed as in a standard lip shave.

The unilateral and bilateral step techniques are another way to close a defect in the lower lip. With these approaches there is less risk to the orbicularis oris muscle, and large defects may be reconstructed. Another approach is to use a transposition flap from the nasolabial region. Here, again, the labial mucosa must be used for reconstruction of the vermilion.

The techniques of Abbé and Estlander are applicable to repairs of both the upper and lower lip. The tumor is excised in a wedge-shaped fashion, but the defect is closed with a wedge-shaped transposition flap from the opposing lip served by the labial artery and vein. Both the donor and recipient sites are closed in a three-layered fashion. This technique can be carried out at a single sitting when used at the commissure. If the Abbé technique is employed for a more central lesion, the vascular pedicle (which crosses the oral orifice) must be separated after 14–21 days in a second operation. Another elegant variation in the middle third of the lip is to close the central lesion primarily but to swing a flap up or down laterally to even out the lengths of the upper and lower lips. Many of these flaps in the corner of the mouth lead to tightening or distortion of the commissure. These changes can, however, be corrected at a later operation.

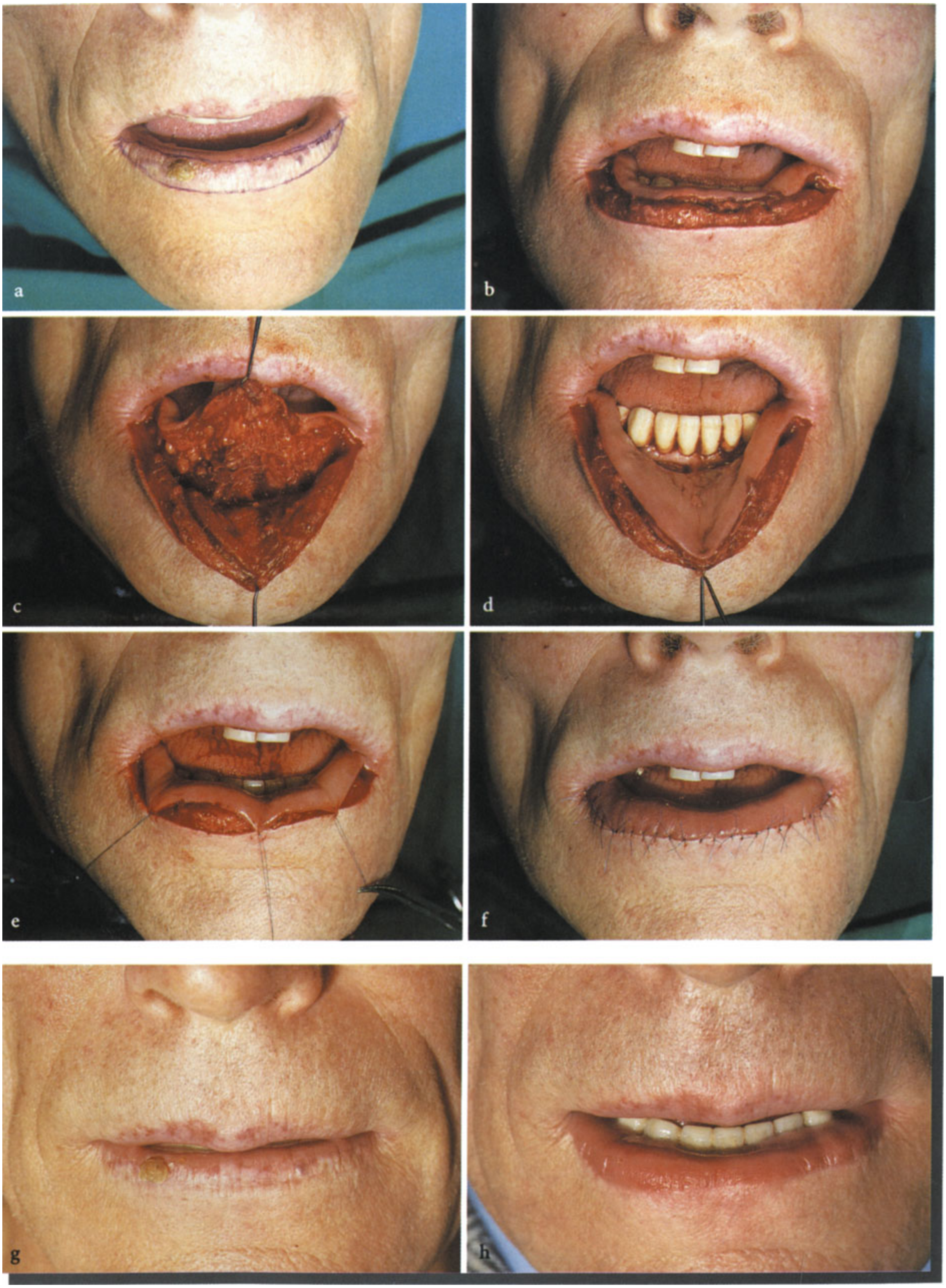
Operations to extend the commissure are needed not only to correct operative defects but also bilaterally in the repair of microcheilia and microstomia. We prefer to proceed by making a horizontal excision from the corner of the mouth through all layers of the cheek, after the necessary length of upper vermilion has been prepared as a flap attached to the lower vermilion (i.e., a flap of vermilion is raised around the corner of the mouth). The upper vermilion then forms the vermilion on the new, larger lower lip while the new upper lip is covered by a mucosal advancement flap.

Most actinic damage, and thus most carcinomas, arise on the lower lip. Basal cell carcinomas are actually more common on the upper lip. The procedures here are similar, but it is easier to move tissue from the nasolabial region.

The treatment of macrochelia, particularly in granulomatous cheilitis and Melkersson-Rosenthal syndrome, is best accomplished by transverse submucosal excision of the excessive tissue. The incision should be made at the junction of the vermilion and the labial mucosa.

Fig. 266. Wedge excision combined with Z-plasty
a Operative plan for excision of squamous cell carcinoma of lower lip
b Excision defect and Z-plasty
c Transposing the two flap tips
d End of operation
e Preoperative appearance
f Appearance after 4 months

Fig. 267. WY-plasty
a W-shaped excision of large squamous cell carcinoma of lower lip
b Excision defect
c Reapproximating flaps with careful attention paid to realigning vermilion border
d Closure in multiple levels (mucosa, muscle, subcutaneous tissue and skin)
e Preoperative appearance
f Appearance after 1 year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◁ **Fig. 268.** Lip shave (vermilionectomy after Langenbeck-von Bruns)
- **a** Operative plan for removing lower lip with extensive diffuse actinic damage
- **b** Excision of entire vermilion
- **c** Freeing the labial mucosa below the submucosa
- **d** Advancing the mucosa to cover the lip (mucosal advancement)
- **e** Tacking the mucosa in place; only skin sutures are used
- **f** End of operation
- **g** Preoperative appearance
- **h** Appearance after 4 months

Fig. 269. Vermilionectomy combined with subcutaneous pedicle flap
- **a** Operative plan including vermilionectomy for diffuse actinic cheilitis plus excision of involved skin laterally
- **b** Appearance after vermilionectomy plus advancement of pedicle flap to vermilion border
- **c** Preoperative appearance
- **d** Appearance after 6 years. This combined approach avoided any deviation of the vermilion border


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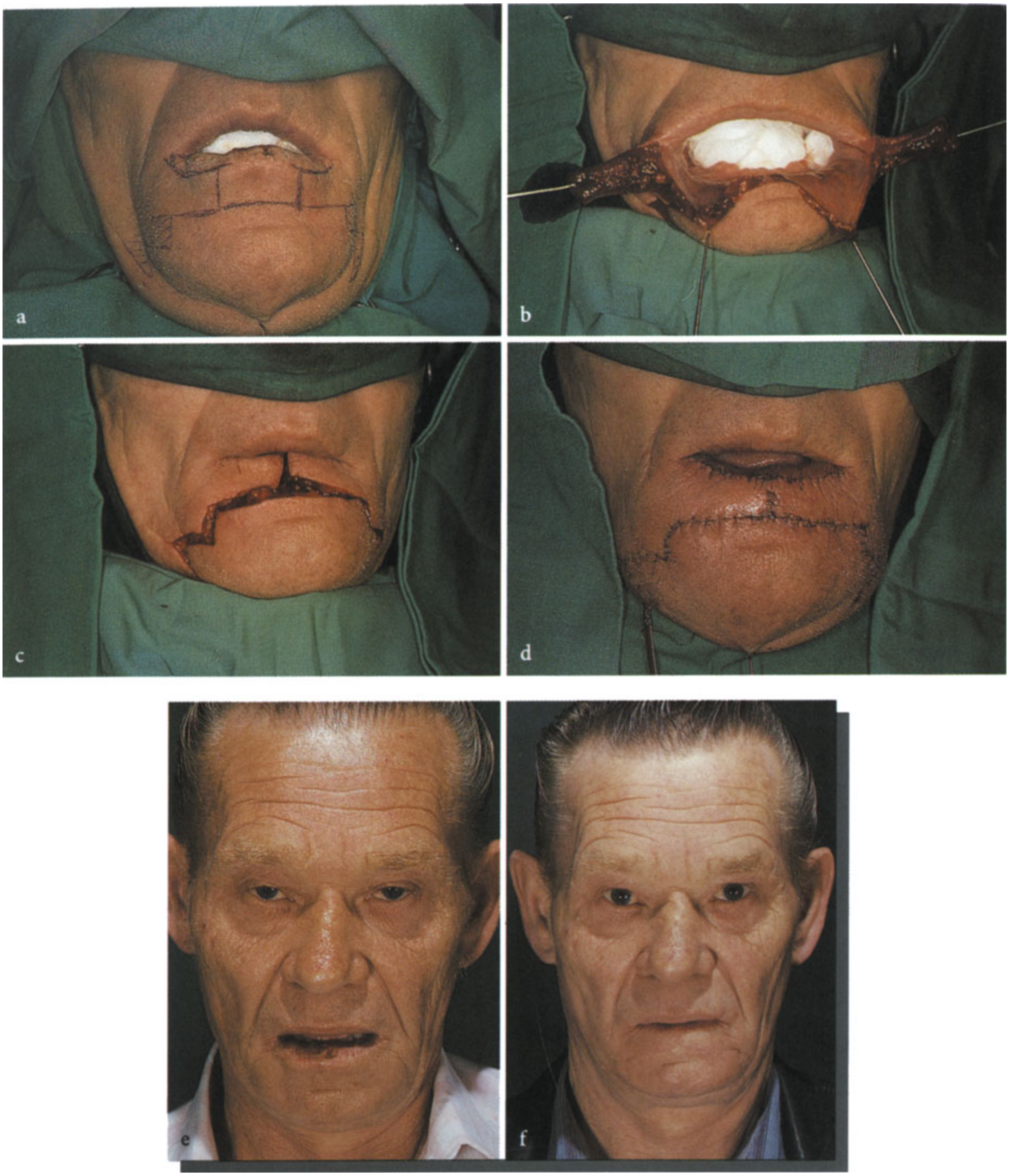
◁ **Fig. 270.** Combination of vermilionectomy with mucosal advancement flap, WY-plasty and wedge excision
- **a** Operative plan to remove two foci of squamous cell carcinoma of the lower lip
- **b** Defects after excision
- **c** Preparing the mucosal advancement flap
- **d** Advancing the mucosal flap
- **e** Approximation of wound edges after excising lateral Burow's triangle
- **f** End of operation
- **g** Preoperative appearance
- **h** Appearance after 4 years

Fig. 271. Advancement flap with back cut
- **a** Defect of lip and skin after removal of squamous cell carcinoma, with operative plan
- **b** Advancement of buccal mucosa to provide intraoral coverage of full-thickness defect
- **c** Advancing the skin flap into place to provide external coverage
- **d** End of operation
- **e** Preoperative appearance
- **f** Appearance after 15 months

Fig. 272. Bilateral trapezoid flaps
a Operative plan for removal of large squamous cell carcinoma
b Intraoral approximation of the mucosa of the lower lip
c Bringing the opposing flaps together
d End of operation after vermilionectomy and mucosal advancement flap
e Preoperative appearance
f Appearance after 6 months

Fig. 273. Step-plasty (advancement flap) combined with vermilionectomy
- **a** Operative plan for removal of squamous cell carcinoma plus vermilionectomy
- **b** Lateral mobilization of flap
- **c** Advancing flap into place
- **d** End of operation
- **e** Preoperative appearance
- **f** Appearance after 2 years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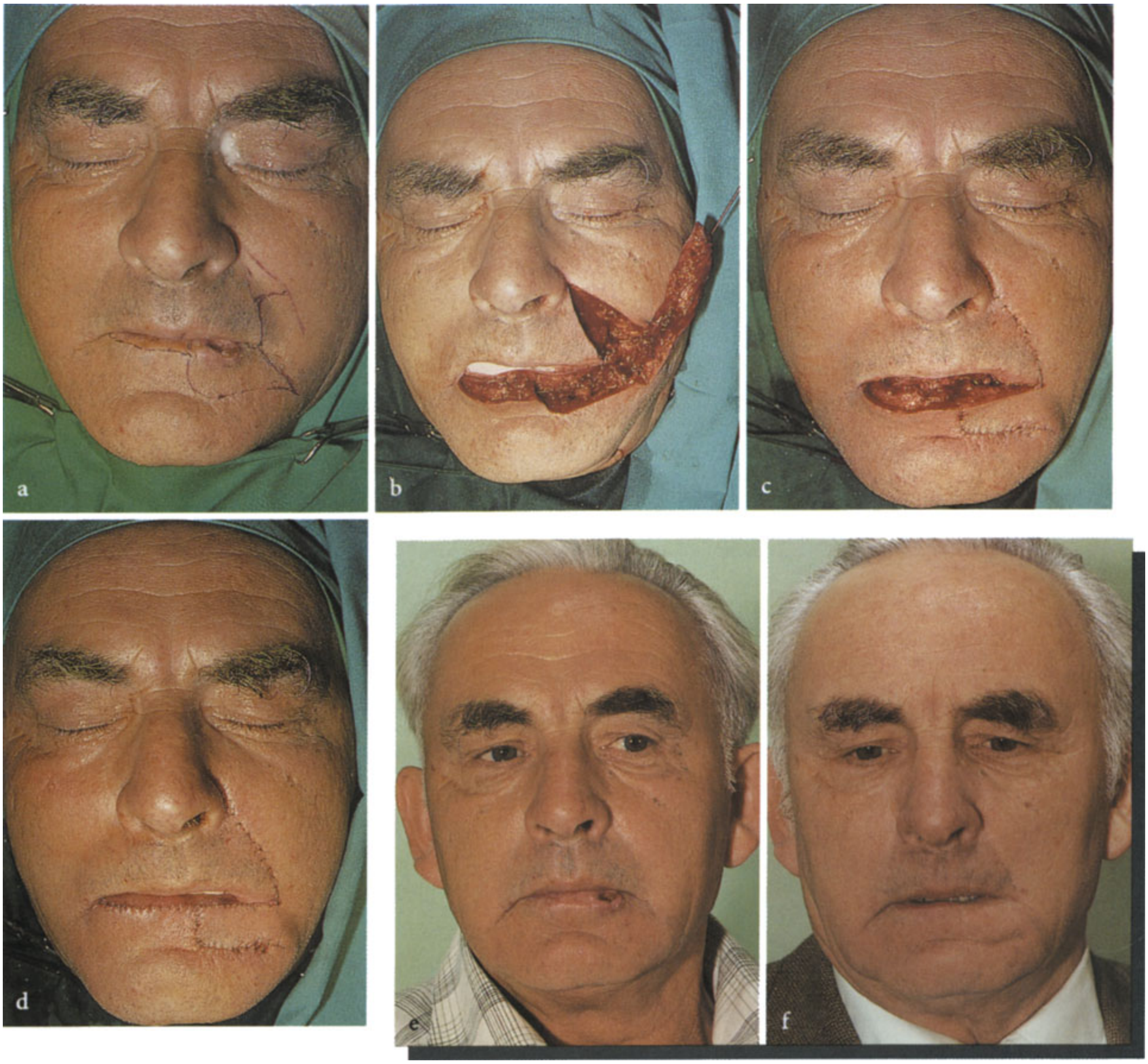

◁ **Fig. 274.** Bilateral step-plasty (bilateral advancement flaps) combined with vermilionectomy
- **a** Operative plan for removal of squamous cell carcinoma associated with diffuse actinic cheilitis
- **b** Preparation of the laterally based skin-muscle flaps; intraorally the mucosa adjacent to the carcinoma is excised
- **c** The mucosa is approximated and the opposing step flaps brought together
- **d** Multilayered closure; mucosal advancement flap is used to replace vermilion
- **e** Preoperative appearance
- **f** Appearance after 2.5 years

Fig. 275. Transposition flap combined with vermilionectomy
- **a** Operative plan to remove an ulcerated squamous cell carcinoma
- **b** Excision defect and preparation of nasolabial transposition flap
- **c** Fitting the flap into place and performing vermilionectomy
- **d** End of operation
- **e** Preoperative appearance
- **f** Appearance after 8 months


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◁ **Fig. 276.** Abbé procedure
a Extensive squamous cell carcinoma of lower lip
b Excision defect and operative plan
c Movement of a vessel-based flap from the upper lip to the lower lip
d Appearance after end of first stage
e Appearance after 2 weeks
f Division of pedicle and final closure
g Preoperative appearance
h Appearance after 4 years

Fig. 277. Advancement flap
a Defect after excision of basal cell carcinoma, with operative plan
b Excision of Burow's triangle
c Advancing the flap
d End of operation
e Preoperative appearance
f Appearance after 4 months


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◁ **Fig. 278.** Estlander procedure
- **a** Defect after excision of squamous cell carcinoma, with operative plan
- **b** Wedge-shaped excision in lateral lower lip and preparation of wedge-shaped flap from upper lip
- **c** Moving the flap from upper lip to lower lip
- **d** Fitting the flap into place
- **e** Another wedge excision is performed to allow final approximation
- **f** End of operation
- **g** Preoperative appearance
- **h** Appearance after 5 years

Fig. 279. Advancement flap
- **a** Extensive full-thickness defect after excision of basal cell carcinoma
- **b** Reapproximation of oral mucosa
- **c** Burow's triangle inserted to prepare for advancement flap
- **d** End of operation
- **e** Preoperative appearance
- **f** Appearance after 2 years

Fig. 280. Modified WY-plasty
a Operative plan for removal of squamous cell carcinoma
b Defect after excision
c Step-by-step closure
d End of operation
e Preoperative appearance
f Appearance after 3 years

Fig. 281. Estlander procedure
a Operative plan for excision of squamous cell carcinoma with Estlander repair
b Wedge-shaped excision of tumor
c Moving the lateral flap into place
d End of operation
e Preoperative appearance
f Appearance after 3 months

Fig. 282. Gillies procedure for microstomia
a Operative plan
b Extension of lateral commissure of mouth and development of transposition flap from upper lip
c Moving the transposition flap into the lateral defect to extend the lower vermilion
d Repairing the upper lip defect with a mucosal advancement flap
e Appearance after final closure
f Appearance after 2.5 years

Fig. 283. Simple excision
a Operative plan for excision of basal cell carcinoma
b Excision defect
c Extensive undermining
d Closure with subcutaneous and continuous intracutaneous sutures
e Preoperative appearance
f Appearance after 3 weeks

Fig. 284. WY-plasty
a Operative plan for excision of probable basal cell carcinoma; final histologic diagnosis was epitheloid granuloma
b Excision defect
c Skin closure with careful approximation of vermilion border
d Wound dressing with nonadhesive gauze
e Preoperative appearance
f Appearance after 1 year

Fig. 285. Transposition flap
a Defect after excision of basal cell carcinoma, with operative plan
b Preparing a transposition flap from the nasolabial fold
c Transposing flap into place
d End of operation
e Preoperative appearance
f Appearance after 1 year

Fig. 286. Advancement flap combined with WY-plasty
a Defect after excision of basal cell carcinoma; operative plan for classic advancement flap parallel to vermilion border
b Lateral mobilization of flap
c Advancing flap into place
d End of operation
e Preoperative appearance
f Appearance after 2 years

Fig. 287. Advancement flap
a Defect after excision of basal cell carcinoma; operative plan for modified advancement flap with crescentic relaxing excision
b Preparation of flap
c Movement of flap into defect
d End of operation
e Preoperative appearance
f Appearance after 2 years

Fig. 288. U-plasty
- **a** Defect after excision of basal cell carcinoma, with operative plan
- **b** Lateral mobilization of flap with excision of Burow's triangles; medially a W-shaped excision to reduce size of primary defect
- **c** Advancement of flap
- **d** End of operation
- **e** Preoperative appearance
- **f** Appearance after 6 months

Fig. 289. Bilateral U-plasty
- **a** Extensive penetrating squamous cell carcinoma of upper lip, with operative plan
- **b** Complete excision of tumor and of 4 Burow's triangles
- **c** Bilateral skin-muscle flaps have been prepared and the intraoral mucosal surfaces approximated
- **d** Final closure after mucosal advancement flap to cover lip
- **e** Preoperative appearance
- **f** Appearance after 2 years
- **g** Preoperative appearance, close-up view
- **h** Appearance after 2 years, close-up view

Fig. 290. Bilateral advancement flaps
a Defect after excision of large basal cell carcinoma, with operative plan
b Preparing the first flap
c Preparing and advancing the contralateral flap
d End of operation
e Preoperative appearance
f Appearance after 9 months

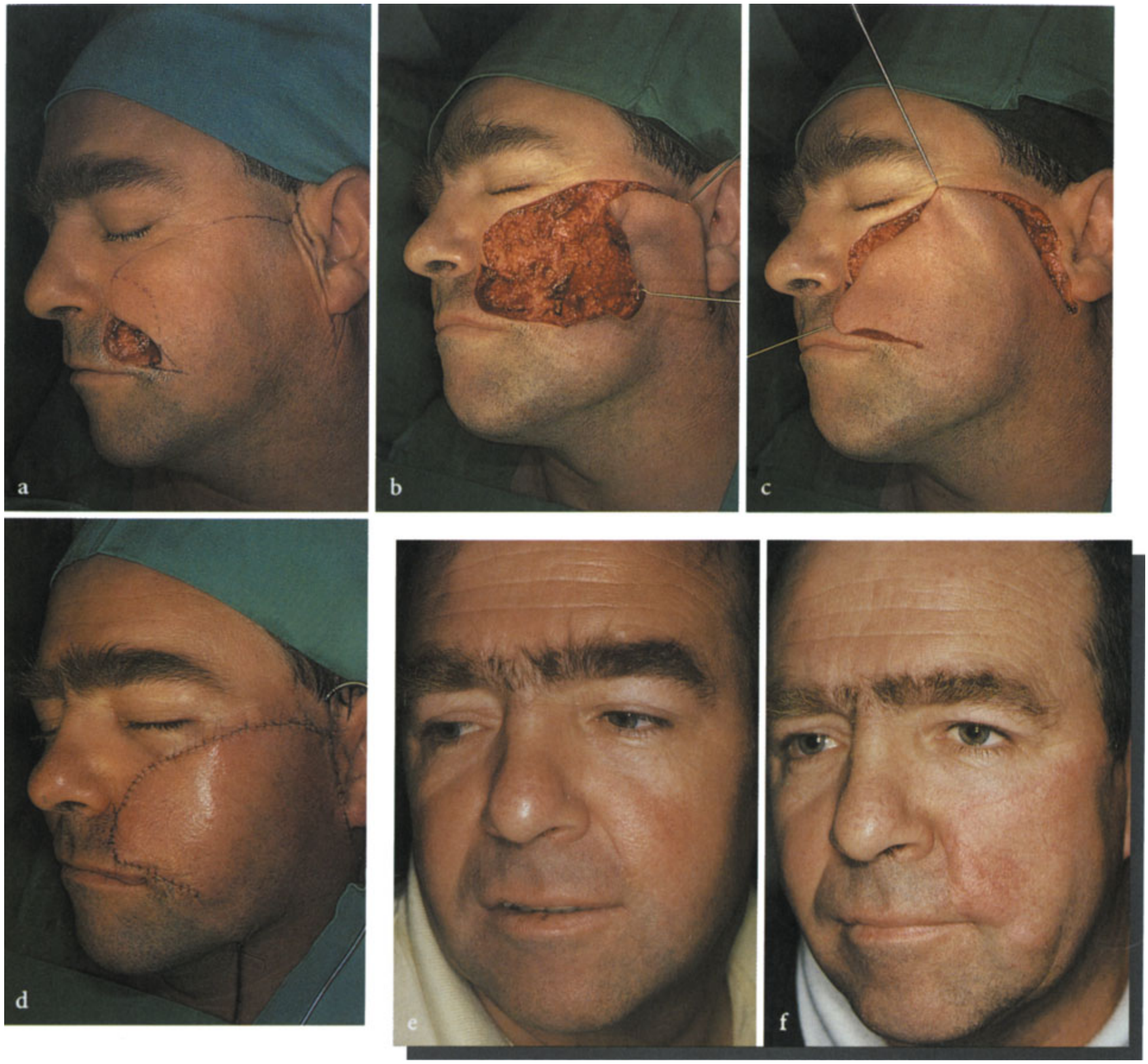


Fig. 291. Rotation flap
a Defect after excision of basal cell carcinoma, with operative plan for simple cheek rotation flap
b Preparation of flap
c Rotating the flap into place
d End of operation
e Preoperative appearance
f Appearance after 6 months

19.8 Oral Cavity

The teeth separate the oral vestibule from the oral cavity. While dermatologists rarely operate in the actual oral cavity, they do perform a number of operations involving the labial and buccal mucosa. This mucosa is freely movable, in contrast to the fixed mucosa along the maxilla and mandible; it is therefore possible to close fairly large defects primarily. In addition, mucosal advancement allows one to cover defects. Care must be taken not to cause puckering of the overlying skin when enthusiastically closing a buccal defect.

19.8.1 Anesthesia

Most procedures can be carried out with infiltrative anesthesia into the mucosa. The nerve blocks that are widely used by dentists may of course also be employed. They include blocking the inferior alveolar and lingual nerves at the mandibular foramen as well as the infraorbital and mandibular nerves at their respective exit points.

19.8.2 Planning the Operation

Slightly different operative equipment is needed for the mouth; an operative chair (ensuring that the patient sits vertically), adequate lighting, and dental suction (both to control bleeding and avoid aspiration) are needed for all but small procedures. The services of a well-trained assistant are also mandatory, as it is almost impossible to obtain adequate exposure alone. One must also be careful about the opening of the parotid duct (Stinson's duct) just opposite the upper second molars. It is sometimes helpful to pass a probe through the duct so that it can be adequately visualized and protected during the procedure. The submandibular glands drain into the floor of the mouth. The wounds are closed with single sutures employing 3-0 to 4-0 resorbable material. Postoperative edema may be a considerable problem, especially on the tongue, which is a good reason to avoid this difficult operative site. If one does operate on the tongue, the surrounding (i.e. accessible) tissue should be cooled with postoperative ice packs. More importantly, the patient must be carefully observed in the immediate postoperative period, and intubation equipment must be available.

19.8.3 Surgical Techniques

Simple undermining or VY-plasties usually suffice on the buccal mucosa. Local advancement flaps can also be used, but larger procedures are generally performed by oral surgeons or otorhinolaryngologists. In addition, techniques such as cryosurgery, electrosurgery, and laser surgery offer many advantages on the oral mucosa. Bleeding is generally less of a problem, and secondary healing is usually excellent.

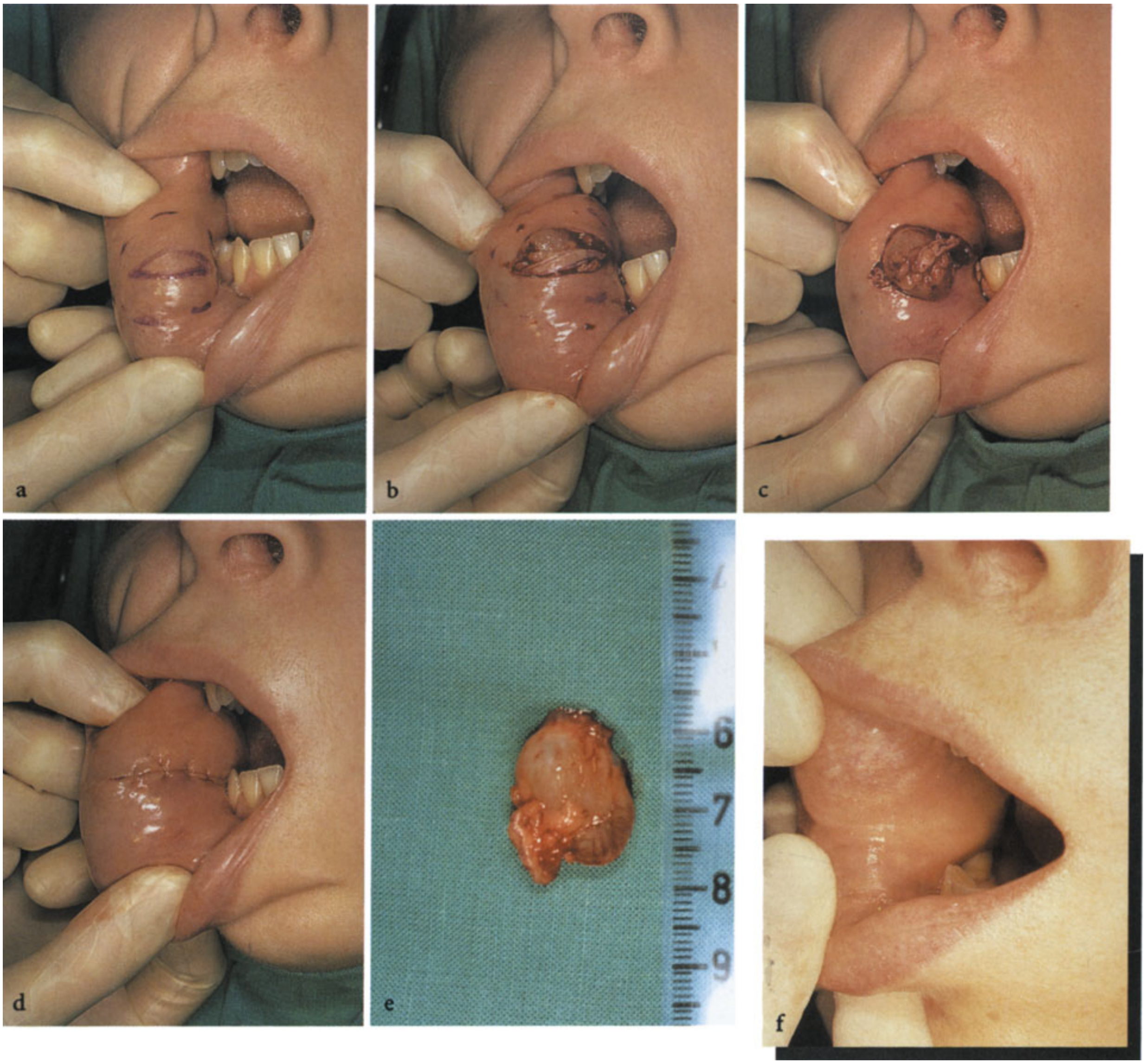


Fig. 292. Excision of submucosal cyst
a Operative plan for excision of cyst
b Elliptical incision and dissection of cyst
c Cyst removed in toto
d Mucosal closure
e Surgical specimen
f Appearance after 1.5 years

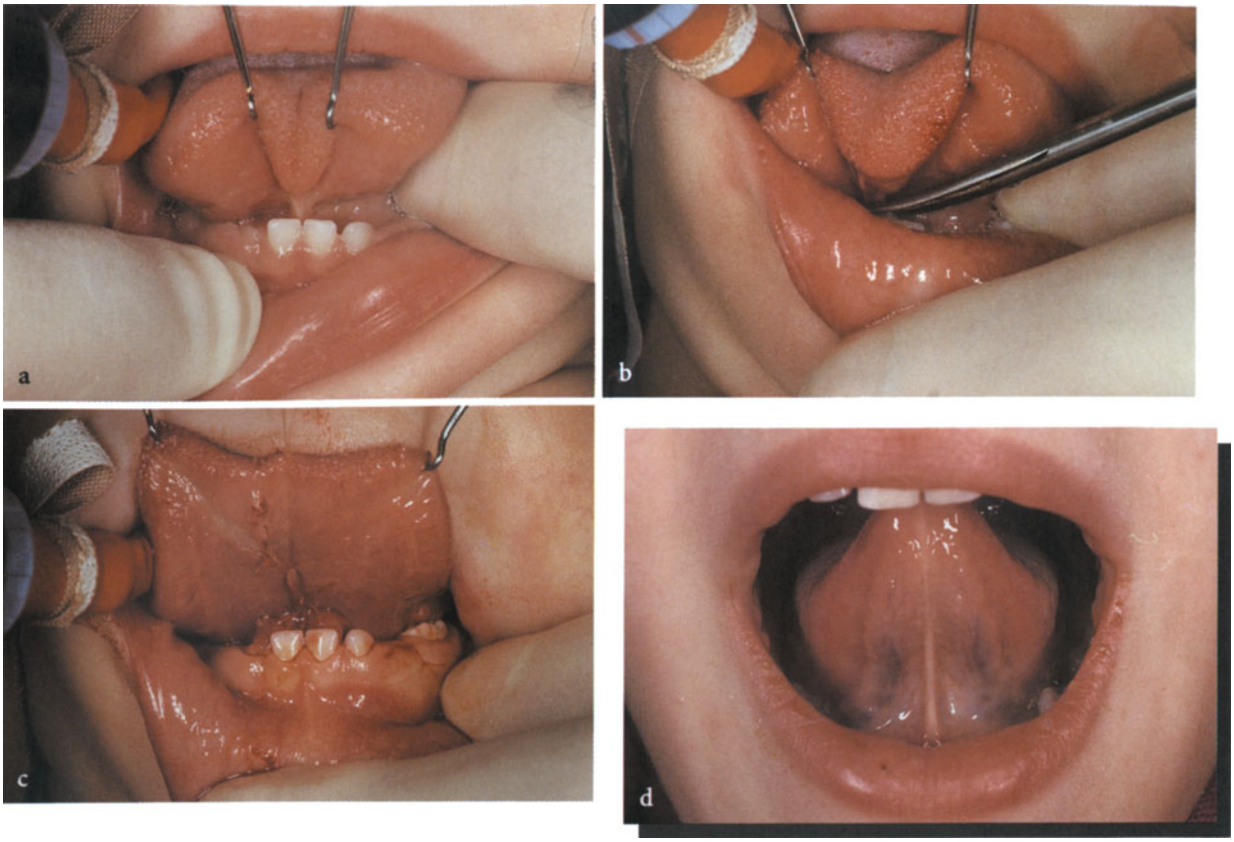


Fig. 293. Frenulumectomy
a Short frenulum in a child
b Splitting the frenulum
c Readaptation of defect on base of tongue
d Appearance after 5 years

Fig. 294. Electrosurgical treatment of leukoplakia
a Benign leukoplakia (leukokeratosis) of buccal mucosa
b–c Electrocautery of area
d Removing cauterized tissue
e Appearance at end of procedure
f Appearance after 4 weeks, following secondary healing

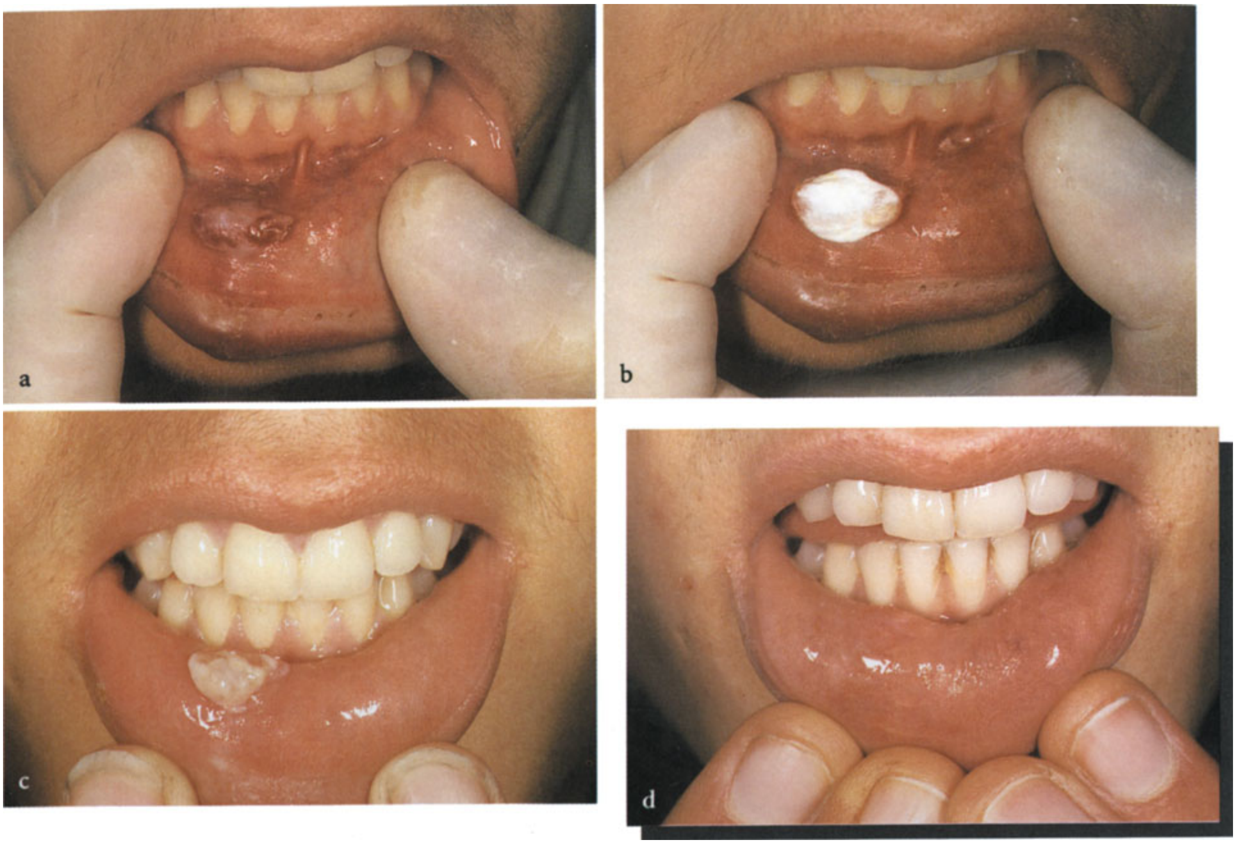


Fig. 295. Cryosurgery of lower lip
a Mucocele of lower lip
b Appearance after cryotherapy with cryoprobe
c Three days after procedure
d Appearance after 1 year

19.9 Chin

The chin region is an important part of facial expression and contributes significantly to the overall aesthetic appearance of the face (giving rise, for example, to such expressions as "strong jawed" and "weak chinned").

19.9.1 Anatomy

Here the muscles of facial expression insert directly into the skin. This makes undermining a quite difficult and invariably bloody procedure. The vascular supply comes from the facial artery and the mental artery, which reaches the skin through the mental foramen along with the mental nerve.

19.9.2 Anesthesia

Anesthesia is obtained easily using local infiltration or the blocking of both mental nerves as they exit the mental foramina.

19.9.3 Planning the Operation

The challenge in working around the chin is that of retaining the contour and not damaging the facial expression. Another problem is that the lines of skin tension run vertically from the lower lip down over the mandible and intersect perpendicularly with the horizontal skin tension lines of the neck.

19.9.4 Surgical Techniques

Only small lesions can be excised and closed primarily by undermining; removal of larger amounts of tissue leads to a concave defect. In addition, one must avoid ectropion of the lower lip. Skin grafts are usually unsatisfactory. In closing a larger defect without tension and replacing the lost deep tissue one is thus faced with using advancement flaps, rotation flaps from the neck, or flaps with a subcutaneous pedicle.

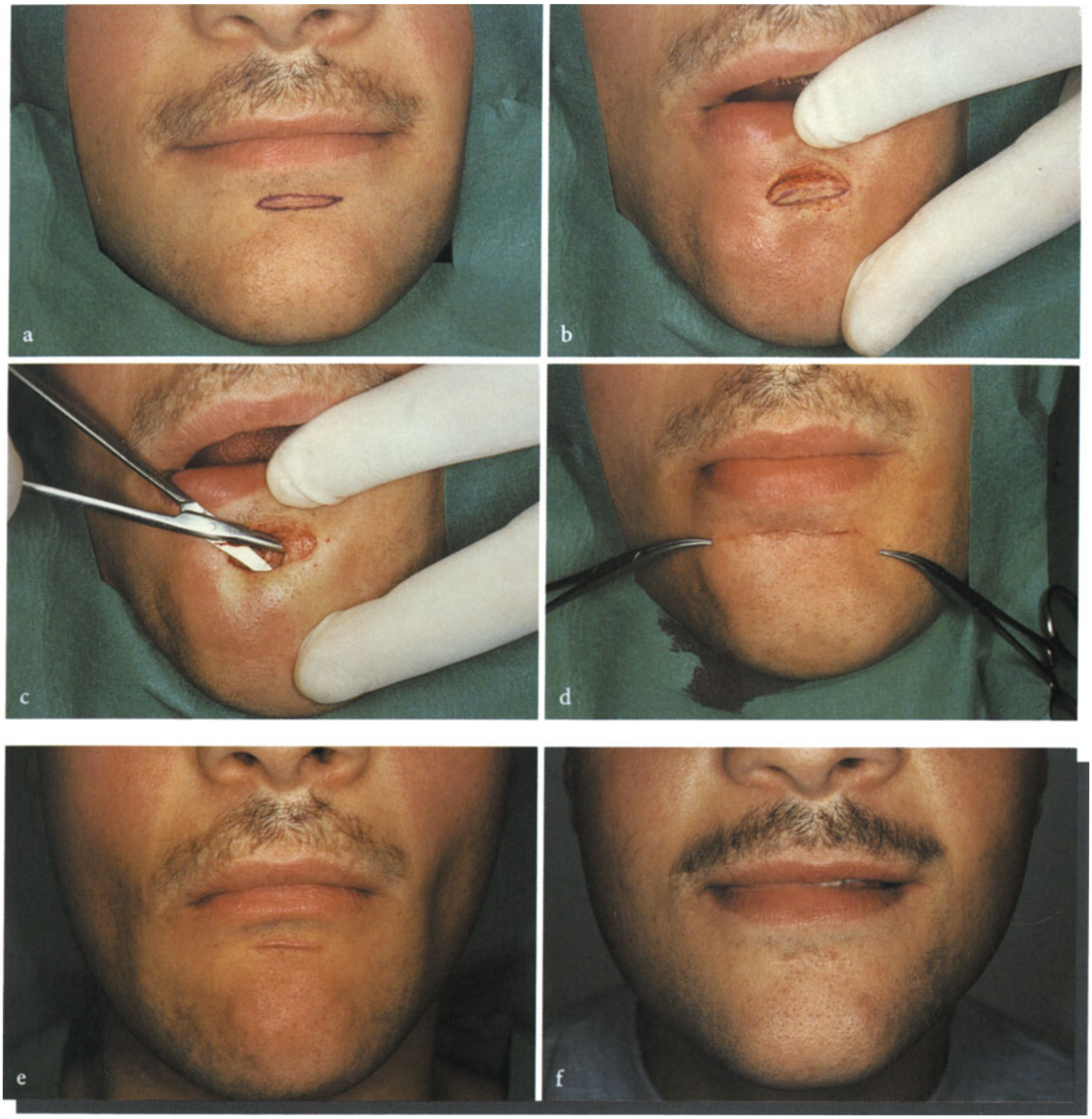


Fig. 296. Primary closure with undermining
a Operative plan for horizontal elliptical excision to correct scar
b Excision of scar
c Undermining
d End of operation
e Preoperative appearance
f Appearance after 3 years

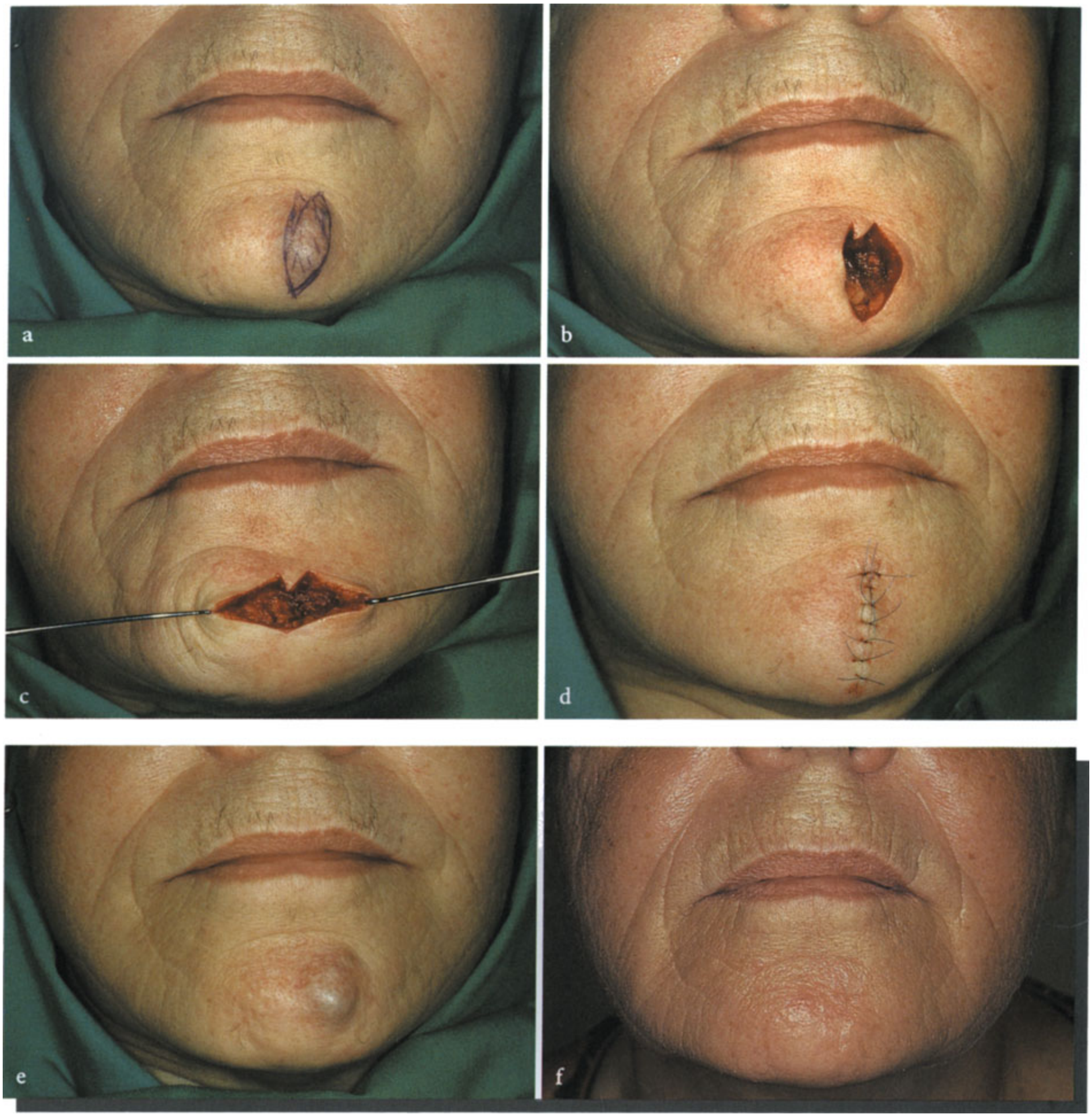


Fig. 297. VY-plasty
a Operative plan for excision of a subcutaneous tumor (Final histologic diagnosis was thrombosed hemangioma)
b Excision defect
c Undermining
d End of operation
e Preoperative appearance
f Appearance after 8 months

Fig. 298. Advancement flap with back cut
a Defect after excision of basal cell carcinoma, with operative plan
b W-shaped excision and mobilization of flap
c Advancing the flap into the defect
d End of operation
e Preoperative appearance
f Appearance after 8 months

Fig. 299. Rotation flap
a Defect after excision of cutaneous metastasis of carcinoma of the prostate, with operative plan
b Complete mobilization of flap
c Rotation of flap
d End of operation
e Preoperative appearance
f Appearance after 6 months. Note a further hematogenous metastasis on upper lip

Fig. 300. Rotation flap
a Large defect after excision of ulcerated basal cell carcinoma, with operative plan to rotate flap from the neck
b Complete mobilization of flap
c Rotation of flap to cover defect
d Final closure after inserting Burow's triangle at point of greatest tension
e Preoperative appearance
f Appearance after 1.5 years

19.10 External Ear

The external ear is also a salient feature of the human face. Many individuals are very concerned about how their ears appear – too large, sticking out too far – and only rarely is the loss of part of the ear acceptable. Virtually every operation on the ear requires reconstructive efforts. However, what is perfect for the antihelix may lead to distortion of the helix, and vice versa.

19.10.1 Anatomy

The architectural structure of the ear, consisting of cartilaginous structures and skin, is exceedingly complex (Fig. 301). The skin is tightly bound to the underlying cartilage except over the helix where it is slightly moveable. The vascular supply comes from the temporal artery in front of the ear and from the posterior auricular artery behind and inferior to the ear (Fig. 302). Many cranial and cervical nerves form a complex network serving the ear; there is considerable individual variation. The auriculotemporal nerve arises from the mandibular branch of the trigeminal nerve and supplies the anterior part of the ear, including the anterior and superior aspects of the ear canal. Branches of the facial, glossopharyngeal, and vagus nerves innervate the concha, the posterior portion of the canal, and small regions of skin behind the ear and over the mastoid process. The auricular major and occipitalis minor nerves, arising from the 2nd and 3rd cervical nerves, innervate the rest of the retroauricular region, including the posterior aspect of the ear, and may wrap around to include some aspects of the anterior surface (Fig. 302).

19.10.2 Anesthesia

The nerve supply is so complicated, variable, and interconnected that a nerve block is rarely effective around the ear. One therefore must infiltrate the surgical field directly. General anesthesia offers many advantages when larger procedures are planned.

19.10.3 Planning the Operation

Only small lesions can be excised and closed primarily without producing a visible defect in the ear, regardless of whether it is a distortion or a reduction. This is true whether or not cartilage is involved. The same problem arises in wedge-shaped excision of the ear, with all its modifications. If more than one-third of the helix is sacrificed, the resulting ear is not only smaller but also tips ventrally. One should

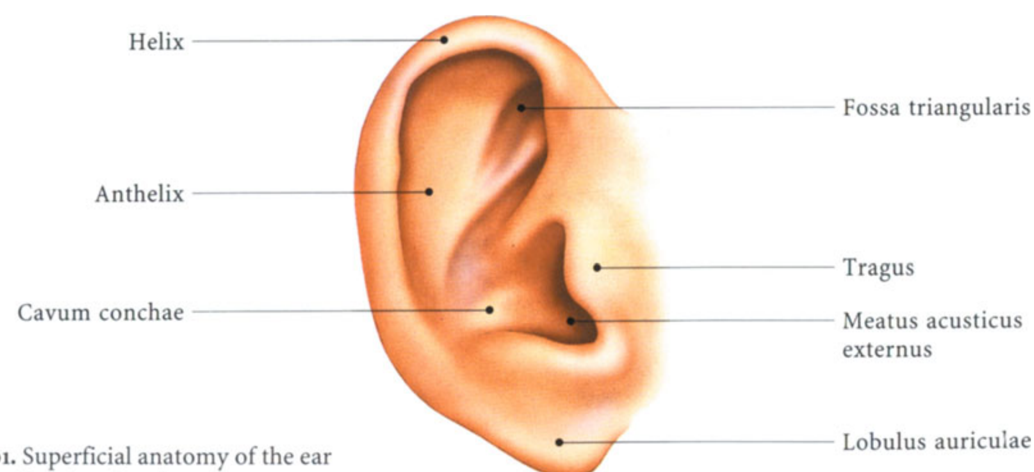


Fig. 301. Superficial anatomy of the ear (anatomic subregions)

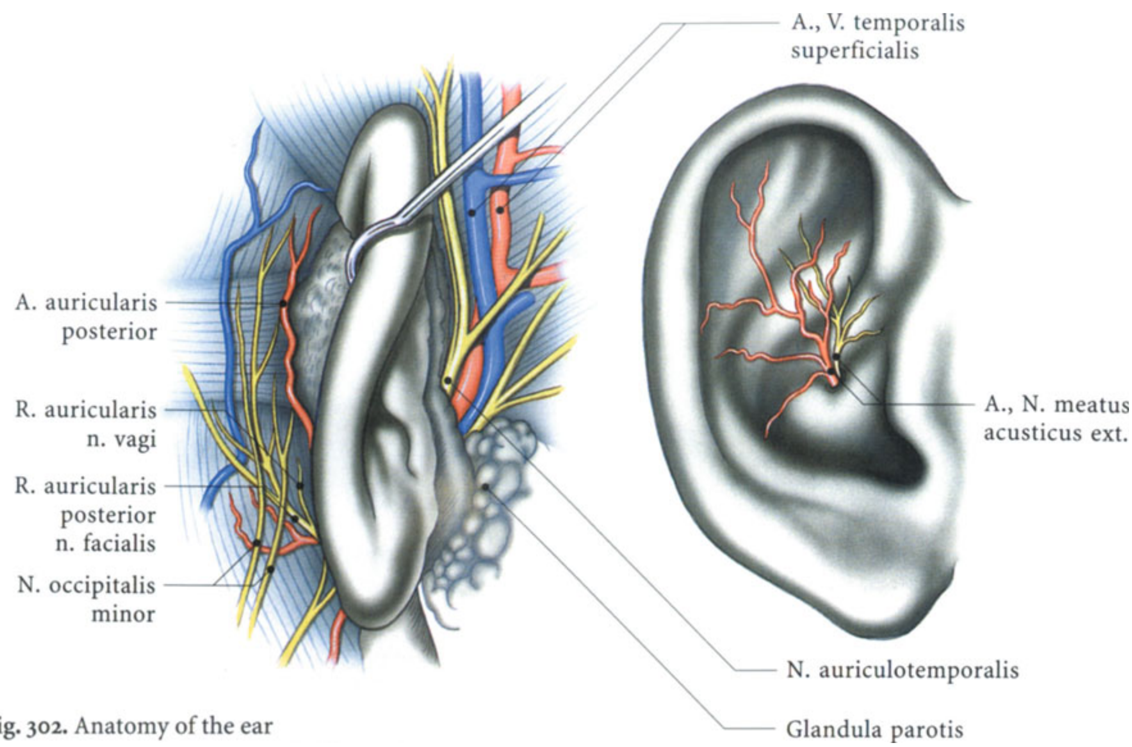


Fig. 302. Anatomy of the ear

therefore be aware of the possible alternatives. If the cartilage and, more importantly, perichondrium is preserved, one can use skin grafts, often taken from the retroauricular region. If not, a pedicle flap can be developed from the retroauricular area and combined with a cartilage graft from the antihelix.

19.10.4 Surgical Techniques

When operating on the helical rim, the popular wedge excision often leads to less than desirable cosmetic results, especially when the now smaller ear protrudes ventrally. We use this technique only for lesions smaller than 1 cm; for larger lesions, if it is used, it should be done as a WY-plasty. Another traditional method is the Trendelenburg technique, in which Burow's triangles are placed to prevent protrusion of the ear.

We prefer to excise a lesion on the helical rim in a rectangular fashion and then cover the defect by advancing the adjacent caudal or cranial helix to cover the lesion, usually with a Burow's triangle in the region of the antihelix. Another possibility is the use of a subcutaneous pedicle flap, moving cartilage and skin from the back of the ear to the helix. Smaller defects can also be covered by transposition or rotation flaps from the retroauricular region. Defects of the posterior of the ear can almost always be repaired with rotation, advancement, or transposition flaps from the retroauricular region. With larger defects a bilobed flap is helpful.

Retroauricular defects are easy to repair because the incision lines needed to move tissue locally are generally not visible. The skin of the retroauricular fold is a valuable source of additional skin, as a surprising amount can be obtained without cosmetic sacrifice.

To repair defects in the region of the antihelix, triangular fossa, or concha one uses transposition or island flaps from the supraor infraauricular area. Another possibility is a transauricular pedicle flap, passing through the ear from the retroauricular region. In a second operation the pedicle must be separated and the remaining defects repaired.

Defects of the tragus are usually replaced by a caudally based transposition flap from the retroauricular area. When the entire tragus including its cartilage is lost, one can use a transposition flap which includes the cartilage from the crus helicis.

The transposition flap from a pre- or infraauricular location is an ideal way for repair of defects of the earlobe. Local advancement flaps are also useful here, depending on the size of the defect.

With larger defects one should always consider skin grafts, which can produce good results. This technique is excellent, provided the perichondrium is preserved, and the wound can be adequately conditioned. If the perichondrium must be sacrificed, one can punch holes in the cartilage with a 2-mm biopsy punch; this allows granulation tissue to grow through the cartilage and cover the wound base.

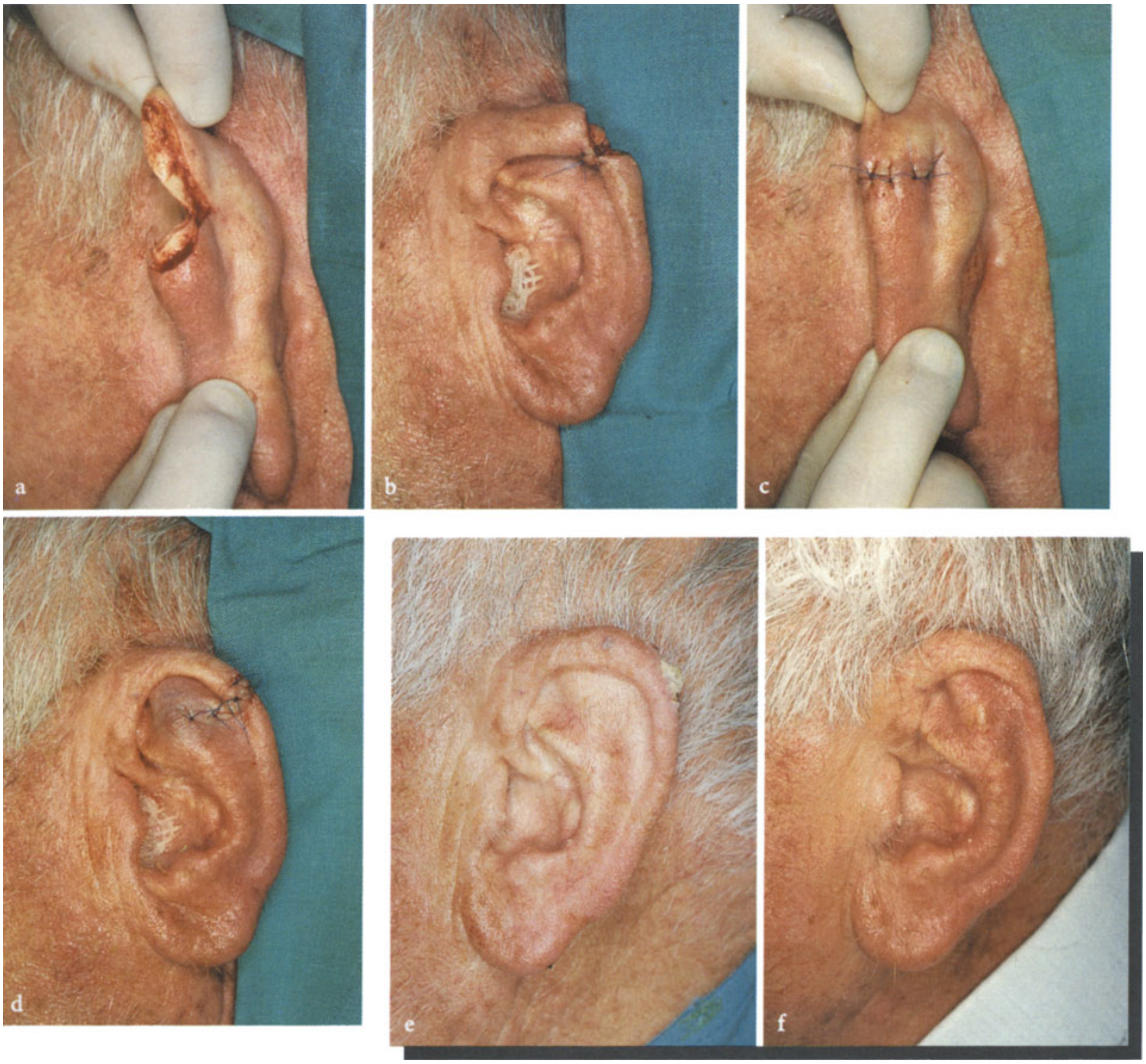


Fig. 303. Wedge excision
a Full-thickness excision of probable squamous cell carcinoma (final histologic diagnosis was hypertrophic actinic keratosis with cutaneous horn
b Step-by-step skin closure, paying special attention to preserving the continuity of the helical rim
c Closure on the posterior aspect
d End of operation
e Preoperative appearance
f Appearance after 2 years

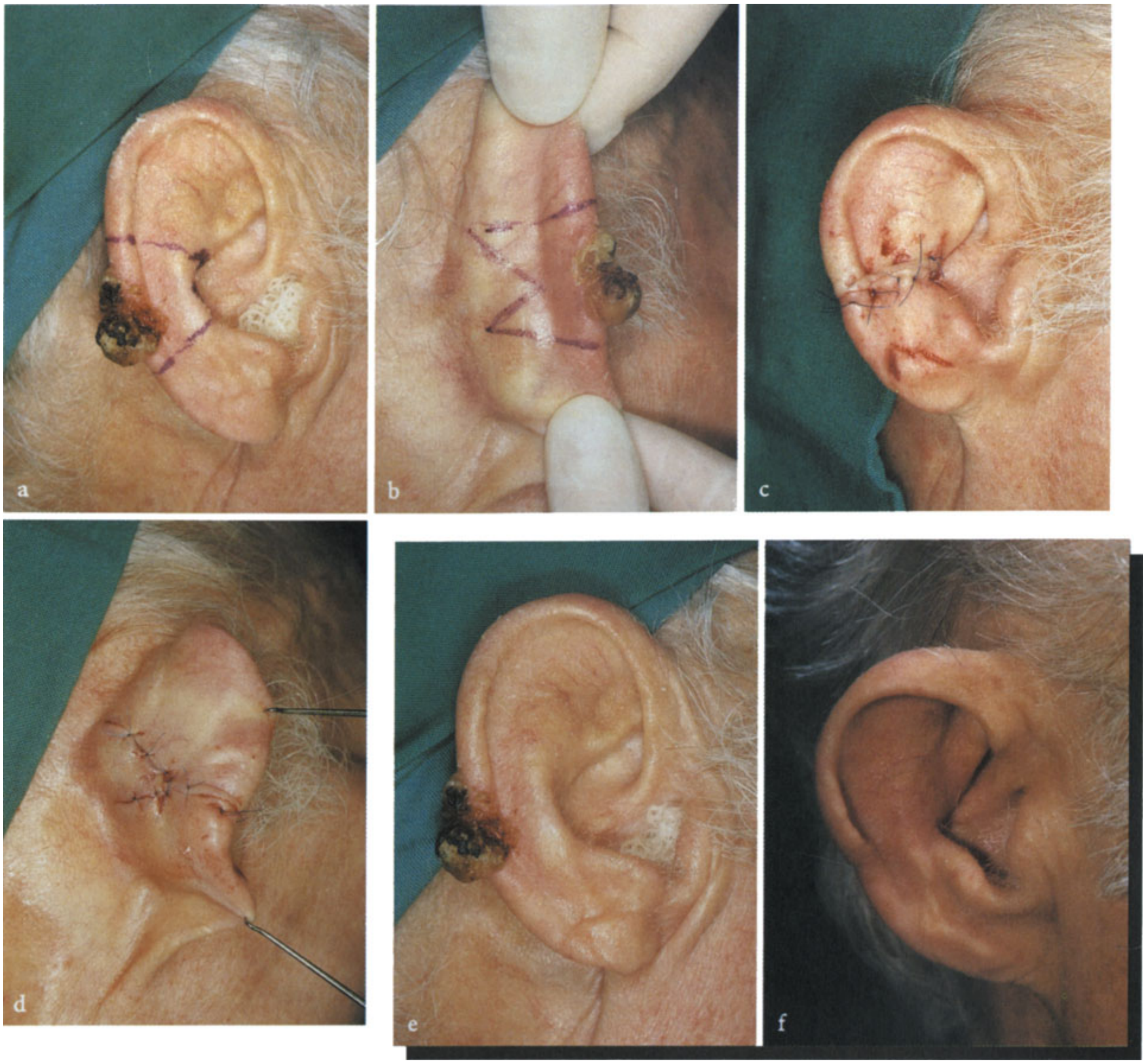


Fig. 304. WY-plasty
a Operative plan for excision of a squamous cell carcinoma
b Retroauricular view of operative plan
c Y-shaped wound closure
d Retroauricular view at end of operation
e Preoperative appearance
f Appearance after 3 months

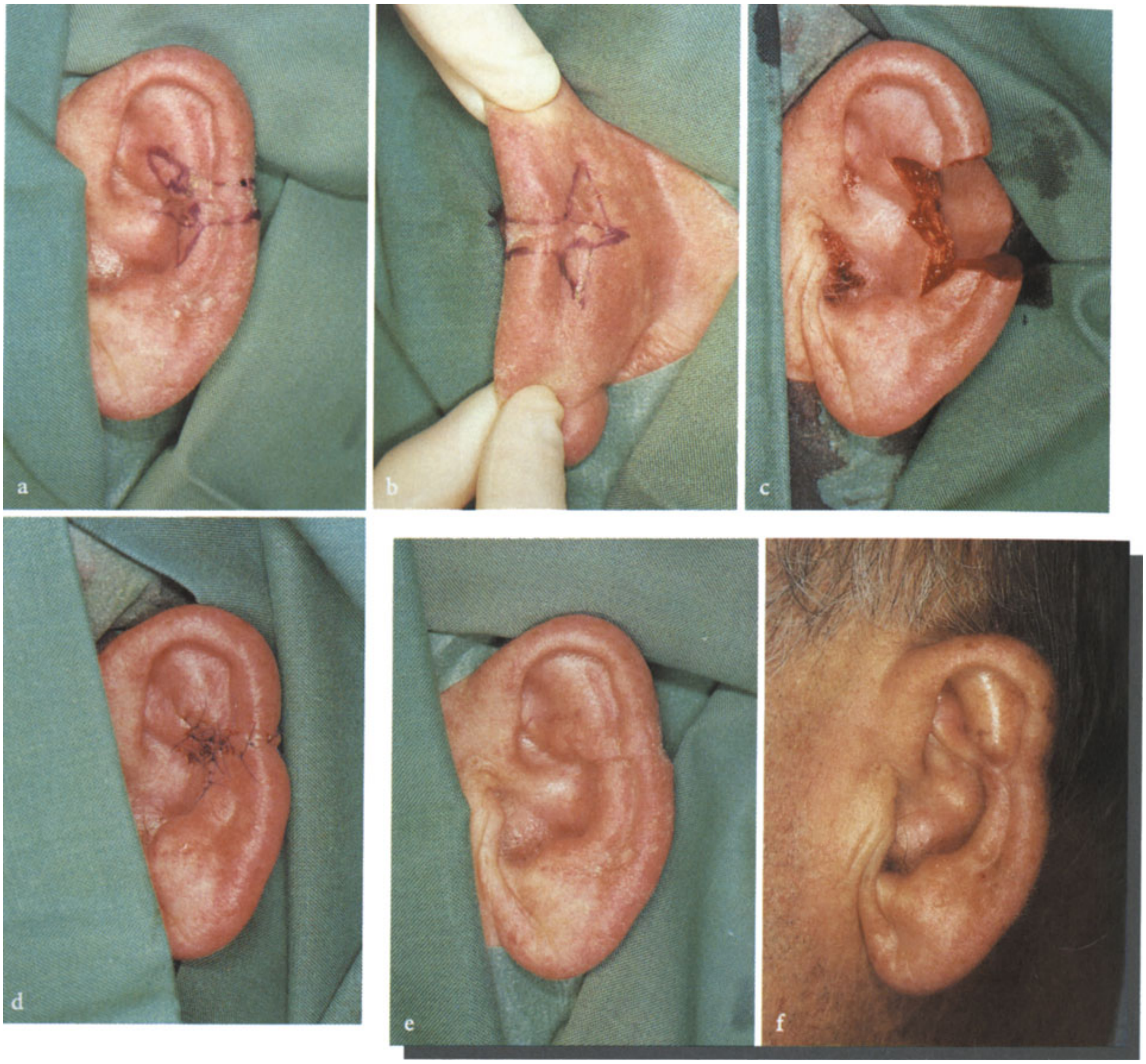


Fig. 305. Trendelenburg excision
a Operative plan for a star-shaped excision of a squamous cell carcinoma
b Retroauricular view of operative plan
c Defect after excision of tumor
d End of operation
e Preoperative appearance
f Appearance after 8 months

Fig. 306. Advancement flap
a Operative plan for excision of squamous cell carcinoma
b Defect including excision of cartilage
c Advancing the retroauricular composite (skin and cartilage) flap forward
d End of operation
e Preoperative appearance
f Appearance after 6 months

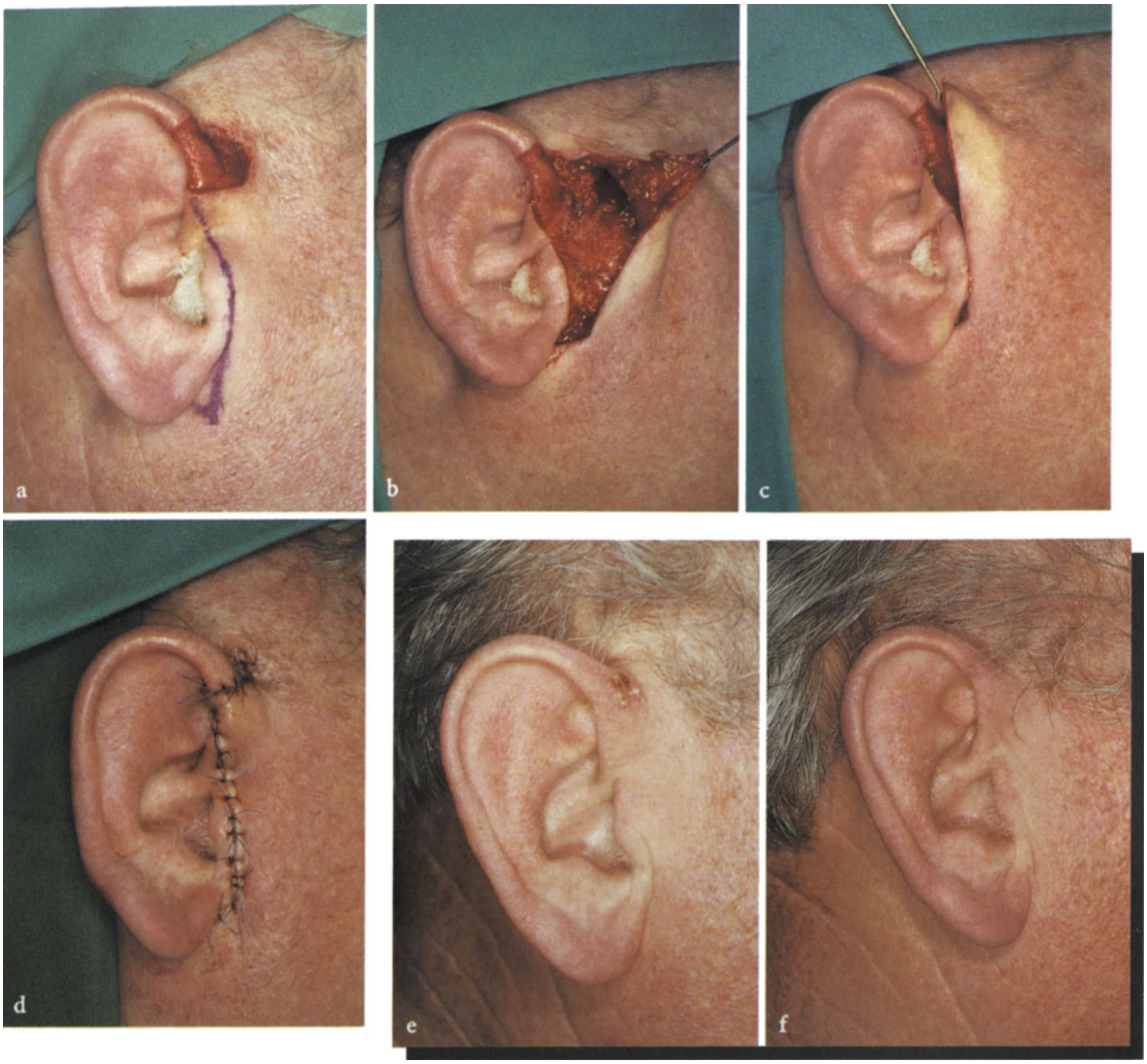


Fig. 307. Advancement flap
a Defect after excision of basal cell carcinoma, with operative plan
b Mobilization of advancement flap
c Tension-free placement of flap
d End of operation
e Preoperative appearance
f Appearance after 9 months

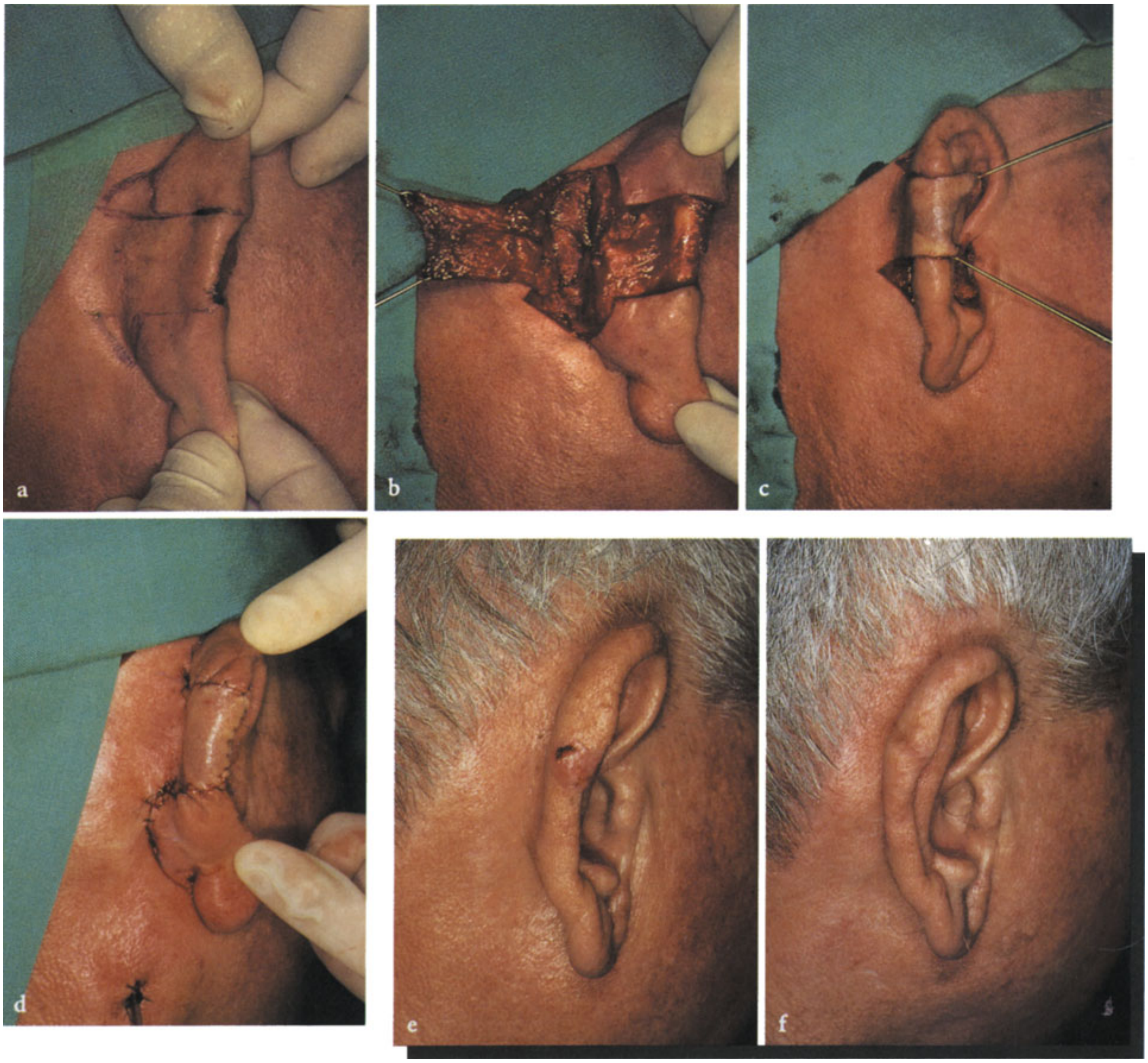


Fig. 308. U-plasty
a Operative plan for reconstructing the helical rim after excision of basal cell carcinoma
b Excision of Burow's triangles and preparation of flap
c Tension-free advancement of flap
d End of operation
e Preoperative appearance
f Appearance after 1 year

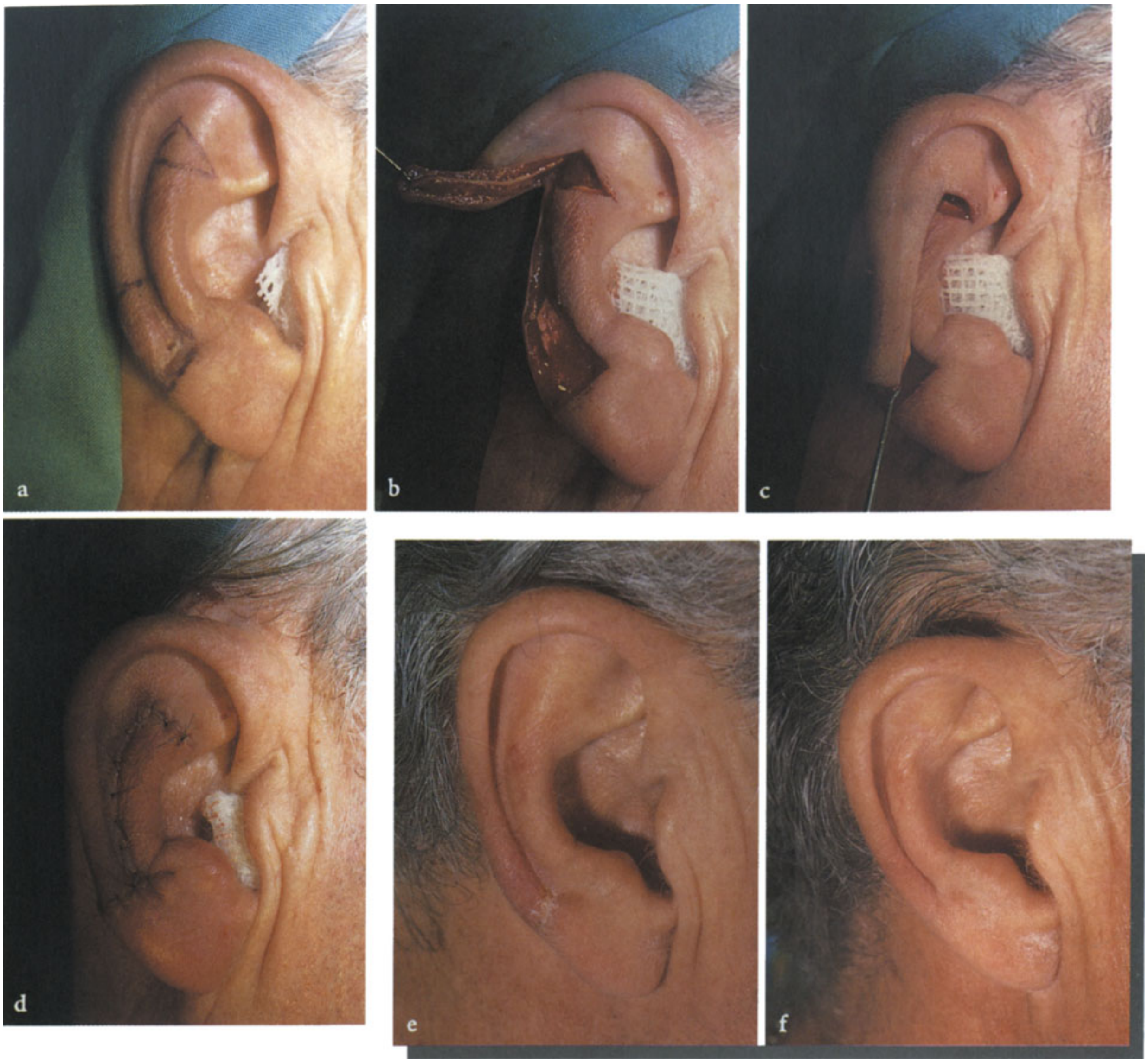


Fig. 309. Advancement of helical rim
a Operative plan for excision of microinvasive squamous cell carcinoma of inferior (caudal) aspect of helix
b Preparation of cranially based flap
c Movement of flap
d End of operation
e Preoperative appearance
f Appearance after 1 year

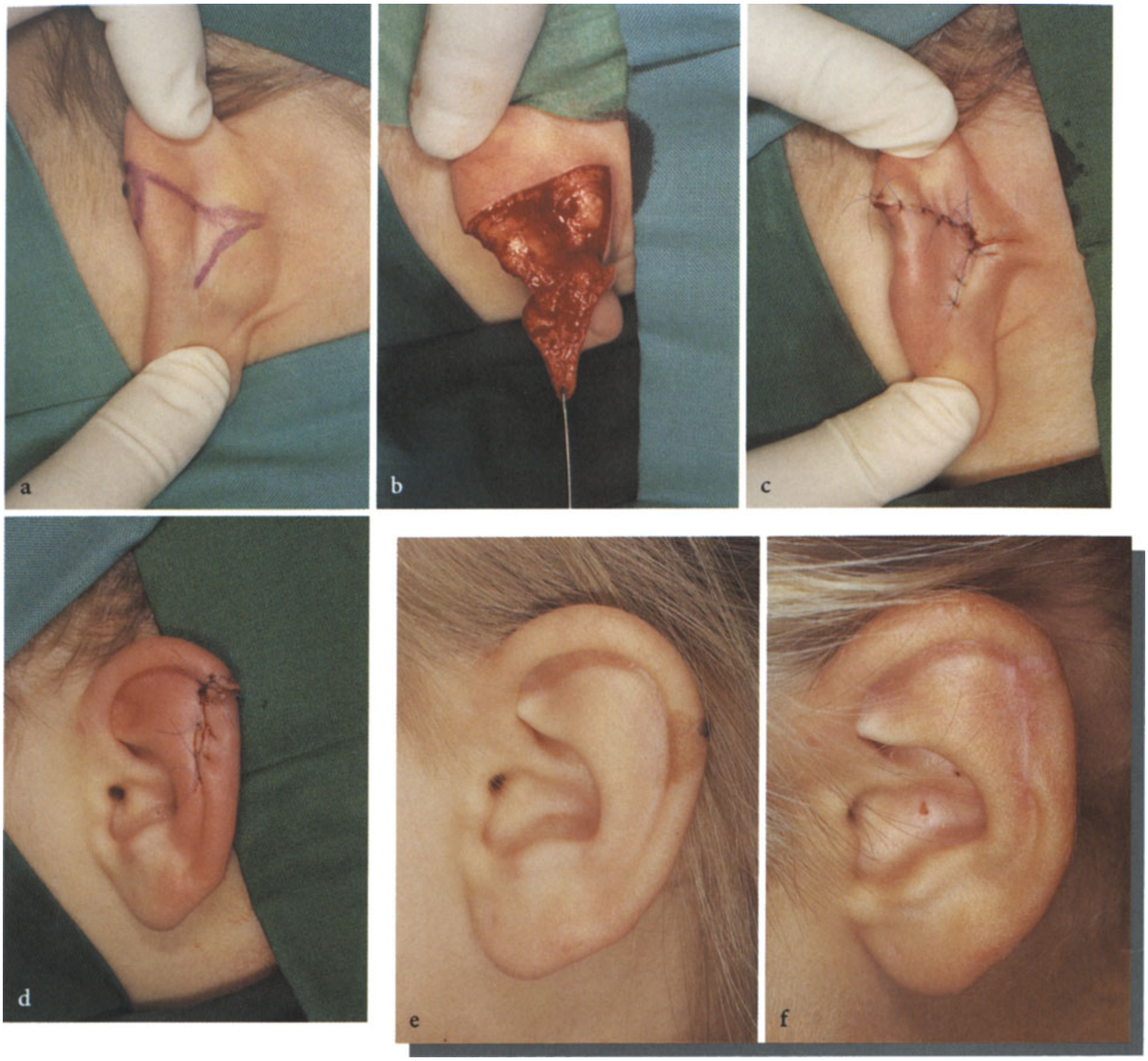


Fig. 310. Advancement flap with back cut
a Operative plan for excision of congenital melanocytic nevus
b Mobilization of flap at level of perichondrium
c Retroauricular view of closure
d End of operation
e Preoperative appearance
f Appearance after 6 months

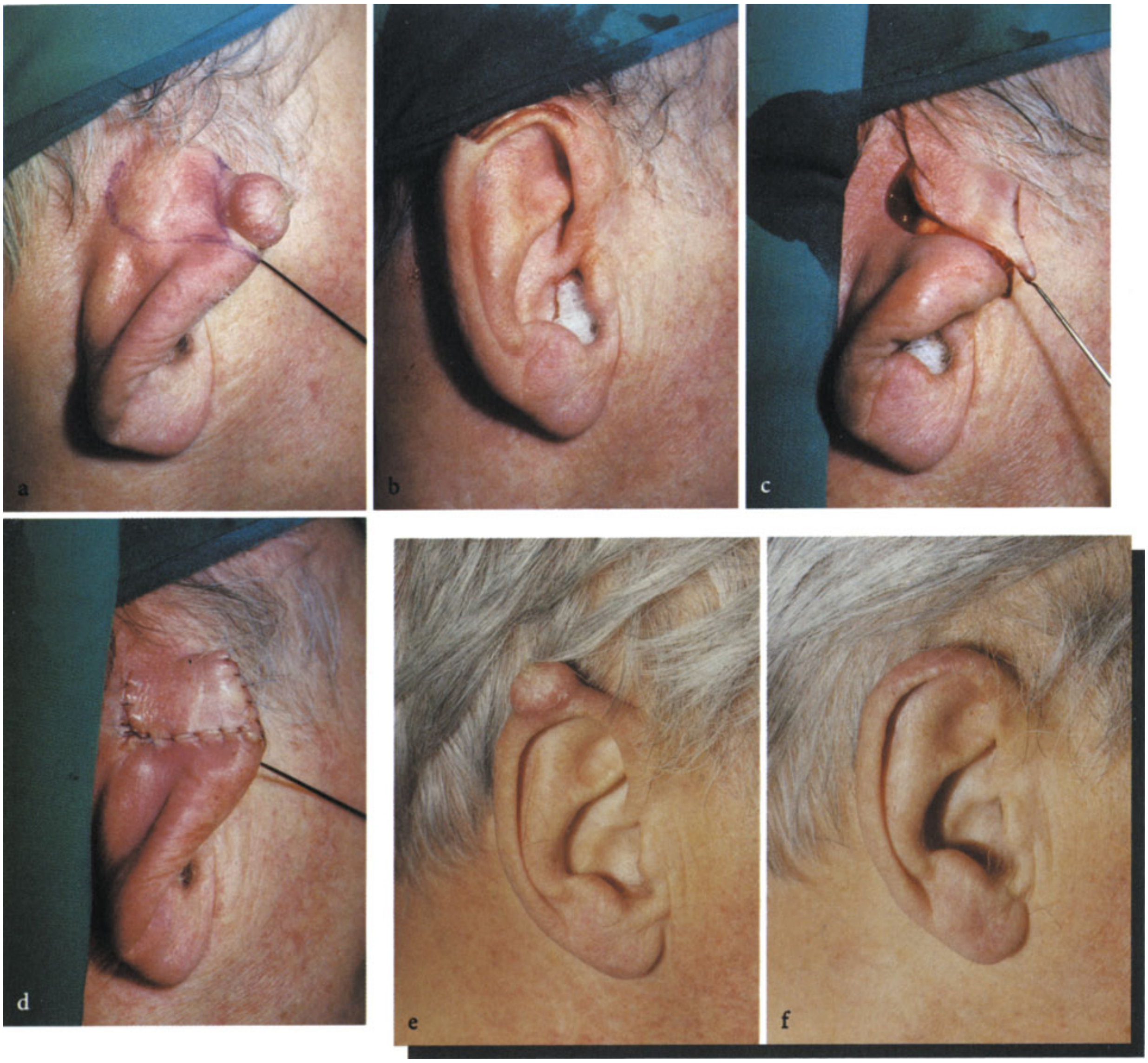


Fig. 311. Rotation flap

a Operative plan for excision of a keratoacanthoma of helix

b Excision defect

c Advancement of flap

d Skin closure with Burow's triangle in retroauricular fold

e Preoperative appearance

f Appearance after 2 weeks

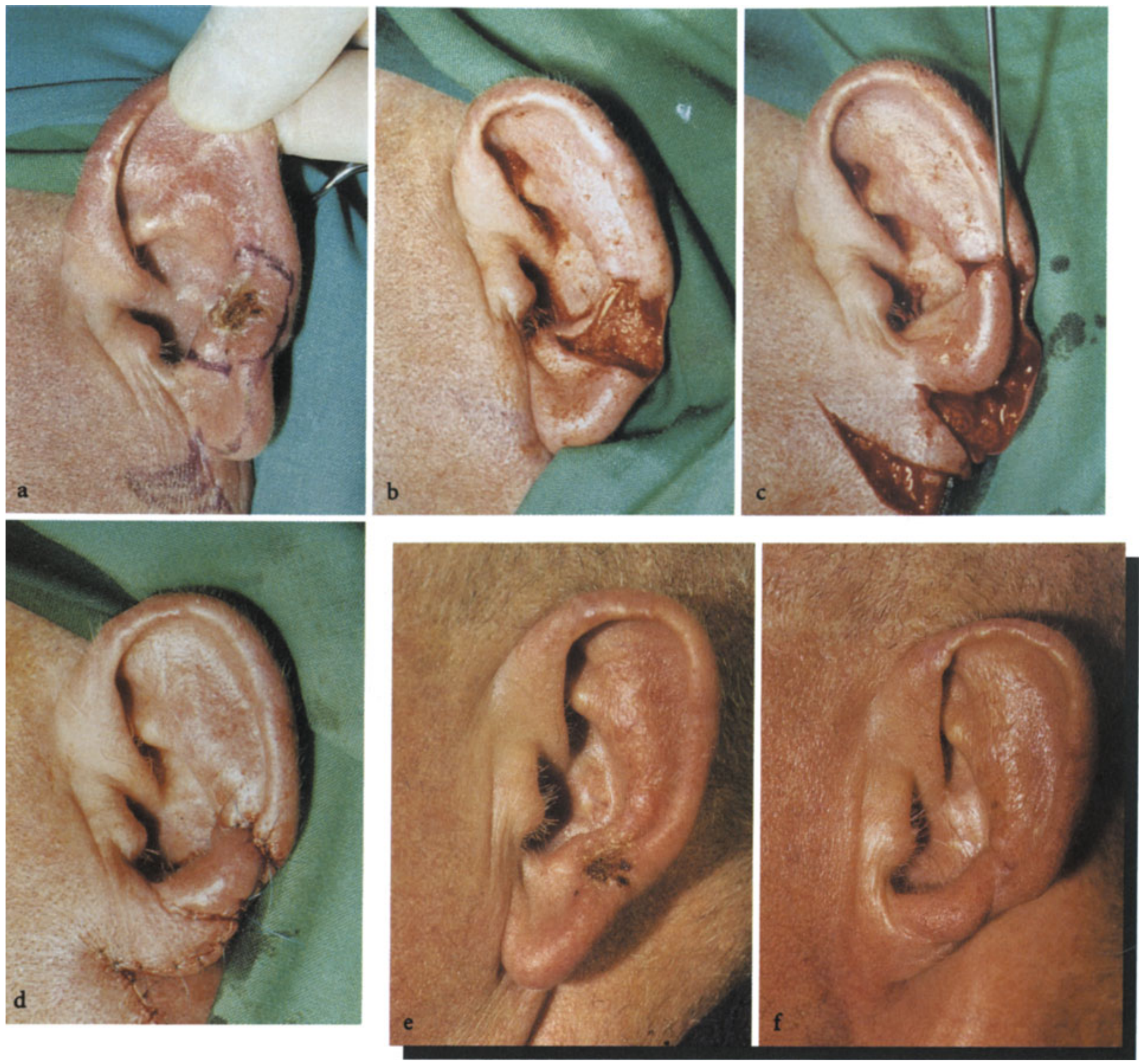
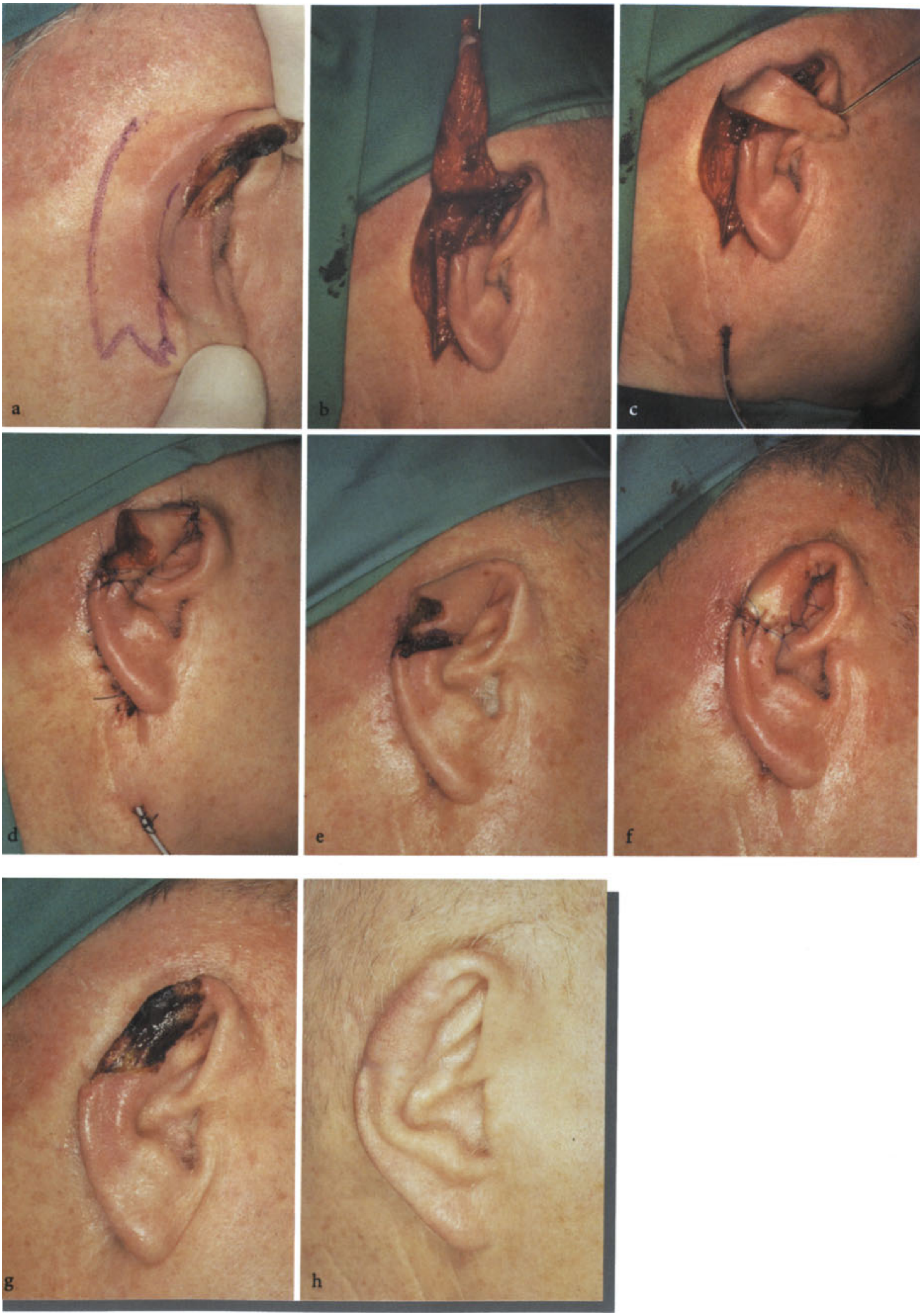


Fig. 312. Bilobed flap
a Operative plan for excision of extensive squamous cell carcinoma
b Excision defect
c Movement of first flap from ear lobe into primary defect, as well as of second flap from preauricular region into secondary defect
d End of operation
e Preoperative appearance
f Appearance after 1.5 years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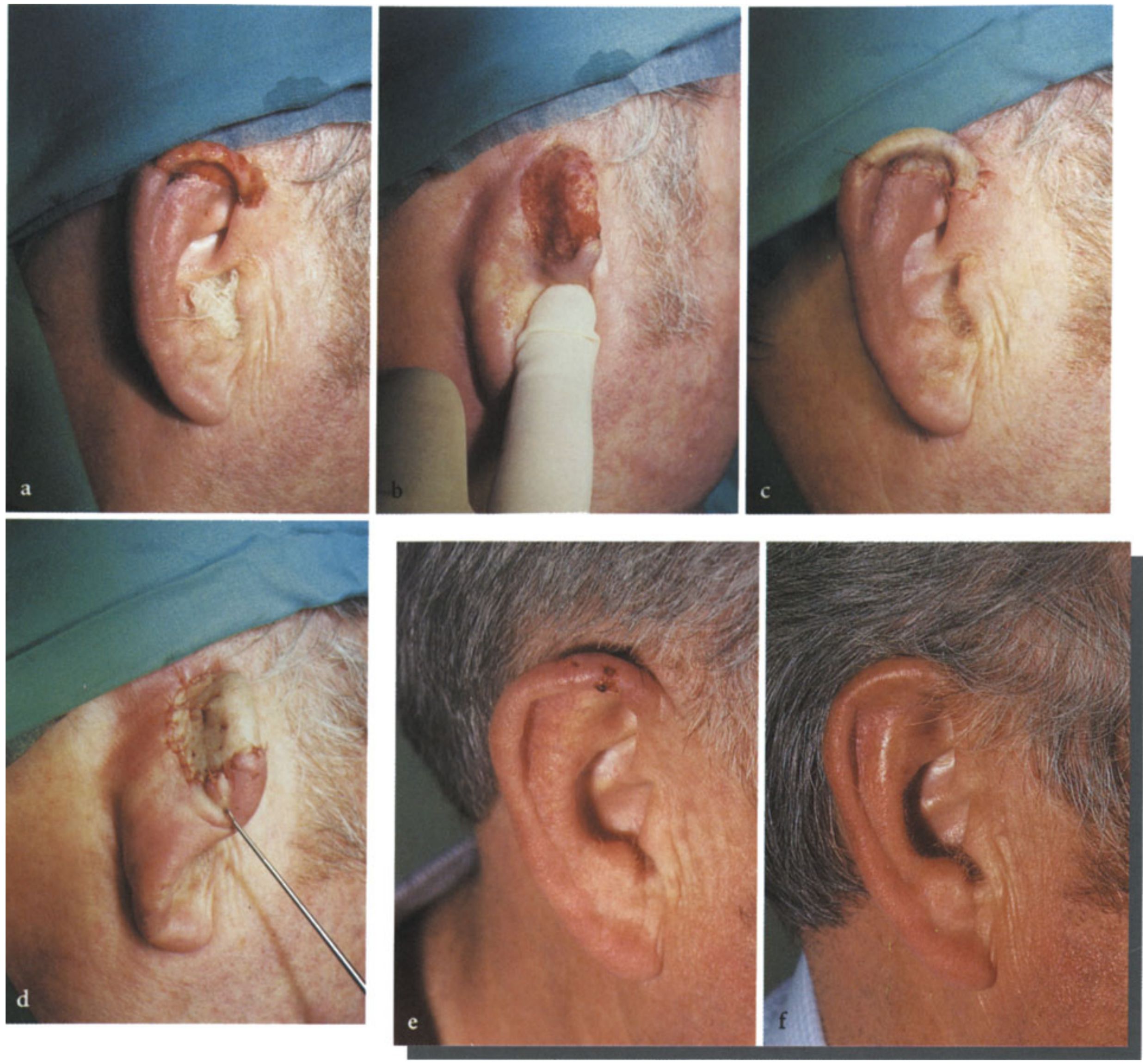

◁ **Fig. 313.** Staged transposition flap

- **a** Defect after excision of squamous cell carcinoma, with operative plan
- **b** Mobilization of proximally based transposition flap from retroauricular region
- **c** Placing flap in defect
- **d** Closure after first operation; the redundant skin was left to ensure the vascular viability of the flap
- **e** Appearance after 2 weeks of healing
- **f** Appearance after final placement of flap
- **g** Preoperative appearance
- **h** Appearance after 2 years

Fig. 314. Full-thickness skin graft

- **a** Defect after excision of an eroded basal cell carcinoma
- **b** Retroauricular view of defect
- **c** Well-matched skin graft from the supraclavicular region
- **d** Retroauricular view
- **e** Preoperative appearance
- **f** Appearance after 1 year


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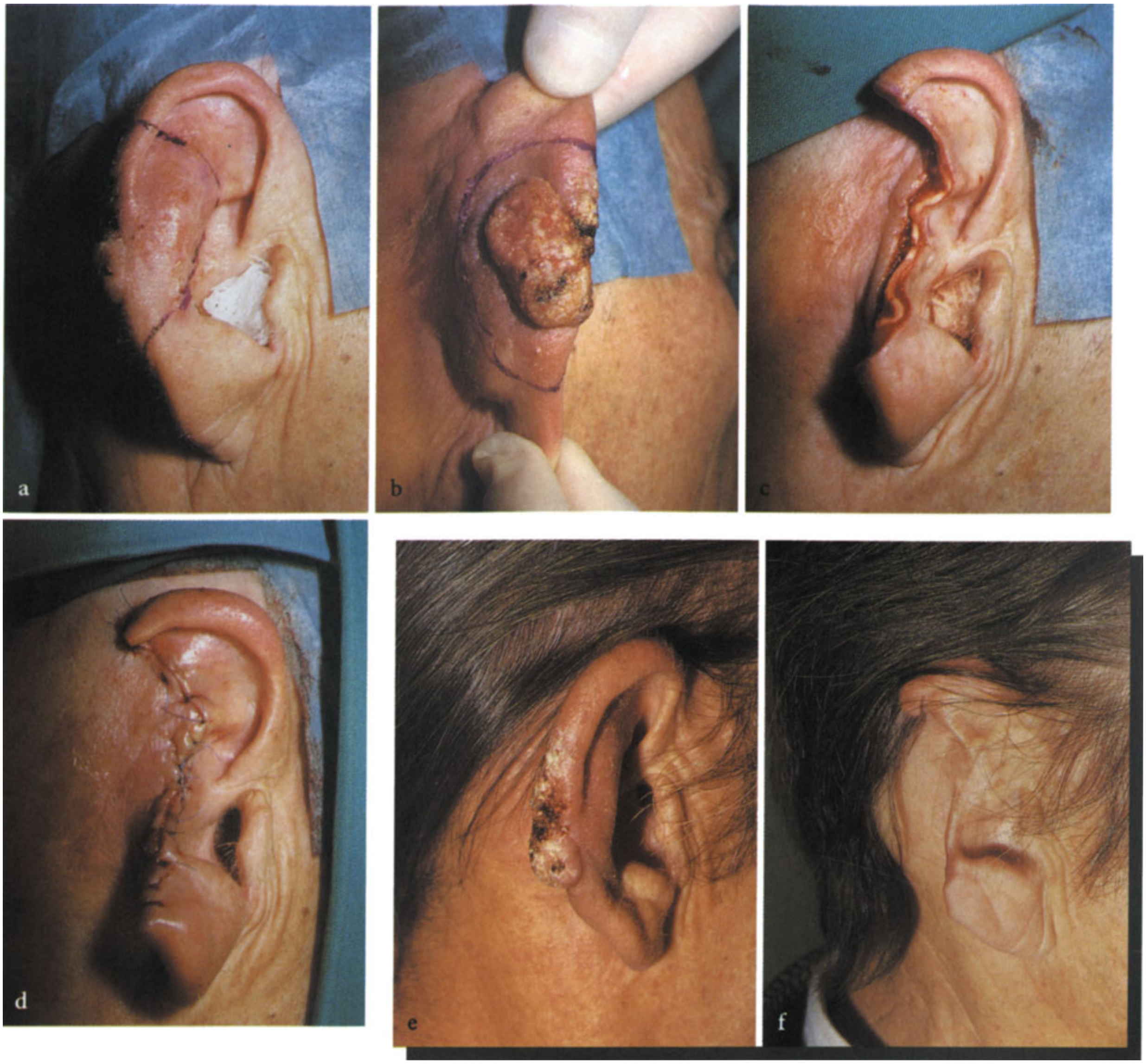

◁ **Fig. 315.** Staged composite advancement flap
a Defect after excision of recurrent basal cell carcinoma which included removal of cartilage
b Operative plan to repair defect
c Preparation of composite flap including skin and cartilage at the tip
d Appearance at end of first stage of operation
e After 2 weeks, the base of the flap is separated and the flap finally fitted in place
f End of operation
g Preoperative appearance
h Appearance after 1.5 years

Fig. 316. Partial ablation of the ear
a Enormous squamous cell carcinoma of the ear
b Retroauricular view with margins of excision
c Extensive defect
d Skin closure after attaching the remaining ear to the retroauricular skin. While cosmetically unacceptable, the closure leaves a functional ear in terms of wearing glasses
e Preoperative appearance
f Appearance after 1 year

Fig. 317. VY-plasty
a Operative plan for excision of basal cell carcinoma
b Excision defect
c Extensive undermining
d End of operation
e Preoperative appearance
f Appearance after 1 year

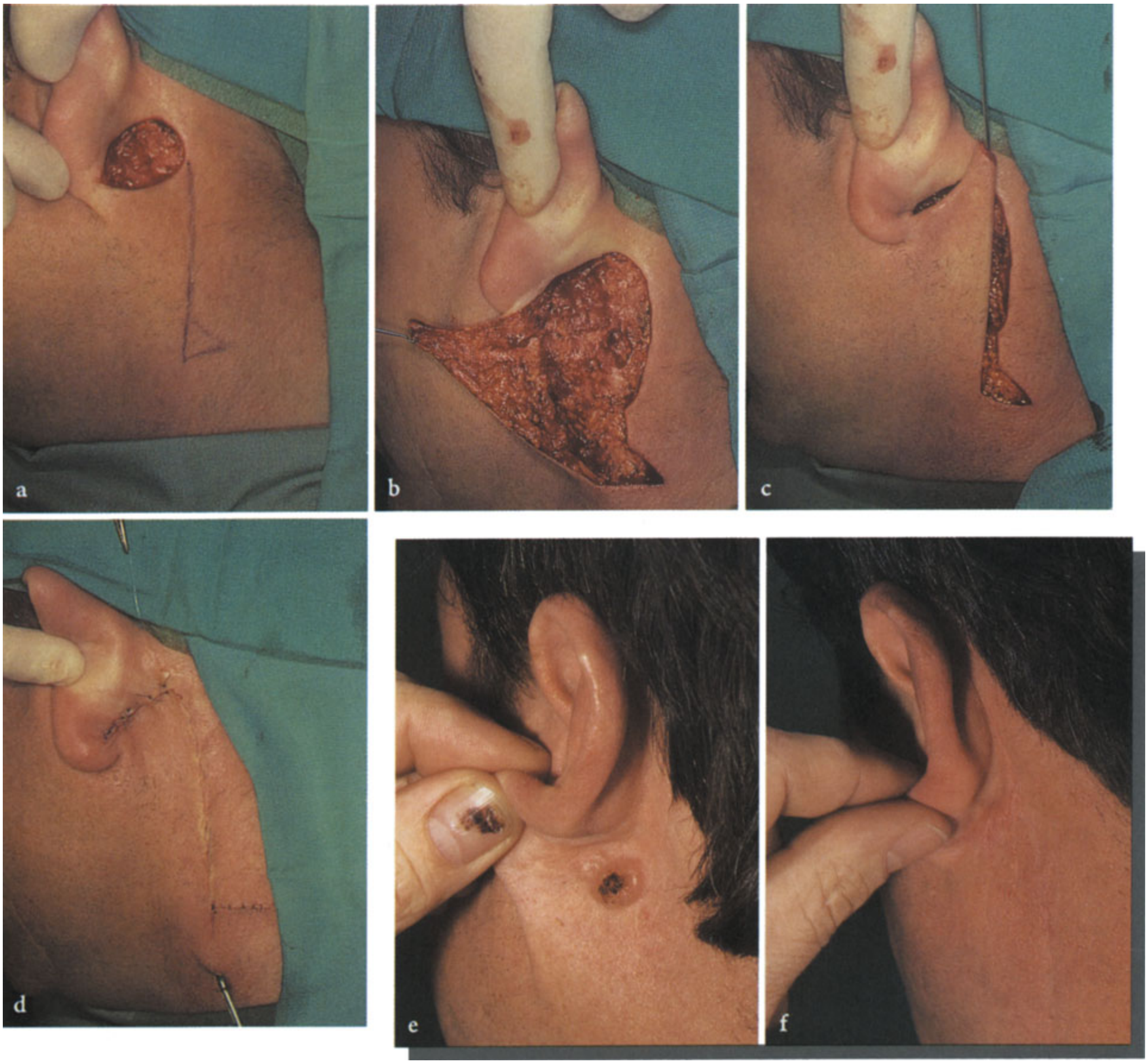

Fig. 318. Advancement flap
a Defect after excision of basal cell carcinoma, with operative plan
b Excision of caudal Burow's triangle and mobilization of flap
c Tension-free advancement of flap
d End of operation
e Preoperative appearance
f Appearance after 1 year

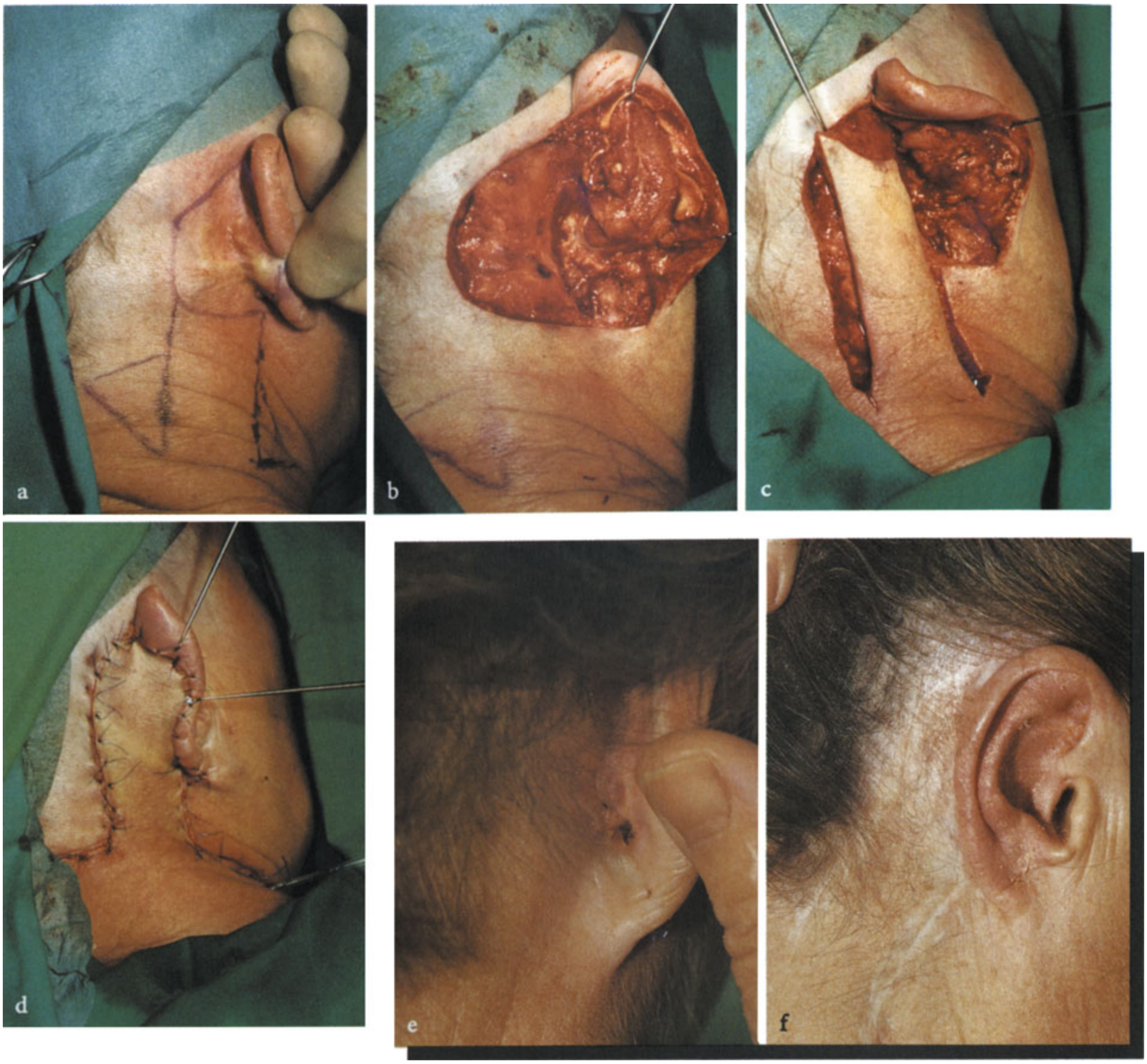

Fig. 319. U-plasty
a Operative plan for excision of recurrent retroauricular basal cell carcinoma
b Defect after excision which included cartilage
c Moving flap into place
d End of operation
e Preoperative appearance
f Appearance after 2.5 years

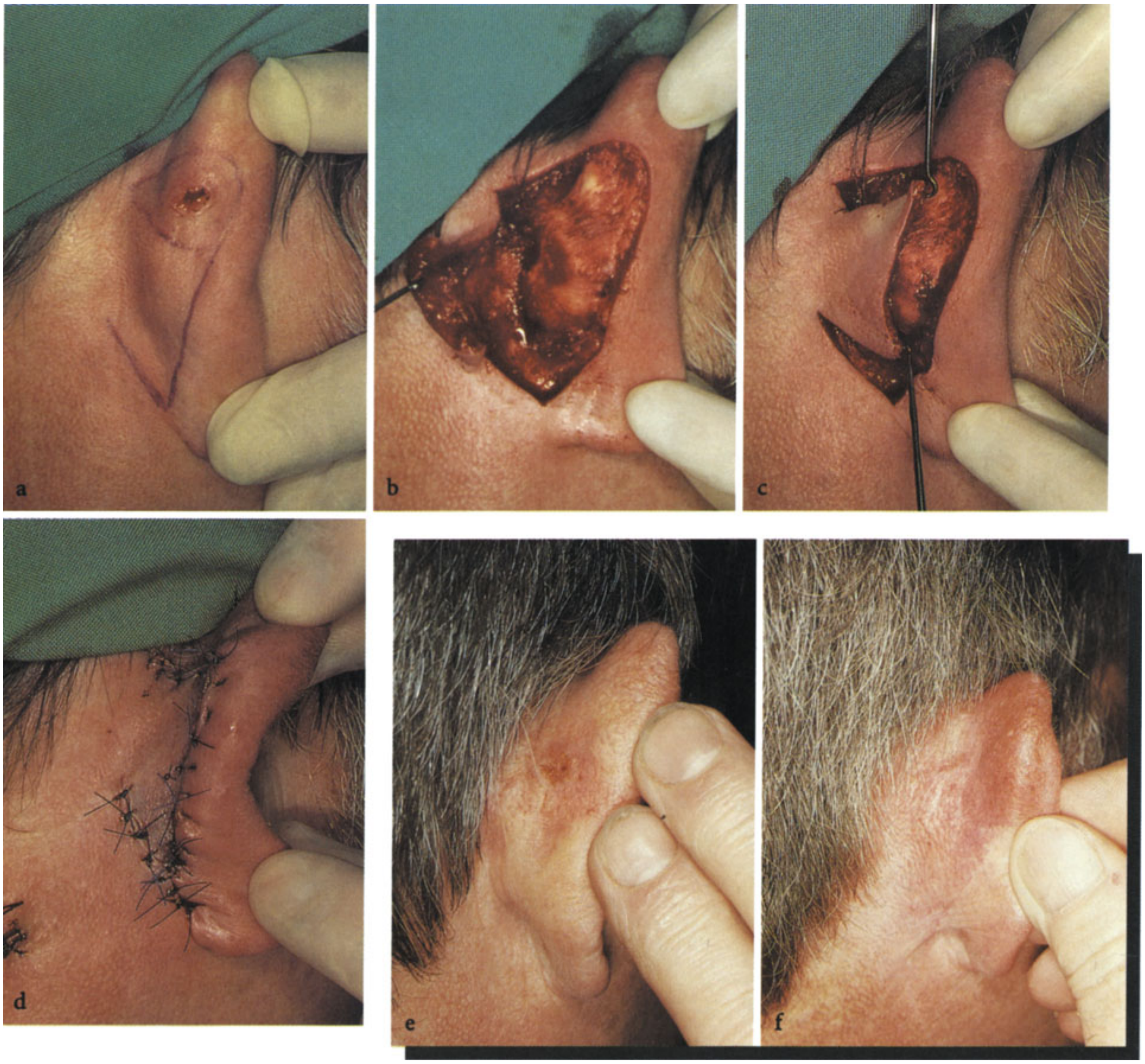

Fig. 320. Advancement flap with back cut
a Operative plan for excision of basal cell carcinoma with reconstruction
b Excision defect and mobilization of flap
c Advancement of flap
d End of operation
e Preoperative appearance
f Appearance after 1.5 years

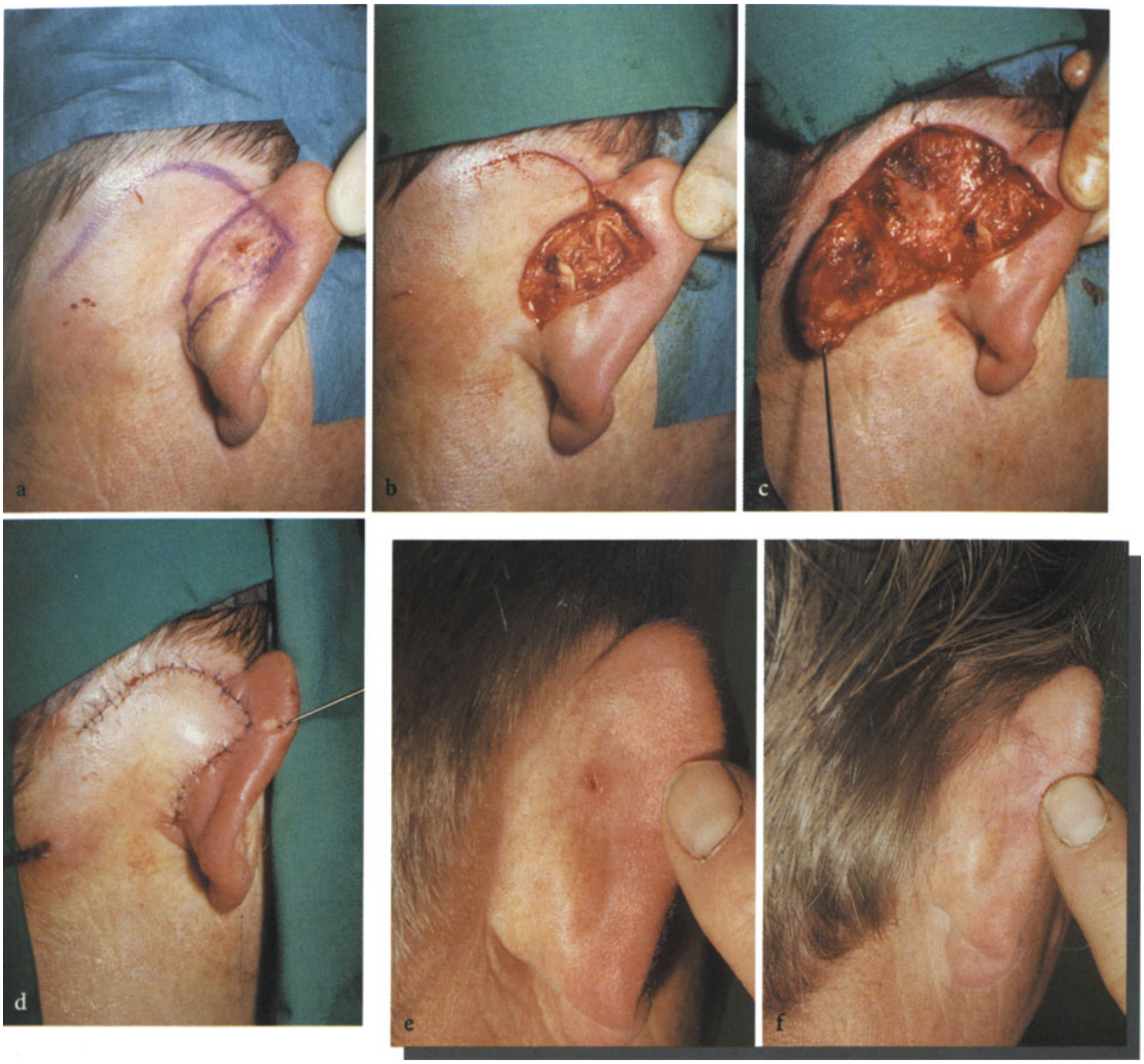

Fig. 321. Rotation flap
a Operative plan for excision of ulcerated basal cell carcinoma
b Excision defect
c Mobilization of retroauricular flap
d End of operation
e Preoperative appearance
f Appearance after 1 year

Fig. 322. Transposition flap (lobed flap)
a Operative plan to transpose preauricular flap posteriorly to close defect left after excision of large ulcerated basal cell carcinoma
b Mobilization of flap
c Placement of flap in retroauricular position
d End of operation
e Preoperative appearance
f Appearance after 1 year

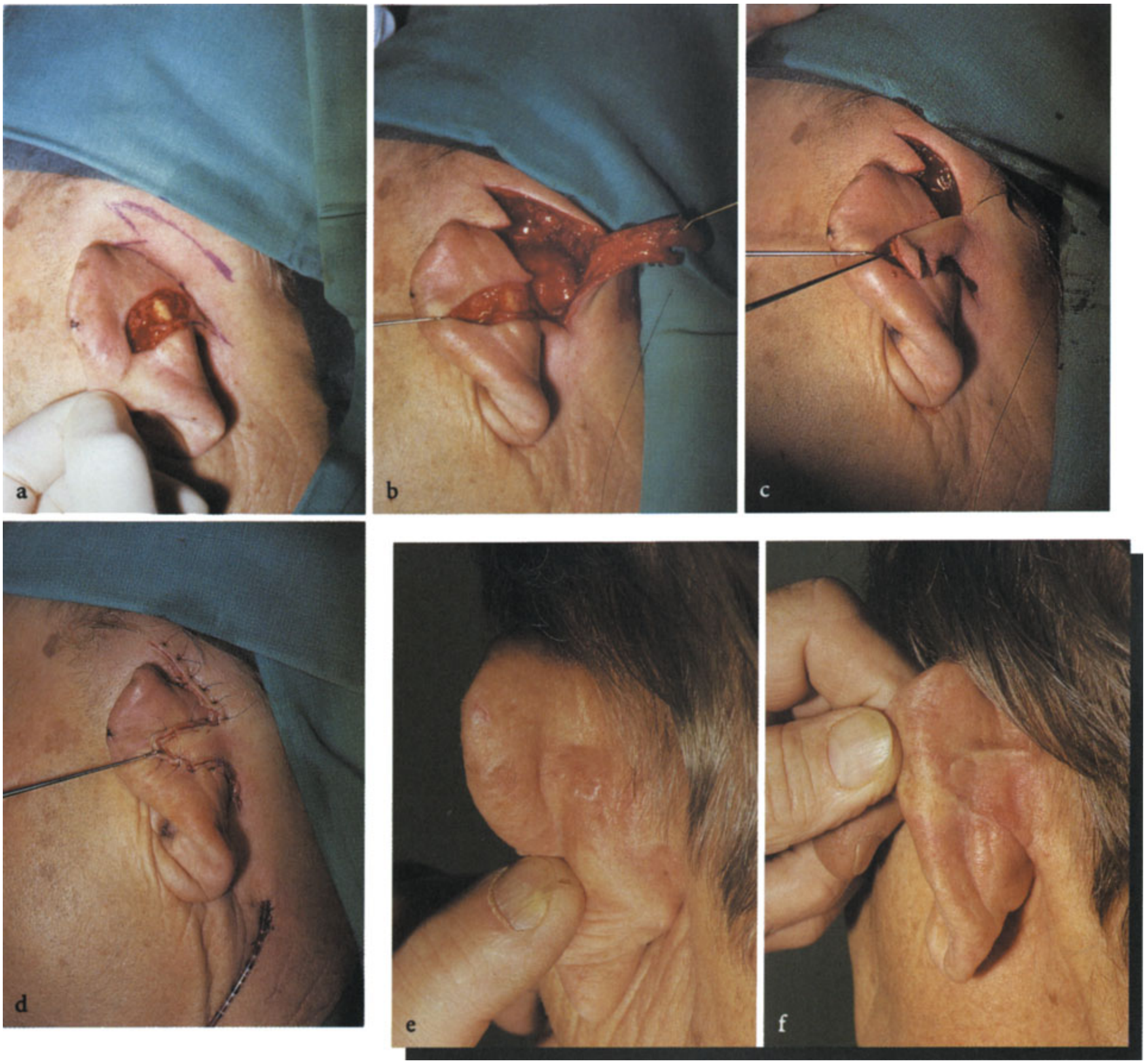

Fig. 323. Transposition flap
a Defect after excision of basal cell carcinoma, with operative plan to swing a caudally based flap
b Mobilization of flap
c Swinging flap into place
d End of operation
e Preoperative appearance
f Appearance after 1 month

Fig. 324. Transposition flap
a Operative plan to excise recurrent basal cell carcinoma in retroauricular area
b Excision defect which included cartilage
c Moving flap into place
d End of operation
e Preoperative appearance
f Appearance after 2.5 years

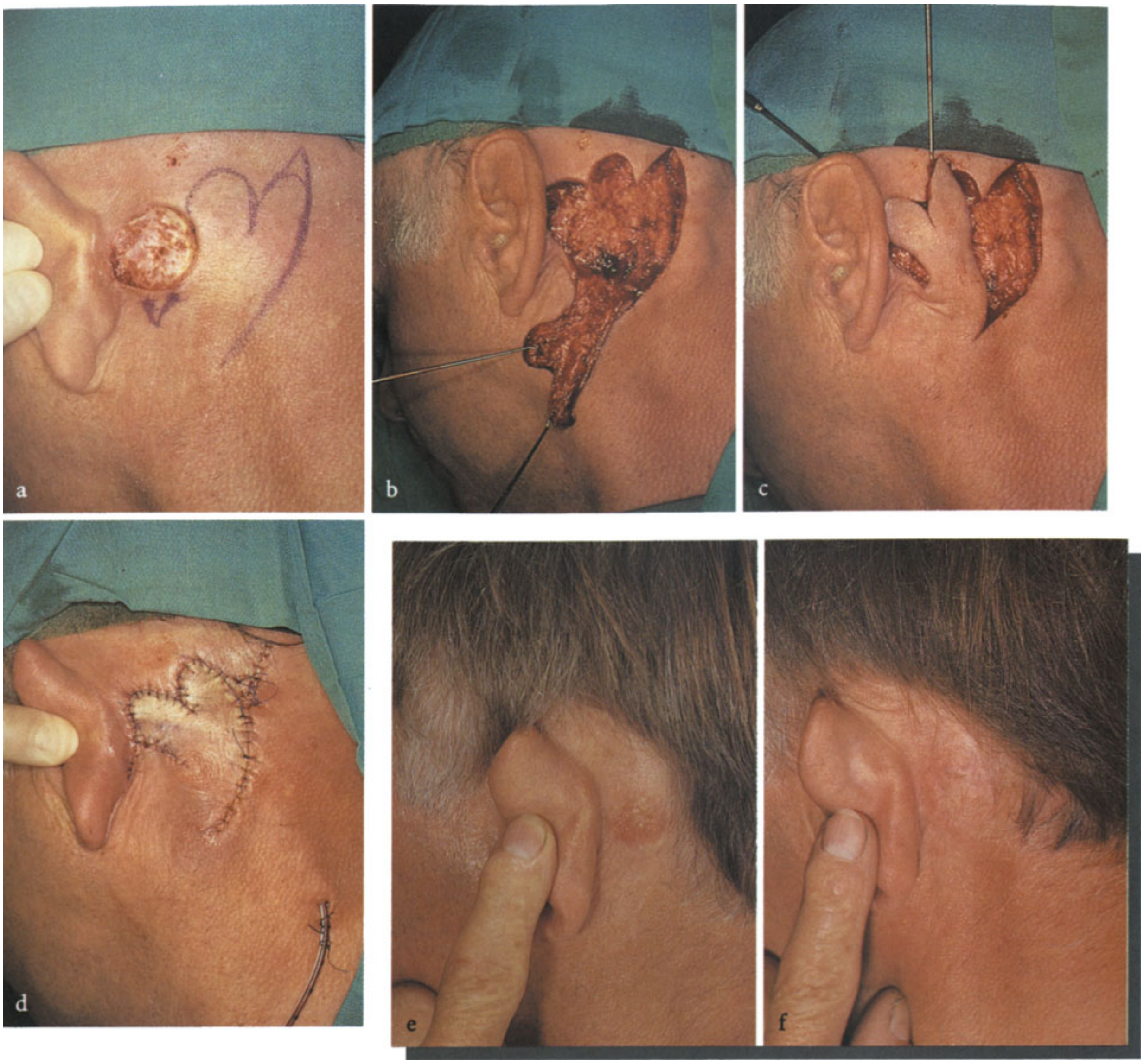

Fig. 325. Bilobed flap
a Defect after excision of basal cell carcinoma, with operative plan
b Mobilization of both flaps
c Tension-free transfer
d End of operation
e Preoperative appearance
f Appearance after 9 months

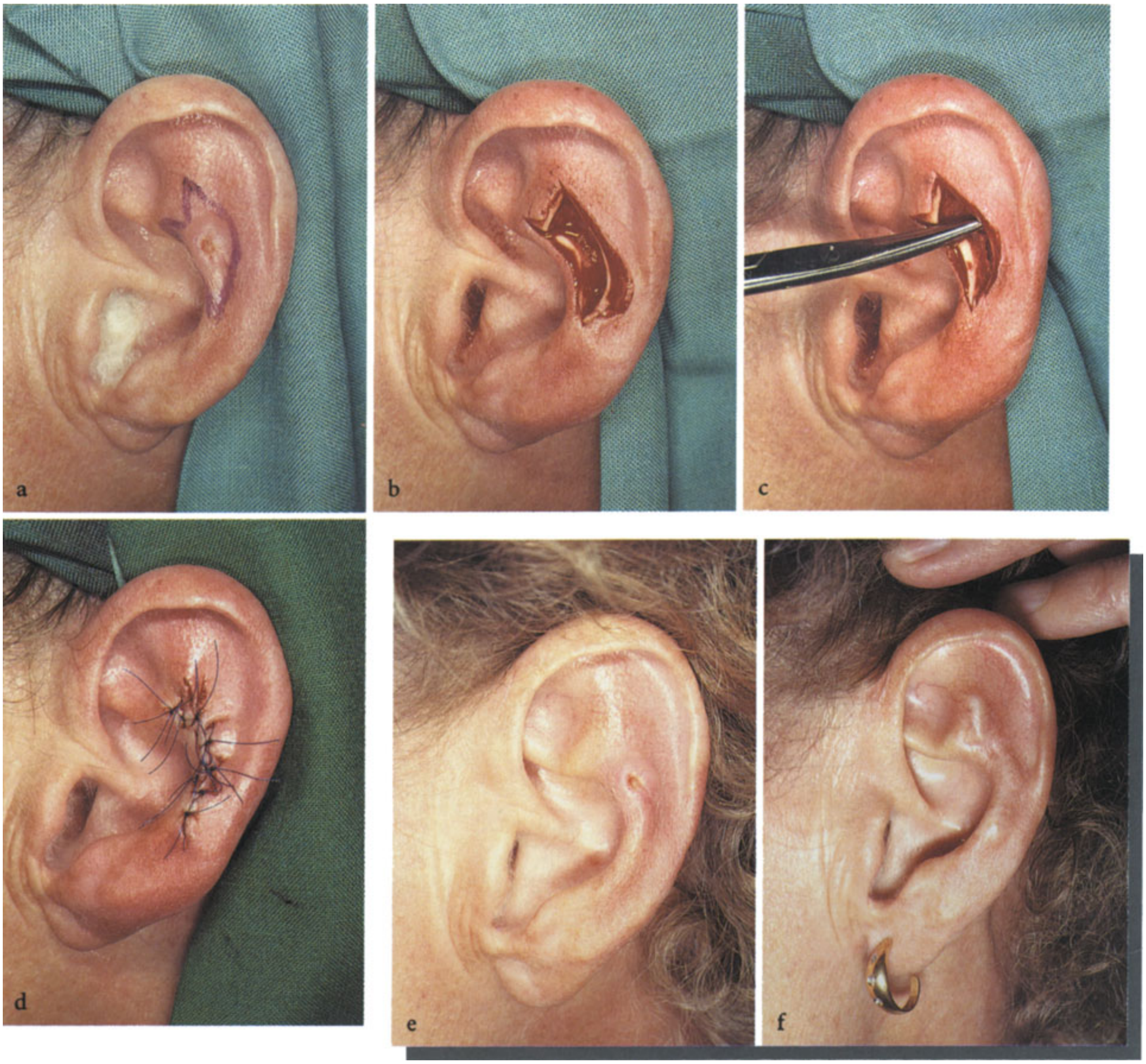

Fig. 326. VY-plasty
a V-shaped excision of chondrodermatitis nodularis of antihelix
b Excision of both skin and cartilage
c Undermining
d End of operation
e Preoperative appearance
f Appearance after 1 year

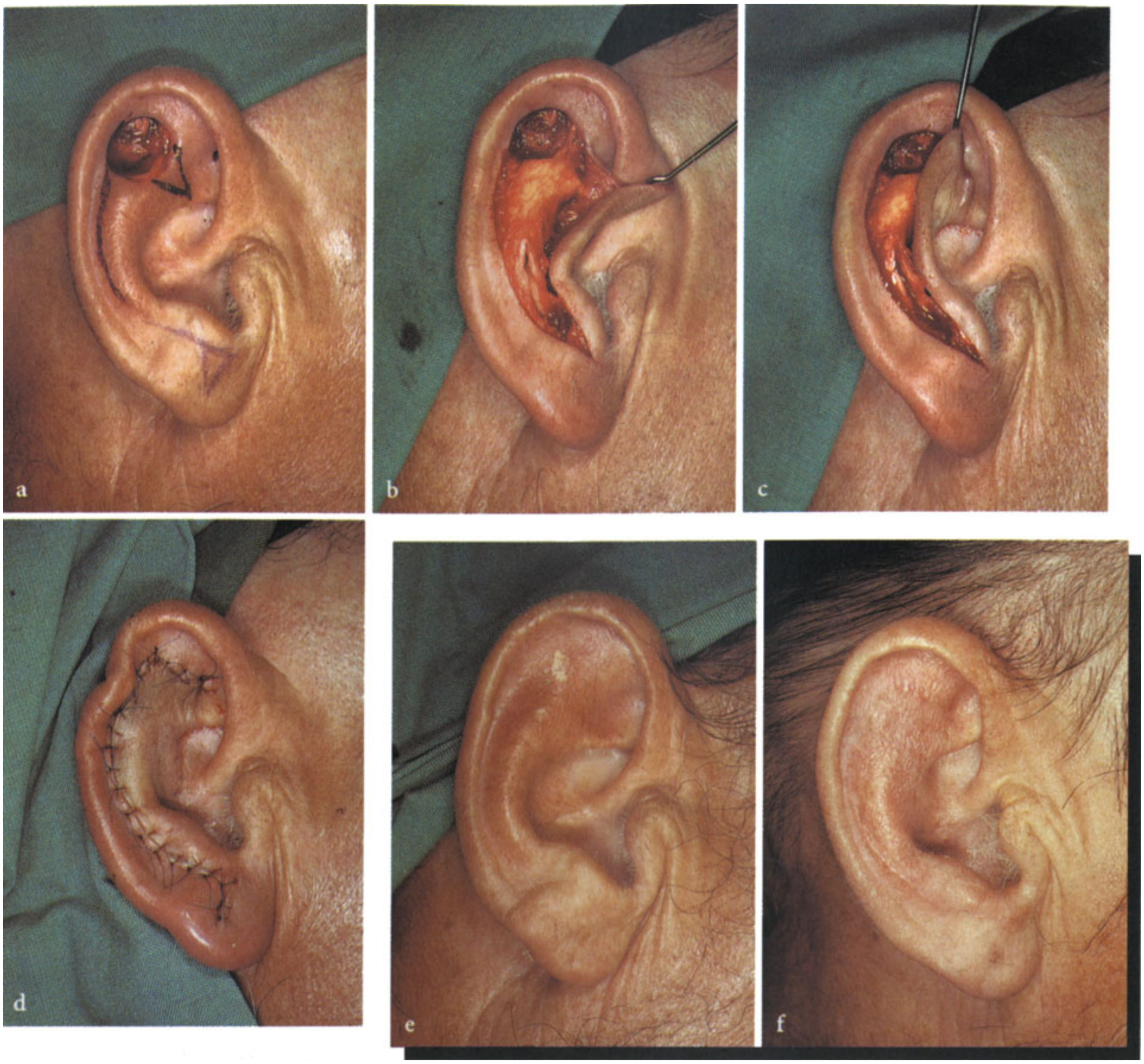

Fig. 327. Rotation flap
a Defect after excision of hypertrophic actinic keratosis, with operative plan
b Mobilization of flap
c Rotation of flap into place
d End of operation
e Preoperative appearance
f Appearance after 3 months

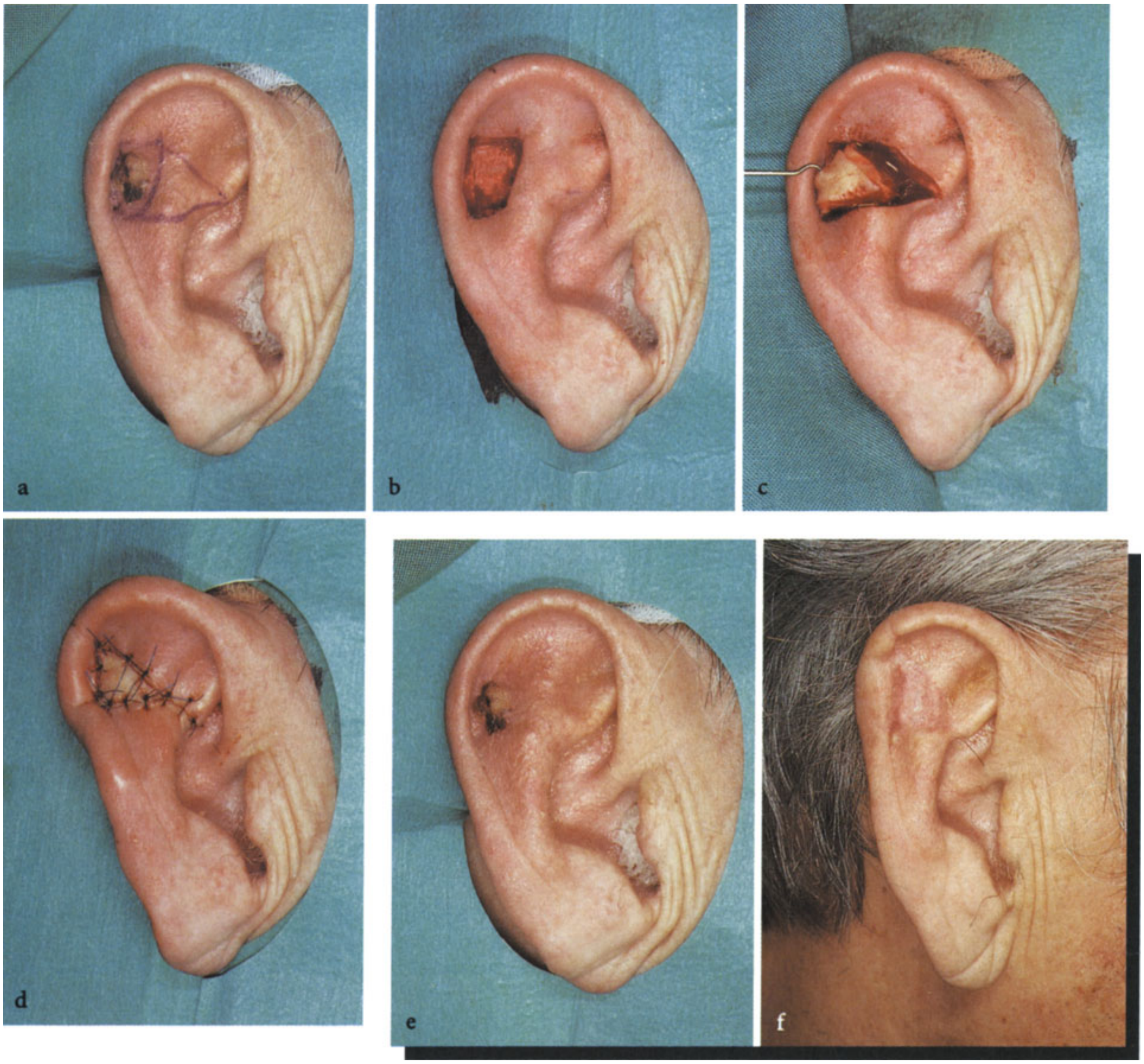

Fig. 328. Advancement flap
a Operative plan for excision of basal cell carcinoma
b Excision defect including removal of cartilage
c Placement of composite skin-cartilage advancement flap
d End of operation
e Preoperative appearance
f Appearance after 1 year

Fig. 329. Bilobed flap
a Defect after excision of ulcerated chondrodermatitis nodularis helicis of antihelix, with operative plan
b Mobilization of flaps
c Placement of flaps
d End of operation
e Preoperative appearance
f Appearance after 1 year

Fig. 330. Tunnel flap
a Defect after excision of squamous cell carcinoma in situ, with operative plan. The proximal hatched area of the flap will be deepithelialized and placed subcutaneously; the distal hatched area will be discarded
b Mobilization of flap
c Tunneling the flap into place
d End of operation
e Preoperative appearance
f Appearance after 4 weeks


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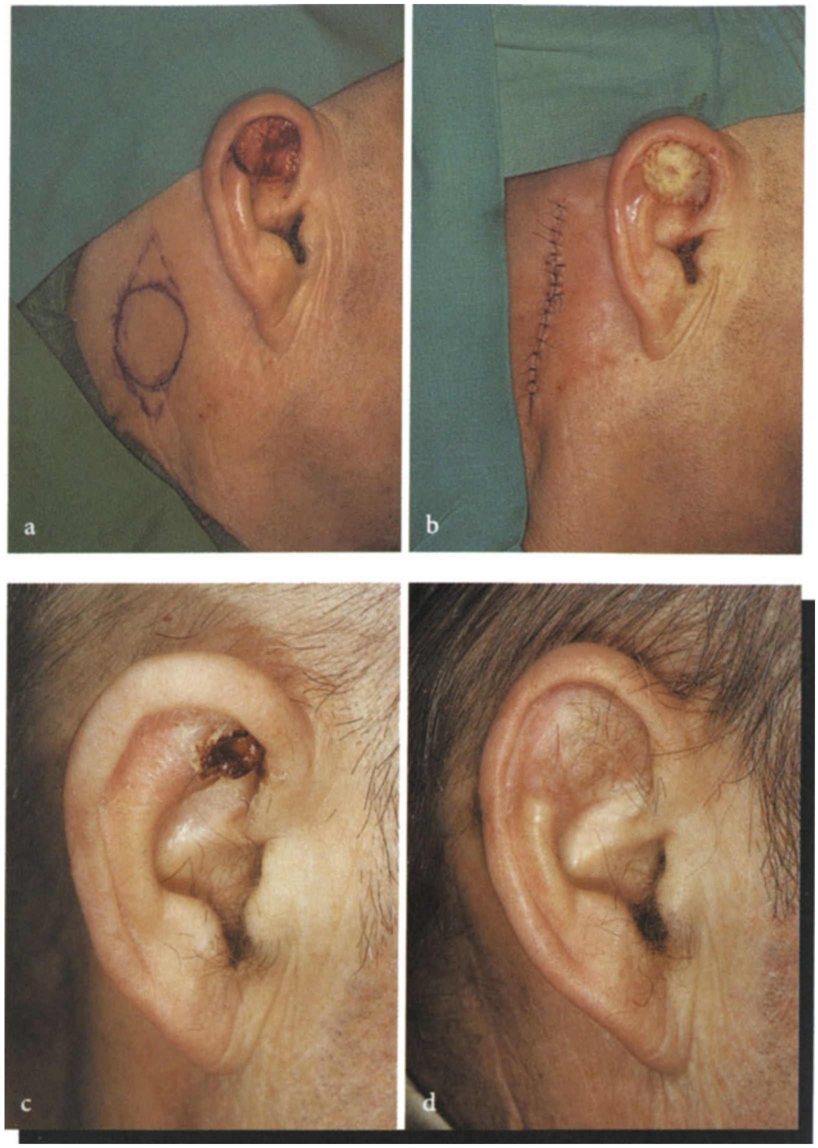

◁ **Fig. 331.** Staged transauricular transposition flap
a Defect after excision of squamous cell carcinoma
b Operative plan to create a retroauricular flap
c After creating a window the flap is passed through the ear
d Appearance after completing first stage
e After 2 weeks, the pedicle of the flap is separated and the flap fitted into place
f End of operation
g Preoperative appearance
h Appearance after 6 months

Fig. 332. Full-thickness skin graft
a Defect after excision of squamous cell carcinoma, with operative plan for a retroauricular skin graft
b Skin graft fitted in place; donor site closed primarily after undermining
c Preoperative appearance
d Appearance after 9 months

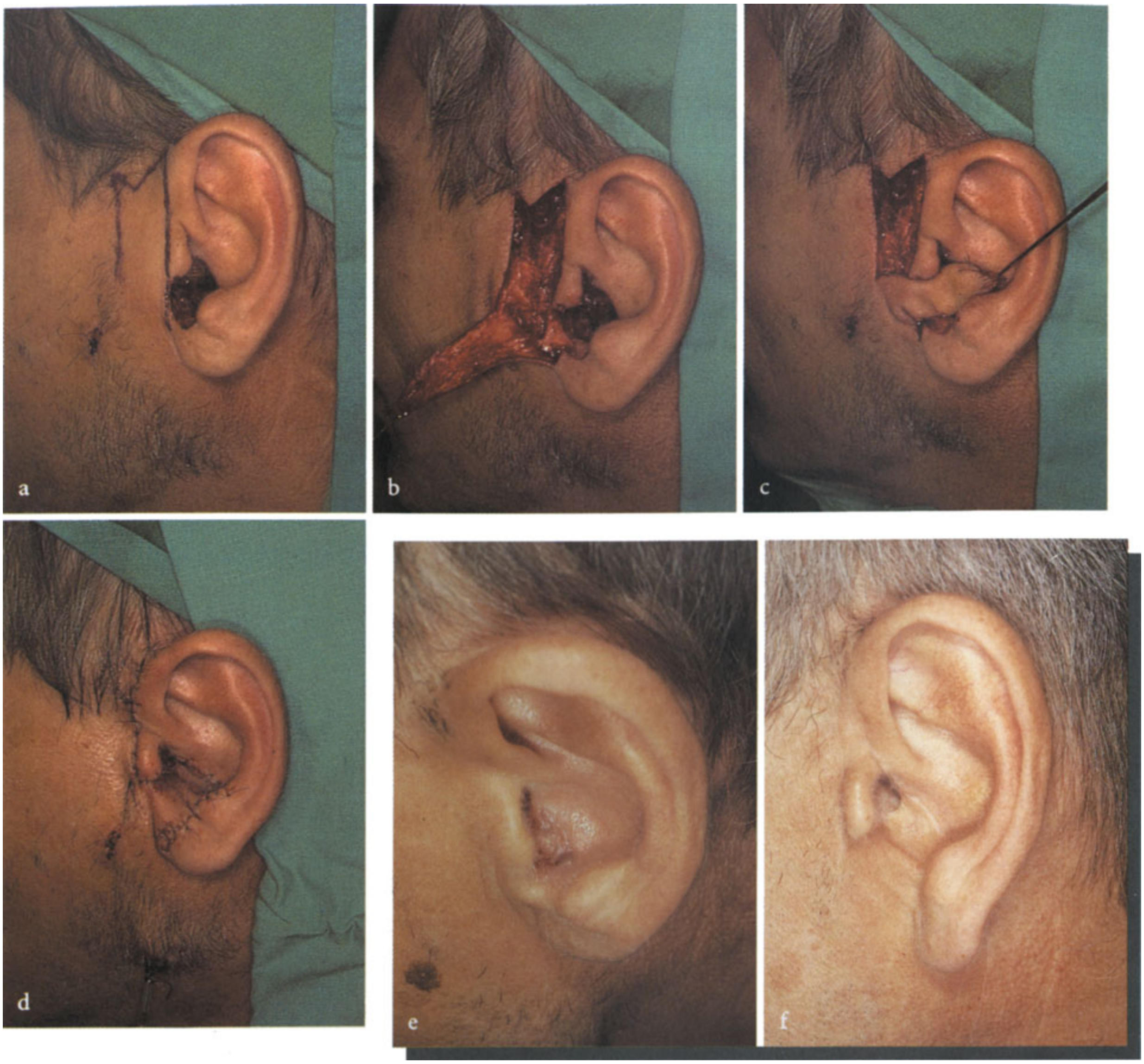

Fig. 333. Transposition flap
a Defect after excision of basal cell carcinoma, with operative plan
b Mobilization of caudally based preauricular flap
c Placing flap into the ear
d End of operation
e Preoperative appearance
f Appearance after 2 years

Fig. 334. Staged transposition flap

a Defect after excision of basal cell carcinoma, with operative plan. The hatched area will later be discarded
b Mobilization of flap
c Moving the flap into the ear
d Appearance at the end of first stage; after 2 weeks, the pedicle of the flap will be separated and the defect closed
e Preoperative appearance
f Appearance after 9 months

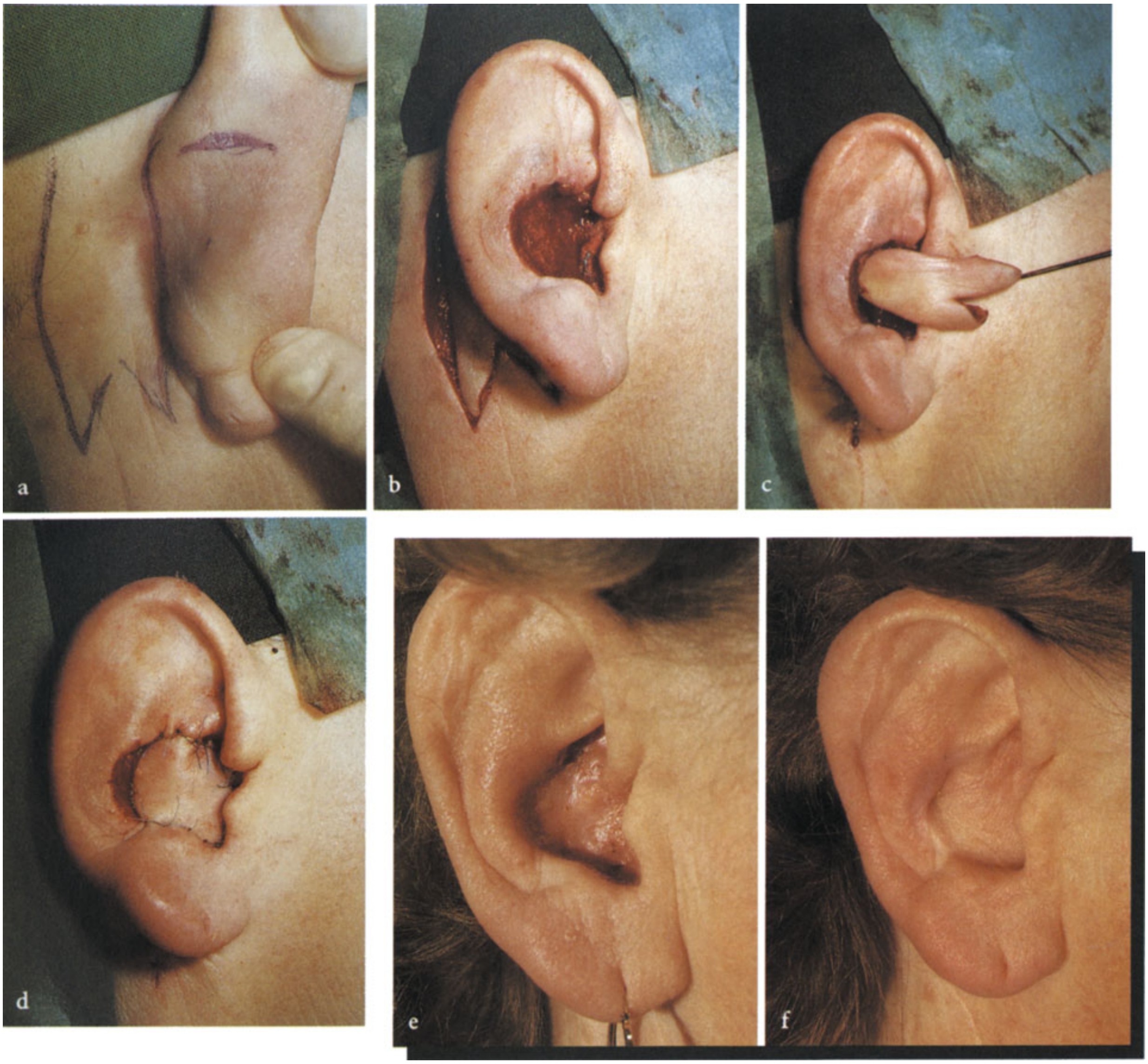

Fig. 335. Staged transauricular transposition flap
a Operative plan for transauricular flap with window marked on retroauricular surface. The flap is designed to cover the defect left by excision of extensive basal cell carcinoma
b Defect after excision of skin and cartilage, with mobilization of flap
c Tunneling the flap through the ear
d Appearance after the first stage; after 2 weeks, the pedicle will be severed and the tip refitted in place
e Preoperative appearance
f Appearance after 2.5 years

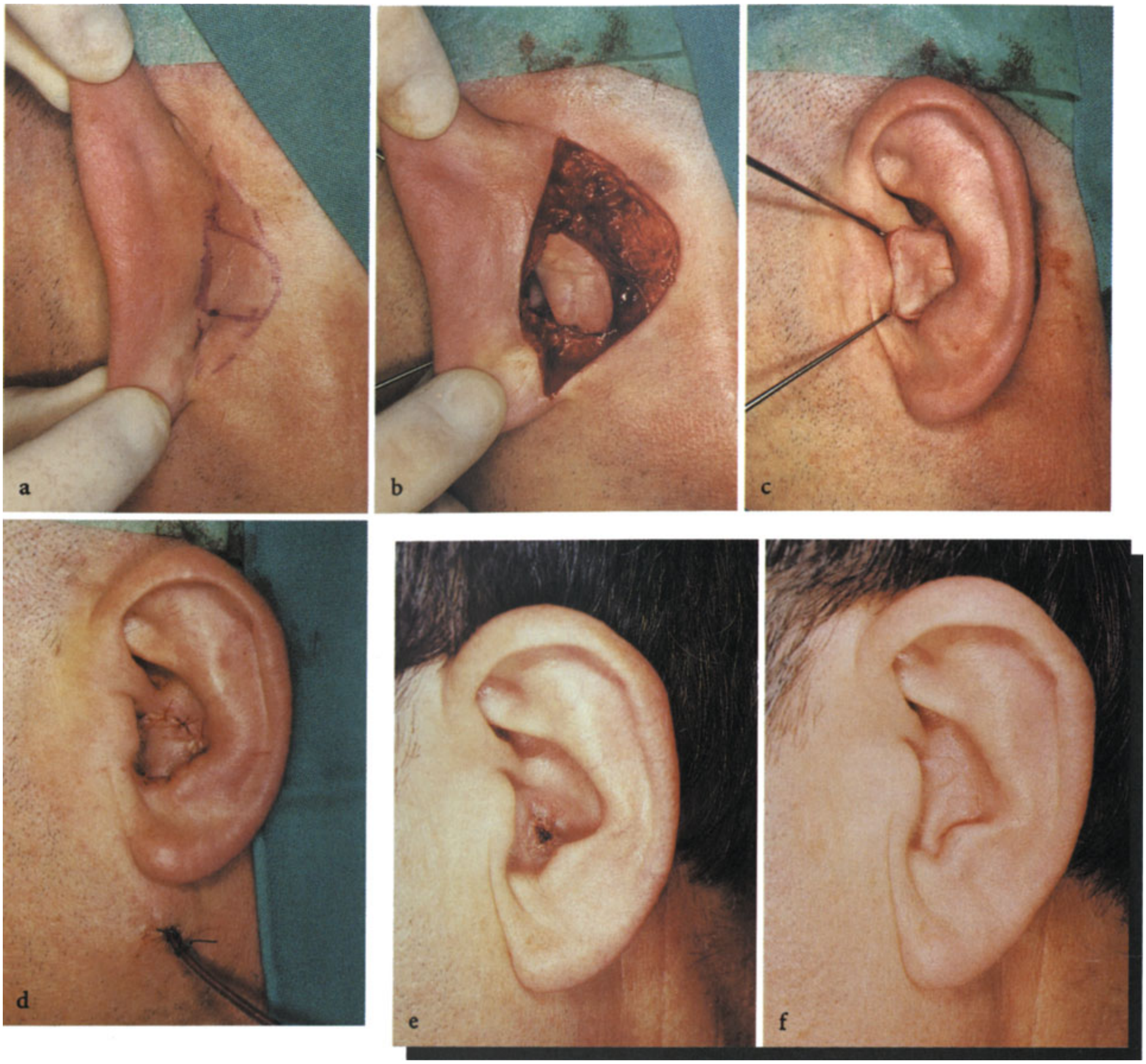

Fig. 336. Island transauricular flap

- **a** Operative plan to prepare retroauricular island flap which will be moved forward to repair defect after excision of basal cell carcinoma. The superior and inferior triangles of the flap will be discarded
- **b** Tunneling the flap through the ear
- **c** Placing the flap anteriorly
- **d** Skin closure; the retroauricular site was closed primarily
- **e** Preoperative appearance
- **f** Appearance after 1 year

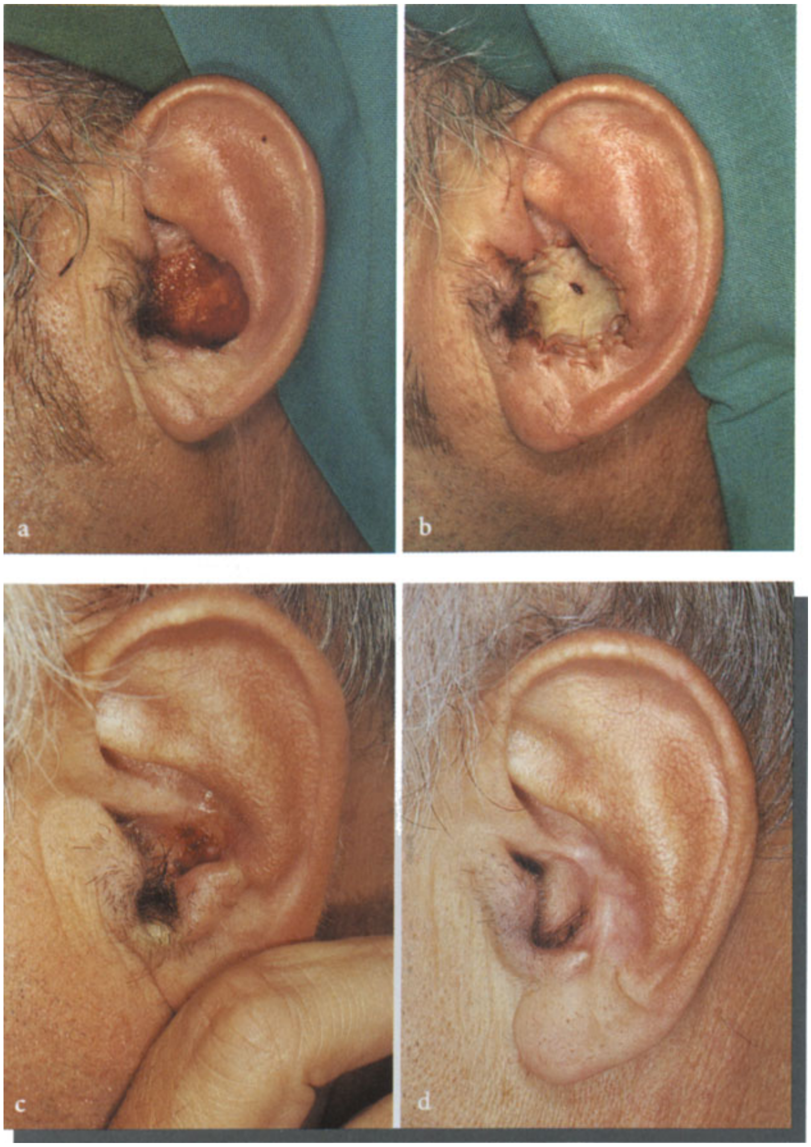

Fig. 337. Full-thickness skin graft
a Defect after excision of basal cell carcinoma which involved the external auditory canal
b Placement of full-thickness skin graft taken from neck
c Preoperative appearance
d Appearance after 1 year

Fig. 338. Tunnel flap ▷
a Defect after excision of recurrent basal cell carcinoma, with operative plan
b Operative plan for retroauricular tunnel flap
c Mobilization of flap and preparation of tunnel
d Removing epithelium from stalk of flap
e Tunneling the flap into place
f Skin closure including primary closure of donor site
g Preoperative appearance
h Appearance after 6 months

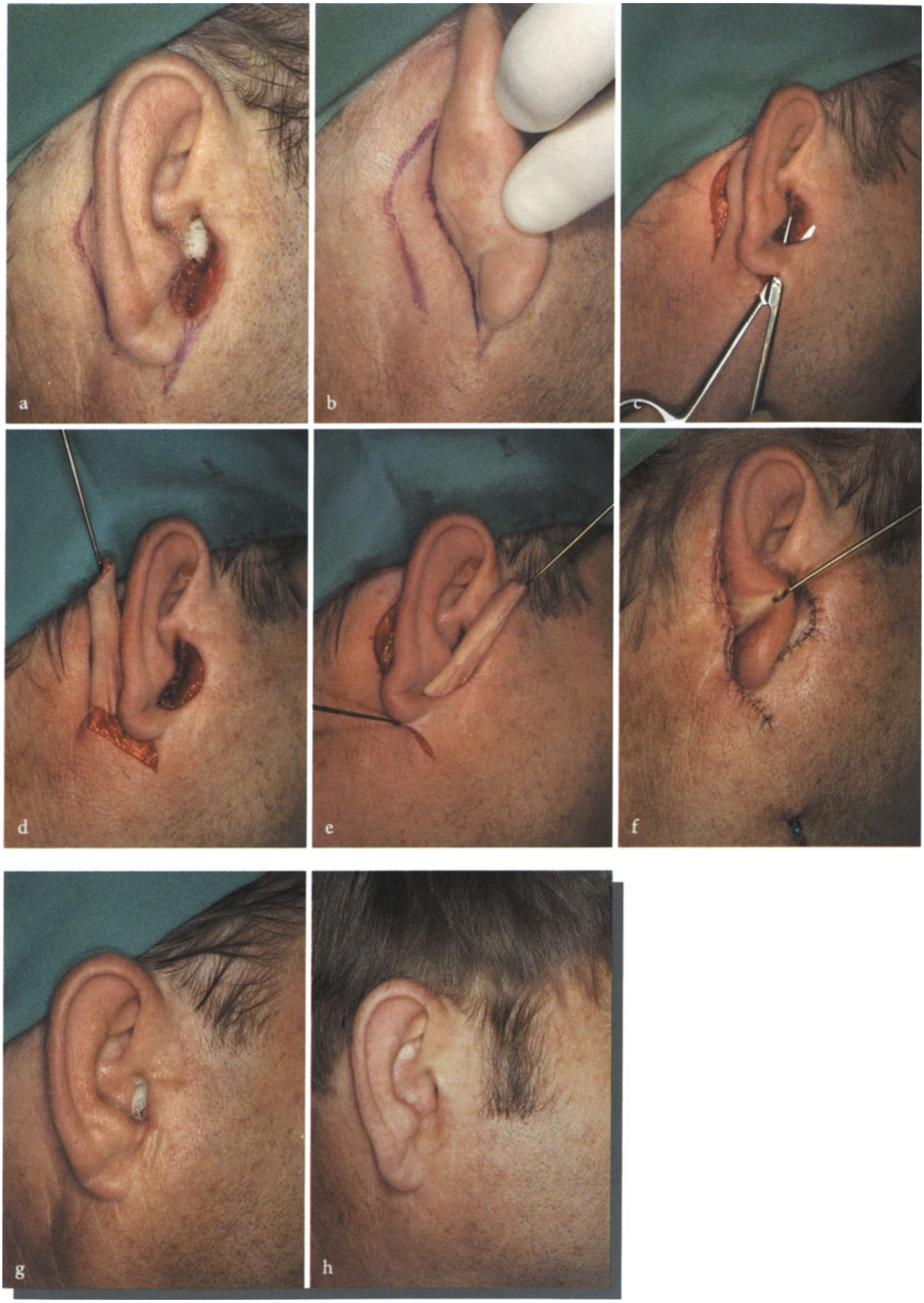
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Fig. 339. VY-plasty combined with transposition flap
a Defect after excision of recurrent basal cell carcinoma
b After partial closure with VY-plasty, the tragus is reconstructed with a composite transposition flap
c Moving the composite skin-cartilage flap into place
d End of operation
e Preoperative appearance
f Appearance after 1 year

Fig. 340. Split-thickness skin graft
a Operative plan for excision of a large sclerosing basal cell carcinoma
b Excision defect; the upper part of the ear was then reattached
c Wound appearance after reconditioning
d Placement of split-thickness skin graft
e Preoperative appearance
f Appearance after 1.5 years

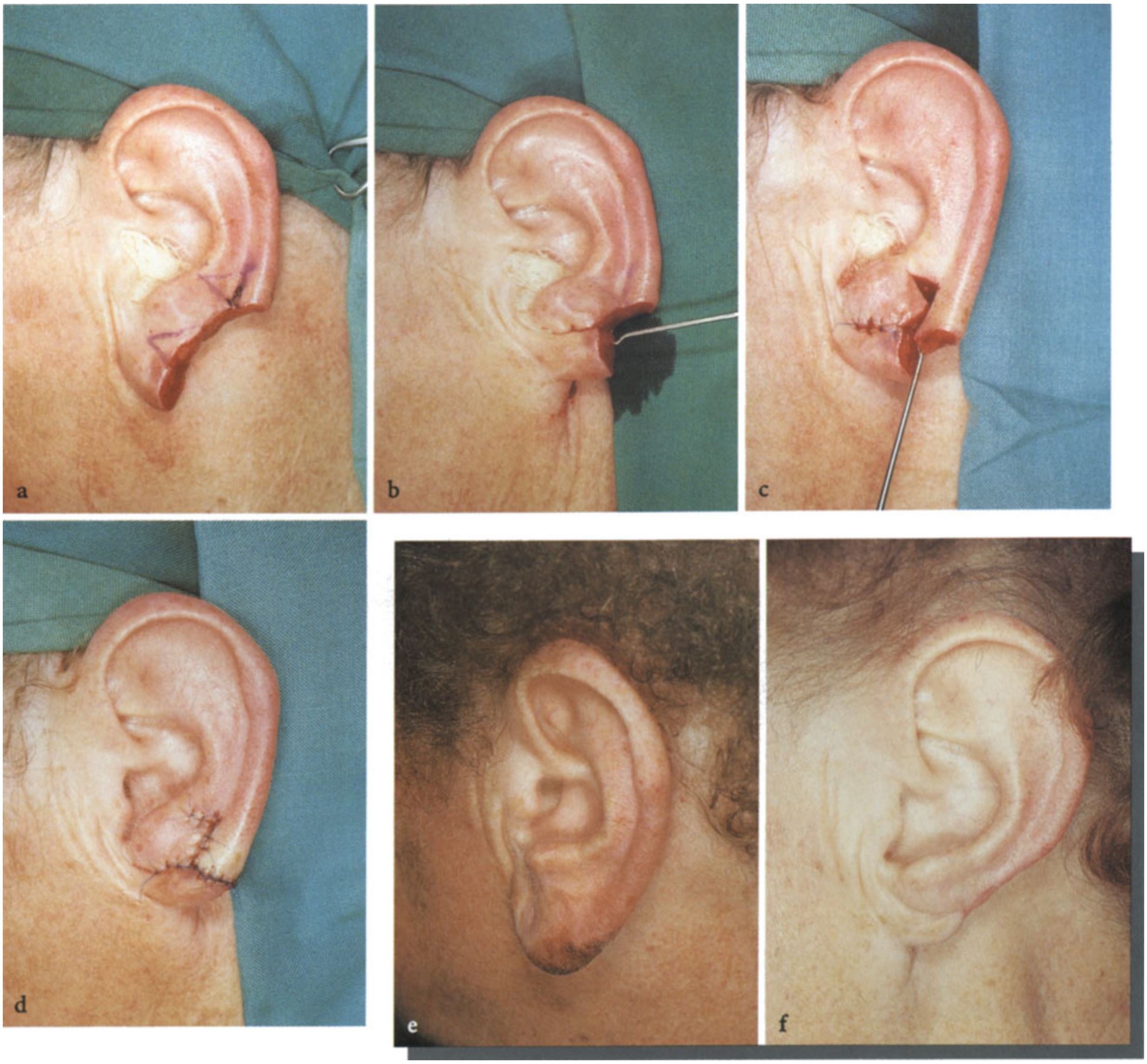


Fig. 341. Advancement flap involving the rim of the helix
a Defect after excision of lentigo maligna, with operative plan
b Appearance after caudal Burow's triangle is excised
c After excision of the second Burow's triangle, the helix rim is moved caudally
d End of operation
e Preoperative appearance
f Appearance after 5 years

a b c d e f

Fig. 342. Ear lobe revision
a Appearance of ear lobe with defect which resulted from the excision of an epidermoid cyst
b Excision of scarred area
c Mobilization of wound edges
d Reapproximation of edges
e End of operation
f Appearance after 3 months

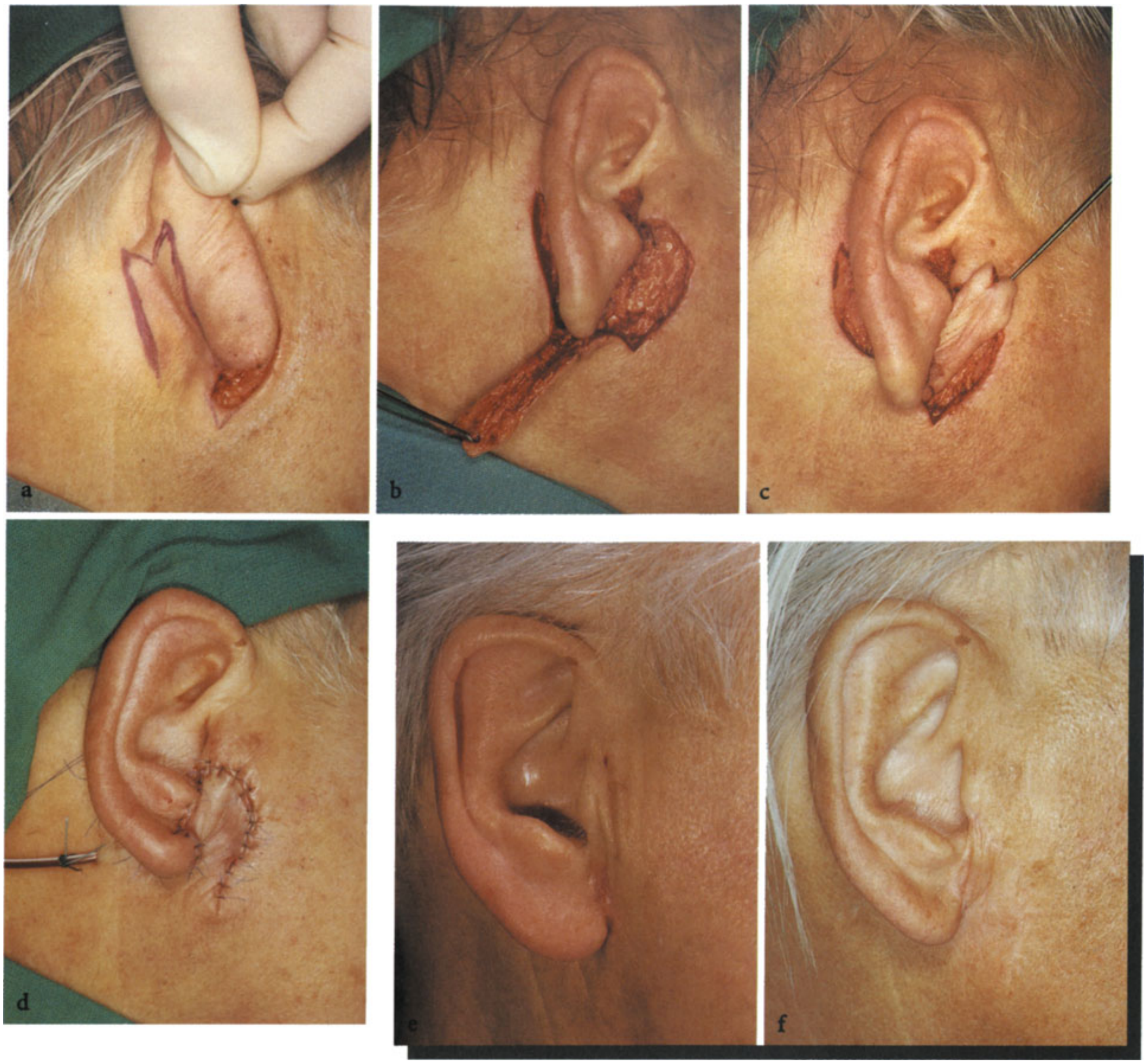


Fig. 343. Transposition flap
a Defect after excision of basal cell carcinoma at base of ear lobe, with operative plan
b Mobilization of retroauricular flap
c Transposing the flap anteriorly
d End of operation
e Preoperative appearance
f Appearance after 2.5 years

19.10.5 Operations for Chondrodermatitis nodularis helicis

Subcutaneous Cartilage Excision

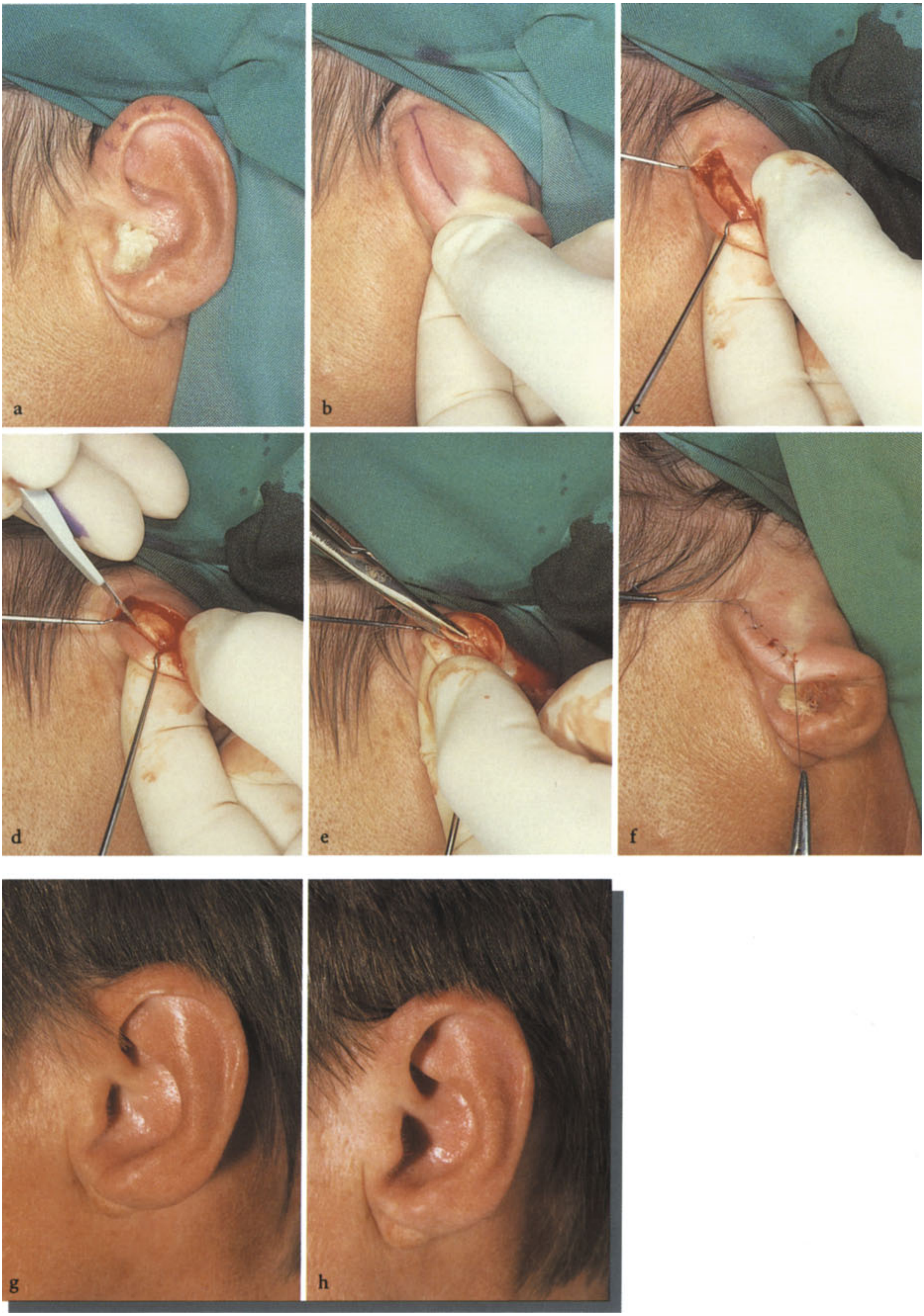
This approach is just as effective as the wedge-shaped excision of the involved area but is much more acceptable cosmetically.

Surgical Technique

A curved incision is made on the postauricular surface about 1 cm from the helical rim. The skin is carefully separated from the cartilage, sparing the perichondrium. One proceeds until the edge of the involved cartilage extrudes from the wound. The elevated cartilage can then be shaved flat with a scalpel or small scissors. After obtaining immaculate hemostasis the skin is folded back over the cartilage and reapproximated with fine 6-0 or 7-0 individual sutures. Occasionally one inadvertently cuts through the skin as one peels it away from the cartilage; these tiny defects can be easily closed with fine sutures. The reactive epidermal changes resolve spontaneously with time once the cartilage abnormality is corrected.

Other Operations

When chondrodermatitis nodularis is not located on the helical rim, the cartilage including most often the skin must be excised, and the defect should then be covered by a local flap.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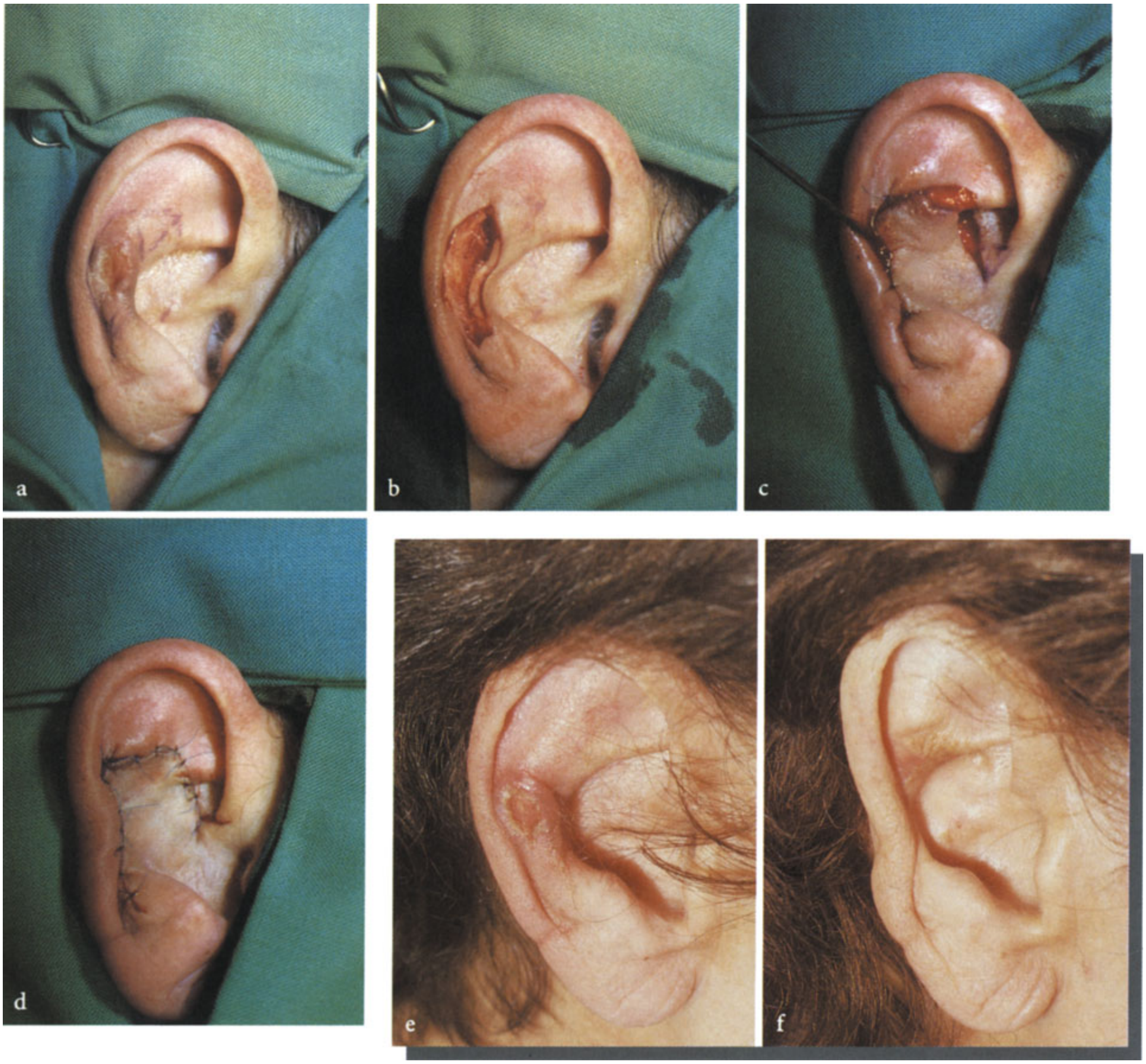


◁ **Fig. 344.** Subcutaneous cartilage excision in chondrodermatitis nodularis helicis

a Typical appearance of chondrodermatitis nodularis helicis marked on superior aspect of helix
b Operative plan for incision in retroauricular area just beneath rim of helix
c Dissection anteriorly to cartilage
d,e Exposure and excision of involved cartilage
f End of operation
g Preoperative appearance
h Appearance after 6 weeks

Fig. 345. Rotation flap to repair chondrodermatitis nodularis helicis in atypical location

a Recurrent chondrodermatitis nodularis of antihelix, with operative plan
b Defect after excision of skin and cartilage
c Posterior movement of rotation flap
d End of operation
e Preoperative appearance
f Appearance after 8 months

19.11 Neck and Nape

Both the anterior and the posterior neck provide abundant skin to allow simple closures of fairly large defects. Nonetheless there are a number of unique anatomic and functional features that restrict the flexibility. The crucial feature is that the mobility of the head must not be restricted. Similarly, the neutral position of the neck should not be distorted by contraction of a scar or because of excessive tissue loss.

19.11.1 Anatomy

The topographic anatomy of the anterior and lateral aspects of the neck is unique in regard to the layers of the fasciae, the presence of the platysma, and the superficial location of some large vessels (Fig. 346). The cervical fascia refers to three separate layers of fascia which divide the anteriolateral neck into compartments. The superficial lamina lies just beneath the platysma and is attached to the sternum and clavicles. Laterally it fuses with the sternocleidomastoid muscle and then moves posteriorly to form the nuchal fascia. We view the superficial lamina as the border for dermatologic surgery in the neck region. The external jugular vein lies superior to this fascia; in its cranial position the vein lies anterior to the sternocleidomastoid muscle while caudally it moves behind the muscle. In a cranial and ventral direction from the sternocleidomastoid muscle, the carotid triangle contains the crucial complex of the common carotid artery, the external jugular vein, and the vagus nerve, all of which the dermatologic surgeon must avoid. The caudal branch of the facial nerve passes along the superior border of the carotid triangle. Medially the hyoid bone and the thyroid cartilage are just below the superficial lamina. Laterally the thyroid cartilage is covered by the sternohyoid and sternothyroid muscles. Caudally the thyroid gland lies above the trachea; its median part is particularly superficial. Lateral to the sternocleidomastoid muscle the branches of the cervical plexus fan out. In addition, the spinal accessory nerve runs in a dorsolateral direction through this region. The skin on the nape is much thicker and has a richer supply of subcutaneous fat, which is separated from the neck muscles by the superficial lamina.

19.11.2 Anesthesia

Nerve blocks are impossible in this region. We prefer general anesthesia to a large amount of local anesthetic.

19.11.3 Planning the Operation

The skin of the lateral and anterior neck is thin and easily movable; in older individuals it is generally present in excess amount. It therefore offers a reserve of tissue. The skin lines run horizontally here. Undermining should be carried out just at the dermal-subcutaneous fat junction to avoid damaging the platysma and to preserve the vital structures lying above the superficial lamina of the cervical fascia.

When working on the posterior neck, one must be sensitive to the lack of extendibility. Even a relatively small defect, when closed, may hamper motion. One should consider the possibility of using tissue expanders when excising larger lesions in the area, as even well-planned flaps may interfere with function.

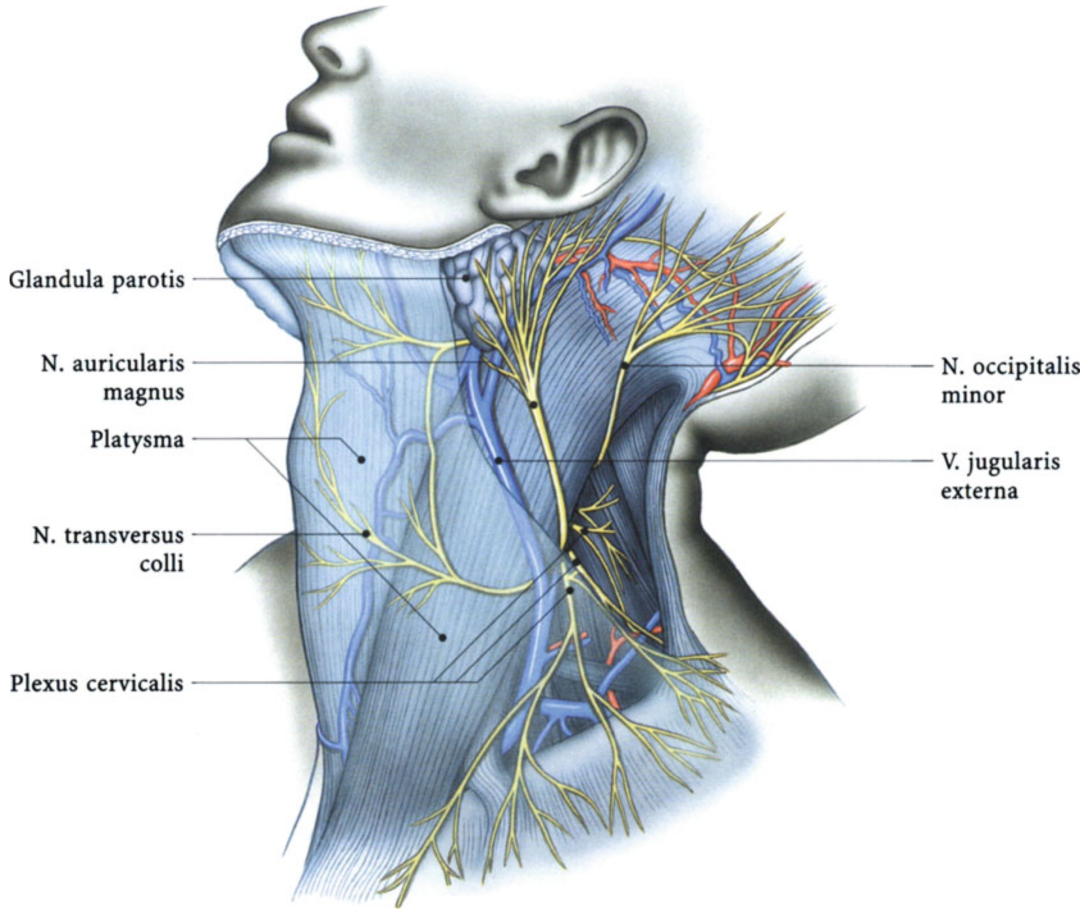


Fig. 346. Anatomy of the neck

19.11.4 Surgical Techniques

After excising a tumor on the neck, one must attempt to replace not only the skin but also the missing subcutaneous tissue. Single- and double-rotation flaps as well as the rhomboid flaps of Limberg and Dufourmental work very well here. On the lateral aspects of the neck one can often swing a bilobed flap from the shoulder region. Skin grafts do not offer good cosmetic results on the neck.

On the nape one can close lesions of up to about 3 cm with adequate undermining or a WY-plasty. Here, however, one must undermine extensively, often encountering marked bleeding. Large defects can occasionally be covered with a skin graft.

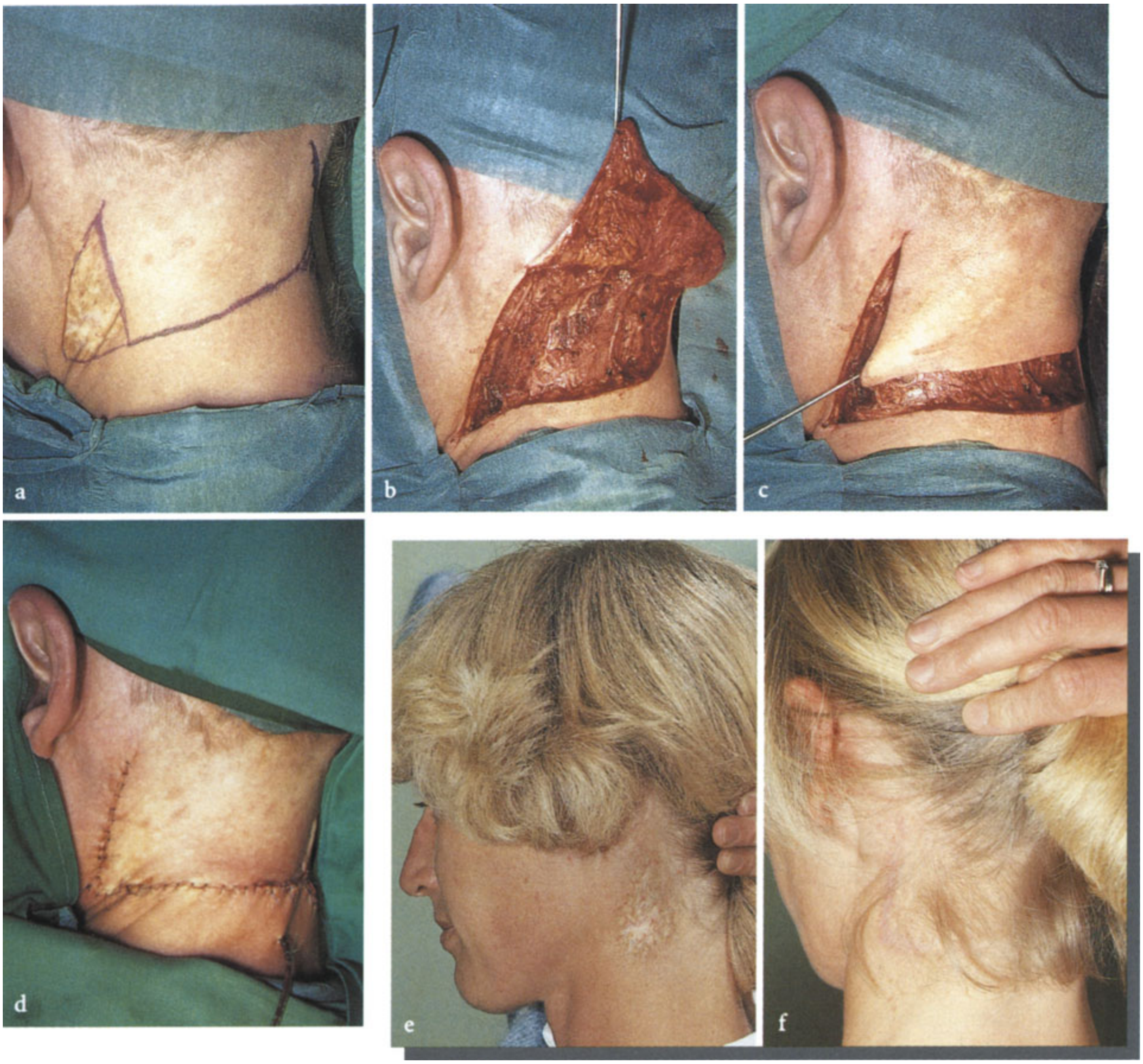


Fig. 347. Rotation flap
a Operative plan to remove area of chronic radiation damage
b Excision of damaged skin and preparation of flap
c Moving the flap into place
d End of operation
e Preoperative appearance
f Appearance after 1 year

Fig. 348. Rotation flap
- **a** Defect after excision of large basal cell carcinoma, with operative plan
- **b** Mobilization and placement of large lateral rotation flap
- **c** End of operation
- **d** Appearance after 4 months
- **e** Preoperative appearance
- **f** Appearance after 4 months, close-up view; good cosmetic results and no impairment of function

Fig. 349. Bilobed flap
a Operative plan for removal of extensive basal cell carcinoma
b Defect after excision
c Operative plan for bilobed flap
d Moving the second flap into place
e Final skin closure; the dog-ear in the cranial part of the flap was left in place for 2 weeks so as to avoid compromising the vascular supply. It was repaired in a second operation
f Appearance after 3 months

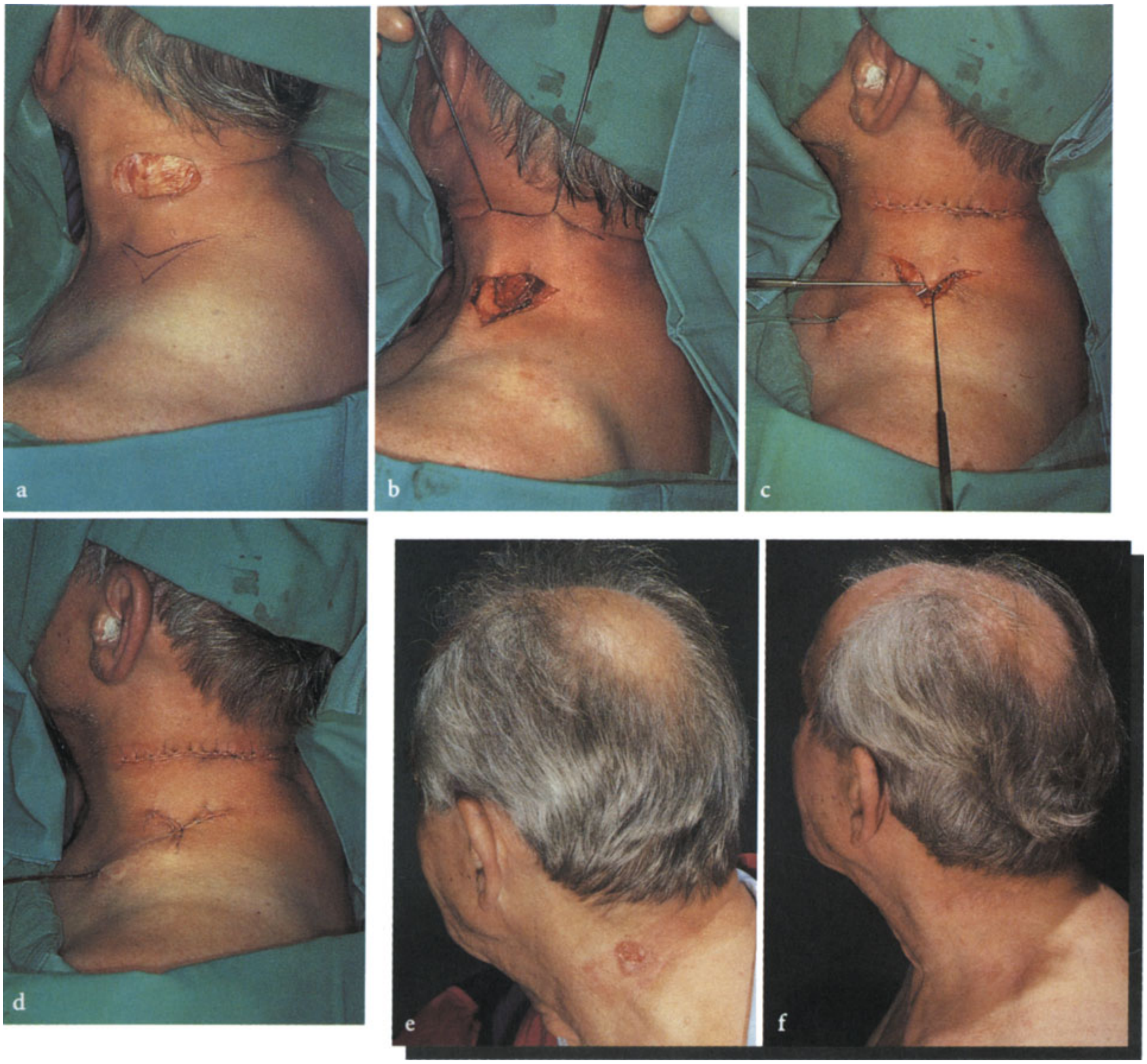


Fig. 350. Bridge flap (bilateral stalked flap)
a Defect after excision of basal cell carcinoma, with operative plan to include a VY-plasty laterally to form a bridge flap
b Moving the bridge flap into place
c Closing the WY defect
d End of operation
e Preoperative appearance
f Appearance after 4 months

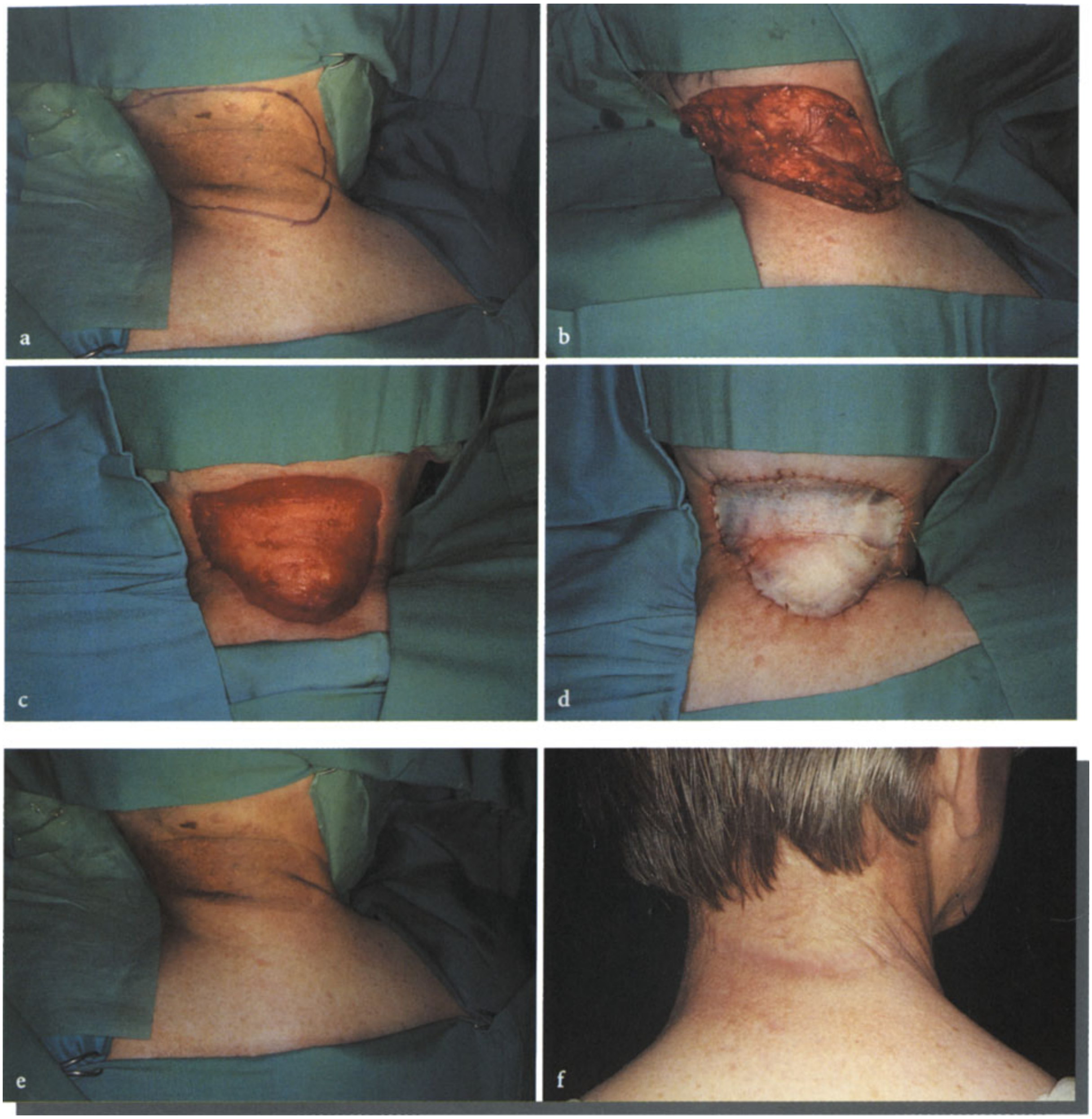


Fig. 351. Split-thickness skin graft
a Operative plan for removal of a congenital melanocytic nevus
b Excision defect
c Wound bed after conditioning
d Placement of a two-part split-thickness skin graft
e Preoperative appearance
f Appearance after 1 year

20 Trunk

20.1 Breast, Abdomen, Back, and Buttocks

Most dermatologic procedures in these areas can be closed primarily after adequate undermining. When operating over the spine, clavicles, and sternum, one often must employ a flap because the skin here is tight and lacks mobility. One must also remind the patient that scars on the trunk are generally not as elegant as those on the head and neck, despite optimal surgical technique and correct closure. Because of wound tension, often exaggerated by muscular action, wounds tend to dehisce and may become hypertrophic. Dehiscence is a particular problem with muscular athletes, especially over the scapulae.

20.1.1 Anatomy

Skin and fat are generally separated from the underlying muscles by the fascia. The fascia is firmly attached to the vertebrae in the back, blending into the nuchal fascia superiorly and attaching to the iliac crests inferiorly. The vascular and nerve supply is characterized by extensive networking, so that flaps do well, necrosis seldom occurs when an artery is cut, and even operative nerve defects are usually temporary. Thus it is best to develop flaps at the level of the fascia.

20.1.2 Anesthesia

Simple excisions are of course carried out under local anesthesia. Larger procedures require general anesthesia.

20.1.3 Planning the Operation

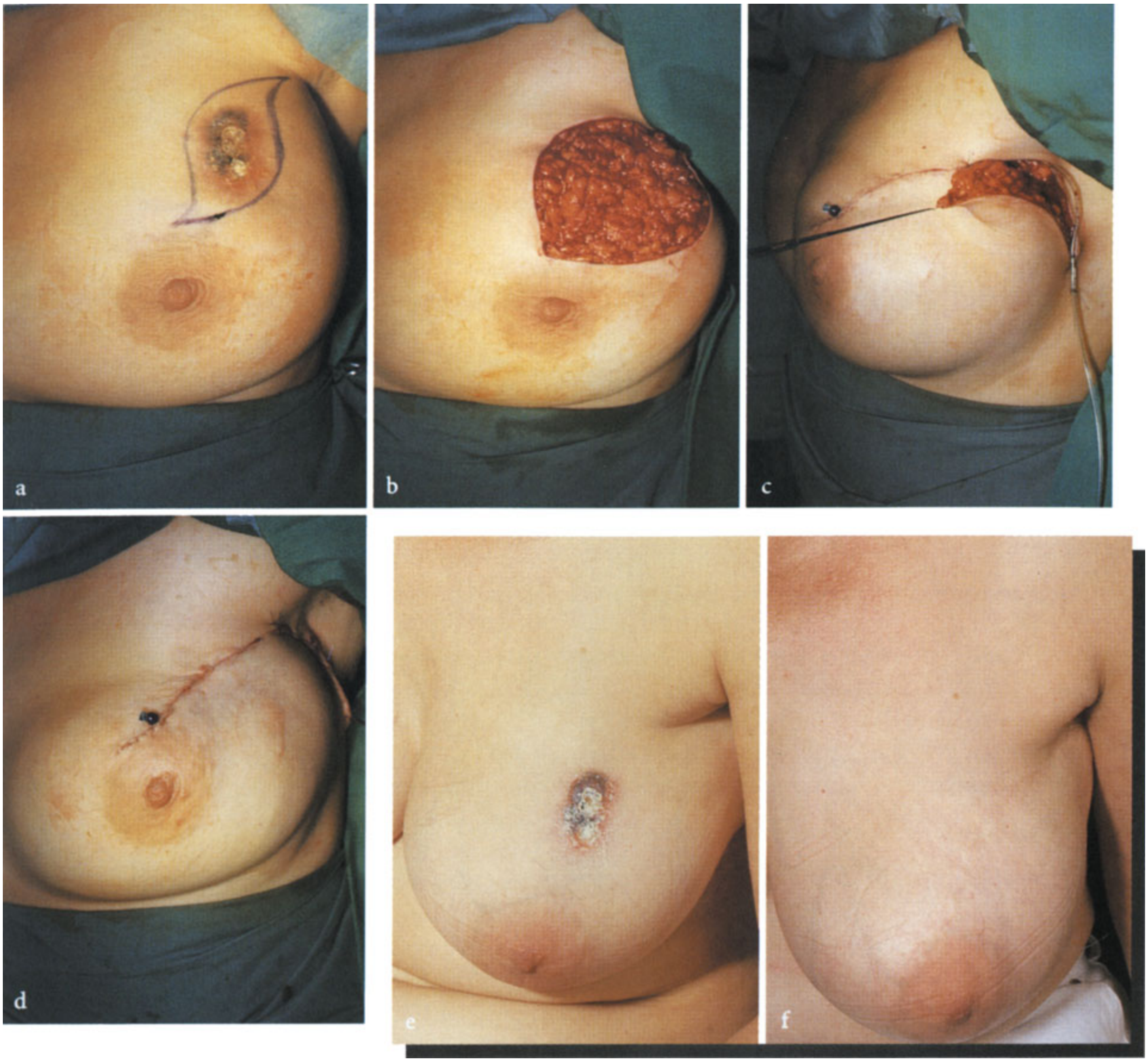
Most major dermatologic procedures on the trunk involve the excision of a malignant melanoma, with a resulting large deep defect as the excision is carried out down to the fascia. In the case of an en bloc excision of the primary tumor and regional lymph nodes the surgeon has little control over the skin defect as it is determined by the scintigraphic evaluation of lymphatic drainage. In any event, thought must be given to replacing the subcutaneous defect, not just pulling the skin together.

Large flaps should be planned with the base located dorsally to ensure maximum vascular supply. Subregions such as the abdomen, flank, and buttocks can be viewed as sites which provide a source of tissue for larger reconstructive procedures while aesthetic subunits such as the breast and décolletage should be avoided.

20.1.4 Surgical Techniques

On the back the placement of adequate subcutaneous sutures is especially important to prevent dehiscence. If a wound cannot be closed without tension, one should either use a local flap or consider a graft. A wound on the back that has been closed under tension invariably produces an unacceptable scar. When grafts are performed, the wound should be conditioned, allowing granulation tissue to fill the deeper part of the defect before the graft is placed.

In the sacral region one is often confronted with lesions containing fistula tracts, such as acne inversa scars and pilonidal cysts. We



like to mark the sinus tracts by injecting them with methylene blue dye. Excision is then carried out beyond the reaches of the tracts, often down to the sacrum. After obtaining hemostasis the defect can generally be closed with a local flap, often from the buttocks. This approach allows faster healing and a shorter hospital stay than the traditional technique of secondary healing. In addition, the cosmetic results are better. If the operation is sufficiently radical and the disease process no longer active, recurrence rates are low.

Fig. 352. Primary closure with undermining
a Operative plan for excision of radiation ulcer
b Excision defect
c Closure beginning medially, with lateral extension of the excision to allow tension-free closure
d End of operation
e Preoperative appearance
f Appearance after 4 years

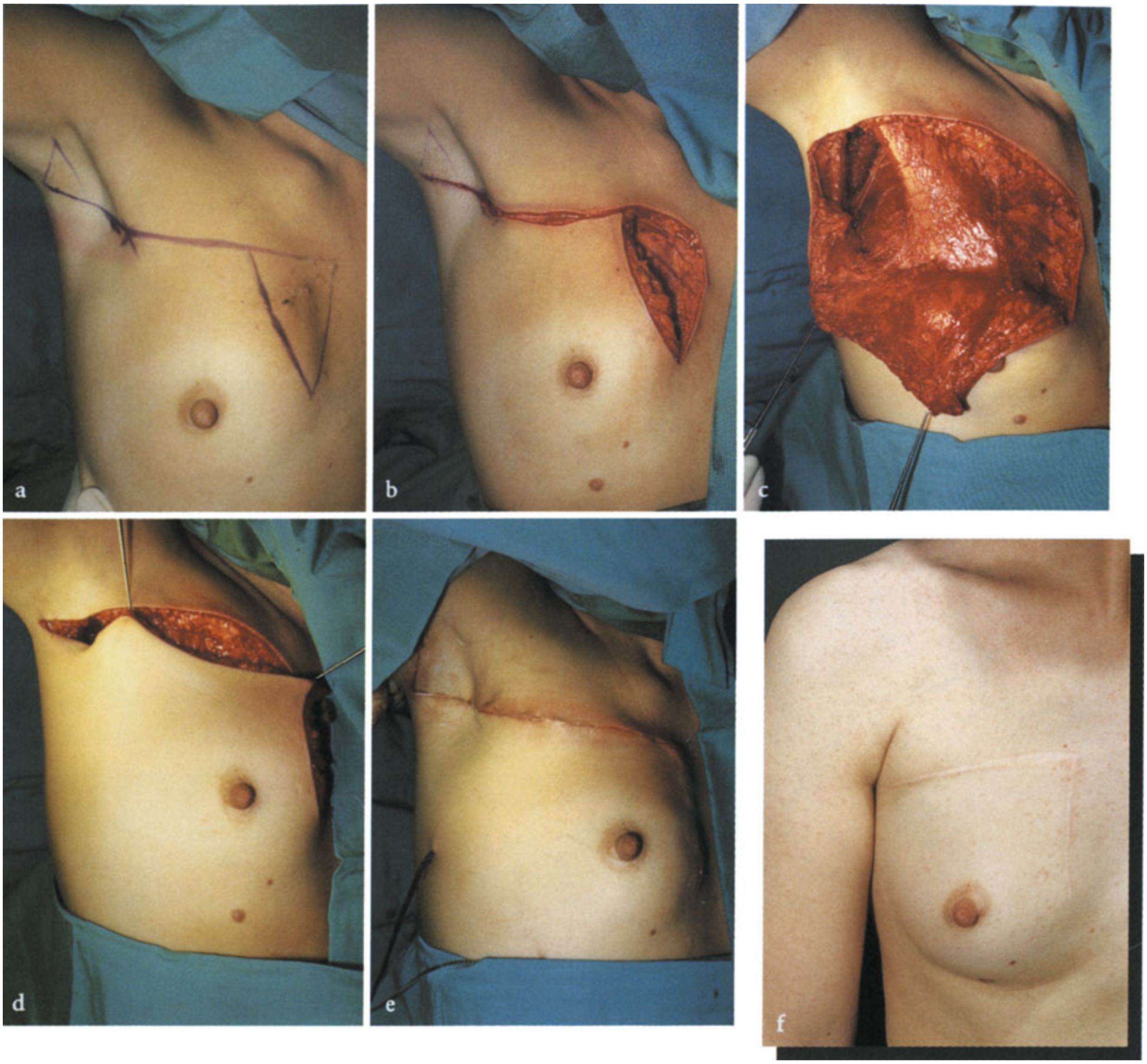


Fig. 353. Advancement flap
a Operative plan for reexcision of a malignant melanoma with axillary lymph node dissection
b Triangular excision in area of breast and horizontal incision to axilla where Burow's triangle is located
c Appearance after lymph node dissection and preparation of flap
d Advancing flap into place
e End of operation
f Appearance after 1.5 year

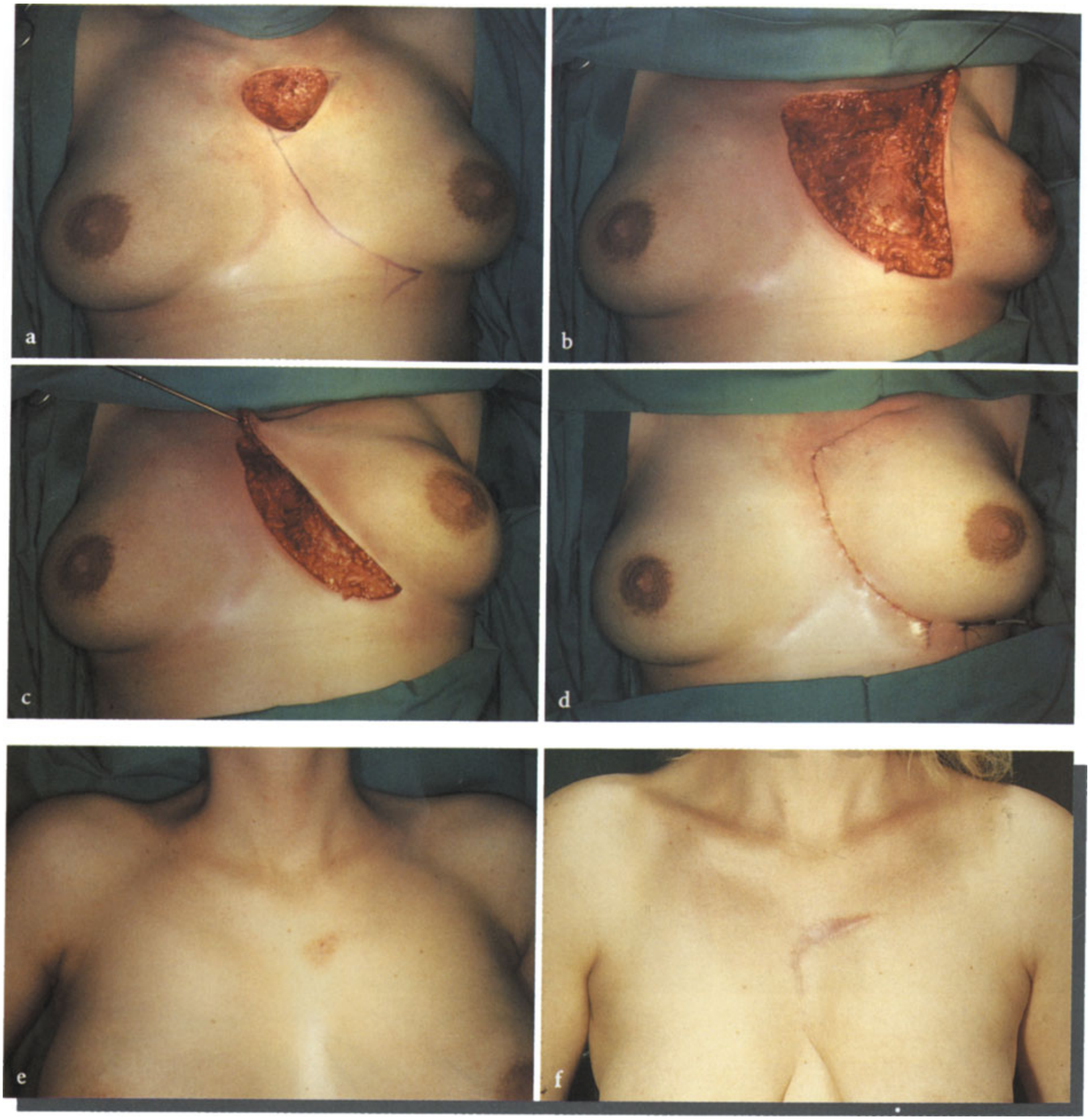


Fig. 354. Rotation flap
a Defect after excision of a poorly differentiated carcinoma, with operative plan
b Mobilization of rotation flap
c Rotating flap into place
d End of operation
e Preoperative appearance
f Appearance after 1 year

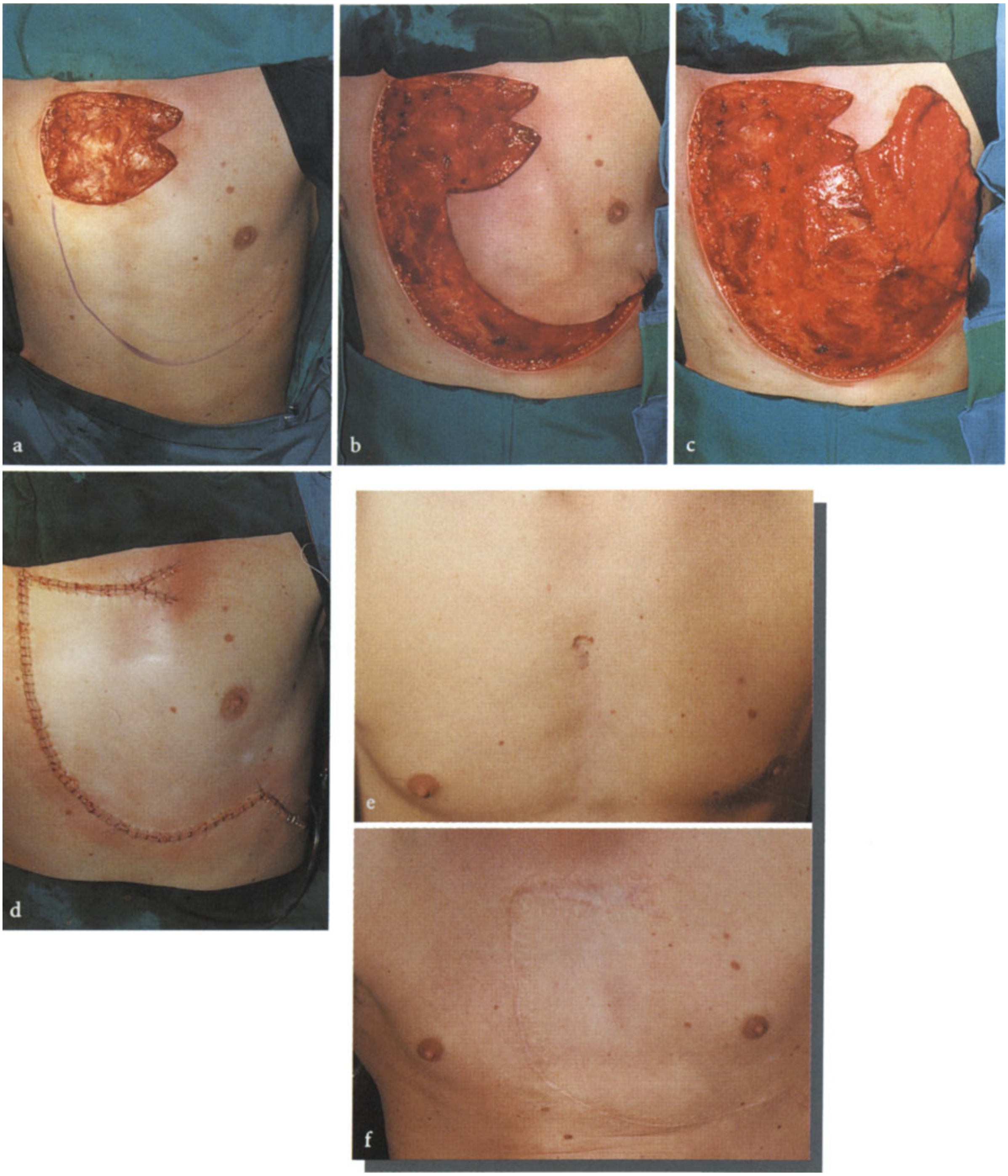


Fig. 355. Rotation flap combined with WY-plasty
a Defect after reexcision of malignant melanoma, with operative plan
b Preparation of rotation flap
c Complete mobilization of flap
d Final closure, including WY-plasty of primary defect
e Preoperative appearance
f Appearance after 3 years

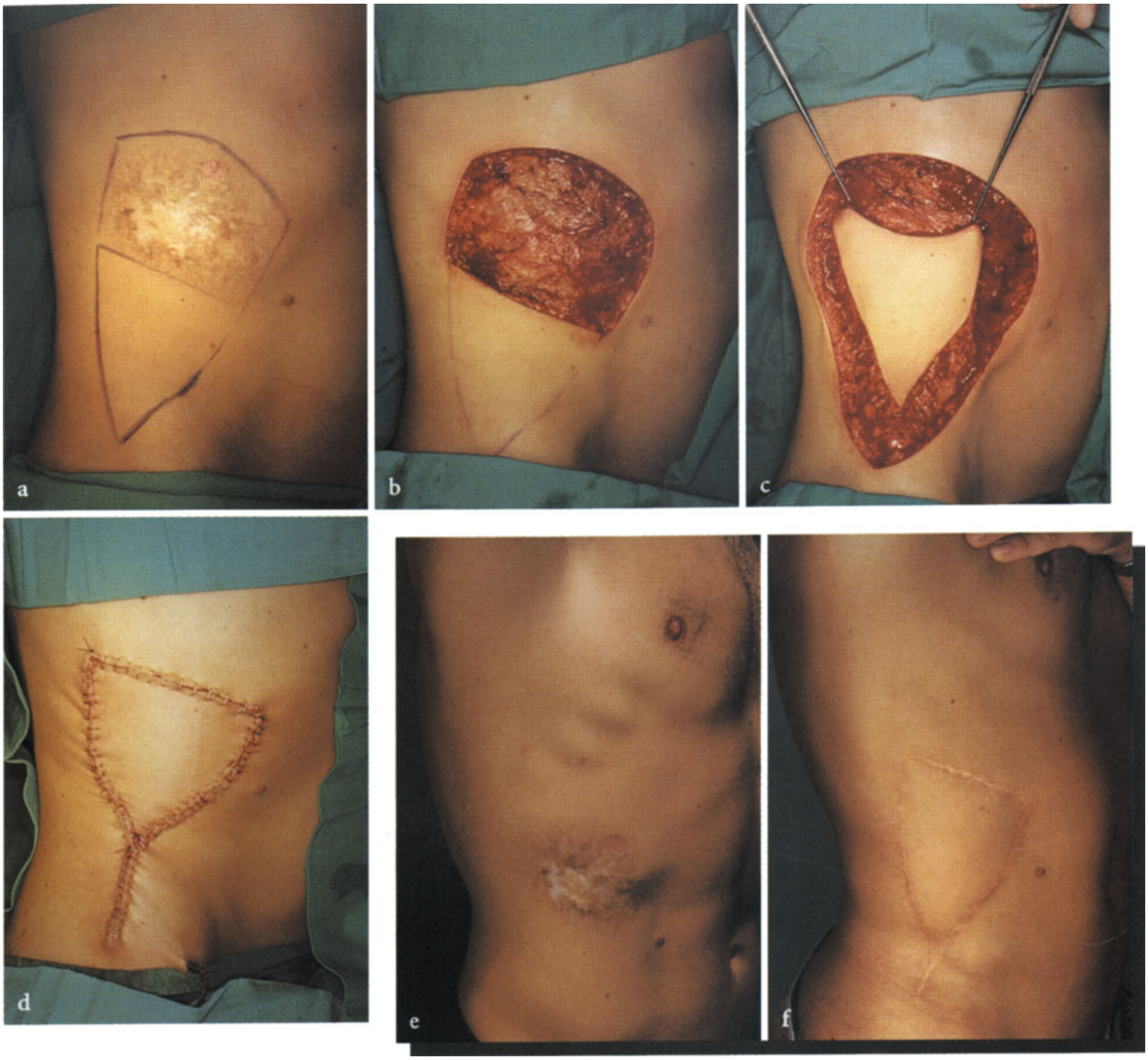


Fig. 356. Subcutaneous pedicle flap
a Operative plan for excision of chronic radiation damage on lateral chest wall
b Excision defect
c Preparation and movement of subcutaneous pedicle flap, avoiding damage to the vascular supply
d End of operation
e Preoperative appearance
f Appearance after 2.5 years

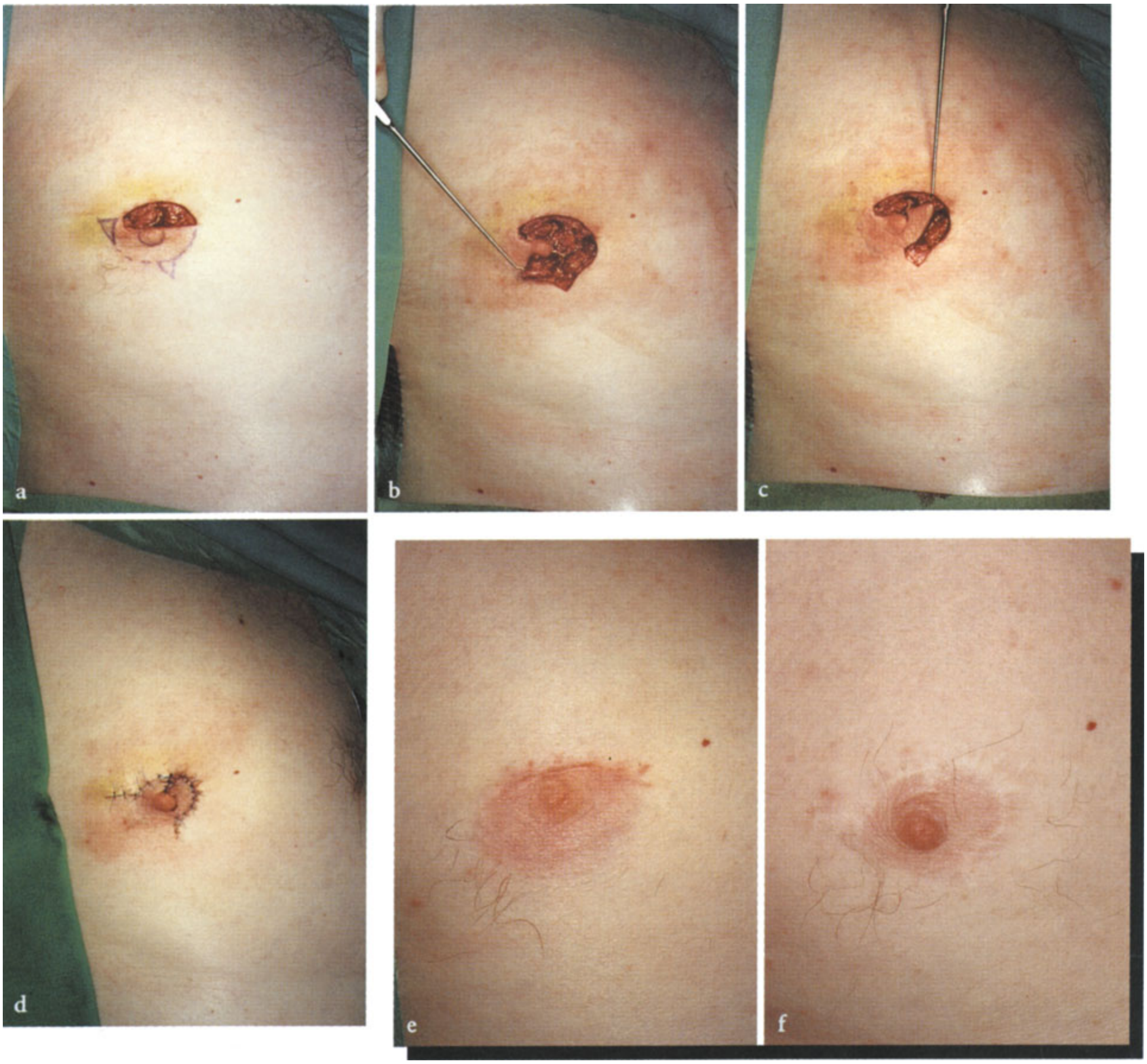


Fig. 357. Areolar rotation flap
a Defect after reexcision of a basal cell carcinoma, with operative plan
b Excision of the first Burow's triangle and preparation of areolar flap
c Rotating the flap into place
d Appearance after excising the second Burow's triangle and closure
e Preoperative appearance
f Appearance after 1.5 years

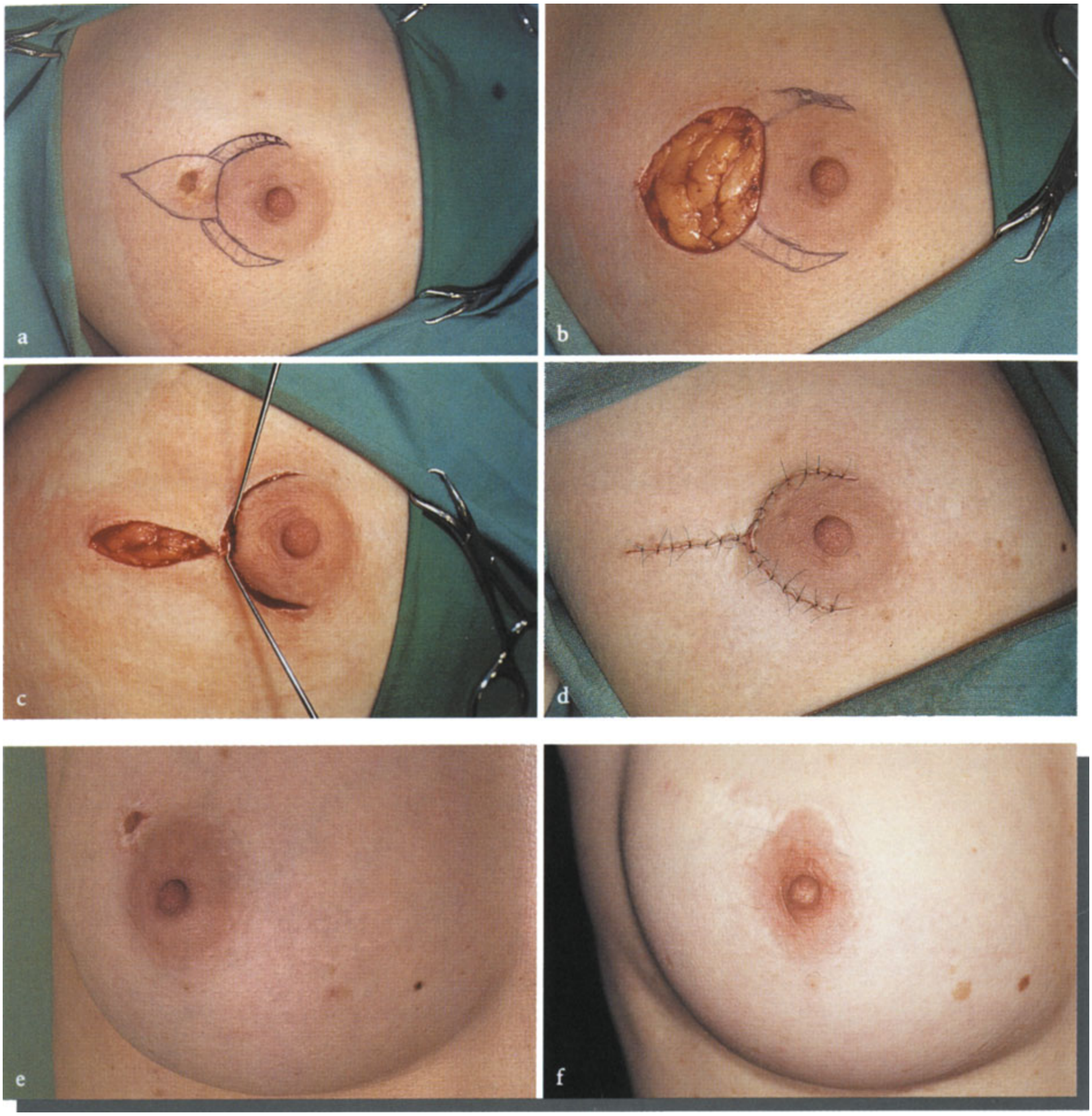


Fig. 358. Bilateral advancement flap with crescentic relaxing incisions

a Operative plan for excision of a periareolar melanocytic nevus which was irradiated during childhood
b Excision defect
c Moving the two flaps into place
d End of operation
e Preoperative appearance
f Appearance after 4 years

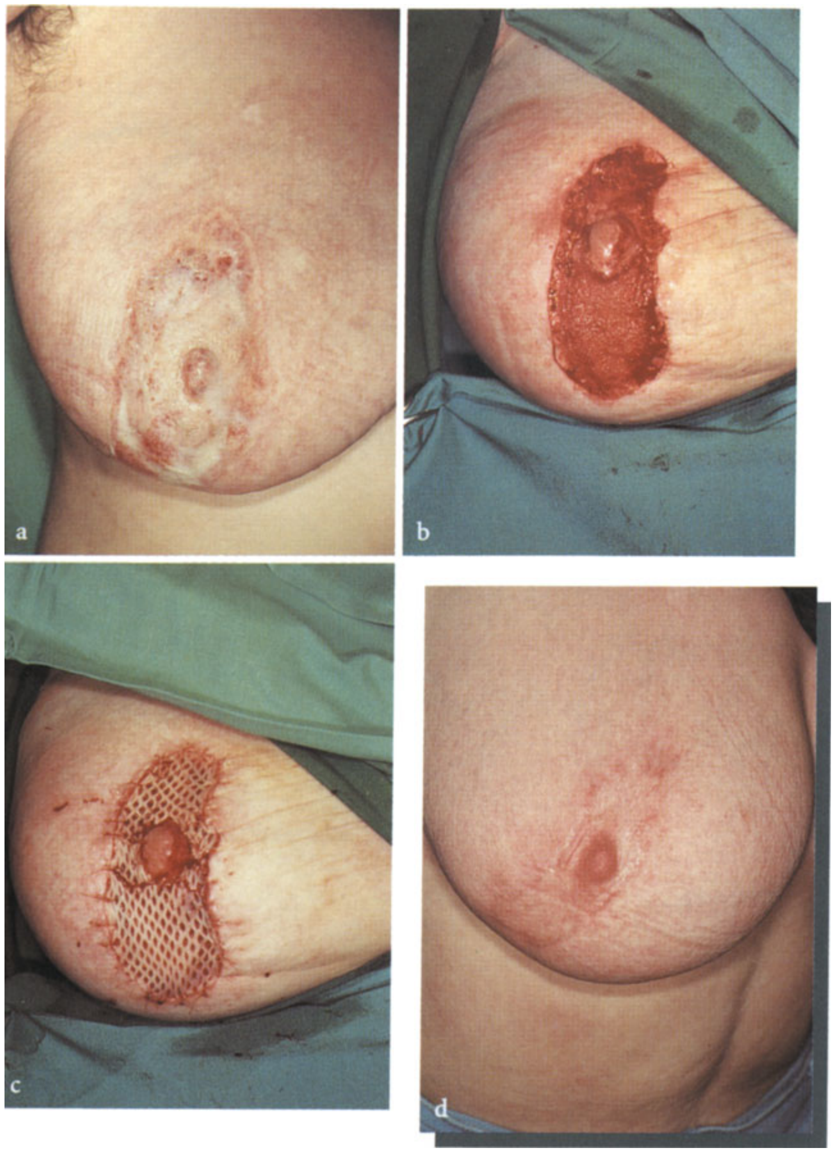


Fig. 359. Mesh split-thickness skin graft
a Appearance after 3° burn
b Wound bed after débridement of necrotic tissue and conditioning
c Mesh graft in place
d Appearance after 6 months

Fig. 360. Primary closure with undermining
a Abdominal fibromatosis
b Defect after excision down to fascia
c Multilayered closure
d Appearance after 5 months

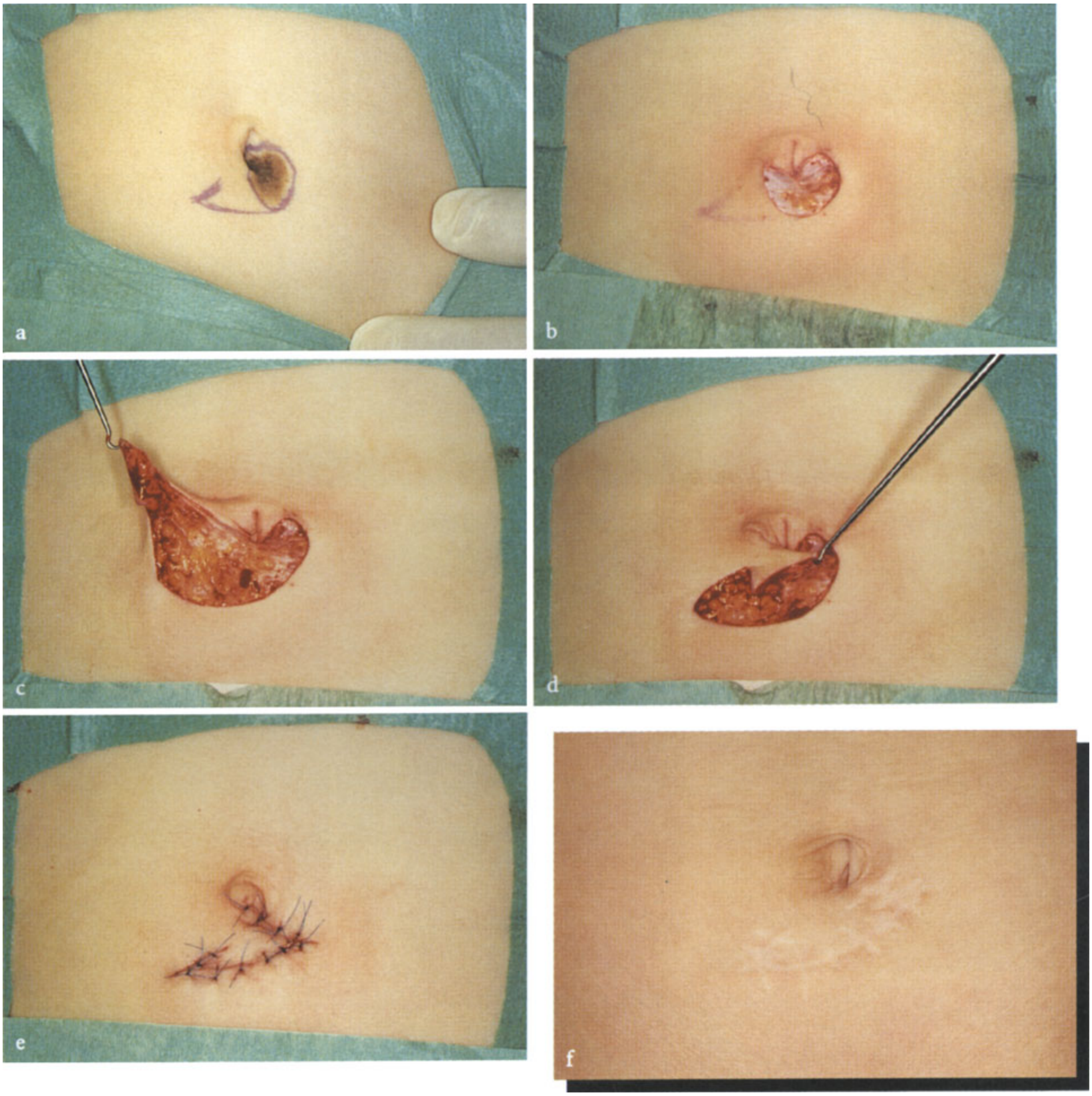


Fig. 361. Advancement flap with back cut
a Operative plan for excision of periumbilical congenital melanocytic nevus
b Excision defect
c Complete mobilization of advancement flap
d Moving the flap into place
e End of operation
f Appearance after 1.5 years

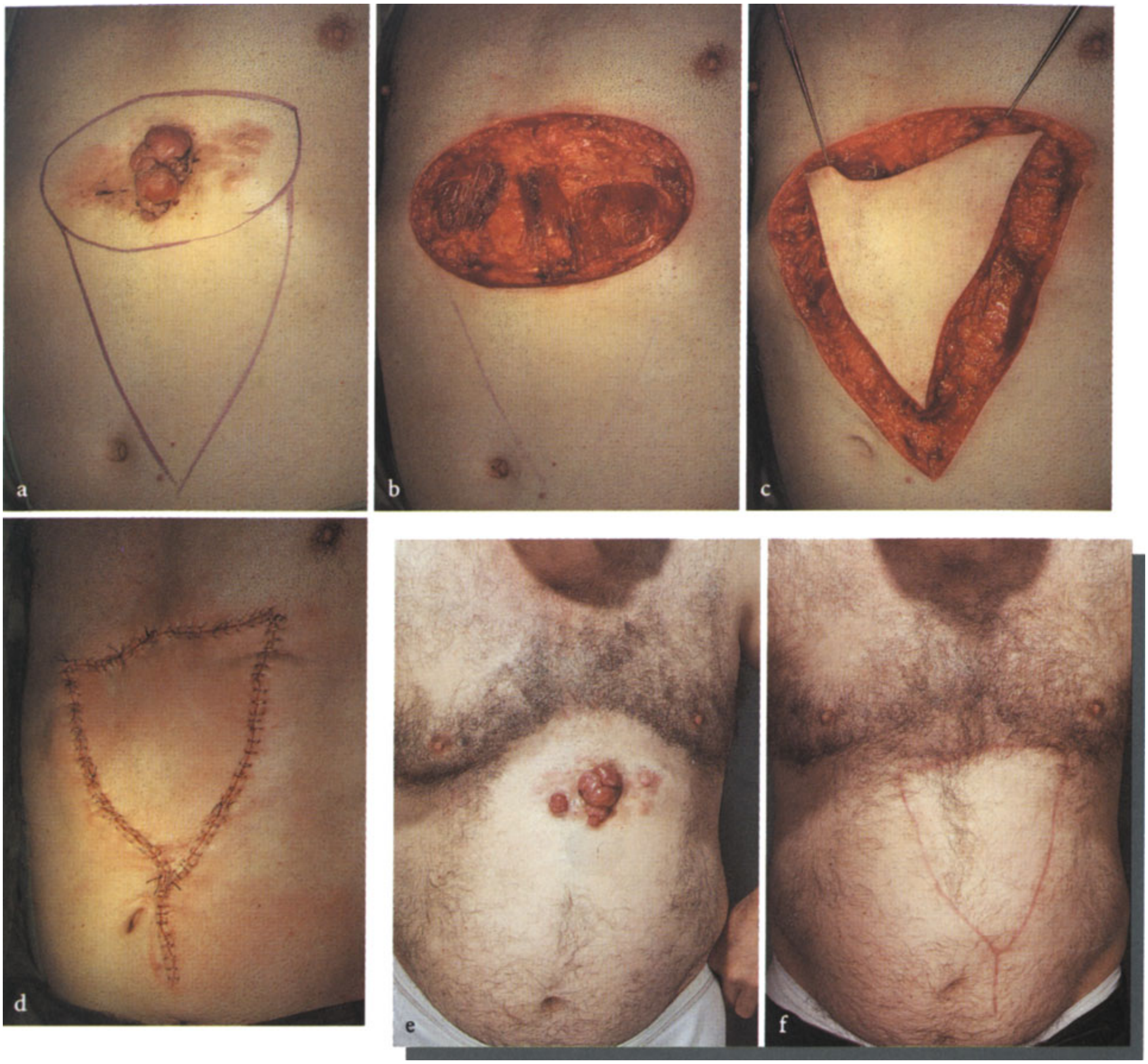


Fig. 362. Subcutaneous pedicle flap
a Operative plan for excision of dermatofibrosarcoma protuberans and repair
b Excision defect
c Preparing and moving the subcutaneous pedicle flap into place, avoiding damage to the vascular supply
d End of operation
e Preoperative appearance
f Appearance after 4 months

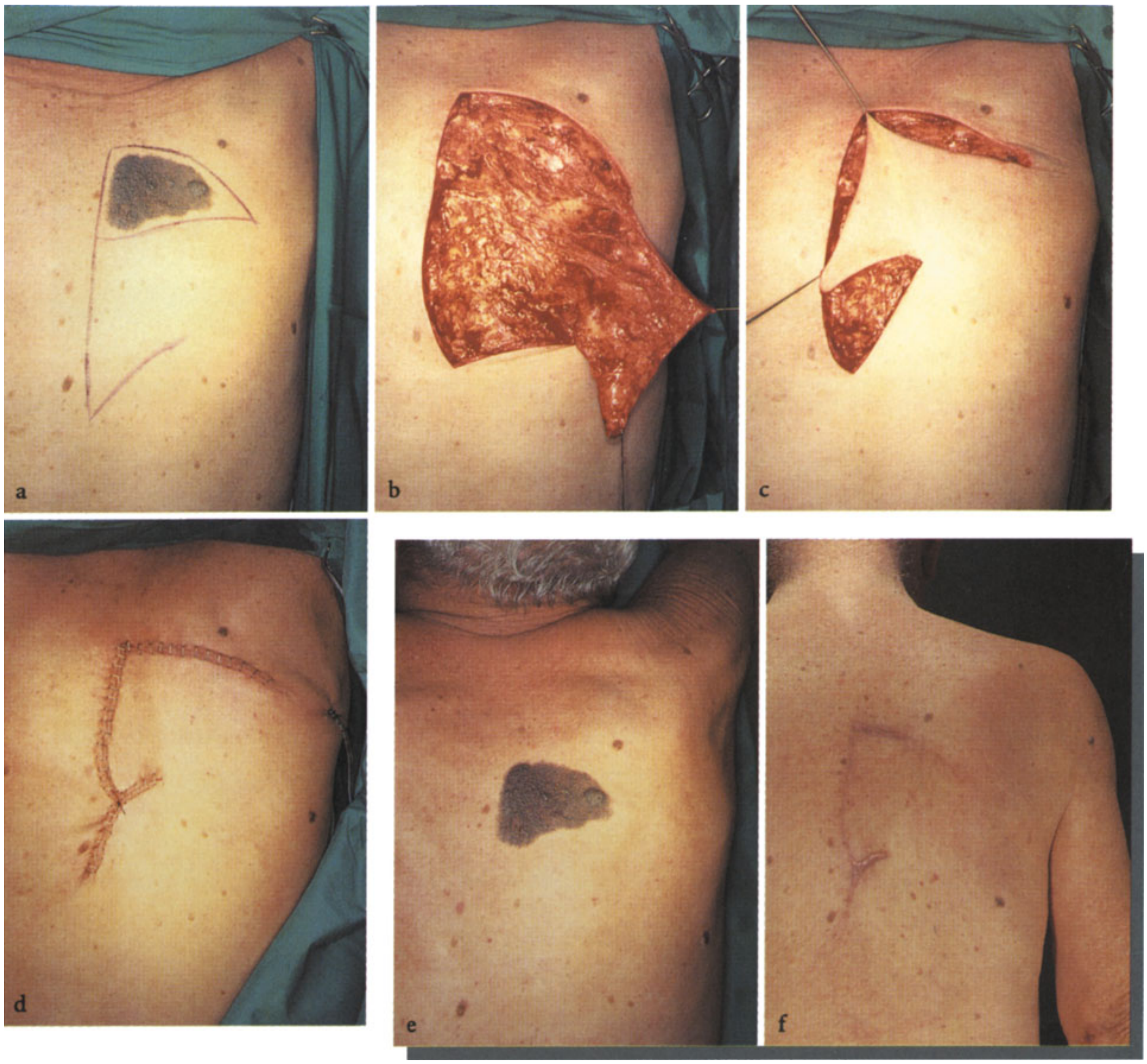


Fig. 363. Advancement flap with back cut
a Operative plan for removal of congenital melanocytic nevus
b Complete mobilization of the flap
c Advancing the flap into place
d End of operation
e Preoperative appearance
f Appearance after 6 months

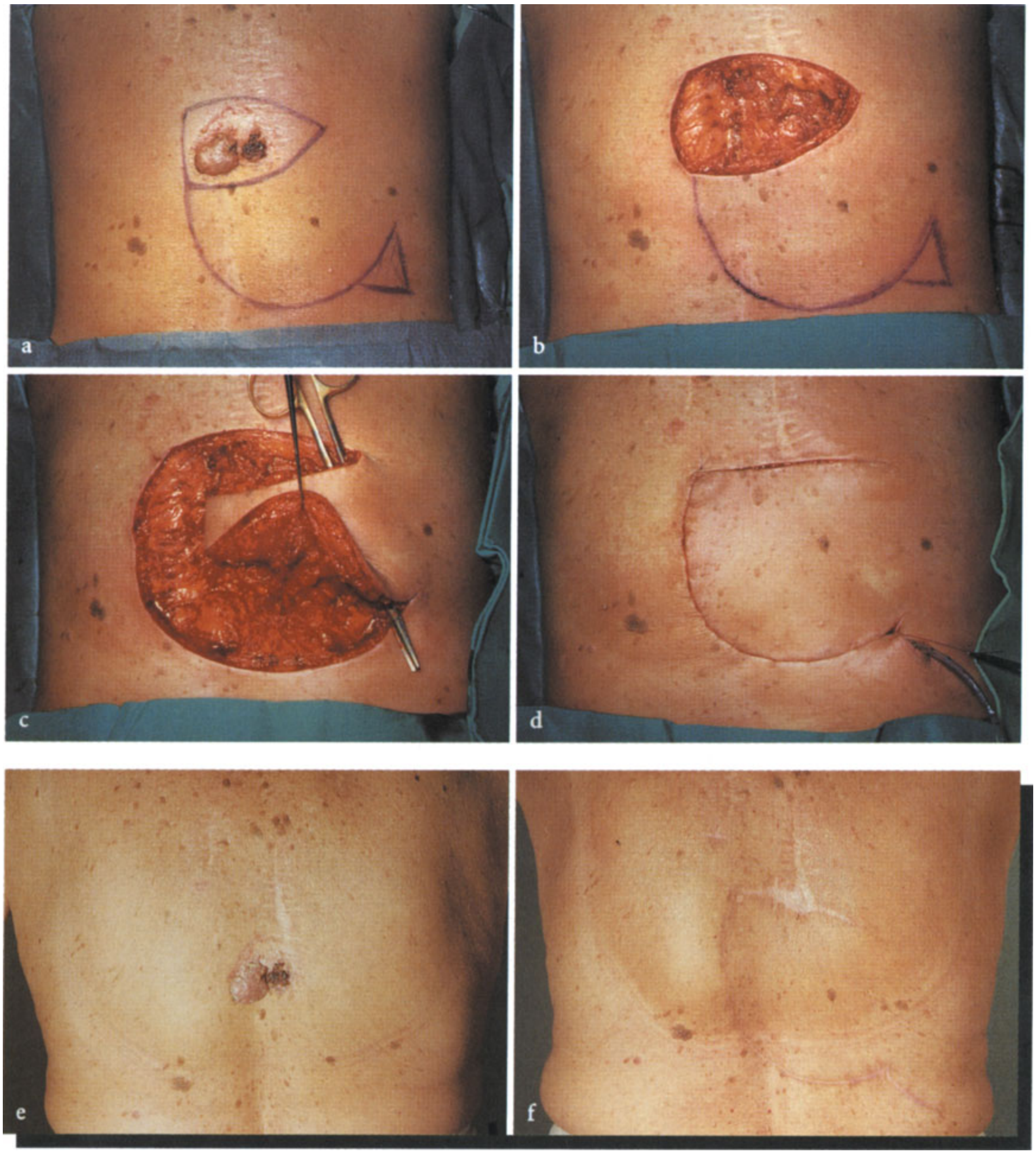


Fig. 364. Rotation flap
a Operative plan for excision of a recurrent basal cell carcinoma
b Excision defect
c Mobilization of the flap
d End of operation
e Preoperative appearance
f Appearance after 1.5 years

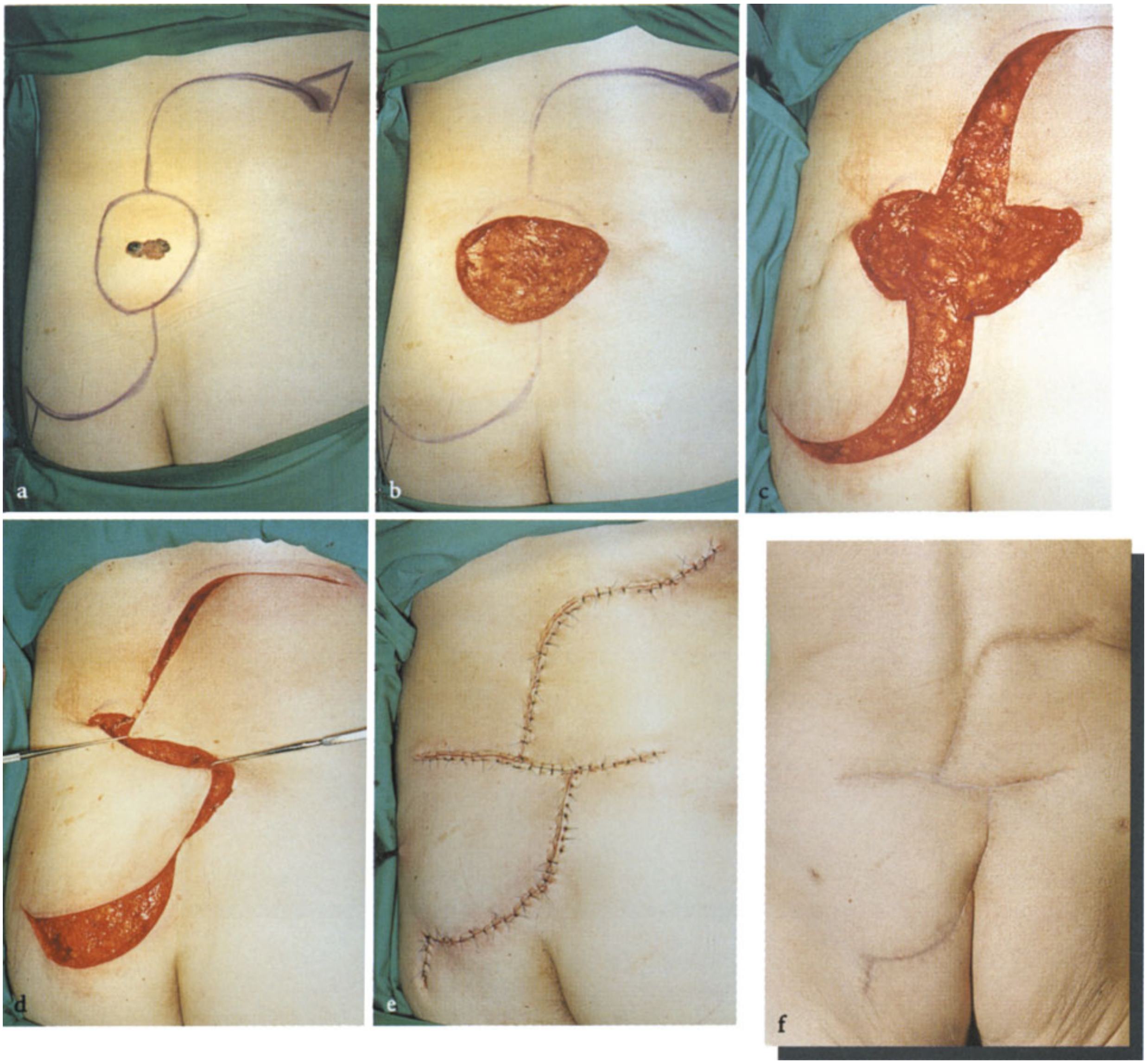


Fig. 365. Double rotation flaps
a Operative plan for wide local excision of malignant melanoma with reconstruction
b Excision defect
c Preparation and mobilization of both flaps
d Bringing the two flaps together
e End of operation
f Appearance after 6 months

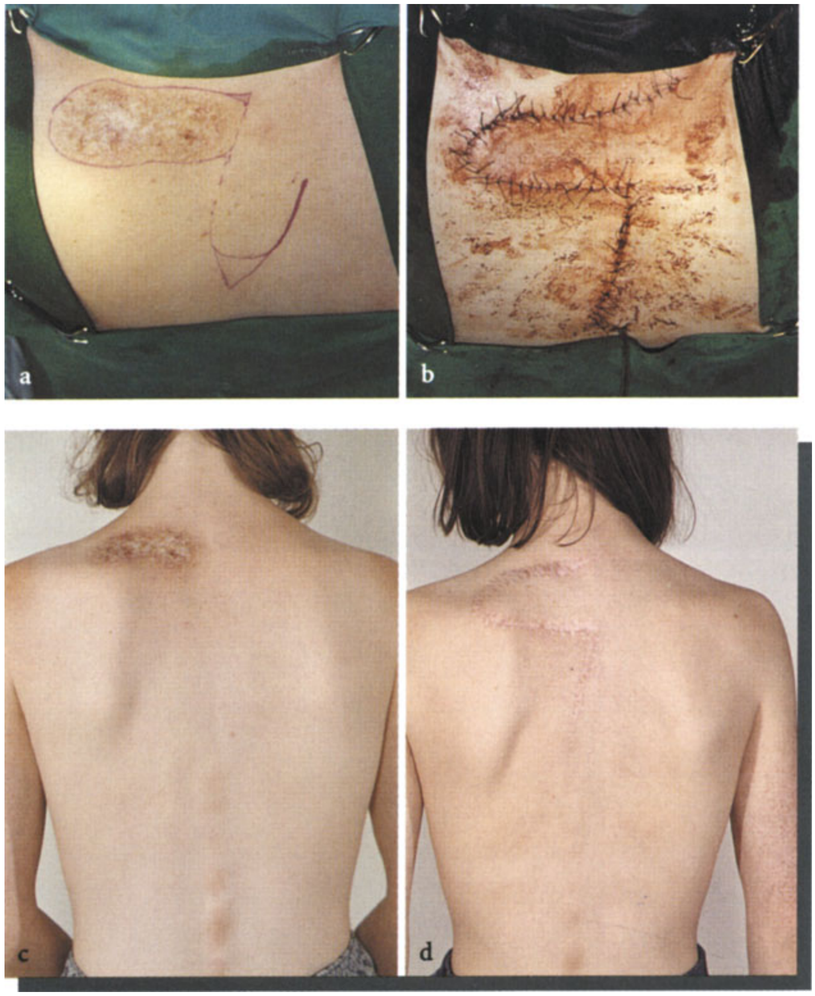


Fig. 366. Transposition flap
a Operative plan for excision of chronic radiation damage on back
b End of operation
c Preoperative appearance
d Appearance after 2.5 years

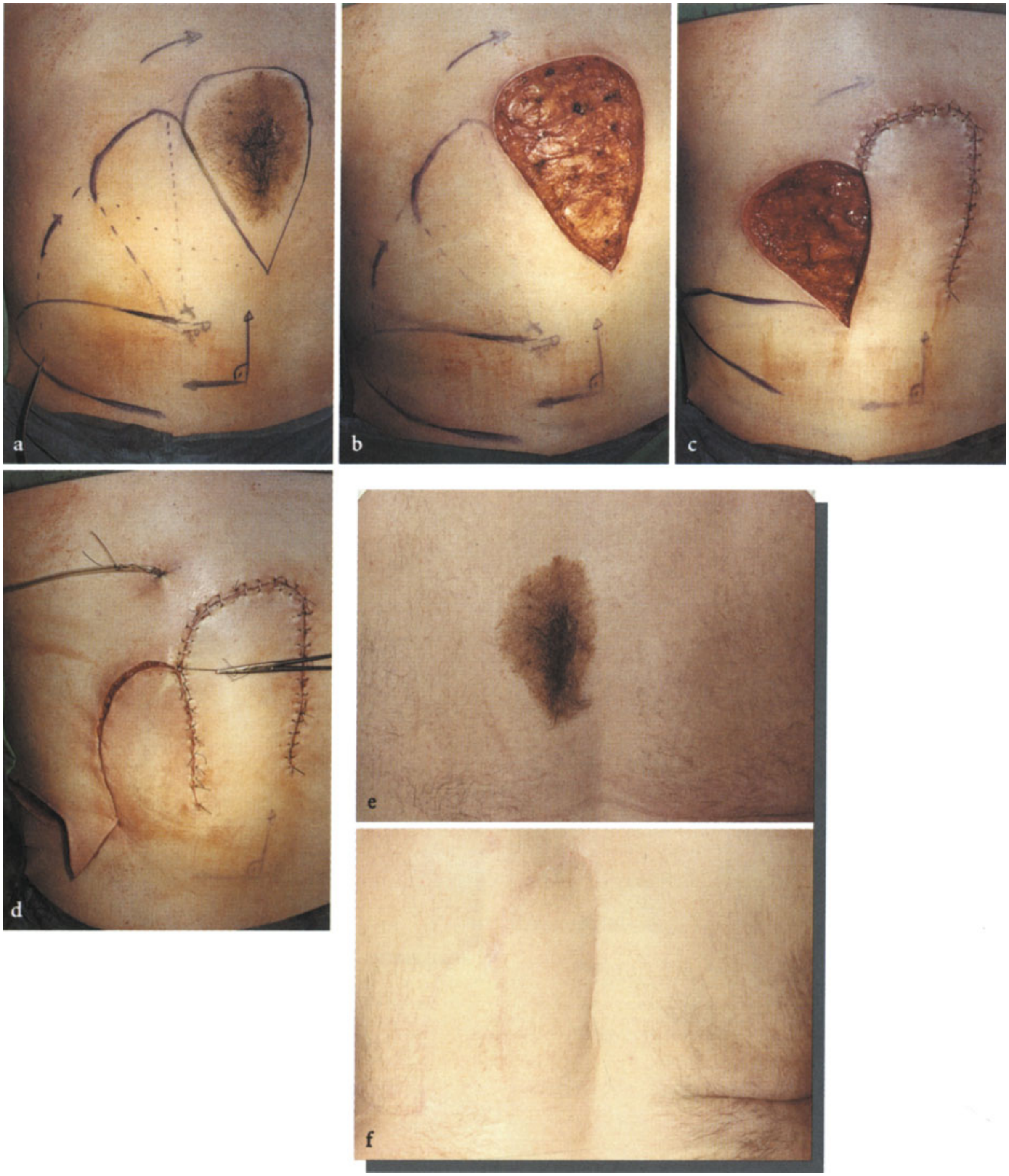


Fig. 367. Double transposition flap (bilobed flap)
a Operative plan for removal of a congenital melanocytic nevus
b Excision defect
c Appearance after first flap has been sewn in place
d Placement of second flap in defect left by first flap
e Preoperative appearance
f Appearance after 3 years

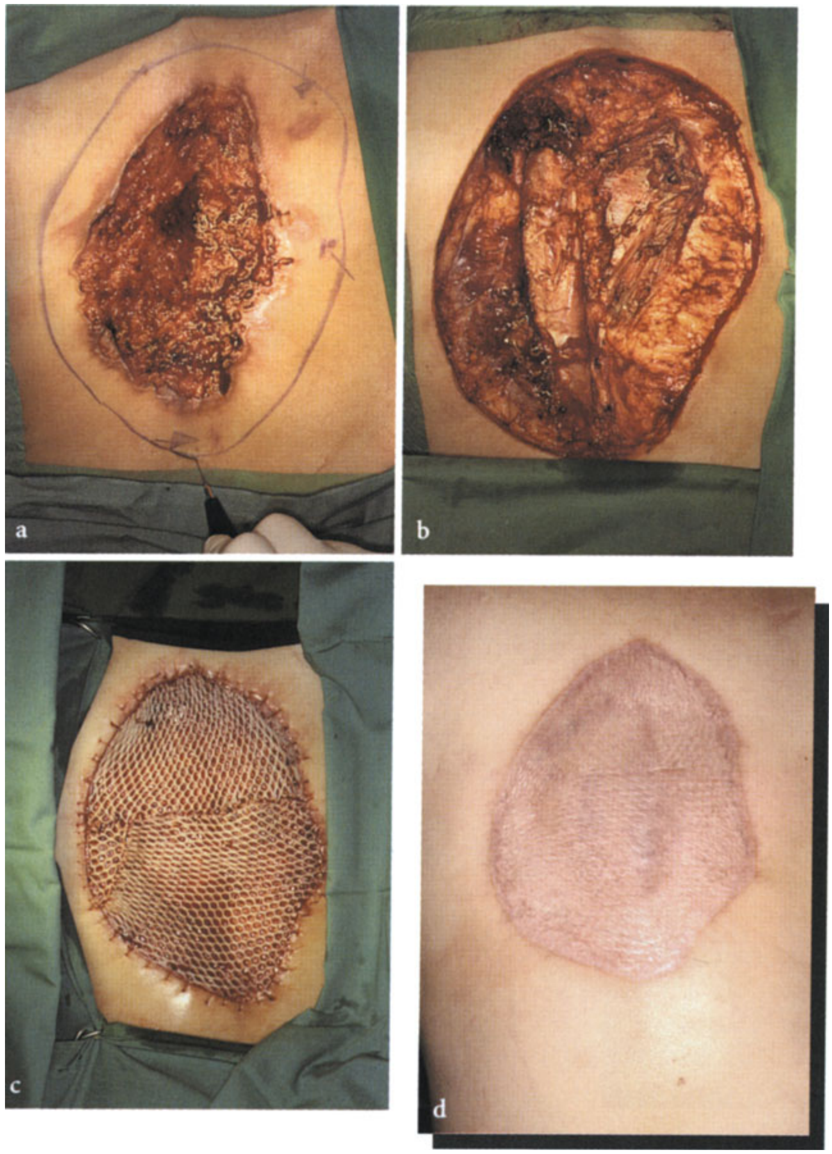


Fig. 368. Mesh split-thickness skin graft
a Operative plan for excision of a giant basal cell carcinoma
b Excision defect
c After wound conditioning, placement of a two-part split-thickness skin graft
d Appearance after 4 months

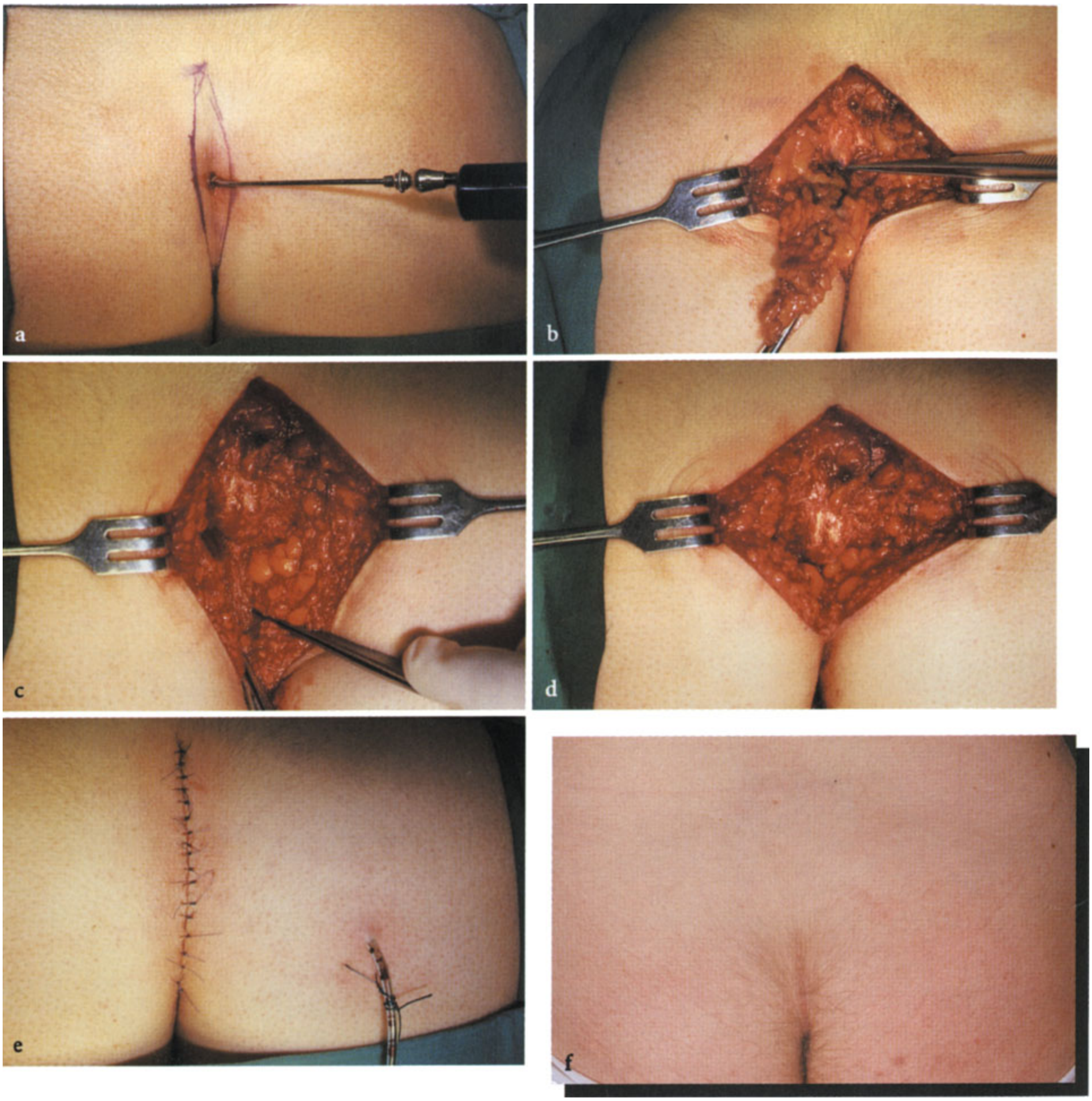


Fig. 369. Primary closure with undermining
a Marking a sacral pilonidal cyst, using methylene blue to track the sinuses
b Excising the blue areas
c Additional excision of residual blue areas
d Excision defect
e Final closure with suction drain
f Appearance after 6 months

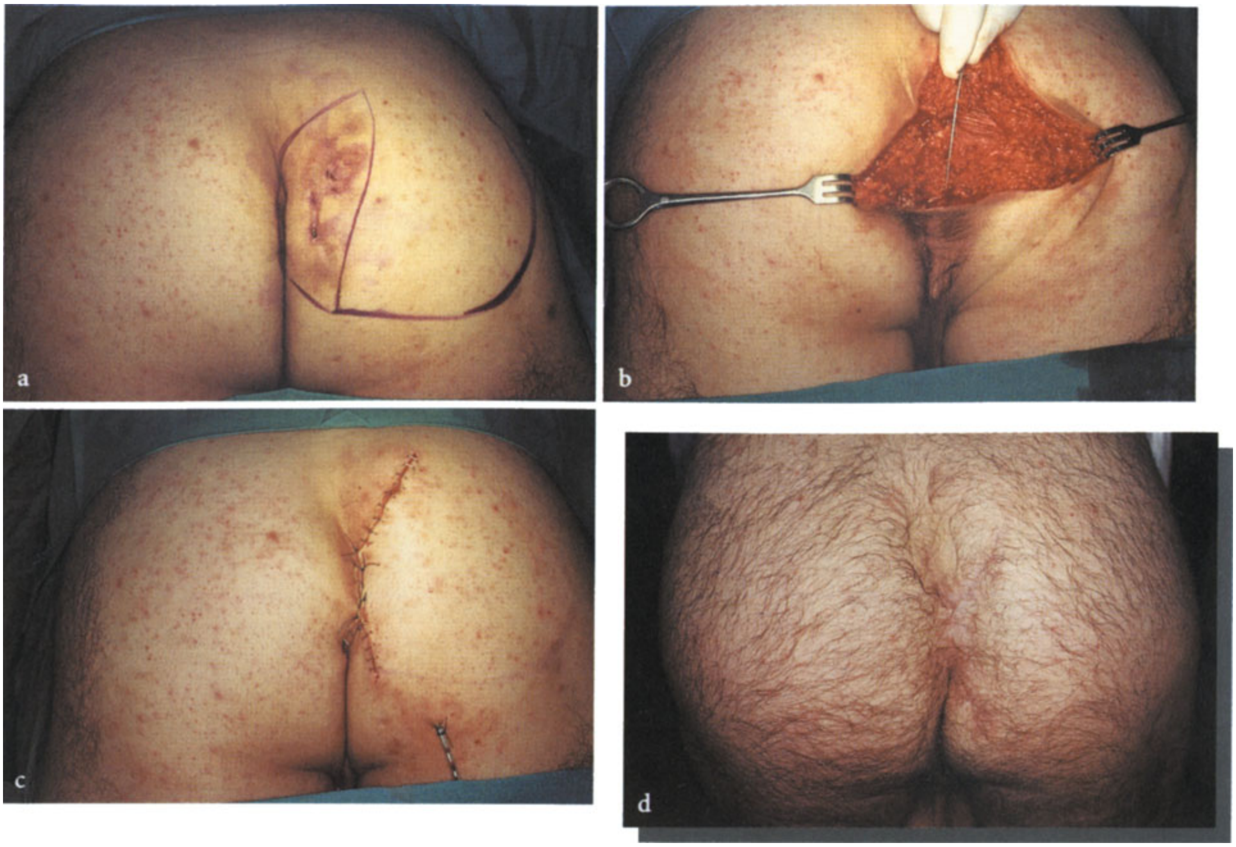


Fig. 370. VY-plasty
a Operative plan for excision of scarred sinus tracts in acne inversa
b Excision defect as additional sinus tracts are identified and excised
c Skin closure with VY-plasty; the planned rotation flap was not needed
d Appearance after 1 year

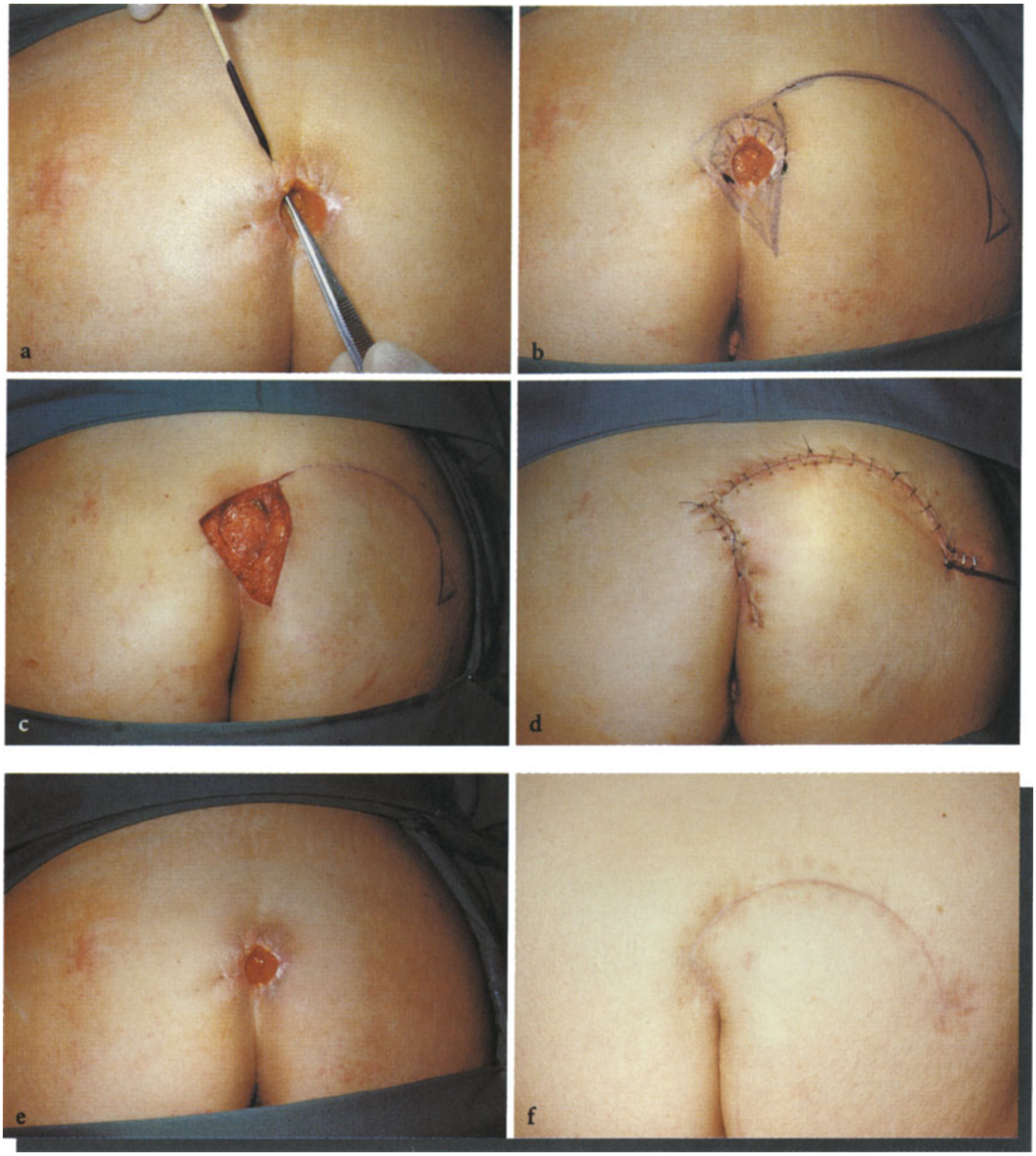


Fig. 371. Rotation flap
a Decubitus ulcer with undermined lateral wall
b Operative plan
c Excision defect
d End of operation
e Preoperative appearance
f Appearance after 3 months

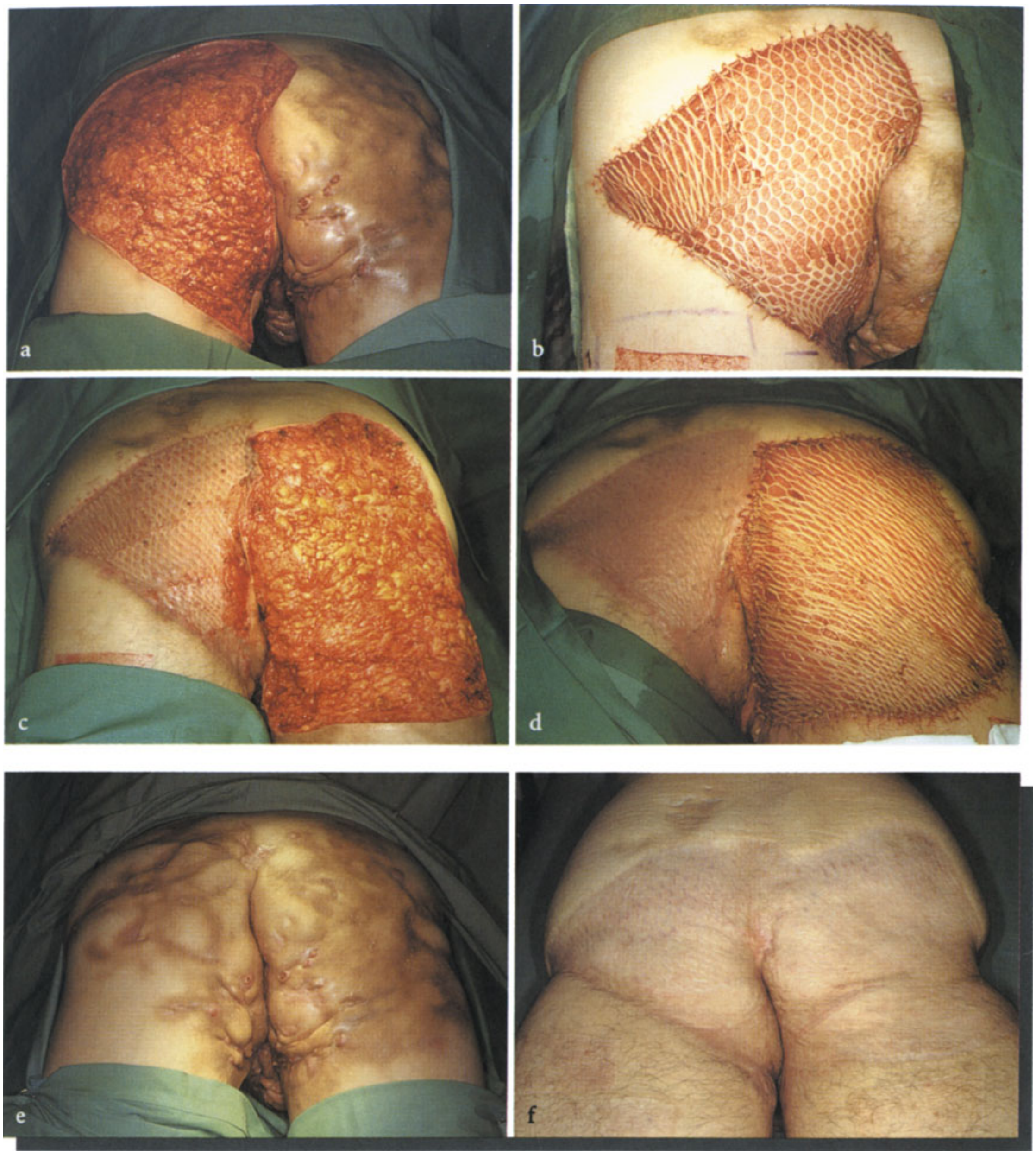


Fig. 372. Multiple mesh split-thickness skin grafts
a Severe acne inversa; defect after excision of one side of the buttocks with its multiple sinus tracts and scars
b After wound conditioning, application of first mesh graft
c Defect after contralateral excision (3 weeks after first operation)
d After another 4 weeks of wound conditioning placement of second mesh graft
e Preoperative appearance
f Appearance 2.5 years after final procedure

20.1.5 Abdominal Lift

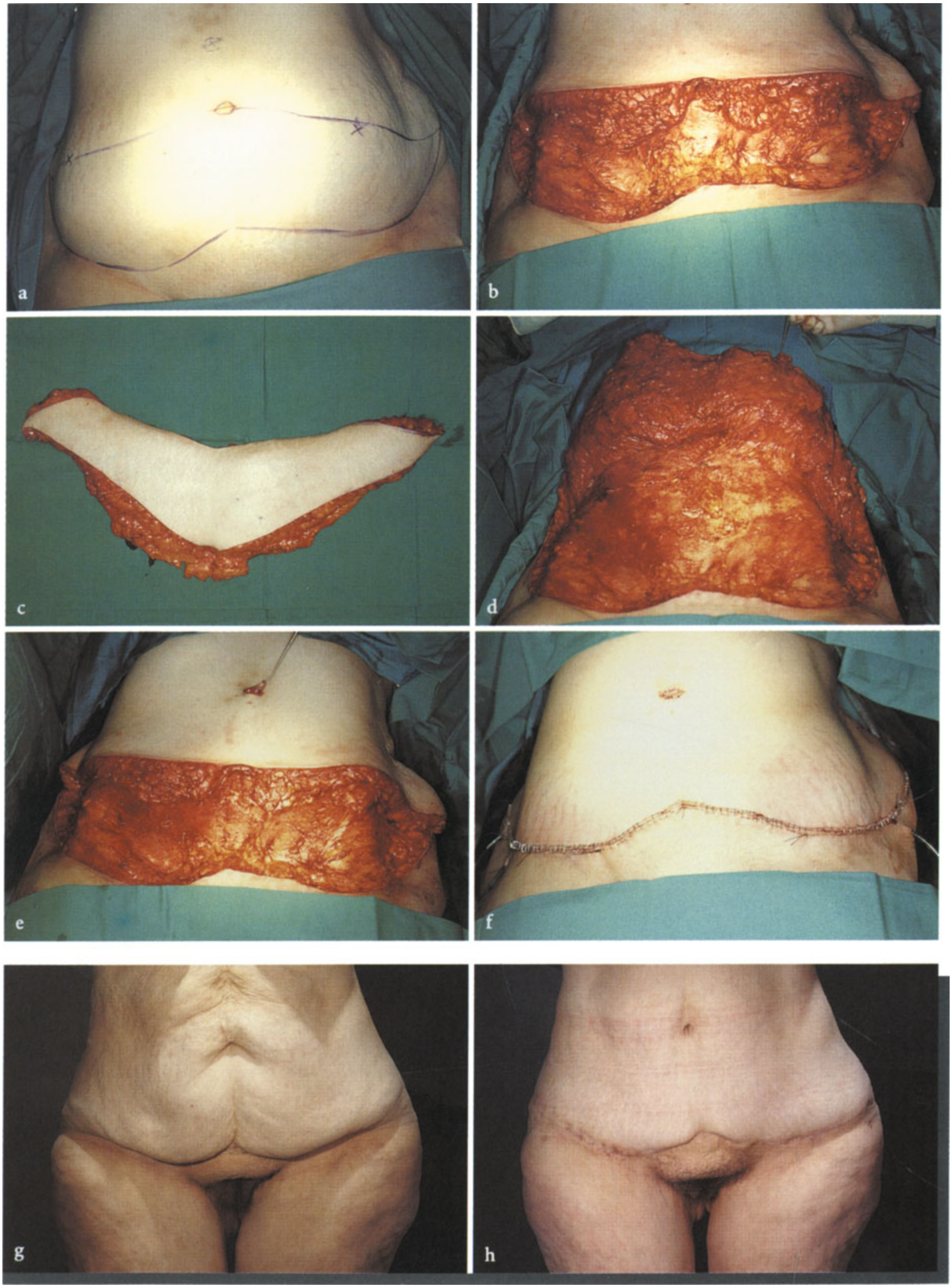
Many women are disturbed by excess skin on the abdomen, often present after pregnancy or marked weight loss. The "belly lift" or "belly tuck" has become a popular operation. While most commonly the procedure is entirely cosmetic, in some patients with persistent intertriginous dermatoses it is medically necessary.

Surgical Techniques

We prefer Pitanguy's modified technique based on undermining or a VY-plasty. The loose skin is removed in an almost triangular excision, with a curved incision made across the abdomen connecting the anterior iliac crests and passing just below the umbilicus. The short arms of the triangle are then made by incisions which run parallel to the inguinal crease and meet at the mons pubis. The skin above the superior margin is then freed by extensive undermining just above the fascia. It is then pulled down to reach the inferior margin and is sutured in place. The umbilicus is preserved and exposed by making a hole in the skin which has been moved to cover it. It must also be tacked in place. Often there is an associated relaxation or diastasis of the rectus muscle; the two rectus sheaths must then be sewn together with a heavy, slowly resorbable suture, for example, PDS 0-0.

This is clearly a major operation with many risks. There is extensive bleeding and marked trauma from the undermining. Fat emboli are a potential hazard. There are some techniques that involve a vertical incision; however, we find that these invariably produce less acceptable cosmetic results.

Fig. 373. Abdominal lift (s. page 394)
a Lax abdominal skin after weight reduction, with operative plan
b Defect after bow-shaped excision
c Surgical specimen
d Mobilization up to the level of the ribcage, but leaving the umbilicus in place
e Advancing the flap, making a window and relocating the umbilicus
d End of operation
e Preoperative appearance
f Appearance after 4 months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20.2 Axillary Region

The operative considerations in the axillae differ little from those elsewhere on the trunk. If considerable scarring has occurred, such as following acne inversa (hidradenitis suppurativa) or radiation therapy for treating breast carcinoma, the planes of dissection are destroyed, and the procedure presents considerably more difficulty. With larger procedures when more subcutaneous tissue is removed, either local flaps or in the case of superficial lesions a free skin graft must be used to fill the loss. The surgical treatment of hyperhidrosis and axillary lymph node dissections are two specialized procedures of this region.

20.2.1 Anatomy

The axilla is bounded ventrally by the pectoralis major muscle and dorsally by the latissimus dorsi muscle. In the vault of the axillary fossa the major nerve-artery-vein bundle is found, passing first beneath the clavicle and then dorsal to the coracobrachialis muscle. The three fascicles of the brachial plexus wind about the axillary artery, while the axillary vein is ventral to the artery. The functionally important dorsal thoracic and long thoracic motor nerves run caudally in the space between the subscapular and anterior serratus muscles (Fig. 374).

20.2.2 Anesthesia

Large and deep approaches to the axilla require general anesthesia.

20.2.3 Planning the Operation

The most important goal in planning a procedure is to ensure that the mobility of the shoulder joint is not hindered. Local flaps should generally be planned with no tension so as to ensure that later contracture of the scar does not restrict elevation.

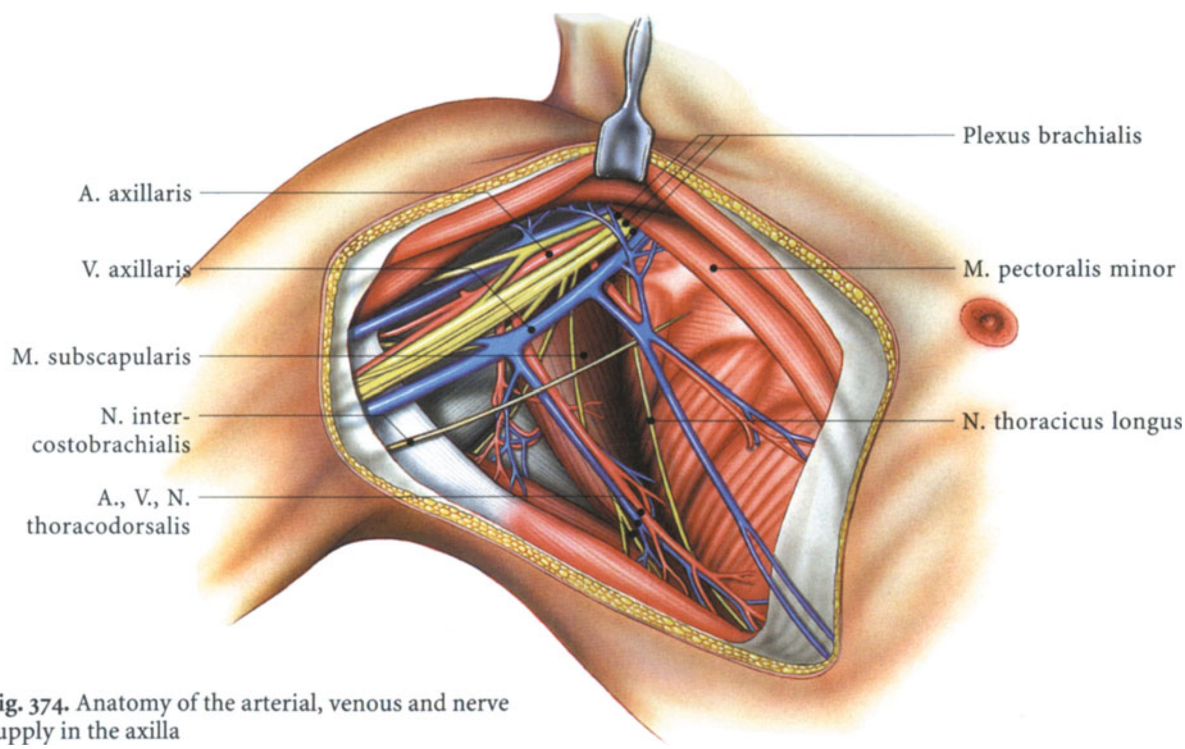


Fig. 374. Anatomy of the arterial, venous and nerve supply in the axilla

20.2.4 Surgical Techniques

Small to medium-sized horizontal elliptical excisions in the axilla can be closed with little or no wound tension. Larger defects can be closed by a rotation flap raised dorsally on the border of the latissimus dorsi muscle or by dorsally oriented transposition flaps and advancement flaps.

Grafts should be placed with the arm abducted to account for the inevitable shrinkage. The arm is held or fixed in an abducted fashion for about a week, which helps maintain shoulder motion.

Fig. 375. VY-plasty
a Operative plan for excision of hidradenitis suppurativa
b Undermining after complete excision
c End of operation
d Appearance after 6 months

Fig. 376. Rotation flap
a Operative plan for excision of hidradenitis suppurativa
b Preparation and placement of caudal flap
c Final closure with Burow's triangle in anterior axillary line
d Appearance after 2 years

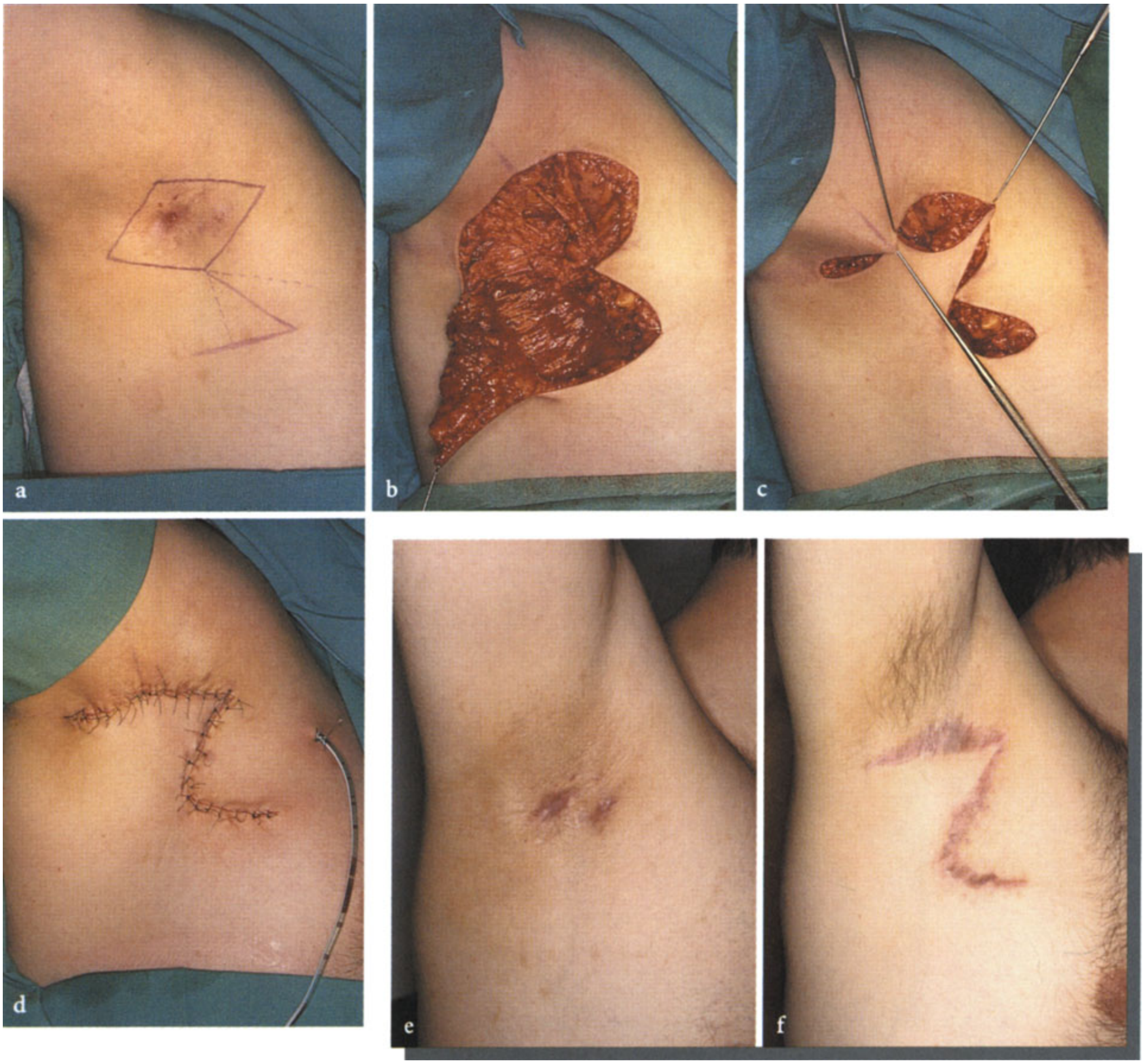


Fig. 377. Transposition flap (rhomboid flap of Dufourmentel)
a Operative plan for excision of hidradenitis suppurativa
b After complete removal of all sinus tracts, as identified with probes, the flap is mobilized
c Tension-free transposition of the flap
d End of operation
e Preoperative appearance
f Appearance after 3 months

Fig. 378. Transposition flap
a Operative plan for excision of ulcerated chronic radiation damage
b End of operation
c Preoperative appearance
d Appearance after 2 years

Fig. 379. Subcutaneous pedicle flap
a Operative plan for excision of hidradenitis suppurativa
b Excision defect after carefully probing, marking and excising all sinus tracts
c Moving the subcutaneous pedicle flap into place
d End of operation
e Preoperative appearance
f Appearance after 6 months

Fig. 380. Dermabrasion
a Dermabrasion of an epidermal nevus
b Appearance at end of procedure
c Preoperative appearance
d Cosmetically acceptable appearance after 6 months

20.2.5 Operations for Hyperhidrosis

Hyperhidrosis is a functional abnormality of the eccrine sweat glands. The extreme sweat production, even at times of rest, can be very distressing to a patient. Not only are social problems obvious, but clothes may become damaged, and various occupations be rendered impossible. Since the cause of hyperhidrosis is unknown, no specific corrective therapy is available. In the axilla, however, one can approach the problem surgically by removing eccrine and also apocrine glands, which leads to both subjective and objective improvement.

Planning the Operation
Many different operations for hyperhidrosis have been recommended in the literature; some of these, such as a sympathectomy, are obsolete. Three major approaches are currently in use: (a) subcutaneous curettage, (b) open curettage with partial excision, and (c) excision with plastic repair. A sweat test should be performed prior to any procedure. We use Minor's test, in which the axilla is painted with tincture of iodine and powdered with starch. The release of sweat creates a blue-black color. The zone of maximum sweating should be marked preoperatively.

Surgical Techniques
Subcutaneous Curettage. An elegant and cosmetically attractive method is the subcutaneous removal of sweat glands by curettage. Under general anesthesia a 2- to 3-cm incision is made caudal to the posterior pole of the marked zone. Next a Metzenbaum scissor is used to undermine the entire marked area of hyperhidrosis. The whole area is then curetted using a sharp curette, such as used in gynecology. Both the superficial and the deep surfaces are scraped to removed the sweat glands and inevitably other tissue. Although the skin appears pale and often livid after the curettage, necrosis is seldom seen. Marked bleeding or significant nerve damage also is uncommon. We insert a size 12 to 14 CH suction drain and then close the wound with subcutaneous and skin sutures. The procedure totally destroys the sympathetic nerves supplying the eccrine glands, but after about 3 months they begin to regenerate and the residual glands start to function again. While normal sweating usually returns, recurrences of hyperhidrosis are uncommon, although they are more frequent than with more radical approaches.

Partial Excision and Open Curettage. A longitudinal ellipse is planned to remove as much of the marked area as possible. It should not be wider than 3–4 cm, to ensure that mobility is retained. Using the method of Gillespie and Kane and that of Salfeld, the eccrine glands beneath the ellipse are excised in toto. The residual area of hyperhidrosis is undermined at the subcutaneous level and the skin everted. The remaining eccrine glands can then be curetted. Again, after placing a drain the wound is closed with subcutaneous and skin sutures.

Excision and Plastic Repair. In addition to the vertical excision discussed above, one can also consider a horizontal excision with a smaller diameter. Other configurations are also possible, depending on the shape of the hyperhidrotic area. One can then use a variety of flaps to close the defect, remembering to plan generous flaps to avoid wound tension, as function is more important than appearance in the axilla .

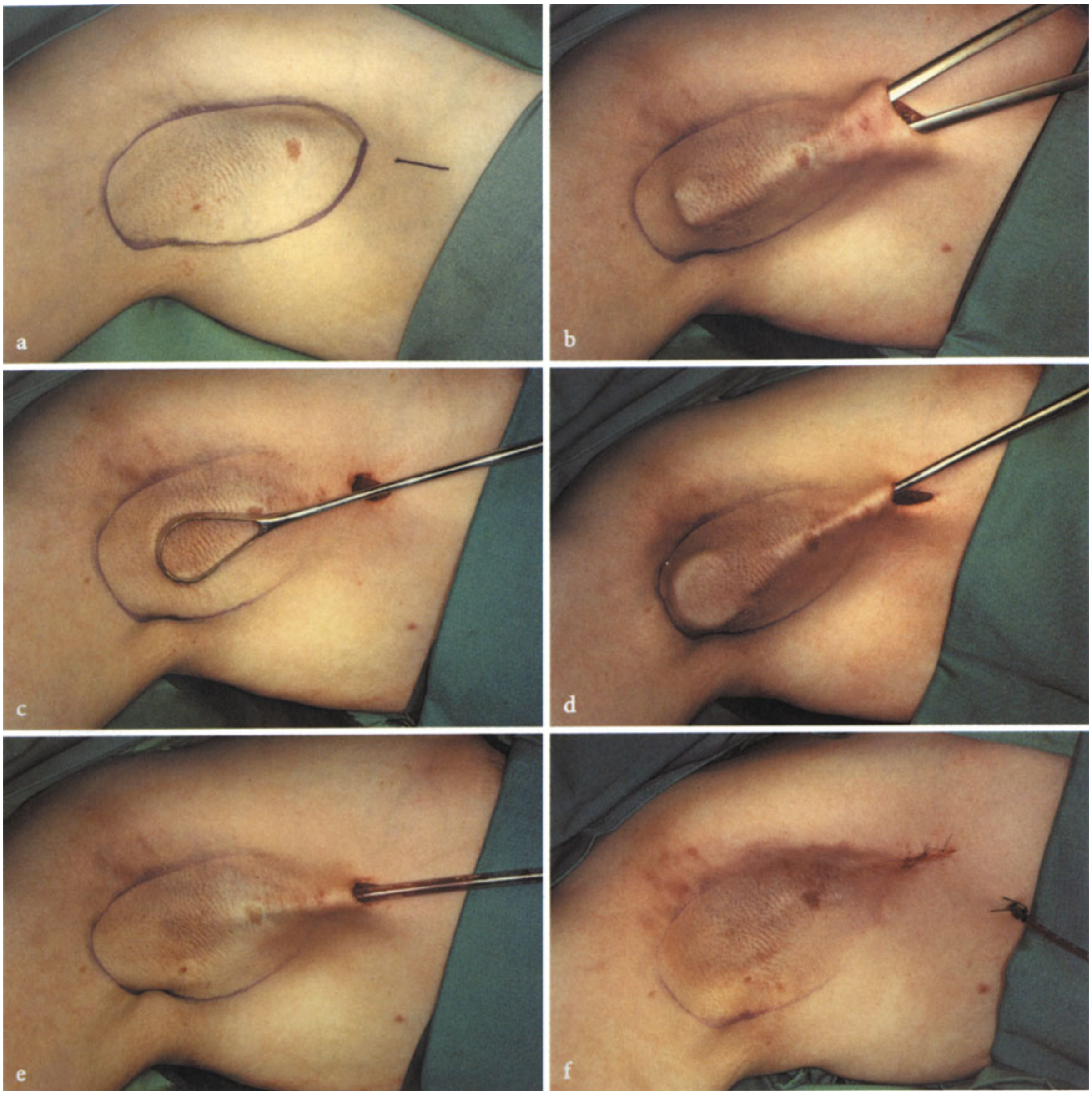
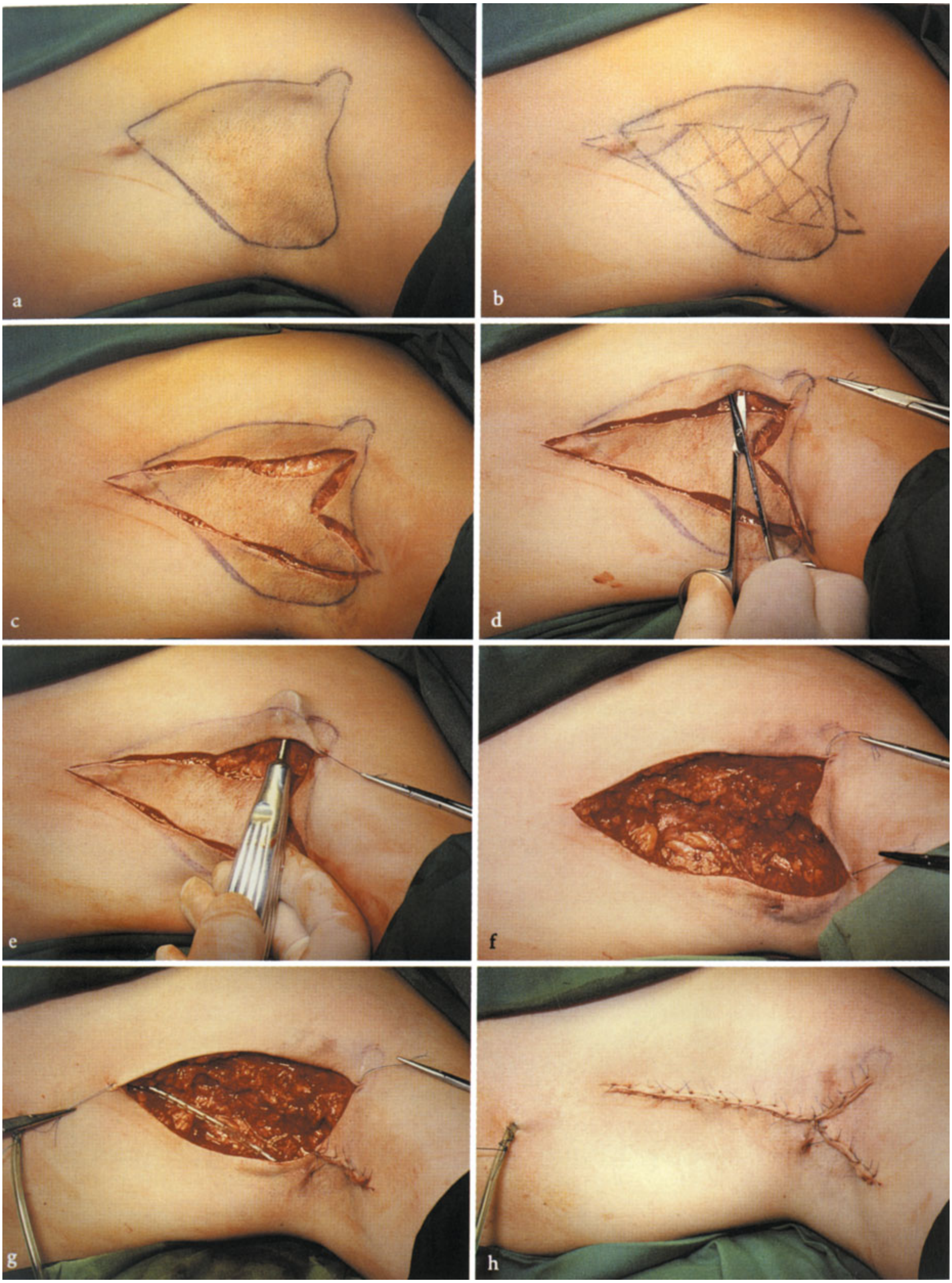


Fig. 381. Subcutaneous sweat gland destruction by curettage

- **a** Following Minor's sweat test, axillary area where sweat glands are concentrated is marked
- **b** After small incision, subcutaneous mobilization with Metzenbaum scissors
- **c** A gynecologic curette is employed
- **d** The entire marked area is curetted,
- **e** Curettage material removed with suction
- **f** Skin closure and suction drain in place

Fig. 382. Sweat test. *Dark color*, sweat
a Preoperative test
b Same test 6 months after operation shows dramatic improvement

Fig. 383. Partial excision combined with sweat gland curettage ▷
a Patient has already had a curettage procedure, as in Fig. 381. Hyperhidrosis persists in marked area
b Cross-hatched area indicates planned VY excision
c Incision
d Undermining the lateral edges
e Curettage of lateral edges
f Excision defect
g Wound approximation
h End of operation with suction drain in place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20.2.6 Axillary Lymph Node Dissection

The role of elective lymph node dissection in treating malignant melanoma remains a controversial issue. Some retrospective studies have shown a prolonged survival for patients with thicker melanomas without clinical evidence of lymph node involvement when treated by excision and prophylactic lymph node dissection. If elective lymph node dissections are considered possibly valuable, the axilla is one place in which the procedure can be performed. For melanoma of the trunk, lymph scintigraphy should be used to detect the lymphatic drainage to be dissected. Metastases of arm melanomas predictably must pass through the axillary nodes.

Elective lymph node dissection is generally employed in the United States and Australia today for lesions with a thickness between 1.5 and 4.0 mm when technically possible. This approach is also widely employed in Germany. The goal is to remove lymph nodes with micrometastases before the metastases reach a size that can serve as a source for deeper and less accessible metastases. One must radically remove all the lymph nodes in the region; otherwise the procedure has not been performed correctly. As a rule of thumb, one should find 15–25 lymph nodes in the axilla and about 10–20 in the inguinal region

If enlarged lymph nodes are either palpated clinically or are identified with sonography or other techniques, there is no question about a therapeutic lymph node dissection. While the approach is theoretically identical, the therapeutic procedure is often more difficult because the abnormal lymph nodes are often bound down to the neurovascular bundle. Their removal thus leads to surgical problems and an increased complication rate.

Radical lymph node dissections are also occasionally considered for other aggressive skin tumors such as Merkel's cell carcinoma, adnexal carcinomas, poorly differentiated squamous cell carcinomas, and even sarcomas.

Anatomy

There are several major groups or chains of lymph nodes in the axilla with slightly different drainage patterns. All must be identified. The lateral axillary group runs along the axillary nerve. The pectoralis axillary group passes along the border of the pectoralis major muscle and is sometimes found within the serrations of the anterior serratus muscle. Another group is the subscapular axillary chain, which accompanies the dorsal thoracic and subscapular veins and also receives lymphatic flow from the dorsal aspect of the shoulder. These branches empty into the central and subpectoral axillary lymphatics; the latter passes behind the pectoralis minor muscle and extends beneath the clavicle. Another main channel are the apical axillary lymphatics, which pass medial to the subclavian vein between the pectoral minor muscle and the clavicle. There is extensive networking between the different groups and marked anatomic variation; thus one must identify and remove all groups and connections (Fig. 384).

Surgical Techniques

The first critical step is to adequately expose the axilla. The type of incision chosen must ensure that all lymph node groups can be visualized and removed. We have had the best success with the approach recommended by Harris, Gumport, and colleagues.

The axilla is exposed through an incision running from the superior lateral border of the latissimus dorsi muscle to the superior lateral border of the pectoralis major muscle and then following this line to the lateral wall of the thorax. The axillary skin is then reflected along the pectoralis major muscle, and the axilla is exposed to the depth of the muscle.

The tissue containing the lymph nodes is then freed along the thorax wall to the lateral edge of the latissimus dorsi muscle. The procedure is extended in a cranial direction deep into the axilla, sparing the pectoralis minor muscle but extending ventrally to below the clavicle and dorsally to below the scapula.

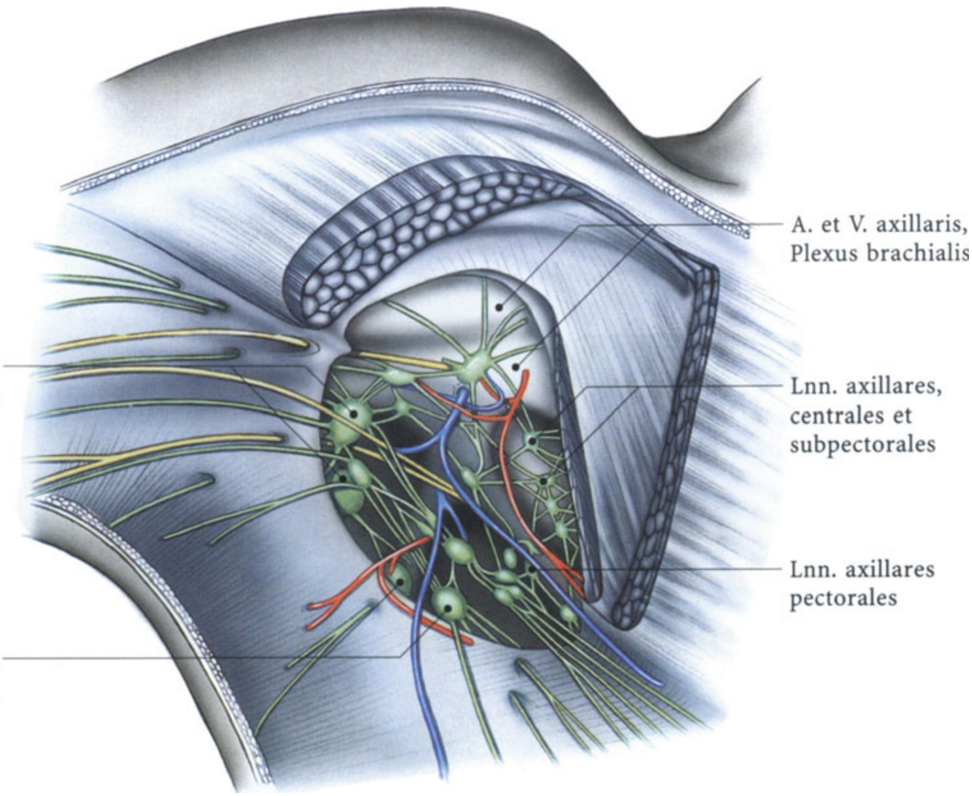
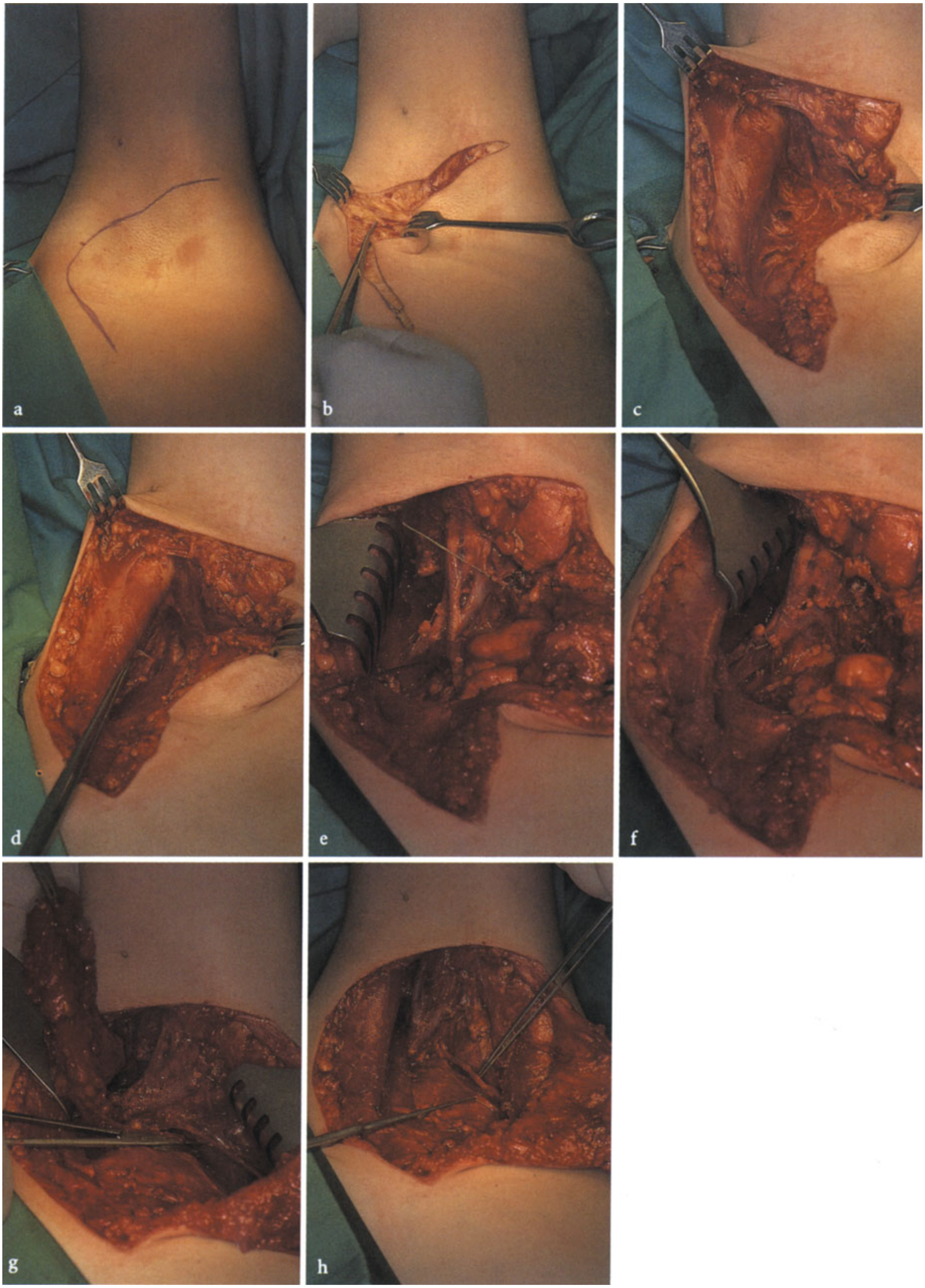


Fig. 384. Anatomy of the axilla with the various lymph node groups

The branches of the axillary artery and vein are ligated with double sutures and then separated. Meticulous hemostasis is required to ensure adequate visualization of the various nodes. One must also avoid traumatizing the brachial plexus. In addition, the dorsal thoracic and long thoracic nerves on the lateral wall of the thorax must be identified; inadvertent severing of these two nerves greatly hampers arm motion. The entire block of fat and lymph nodes is removed from the depths of the axilla and then excised from the overlying skin. After placing a drain, the subcutaneous tissue and skin are closed.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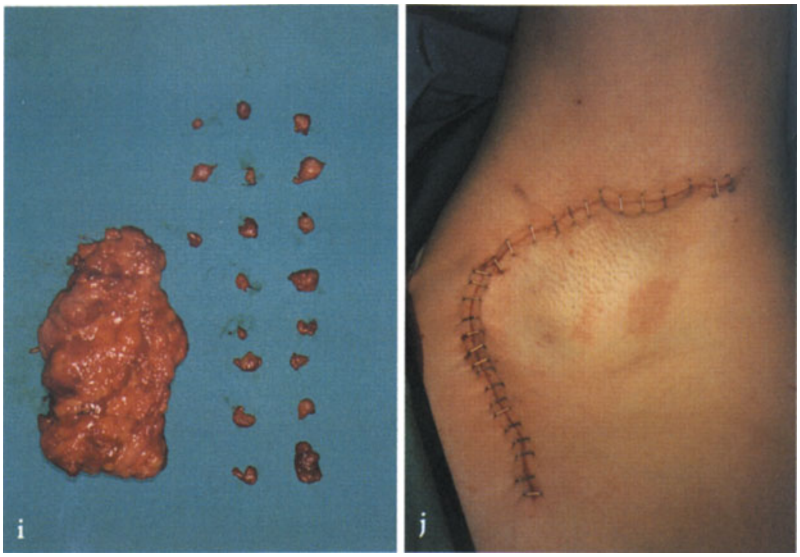
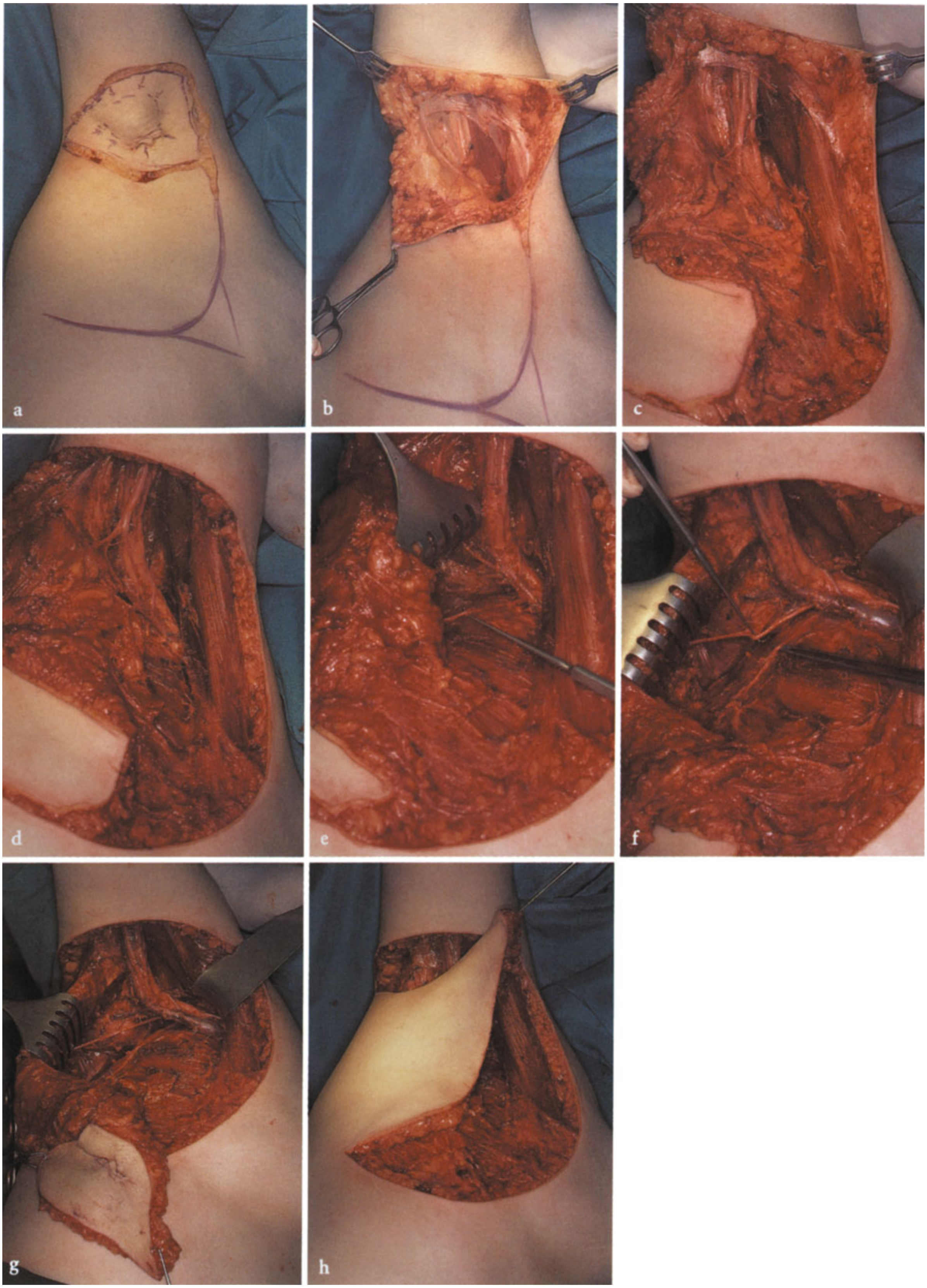


Fig. 385. Axillary lymph node dissection
- **a** Bow-shaped incision along the anterior axillary line to the axillary crease
- **b** Subcutaneous dissection to the lateral border of the pectoralis major muscle
- **c** Exposure of the pectoralis major muscle
- **d** Appearance after dissection around the pectoralis major muscle
- **e** Identification of the neurovascular bundle and exposure of the infraclavicular and subpectoral lymph node groups
- **f** Further dorsal dissection to expose the central axillary lymph nodes
- **g** Dissection of subscapular lymph node group
- **h** Operative field after removal of all lymph node groups with sparing of the axillary neurovascular bundle as well as the long thoracic and dorsal thoracic nerves
- **i** Surgical specimen with individual lymph nodes
- **j** Skin closure using staples after placing suction drain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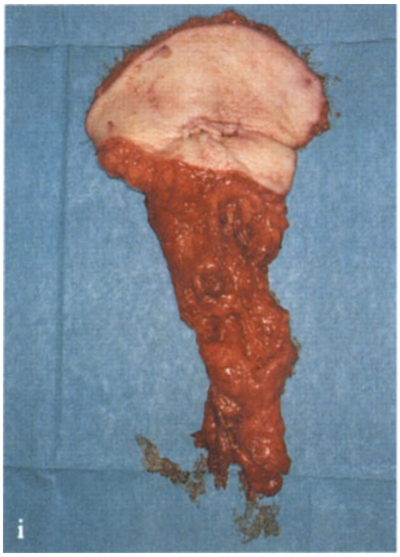

Fig. 386. Axillary lymph node dissection combined with rotation flap

a Operative plan for excision of a local recurrence of a sweat gland carcinoma, combined with an axillary lymph node dissection
b Dissection to expose brachial plexus and ventrally the lateral border of the pectoralis major muscle
c Dissection along the pectoralis major muscle
d Appearance after dissection of the subpectoral and infraclavicular lymph node groups
e Deeper dissection dorsally with exposure of the neurovascular bundle
f Appearance after dissecting the subscapular and central axillary lymph node groups, sparing the long thoracic and dorsal thoracic nerves
g The complete dissection bloc is removed and hemostasis obtained
h Rotation of skin flap to cover defect
i Surgical specimen
j Final closure after excision of Burow's triangle and placement of suction drain

20.3 Inguinal Region and Mons Pubis

Procedures in the inguinal region are usually uneventful, as closure and reconstruction are generally readily accomplished. Nonetheless this region deserves respect because of its complicated anatomy.

20.3.1 Anatomy

The fascia lata covers the inguinal region, attached to the anterior iliac spines, the aponeuroses of the external oblique muscles, and the pubic bone. The saphenous fossa lies just beneath the inguinal ligament and is bordered laterally by the falciform ligament. The great saphenous vein joins the femoral vein in the median part of the saphenous fossa. The femoral artery and nerve both lie lateral to the femoral vein. The superficial inguinal lymph nodes are found in the region of the saphenous fossa, running caudally along the great saphenous vein and cranially just beneath the inguinal ligament along the superficial circumflex iliac vein.

20.3.2 Anesthesia

Either spinal and general anesthesia is suitable for larger procedures in this area.

20.3.3 Planning the Operation

The considerations here are similar to those for surgery on the trunk. The approach to acne inversa is analogous to that in the axilla. A specialized procedure is dissection of the inguinal nodes, used for the same indications as axillary node dissection (see Sect. 20.2.6). When performing inguinal surgery, it is important to mobilize the patient as soon as possible after the surgery to reduce the risk of acute complications such as thrombi and emboli and to avoid a loss of mobility.

20.3.4 Surgical Techniques

Extensive undermining or VY-plasties are usually sufficient. Large lesions such as congenital nevi can be excised serially. The lower abdomen, especially in older patients, is a good reservoir of tissue; a variety of local flaps can be used to mobilize needed skin. While it is often recommended to let the wound base heal secondarily after extensive excision of acne inversa scars and fistulae, we have found this approach problematic. In addition to a long healing time, extensive scarring occurs, often interfering with limb motion and distorting both the male and female genitalia. We therefore attempt to close defects whenever possible.

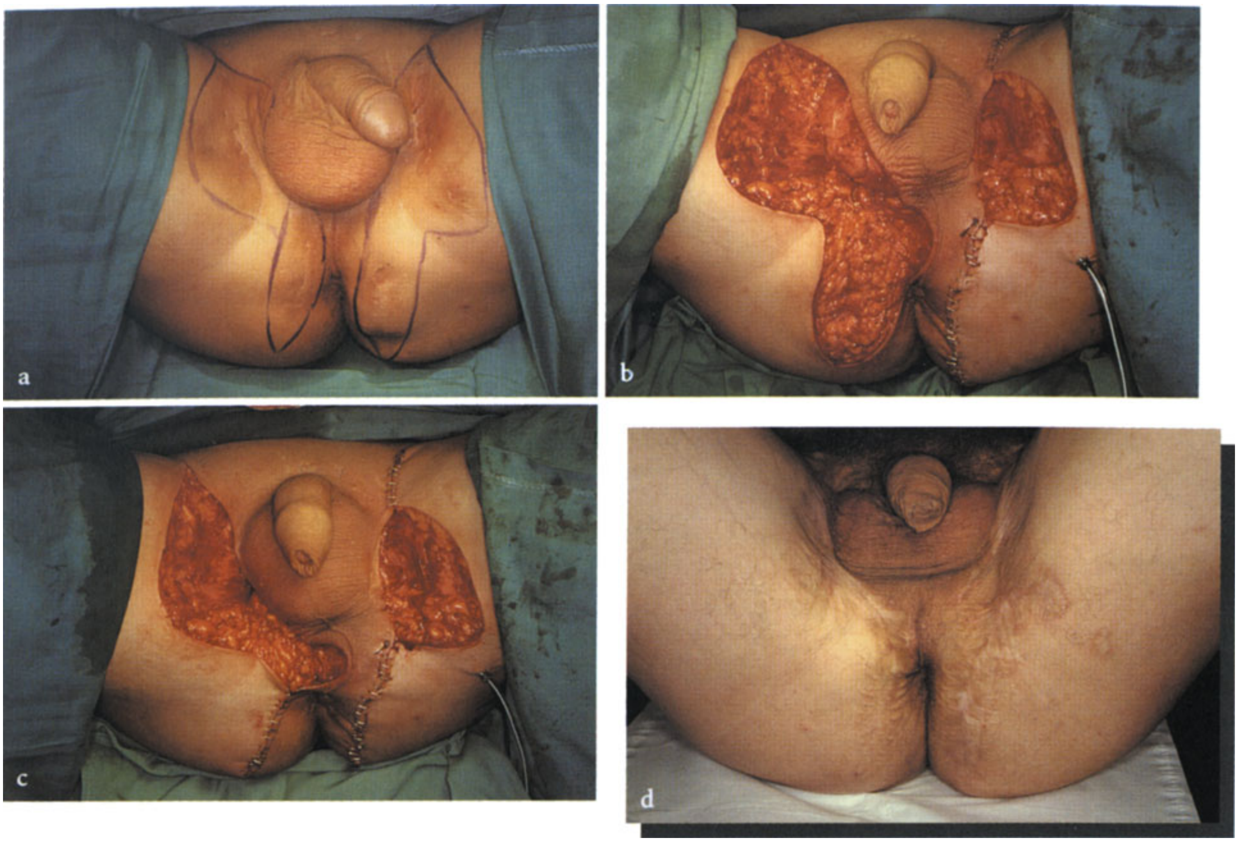

Fig. 387. Primary closure with undermining, combined with secondary healing
a Operative plan for extensive excision in acne inversa
b Excision defect partially reduced by undermining and closure with skin staples
c Similar approach on contralateral side with partial closure; most of defect allowed to heal secondarily
d Appearance after 2 years

Fig. 388. VY-plasty
- **a** Operative plan to remove the central, clinically abnormal part of a congenital melanocytic nevus
- **b** Step-by-step excision and wound closure
- **c** Y-shaped closure
- **d** End of operation
- **e** Preoperative appearance
- **f** Appearance after 3 years. The patient declined further treatment since the histologic evaluation of the initial specimen revealed no sign of malignant change

Fig. 389. Serial excision ▷
- **a** Large congenital nevus in region of groin and mons pubis; operative plan for first stage excision
- **b** Appearance after VY-closure of initial excision
- **c** Operative plan for the next stage
- **d** Appearance after VY-closure
- **e** Operation for excision of residual areas, using primary closure with undermining
- **f** Skin closure of final procedure
- **g** Preoperative appearance
- **h** Appearance 1 year after final operation. Tiny residual areas were later excised with simple ellipses. The entire series took 3 years

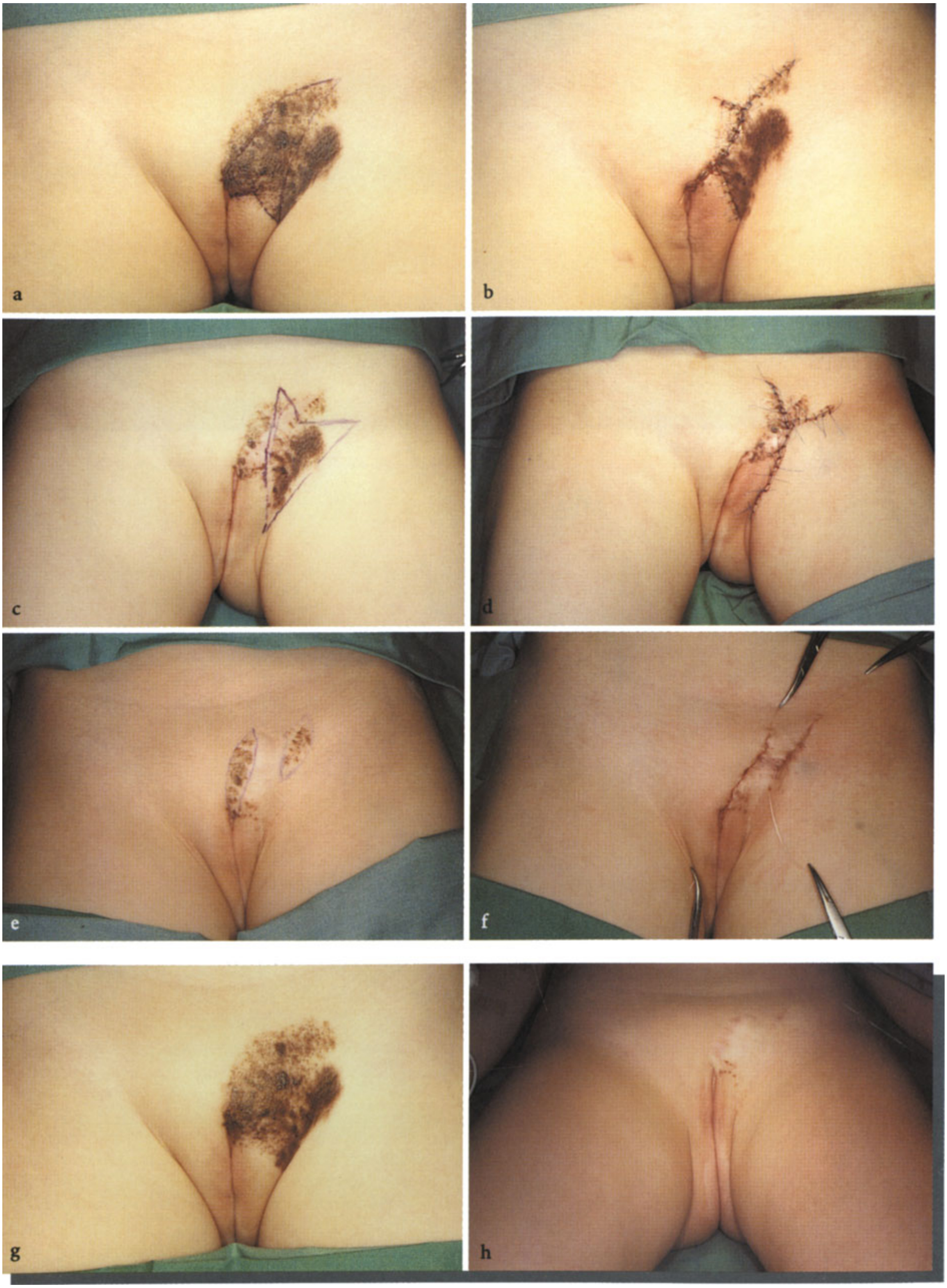
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Fig. 390. Dermabrasion
a Large congenital melanocytic nevus in area of groin and mons pubis
b Appearance after dermabrasion
c Preoperative appearance
d Appearance after 1.5 years

20.3.5 Inguinal Lymph Node Dissection

Indications for elective and therapeutic inguinal lymph node dissection are similar to those for the corresponding axillary procedure (see Sect. 20.2.6). If inguinal node metastases are associated with iliac node involvement, it is preferable to have the entire procedure carried out by a general surgeon.

Anatomy
A solitary superficial lymph node is often found in the inguinal region and excised for diagnostic purposes; this procedure is relatively simple and straightforward. Deeper structures are totally spared. When planning a radical lymph node dissection, however, one must be aware of the complex anatomic structure of the region, which inevitably brings the surgeon in close proximity with many vital structures. The superficial inguinal lymph nodes are divided into a horizontal tract which courses along the inguinal ligament and a vertical tract associated with the great saphenous vein. These groups drain through the cribriform fascia into the deep inguinal lymphatics (Fig. 391).

Surgical Techniques
We employ the radial lymph node dissection technique according to Tritsch. A curved excision including skin (to avoid skin necrosis) is made from the anterior iliac spine to the opening of the adductor canal in the upper thigh. The tissue block containing the lymph nodes is dissected at the level of the fascia of the abdominal and thigh muscles, starting proximally and moving distally. Bleeding vessels must be ligated or sutured. In the area of the inguinal canal one must be especially diligent regarding hemostasis to avoid the possibility of a postoperative retroperitoneal hematoma developing behind the inguinal ligament. The femoral artery and vein are then identified. The great

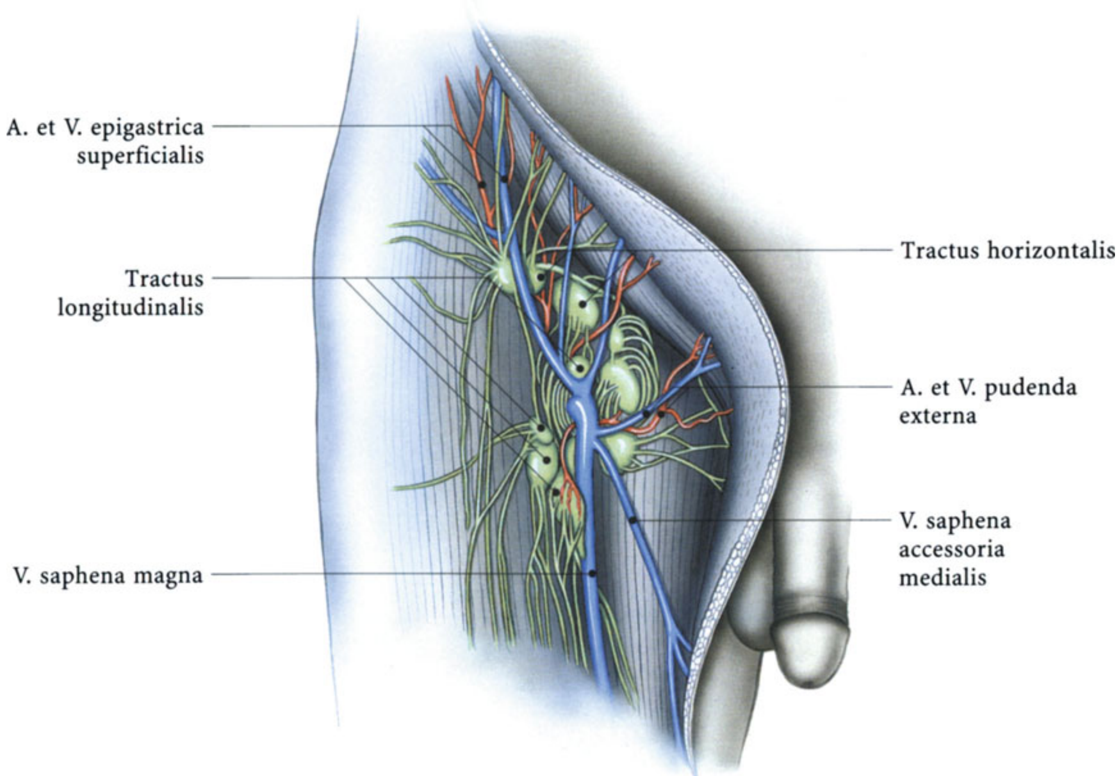
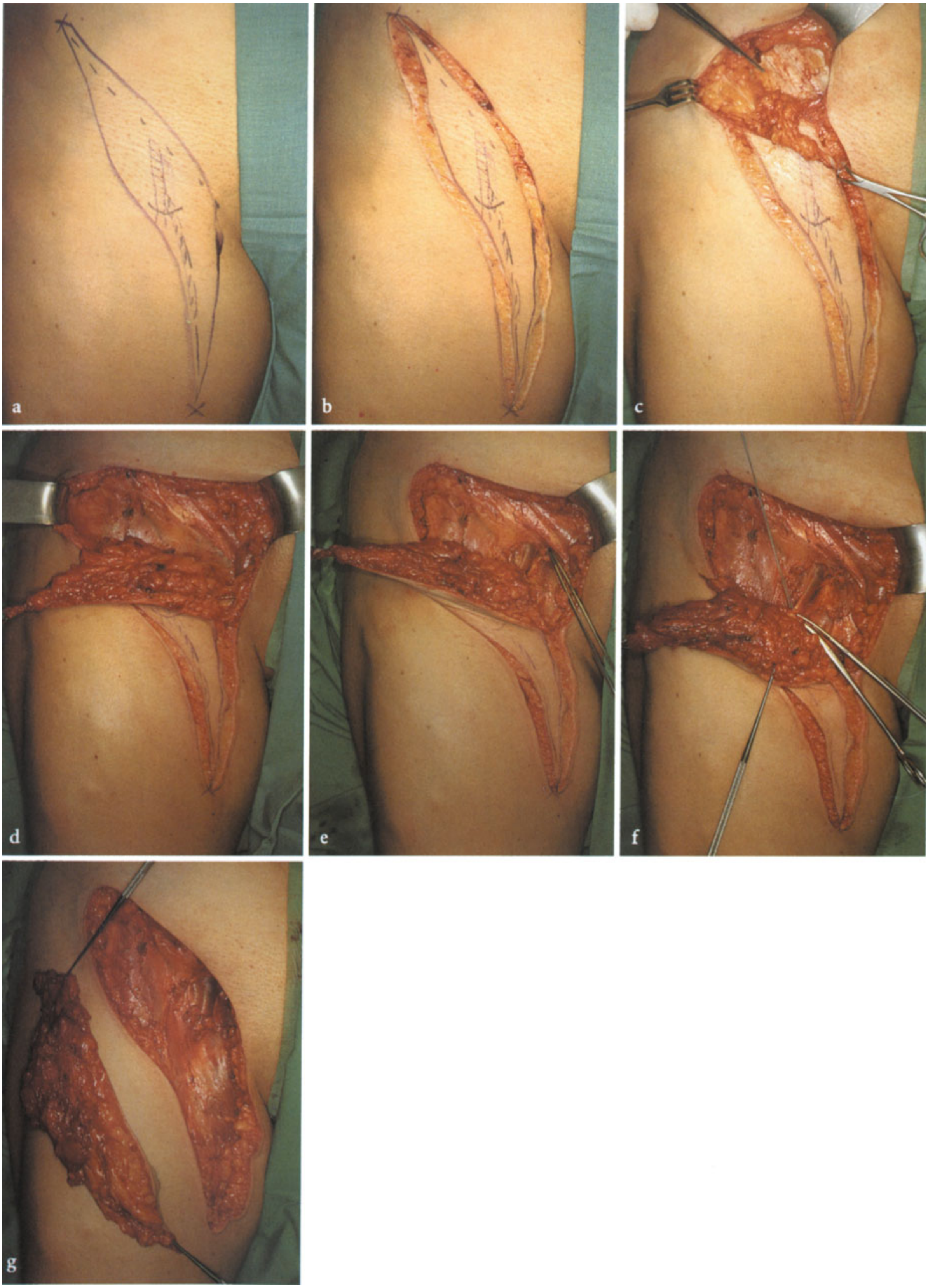


Fig. 391. Anatomy of the inguinal region with the inguinal lymph node groups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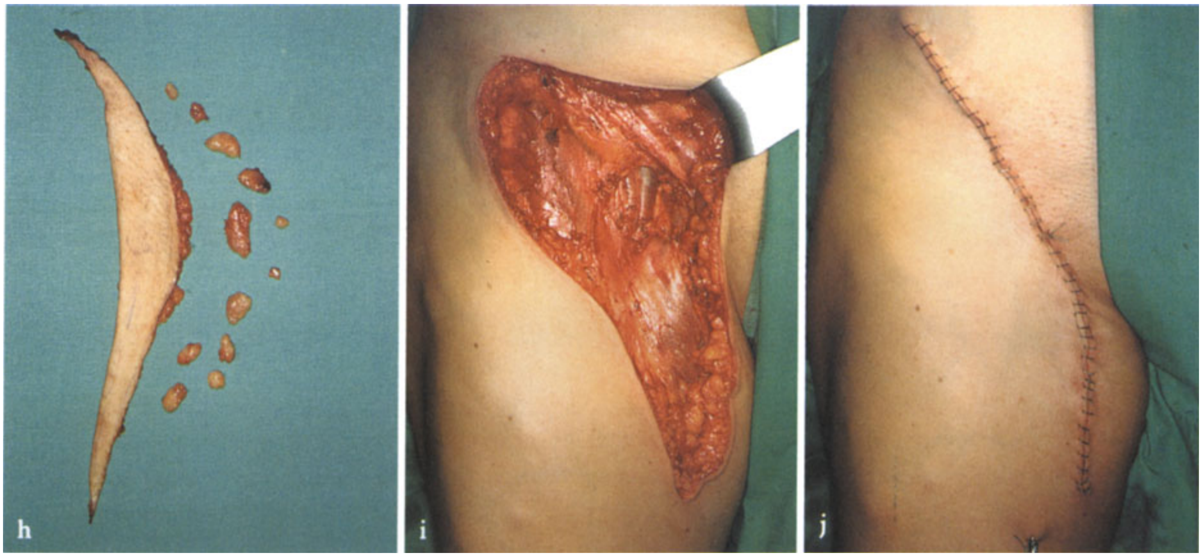


Fig. 392. Inguinal lymph node dissection
a Operative plan for inguinal lymph node dissection. The femoral artery and vein as well as the great saphenous vein are marked. *Dotted line*, the inguinal ligament
b Skin incision
c Cranial dissection to the inguinal ligament
d Dissection along the inguinal ligament
e Exposure of the lymph nodes in the inguinal fossa with delineation of the major vessels
f High ligation of the great saphenous vein at its level of entry into the femoral vein
g Complete excision of the specimen
h Surgical specimen including individual nodes
i Final operative defect with meticulous hemostasis
j Skin closure following multiple layers of deep closure

saphenous vein is approached as in varicose vein surgery; this is doubly ligated at its juncture with the femoral vein and separated. The dissection is then extended to the adductor canal still remaining above the fascia. At this point the entire dissection is removed in one piece and submitted for pathologic evaluation. The gracilis muscle can be transposed to cover the inguinal vessels, but this is seldom necessary. A drain (12–14 CH) is inserted and the wound closed in layers. The initial skin incision line can be varied when an en bloc excision of melanoma with lymph node dissection is performed.

20.4 External Genitalia and Perineum

Viral papillomas, cysts, inflammatory changes, and a variety of benign and malignant tumors may involve the genitalia. A variety of surgical approaches are needed to deal effectively with these problems.

20.4.1 Anatomy

The muscular structures of the perineum extend past the superficial anatomic landmarks. The external anal sphincter and the ischiocavernous and bulbospongious muscles are all very superficial. The innervation is provided posteriorly by the anal nerve, in the middle by the perineal nerve, and anteriorly by the perineal branches of the posterior femoral cutaneous nerve. The vascular supply is found on the dorsolateral aspect as the internal pudendal arteries and veins, moving further ventrally to form the clitoral artery, or the dorsal penile artery (Fig. 393).

The penis is innervated by the dorsal penile nerve with its rich branches. The ventral aspect of the penis is served by branches of the genitofemoral and ilioinguinal nerves. The same nerves also supply the scrotum. On the dorsal surface of the penis are found the dorsal penile vein, artery, and nerve; the vein is medial (Fig. 394).

The location of Bartholin's glands is important in operating on the female genitalia. They lie dorsolateral to the labia minora and open via ostia into the vestibule at the beginning of its posterior third.

20.4.2 Anesthesia

When removing widespread viral papillomas, we prefer general anesthesia in women but use a penile nerve block in men. The latter technique is applicable in almost all surgical procedures on the penis. Local anesthetics are adequate for small lesions, whether on the penis, scrotum, or female genitalia. The pudendal block, widely used in obstetrics, is rarely used in cutaneous surgery.

20.4.3 Male Genitalia

Planning the Operation

Probably the most common procedure performed on the male genitalia is electrosurgical removal of condylomata acuminata. One must try to remove all lesions and pay particular attention to intraurethral foci. The technique is described in Part A (see Sect. 11.1).

Chronic balanitis, especially when it occurs in a patient with a partial phimosis, can lead to synechiae about the prepuce, strictures in the region of the frenulum, and further stenosis of the foreskin, leading to paraphimosis.

Premalignant and malignant lesions also occur on the penis. Since penile squamous cell carcinoma is a potentially fatal disease, the initial surgery should be designed to be curative rather than to devote undue attention to tissue sparing. Both chronic balanitis and lichen sclerosus et atrophicus, known on the male genitalia as balanitis xerotica obliterans, can be viewed as facultative premalignancies. Obligatory premalignancies include erythroplasia of Queyrat (squamous cell carcinoma in situ) and some forms of leukoplakia. Carcinoma of the penis can arise de novo or in the context of a precursor lesion. It is much more common in uncircumcised patients. The exact location, size, and degree of differentiation are significant variables in determining the prognosis. Only lesions that are identified at an early stage can be treated without sacrificing part of the penis.

Surgical Techniques

Elliptical excision and VY-plasty are practical only with very small lesions on the glans. On the other hand, considerable defects on the foreskin and shaft can easily be covered by these techniques because the skin can easily be stretched. Most excisions are extended in a horizontal fashion.

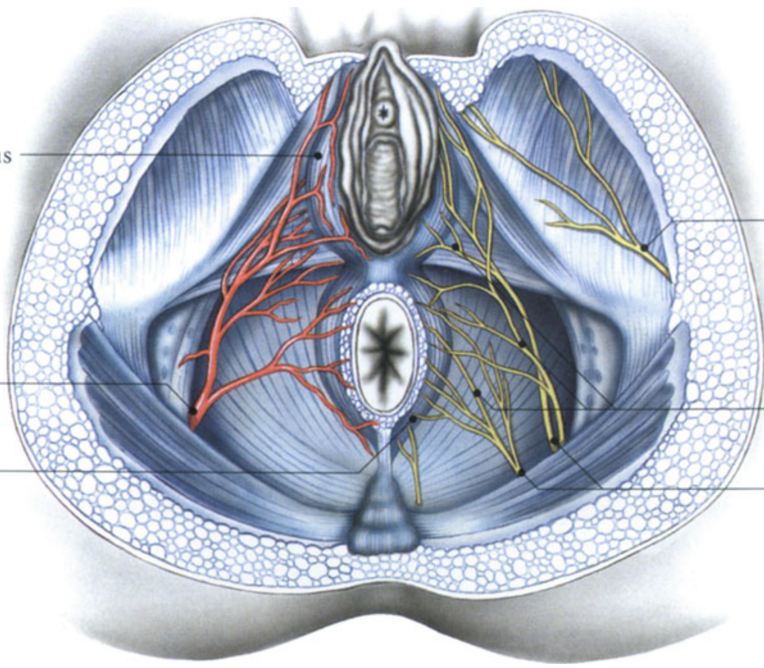


Fig. 393. Anatomy of the perineum

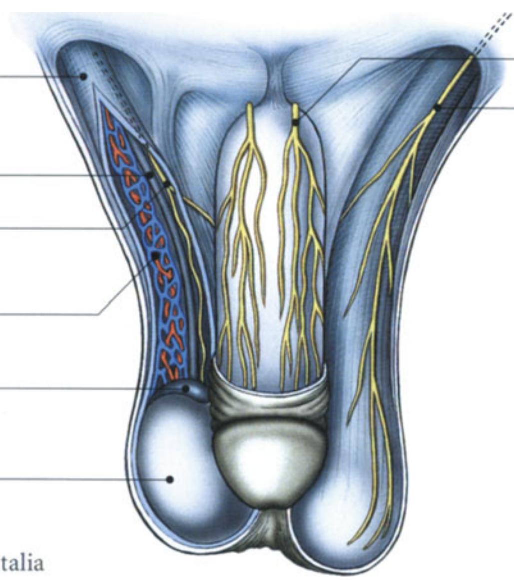


Fig. 394. Anatomy of the male genitalia

Synechiae can be separated manually, just as in a newborn; alternatively, a blunt probe or sound can be used. After they have been broken up, circumcision should be performed; otherwise recurrences are the rule. Frenuloplasty is a simple procedure to repair either a stricture of the frenulum or a congenitally short frenulum. A horizontal incision is made and then closed longitudinally, gaining length.

When dealing with a paraphimosis, a vertical excision of 1–2 cm is made directly over the stricture. After this has been split, the prepuce can be replaced in its proper location. A deeper excision runs the risk of injuring the corpora cavernosa. Again, after the acute process has resolved, a circumcision is necessary to avoid recurrences.

We perform the circumcision according to Rebreyoud to repair a congenital or acquired phimosis. The entire inner surface of the foreskin is removed. An incision is made parallel to the coronal sulcus at the border to the outer surface of the stretched foreskin, and the outer foreskin is then peeled backward. The frenulum is divided and the inner piece dissected away from the subcutaneous tissue and then excised. The end must then be readapted to the tissue beneath the coronal sulcus. In this procedure one should spare as much subcutaneous tissue as possible, for it is rich in nerves; if dealing with a frank malignancy such as a carcinoma in situ or a very small, thin carcinoma, one should sacrifice the tissue. In effect, the procedure results in a shortening and folding of the foreskin, with the scars buried in the coronal sulcus.

The technique of Happle is used to repair a defect on the glans, such as that resulting from removal of a carcinoma in situ or a small malignant tumor. The inner foreskin is removed, just as described in the above procedure, but then a U-plasty flap from the foreskin is developed and moved forward to cover the defect on the glans. The stump of the outer foreskin is then reanastomosed at the level close to the coronal sulcus.

If a larger invasive squamous cell carcinoma is present on the glans or extends to the inner aspect of the foreskin, a partial penectomy must be performed. The urethra is catheterized and the distal one-third or one-half of the penis removed layer by layer. First the corpora cavernosa and spongiosa with their respective fascia are closed. Then the skin of the shaft is fashioned into a prepuce and attached to the stump of the urethra. The catheter is left in place for about 7 days. The penectomy is usually accompanied by a bilateral inguinal lymph node dissection; this part of the procedure is generally done by urologists.

Skin and mucosal grafts do fairly well on the penis and can be applied just as on other areas of the body. On the scrotum and perineum there is usually enough free skin that almost every wound can be closed primarily or with simple procedures such as the VY plasty. Only rarely is a flap or graft needed.

Sometimes lichen sclerosus et atrophicus leads to urethral (meatal) stenosis. The urethral orifice can be enlarged with a variety of meatoplasties.

Fig. 395. Simple excision
a Hemangioma on glans
b Simple elliptical excision and closure
c Catheterization for 7 days to avoid urethral stricture
d Appearance after 3.5 years

Fig. 396. Lysis of adhesions or synechiae of prepuce
a Postinflammatory development of synechiae involving glans and prepuce, demonstrated with probe
b Careful separation using the probe
c Manual separation to complete task
d Appearance after procedure
e Preoperative appearance
f Appearance after 5 years with partial recurrence

Fig. 397. Plastic repair of frenulum
a Short frenulum
b Local infiltrative anesthesia
c Horizontal splitting of frenulum
d Vertical closure
e Preoperative appearance
f Appearance after 1 year

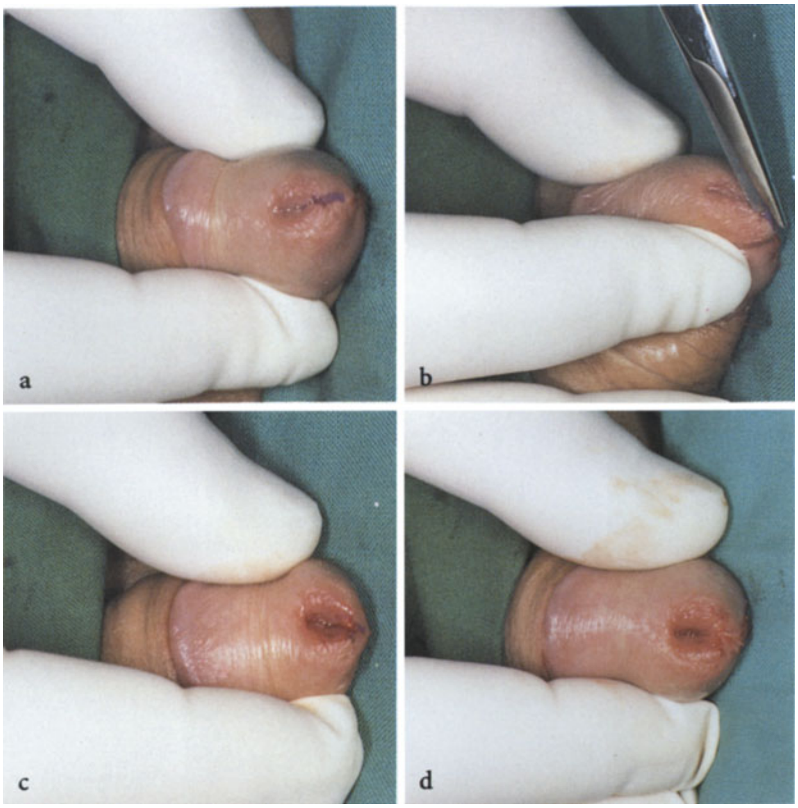
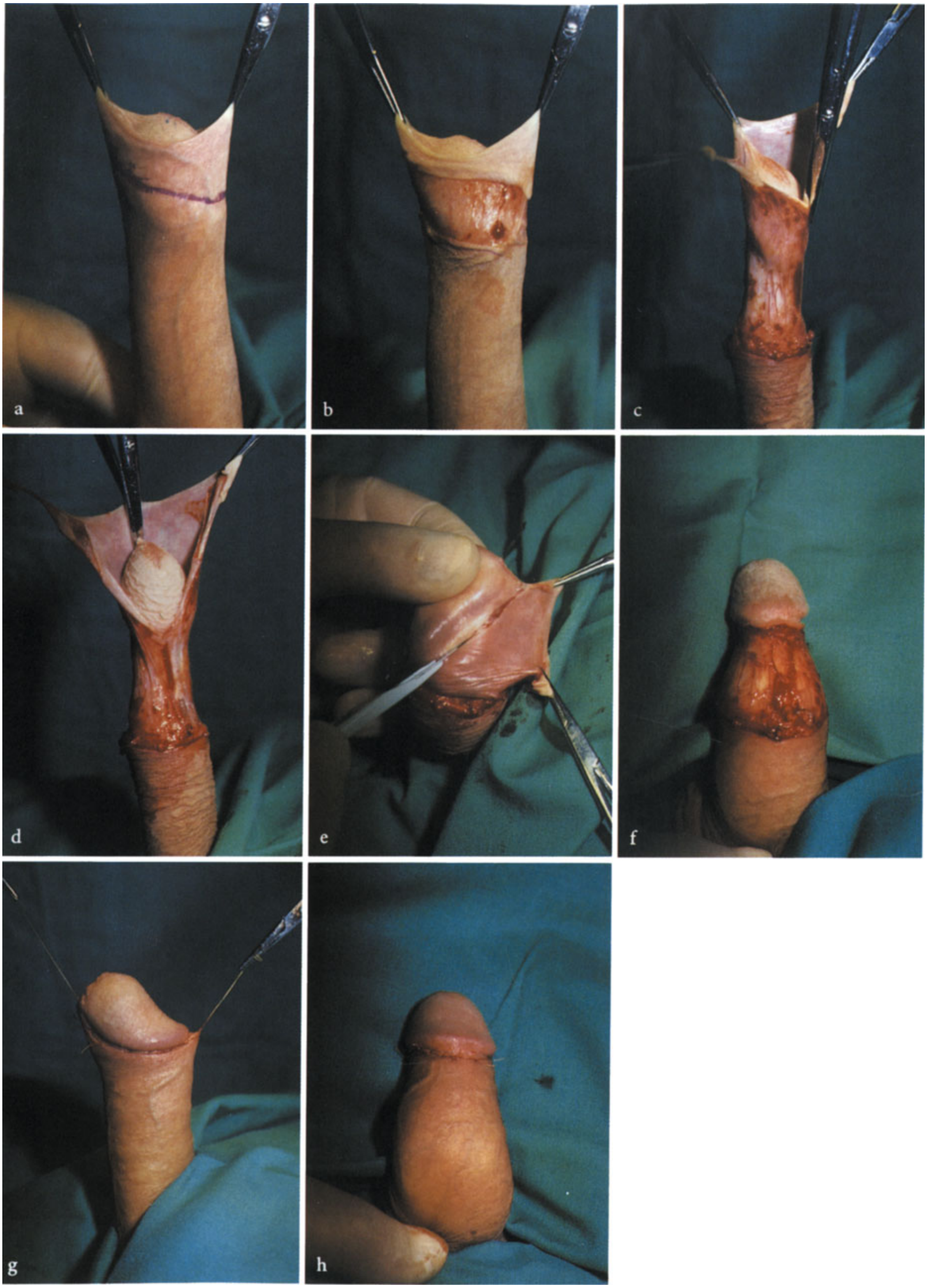


Fig. 398. Meatoplasty
a Operative plan to enlarge meatus in patient with urethral stricture
b Simple incision with surgical scissors
c Incision defect
d Urethral mucosa adapted to skin of glans

Fig. 399. Dorsal incision in paraphimosis
- **a** Longitudinal dorsal incision through the restricting band in a patient with lichen sclerosus et atrophicus and paraphimosis
- **b** Reduction in tension after the excision with lateral expansion
- **c** Prepuce can now be reopposed
- **d** Appearance at end of procedure
- **e** Appearance after secondary healing
- **f** Appearance later following a circumcision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◁ **Fig. 400.** Circumcision
- **a** Foreskin is grasped and stretched slightly; then a horizontal incision is made parallel to the coronal sulcus
- **b** The outer part of the foreskin is peeled backward
- **c** The inner part of the foreskin is divided longitudinally on the dorsal aspect
- **d** The frenulum is severed
- **e** The inner part of foreskin is excised beneath the sulcus
- **f** Careful hemostasis is required
- **g** The foreskin is reapproximated proximal to the sulcus
- **h** Final appearance

Fig. 401. Penile U-plasty (Happle)
- **a** Operative plan for excision of erythroplasia of Queyrat (squamous cell carcinoma in situ)
- **b** Design of the U-plasty to bring skin from the prepuce to the glans
- **c** Appearance after circumcision with retention of a U-shaped advancement flap
- **d** The flap is placed in the defect and the balance of the foreskin reapproximated at the level of the sulcus
- **e** Preoperative appearance
- **f** Appearance after 1.5 years

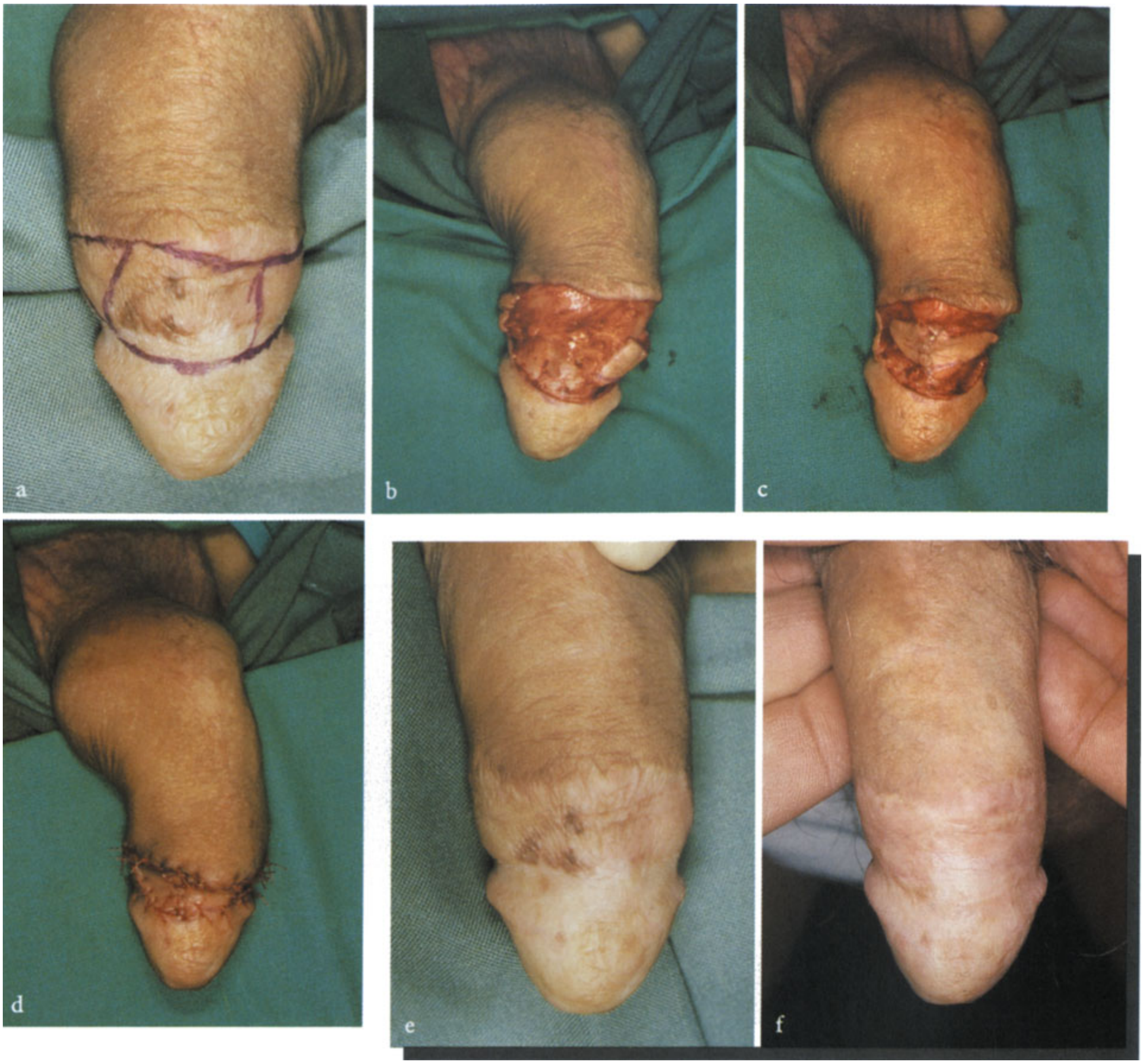

Fig. 402. Double subcutaneous pedicle flaps
a Operative plan for excision of penile melanosis with reconstruction; the patient was already circumcised so this reservoir of tissue was not available
b Excision defect and preparation of two subcutaneous pedicle flaps
c The flaps are moved together and adapted
d End of operation
e Preoperative appearance
f Appearance after 5 years

Fig. 403. Triple transposition flaps (Dufourmentel) ▷
a Defect after excision of widespread extramammary Paget's disease involving penis and scrotum, with operative plan
b Preparation of the first cranial flap
c The first flap is in place and the operative plan for the second one illustrated
d Mobilization of flap from the right side
e Placement of right-sided flap and mobilization of left-sided flap
d End of operation
e Preoperative appearance
f Appearance after 8 months


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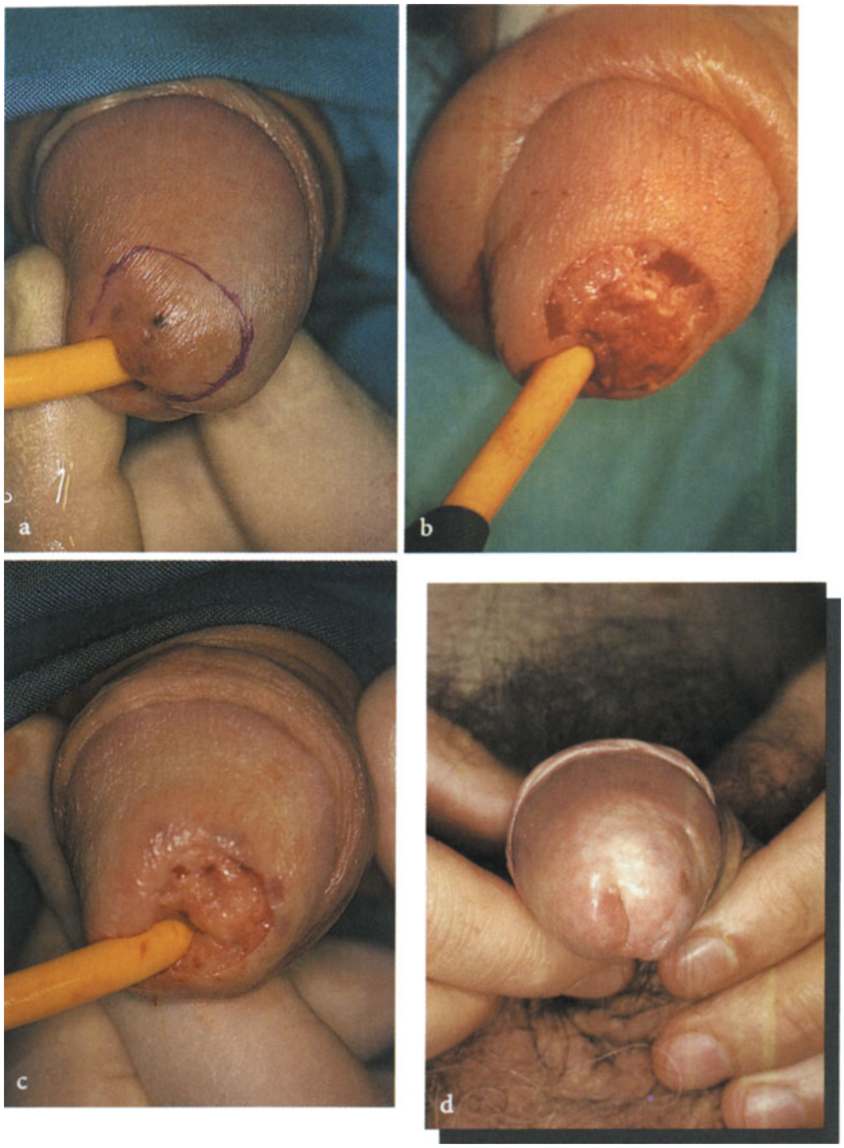

Fig. 404. Mucosal graft
a Excision of malignant melanoma of the glans
b Excision defect
c Appearance after wound conditioning before placing a buccal mucosal graft
d Appearance after 5 years

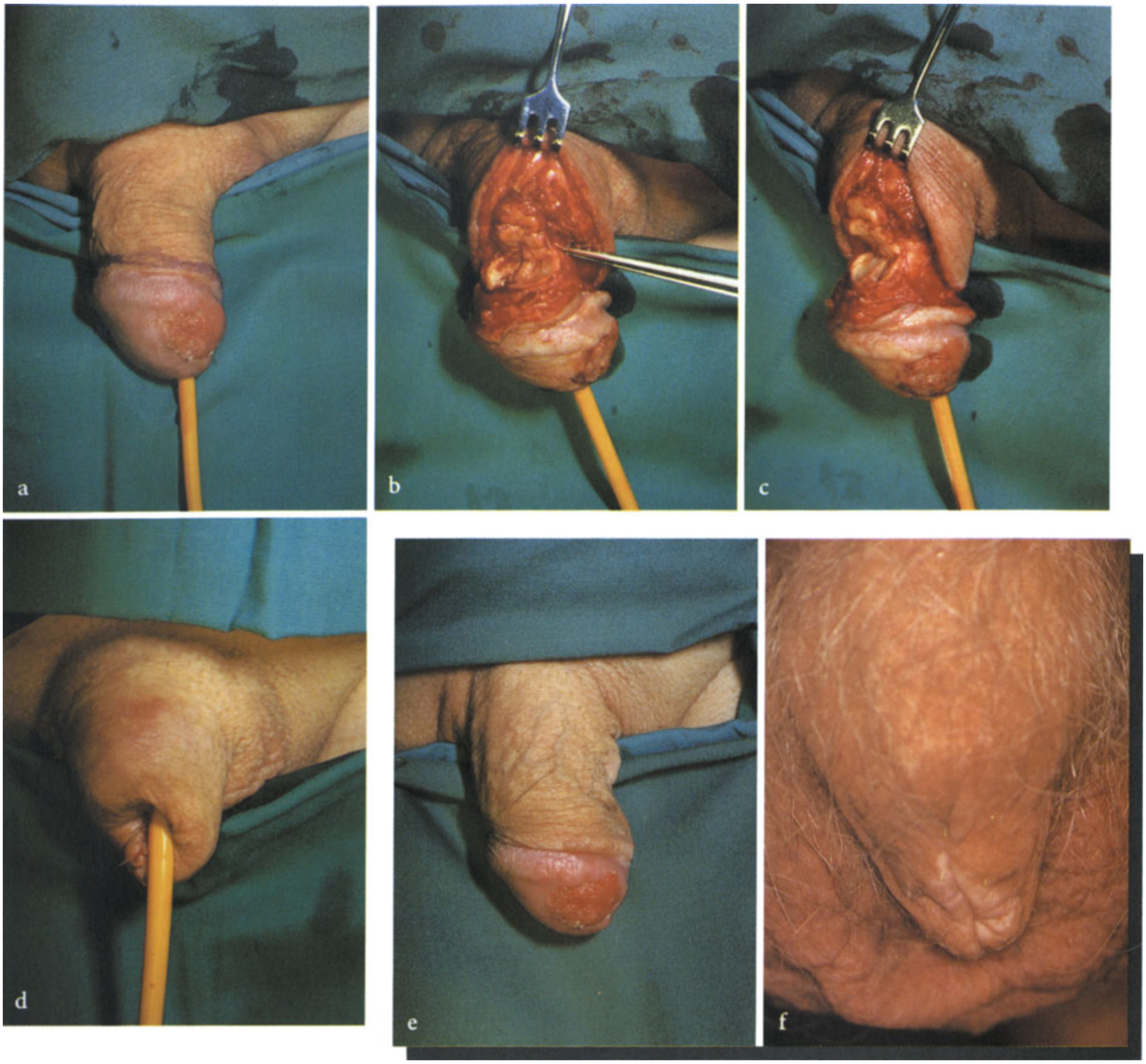

Fig. 405. Partial amputation
a Squamous cell carcinoma (T2) of the glans
b After a catheter is inserted for guidance, the penis shaft is severed
c The fascia of the corpora cavernosa is closed and the skin of the shaft approximated to the urethral lining
d End of operation
e Preoperative appearance
f Appearance after 1 year

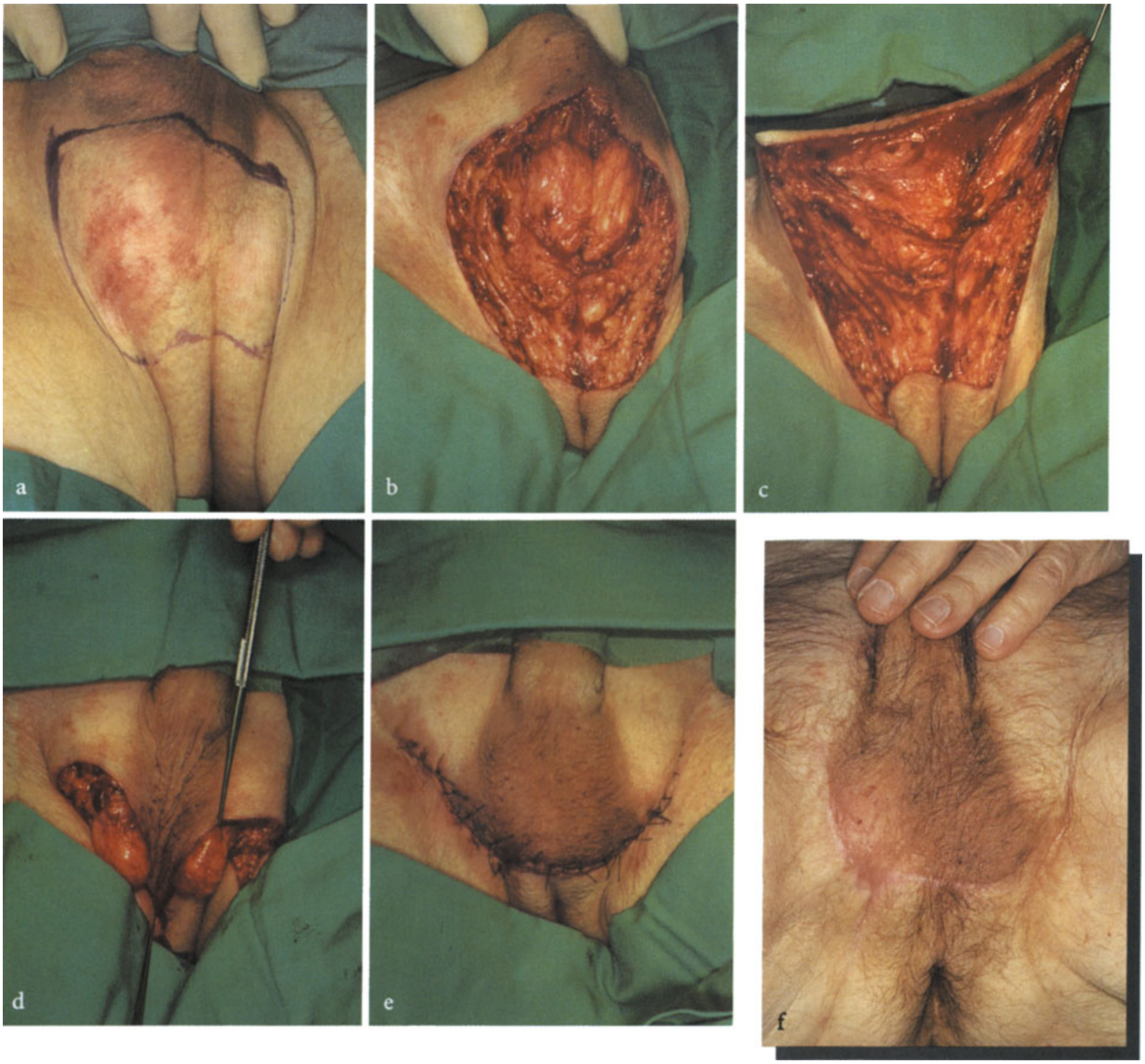

Fig. 406. Primary closure with undermining
a Wide excision of extramammary Paget's disease of the scrotum
b Excision defect
c Extensive undermining
d Bringing the edges together
e End of operation
f Appearance after 1.5 years

Fig. 407. VY-plasty
a Bowen's disease (squamous cell carcinoma in situ) on scrotum
b V-shaped excision
c Y-shaped closure
d Appearance after 6 months

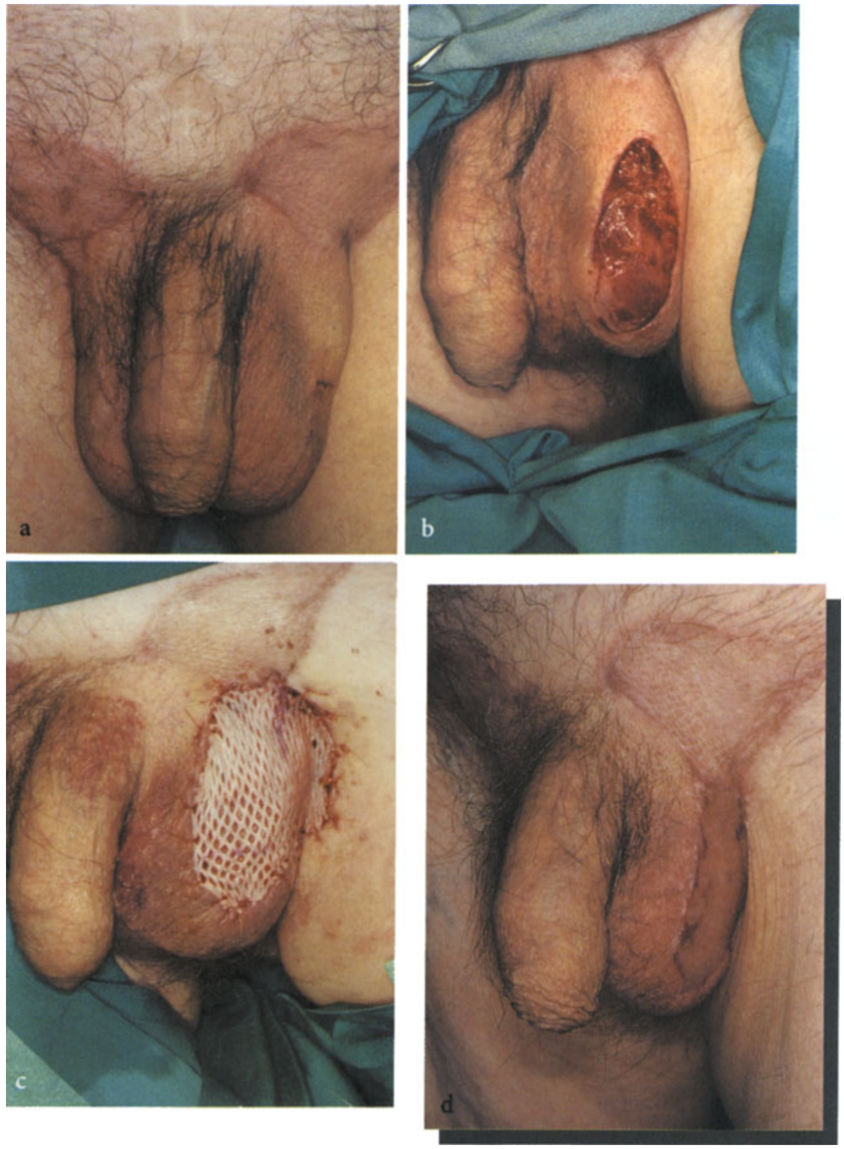

Fig. 408. Mesh split-thickness skin graft
a Extensive multifocal extramammary Paget's disease, following excision and grafting bilaterally
b Excision defect after yet another focus on scrotum is excised
c Appearance after mesh split-thickness skin graft is applied
d Appearance after 2 months

Fig. 409. VY-plasty
a Operative plan for excision of squamous cell carcinoma in situ
b V-shaped excision
c Y-shaped closure
d Appearance after 2 years

20.4.4 Female Genitalia

Planning the Operation

The excision of benign and premalignant lesions on the female genitalia is performed by dermatologists only when the defects are easily closed by undermining or a simple repair. More complicated procedures, particularly the radical treatment of vulvar carcinomas, are best left to the gynecologist.

Surgical Techniques

We usually employ a simple ellipse with undermining or a VY-plasty. The former can be used around the introitus, arranged either tangentially or radially. The VY-plasty is especially useful about the clitoris. Small flaps can be developed using the tissue of the adjacent upper thigh and inguinal region as a reservoir. The labia majora themselves offer some opportunity to move a flap medially. All of the classical flaps can be employed as needed.

Fig. 410. VY-plasty
a Appearance following a poorly healing episiotomy and chronic recurrent vulvovaginitis
b V-shaped excision
c Excision defect
d Layered closure with careful attention to approximating the bulbospongiosus muscle
e Preoperative appearance
f Appearance after 10 years

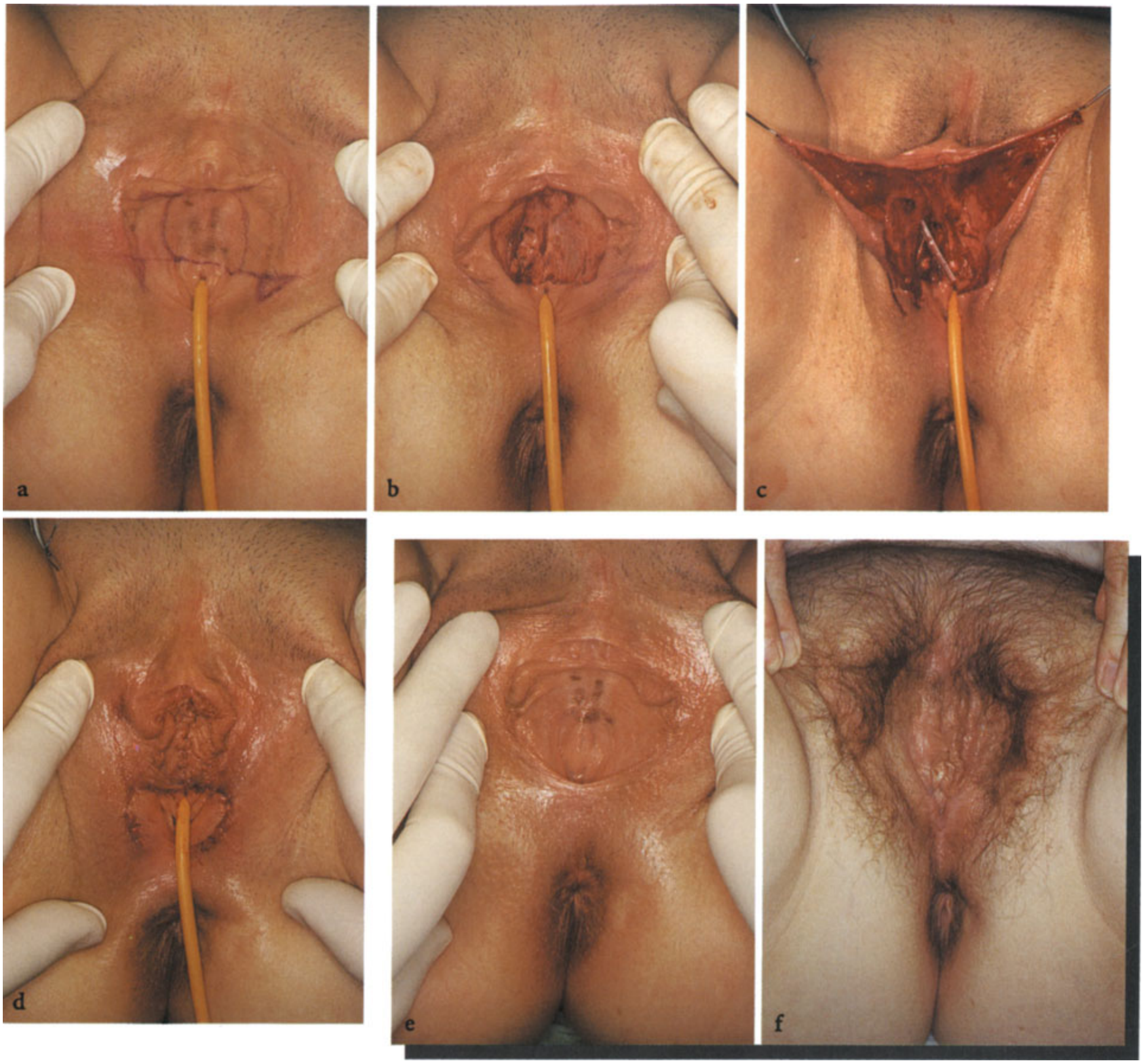

Fig. 411. Bilateral advancement flaps
a Operative plan for excision of labial melanosis with reconstruction
b Excision defect
c Lateral mobilization of the flaps
d End of operation
e Preoperative appearance
f Appearance after 6 months

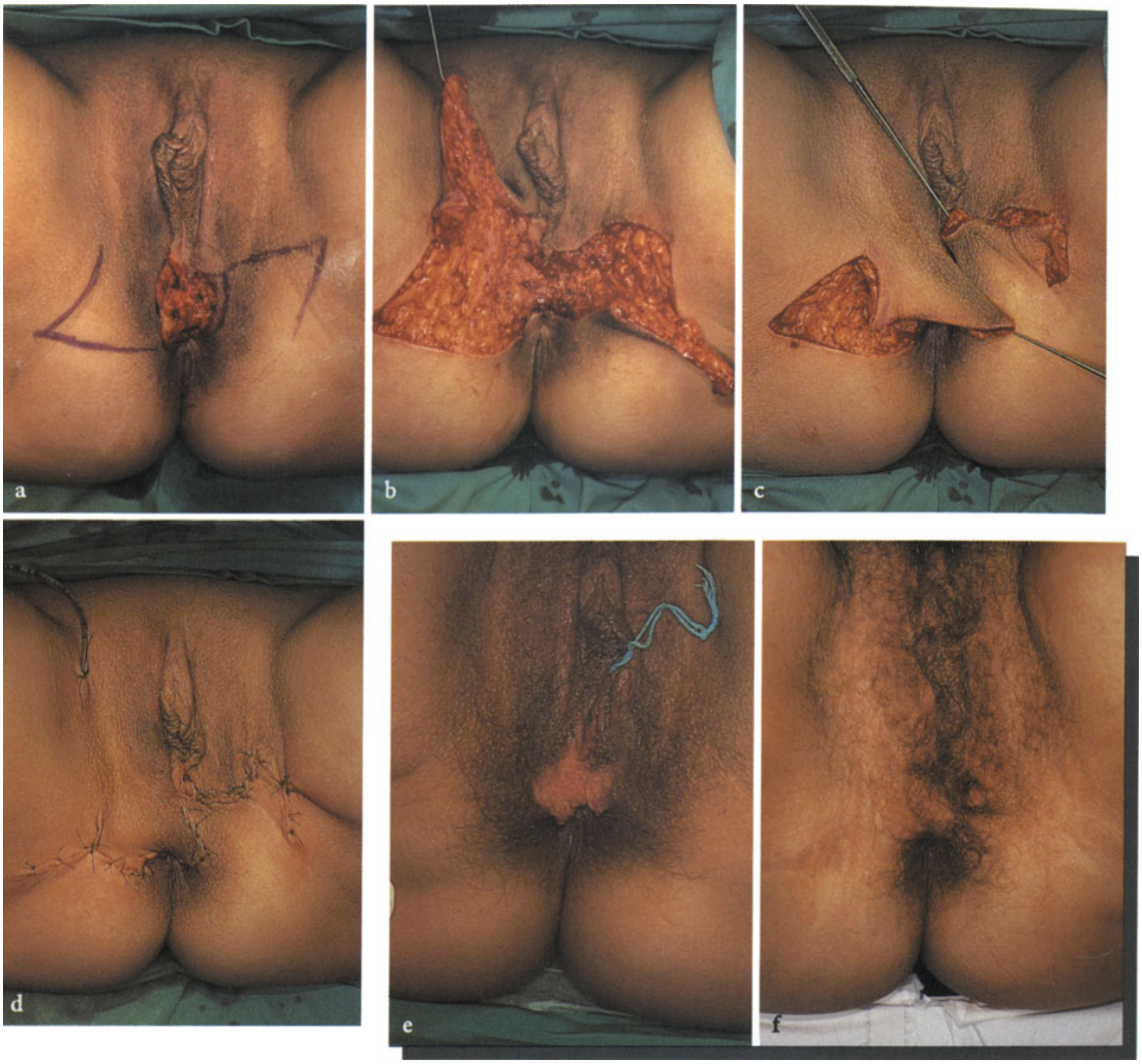

Fig. 412. Bilateral transposition flap (Dufourmentel)
a Defect after excision of Bowen's disease (squamous cell carcinoma in situ) at posterior commissure, with operative plan
b Preparation of the bilateral flaps
c Transposing the flaps into place
d End of operation
e Preoperative appearance
f Appearance after 15 months

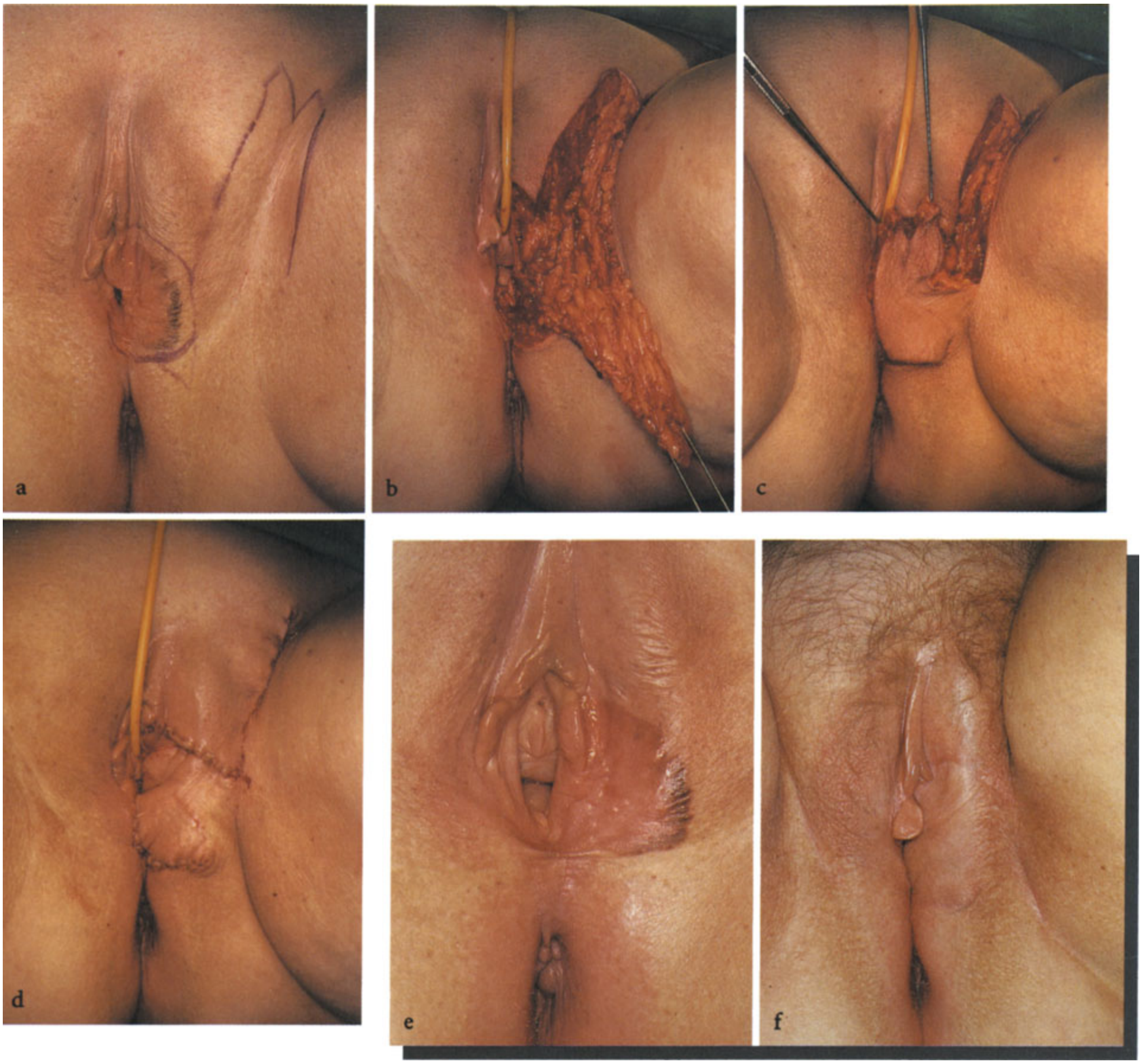

Fig. 413. Transposition flap
a Operative plan for excision of Bowen's disease (squamous cell carcinoma in situ) with repair
b Excision defect and preparation of transposition flap
c Placing flap in defect
d End of operation
e Preoperative appearance
f Appearance after 6 months

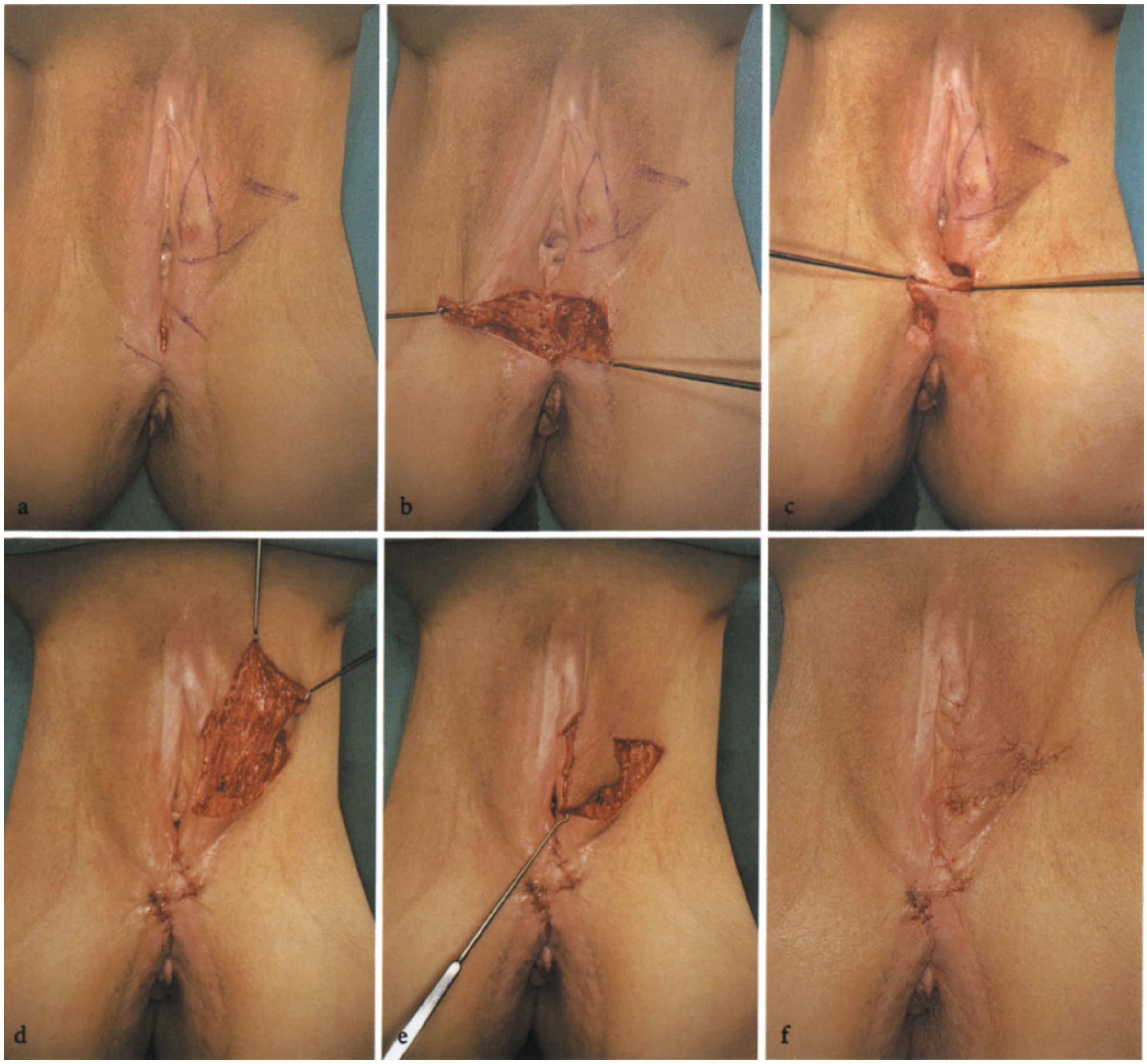

Fig. 414. Advancement flap with back cut, combined with Z-plasty

a Extensive lichen sclerosus et atrophicus with perineal erosion and invasive squamous cell carcinoma on medial aspect of left labia majora. Operative plan is marked

b Z-plasty prepared to repair perineal defect

c Moving the flaps of the Z-plasty into place

d Excision of labial defect with advancement flap and back cut

e Moving the advancement flap into place

f End of operation

g Preoperative appearance

h Appearance after 1 year

20.5 Anal and Perianal Region

The list of possible operations in this area includes many procedures which are not applicable to the rest of the skin. This had led to a certain degree of specialization. Probably the most common reason for surgery are problems associated with the hemorrhoidal complex, including anal tags, perianal thromboses, fissures, and hypertrophic anal papillae. Further indications are anal fistula and abscesses often associated with inflammatory bowel disease; viral papillomas, often extensive and with cytologic atypia (bowenoid papulosis); and unusual tumors such as extramammary Paget's disease. Prior to any anal surgery the digital rectal examination and proctoscopy should be performed to avoid overlooking any internal lesions.

When dealing with viral papillomas, one must exclude other sexually transmitted diseases and especially HIV infection. Sexual partners should be evaluated or at least counseled to seek evaluation. When children have perianal papillomas, the possibility of child abuse must be considered.

20.5.1 Anatomy

The anal canal has a length of 2.5–4.5 cm. The innermost or hemorrhoidal portion is characterized by the columns of Morgani and the anal sinuses, both of which are oriented along the length of the canal and serve to close it, with motion supplied by the underlying internal anal sphincter. This region is supplied by the superior hemorrhoidal plexus. Caudally the anal sinuses end at the pectinate line (also known as dentate line) which serves as the cranial border of the intermediate zone or anoderm, a band of nonkeratinized epithelium. The caudal end of this zone is the anocutaneal line, which marks the transition to keratinized stratified squamous epithelium or skin, known as the cutaneous zone. The superficial

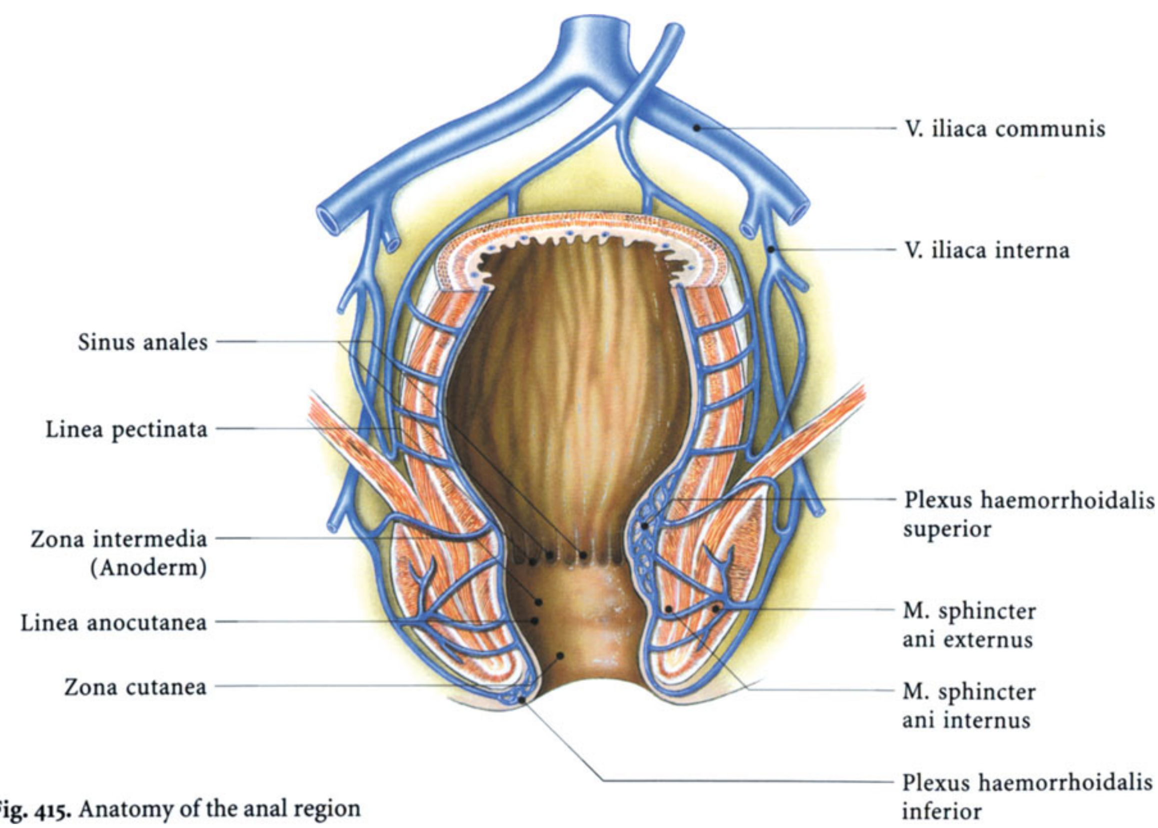

Fig. 415. Anatomy of the anal region

portion of the external anal sphincter lies just beneath this region, which is served by the inferior hemorrhoidal plexus (Fig. 415).

20.5.2 Anesthesia

Operations which involve the perianal region or cutaneous zone can be managed satisfactorily with local infiltration. Lengthier and more internal operations require general anesthesia. When dealing with perirectal abscesses and fistulae, it is always wise to employ general anesthesia as the lesions are quite painful and often extend far deeper than clinically expected.

20.5.3 Planning the Operation

We prefer to perform rectal surgery in the dorsal lithotomy or gynecologic position with the patient on his back, the legs up and spread, and the perineum down at the edge of the table. Localization of lesions is then based on the hands of a clock, from the perspective of the surgeon, not the anatomist.

One pitfall is the extrusion of anal mucosa through the wound secondary to wound tension. Such tissue remains permanently weeping and inflamed and continues to be a chronic problem until reoperated. Thus almost all elliptical excisions should be performed in a radial fashion; tangential ellipses are acceptable only if extremely small in diameter and relatively external. Local flaps also threaten to distort the anal anatomy by wound tension, especially by scar formation. Thus flaps in this region should be generous enough to avoid this negative aspect.

When treating perianal viral condylomata, one must be aware of whether intraanal lesions are also present. If so, they can be treated at the same sitting. The recurrence rate is high, regardless of technique. Small lesions may be overlooked, but many subclinical viral infections are also present which evolve into condylomata following the surgery. The list of operative choices is long: curettage and electrocautery, hot-loop surgery, CO_2 laser, and cryosurgery. Adjuvant therapy with interferon has been recommended for extensive lesions. More important is close clinical follow-up to identify and treat recurrences before they become widespread.

20.5.4 Surgical Techniques

The extremely painful external hemorrhoid, or perianal thrombosis, represents a thrombophlebitis of one of the external hemorrhoidal veins. Rapid pain relief is provided by local anesthesia, radial incision, and extirpation of the thrombus and vessel wall. The wound heals well over a few days without suturing. Occasionally a second asymptomatic thrombus is seen nearby; this should also be removed.

Large condylomata acuminata (carcinoma of Buschke-Löwenstein, verrucous carcinoma) can be removed best with radical excision; electrocautery and CO_2 laser are other possibilities. One can treat small fibromas, papillomas, and anal skin tags just as one treats condyloma acuminata, by excising them with electrocautery at their base and allowing them to heal by secondary intention.

Larger anal skin tags are best excised with dissection scissors, but they can also be excised with a hot knife. The defect is best closed with a resorbable suture, although secondary healing also works well. It is better not to treat more than three or four anal skin tags in one session and to leave abundant normal skin behind; otherwise strictures may form as the lesions heal.

For repair of a partial rectal prolapse or a chronic ectropion of mucosa we prefer a modification of the Milligan-Morgan method, similar to a VY-plasty. The same technique can be used for large anal skin tags and external hemorrhoids. The lesion is excised with a radial rhomboid and a triangle is then moved from the adjacent skin to close the defect, just as with a VY-plasty. Closure is accomplished with resorbable sutures.

Acute and subacute anal fissures sometimes do not heal with conservative treatment. Since there is an extremely high tonus of the sphincter, one can attempt a digital sphincter dilatation. After two to four fingers are introduced into the anal canal, increasing pressure is applied to dilate the canal gradually. Since rupture of either the internal or external anal sphincter represents a disastrous complication, only those with experience should attempt this procedure.

Chronic anal fissures can be treated by excision after digital sphincter dilatation. Another possibility is to curette the base and allow secondary healing. Fissures often arise in connection with a a sentinel pile; this can also be excised. Another possibility is a lateral or posterior sphincterotomy either alone or with a simultaneous excision of the fissure.

Incomplete and complete submucosal and subcutaneous anal fistulae can best be visualized by methylene violet injection and then explored with a probe. Using the probe for a guide, the entire fistula tract is then opened; if needed, the roof of the fistula is excised. The fistula tract is either excised or curetted and allowed to heal secondarily.

Deeper anal fistulae should be treated by general surgeons. The same is true of periproctal abscesses. Dermatologists occasionally treat very superficial perianal abscesses, which must be opened with an elliptical excision, packed, and allowed to heal from their base. When not treated correctly, perianal abscesses frequently progress to chronic fistula formation.

Reconstructive procedures after excision of perianal tumors can be generous advancement or rotation flaps. Wound tension should be avoided to minimize scar formation and subsequent functional anal problems.

The postoperative care of such surgery patients hinges primarily on sitz baths and antibiotic or antiseptic ointments. Systemic antibiotics are rarely needed, but adequate pain relief is always required. Laxatives should be prescribed to avoid painful postoperative bowel movements. Following major procedures it may be wise to allow the bowel to rest for a few days.

Fig. 416. Simple excision
a Tangential excision of an eroded anal tag at 12 o'clock
b Radial excision of an anal polyp at 5 o'clock
c Preoperative appearance
d Appearance after 5 years

Fig. 417. VY-plasty for partial anal prolapse
a Operative plan for excision of inner aspect of the prolapse
b V-shaped excision of mucosa
c Excision defect
d Y-shaped closure with tip of perineal skin included in anal ring
e Preoperative appearance
f Appearance after 1 year

Fig. 418. Excision of anal fissure
a Anal fissure at 7 o'clock
b Incision of fissure
c Complete excision of entire fissure base with secondary healing
d Appearance after 4 weeks

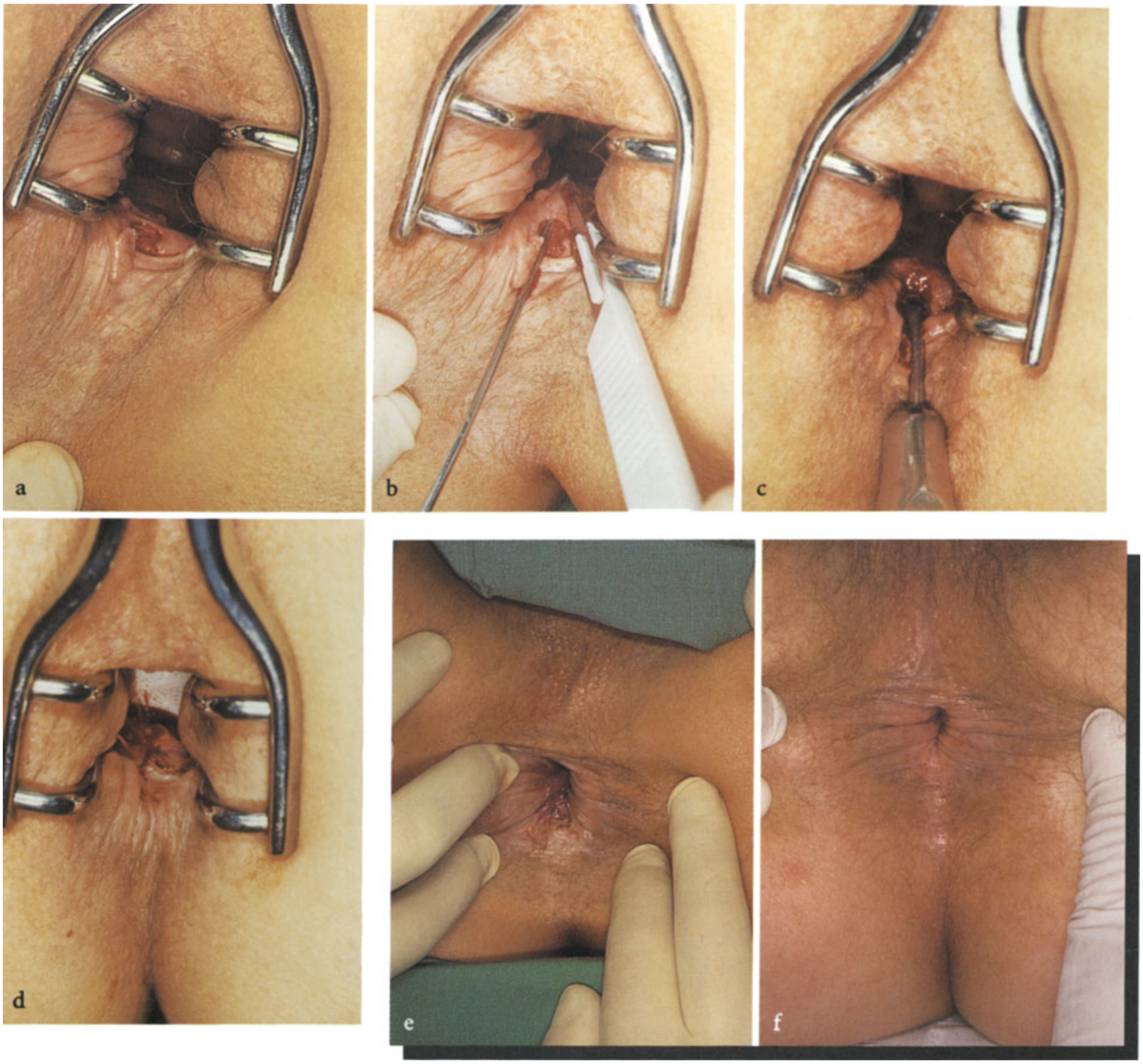

Fig. 419. Excision of an anal fistula

a Incomplete submucosal anal fistula at 6 o'clock
b Probing and splitting the fistula
c Curettage of the fistula tract
d Closure, although healing by secondary intention is also possible
e Preoperative appearance
f Appearance after 1 year

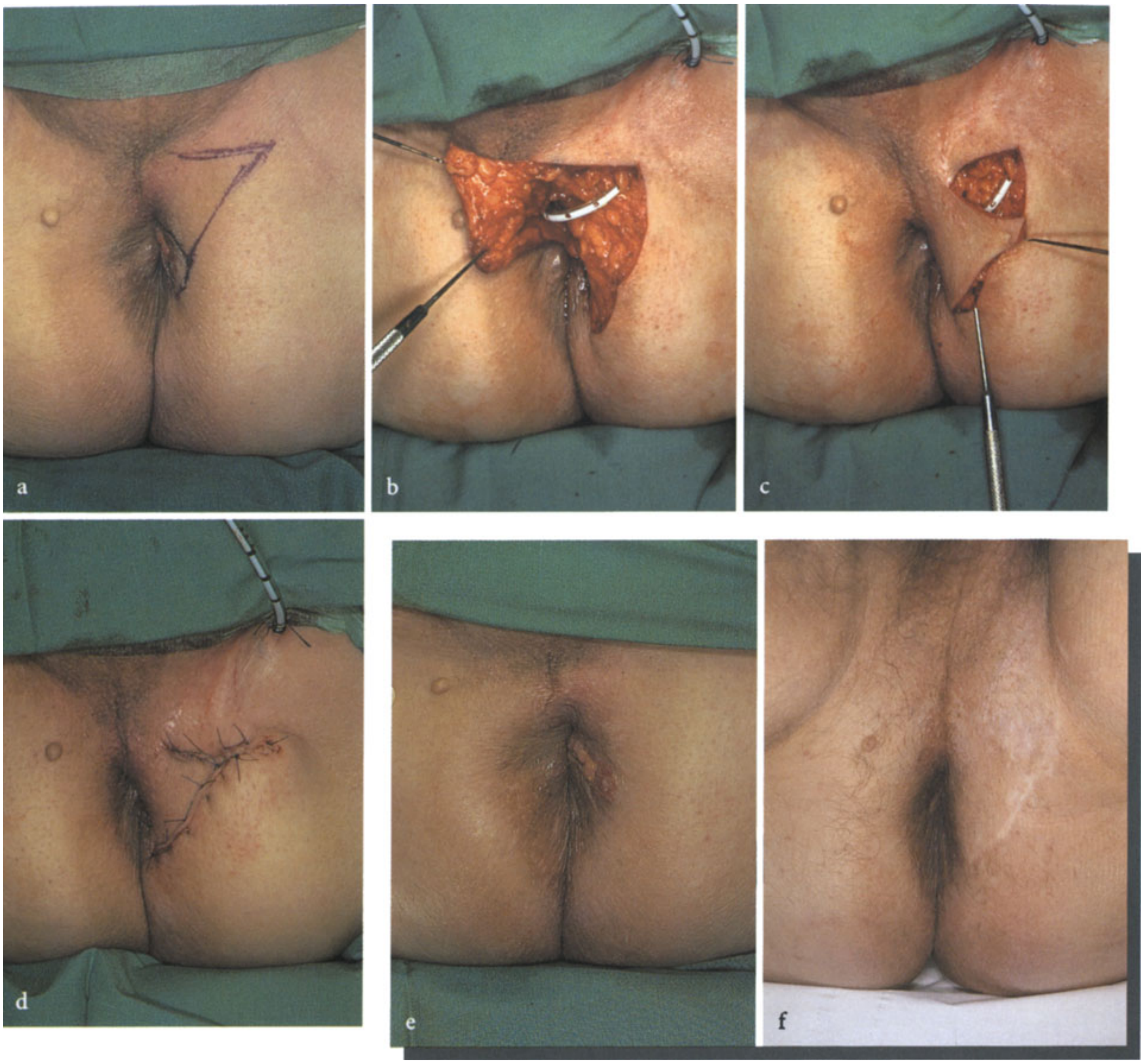

Fig. 420. Advancement flap with back cut
a Operative plan for perianal Bowen's disease (squamous cell carcinoma in situ)
b Excision defect and mobilization of advancement flap
c Moving the flap into place
d End of operation
e Preoperative appearance
f Appearance after 3 years

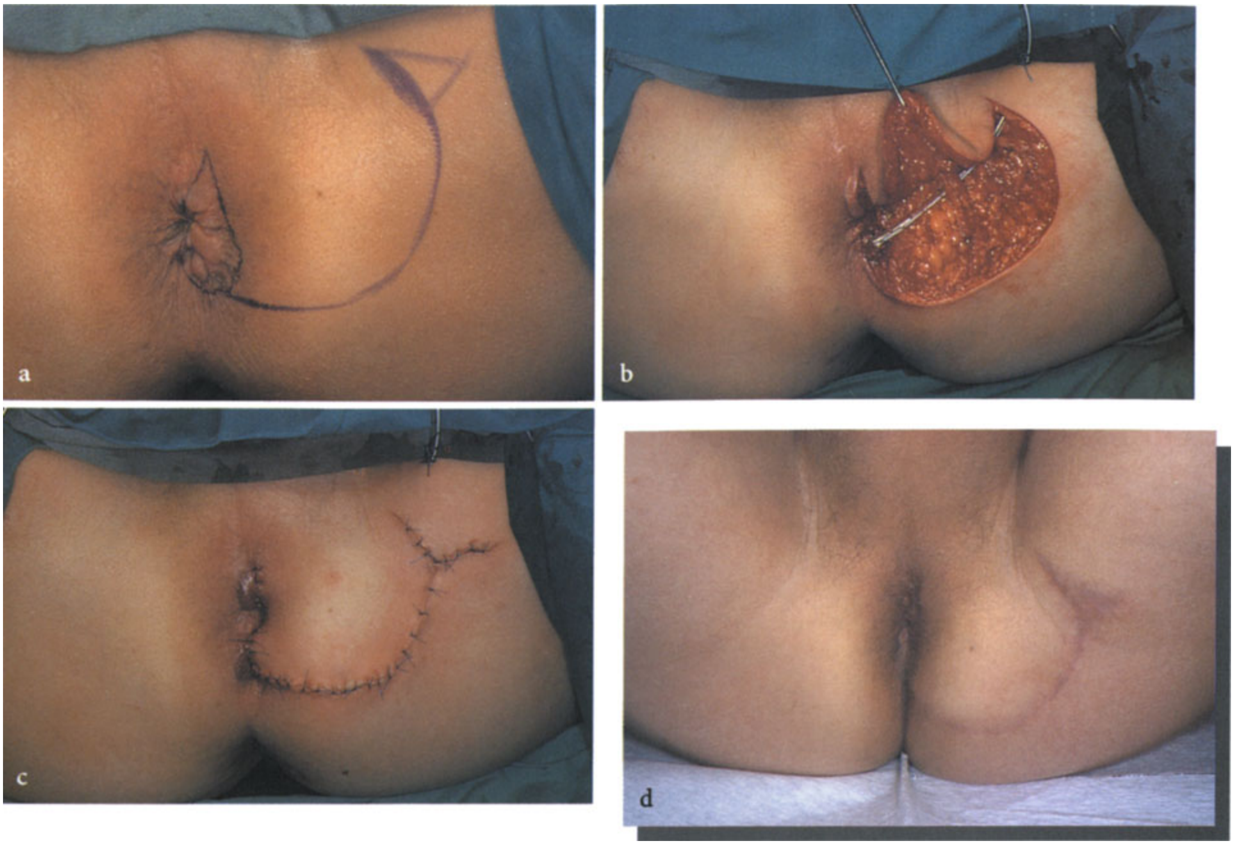

Fig. 421. Rotation flap
a Operative plan for excision of Bowen's disease (squamous cell carcinoma in situ) with simple rotation flap
b Mobilization of the flap
c End of operation
d Appearance after 6 months

21 Extremities

21.1 Arms and Legs

The skin on arms and legs is attached relatively firmly to the underlying fascia with minimal subcutaneous tissue. The skin over the knees and elbows appears relatively mobile, but there is little subcutaneous tissue, and removal of large amounts of skin leads to restriction of motion. Thus flaps are generally not very successful.

21.1.1 Anatomy

The anatomy is simple; the vessels and nerves for the most part are deep to the fascia. The more complicated anatomic problems are discussed above (see Chap. 15).

21.1.2 Anesthesia

Almost all cases can be performed under local anesthesia. Only rare cases require a regional block or general anesthesia.

21.1.3 Planning the Operation

The main indications for cutaneous surgery on the extremities are benign and malignant tumors and congenital malformations. Elliptical excisions or VY-plasties should be oriented along the skin tension lines, which usually means horizontally. However, when a lesion itself is oriented longitudinally, it is more effective to use a vertically oriented or curved incision. Undermining is easier when carried out at the level of the fascia, not that of the subcutaneous fat.

When planning local flaps, one should avoid the antecubital and popliteal fossae; wound healing here can lead to contractures and restricted motion. When there is doubt, it is wise to use a skin graft. If a deep wound is present, the base can then be conditioned prior to grafting in order to fill the soft tissue defect. Z-plasties are the best way in which to correct scars, especially those over joints; they add length and allow mobility. Sometimes we combine a Z-plasty with a skin graft.

21.1.4 Surgical Techniques

Sequential partial excisions can be used with large congenital melanocytic nevi, epidermal nevi, and tattoos. One simply repeats an elliptical excision or VY-plasty several times with an appropriate interval of 6–12 months between stages. Another approach is the use of tissue expanders.

Attempts to remove decorative tattoos with high-speed dermabrasion frequently fail. The particles are generally too deep and lie at such varying levels that complete removal is impossible. In addition, marked scarring is common on the extremities. Salabrasion (see Sect. 6.5) may offer minimum improvement, but most tattoo removal today is carried out by lasers.

When performing a Z-plasty to revise a scar, one must be alert to the possibility that underlying vessels or nerves can be involved, and that it is therefore necessary to proceed carefully. Local flaps can be used cautiously to fill the resulting defect but only when the vascular supply is excellent. Otherwise one should start with a skin graft.

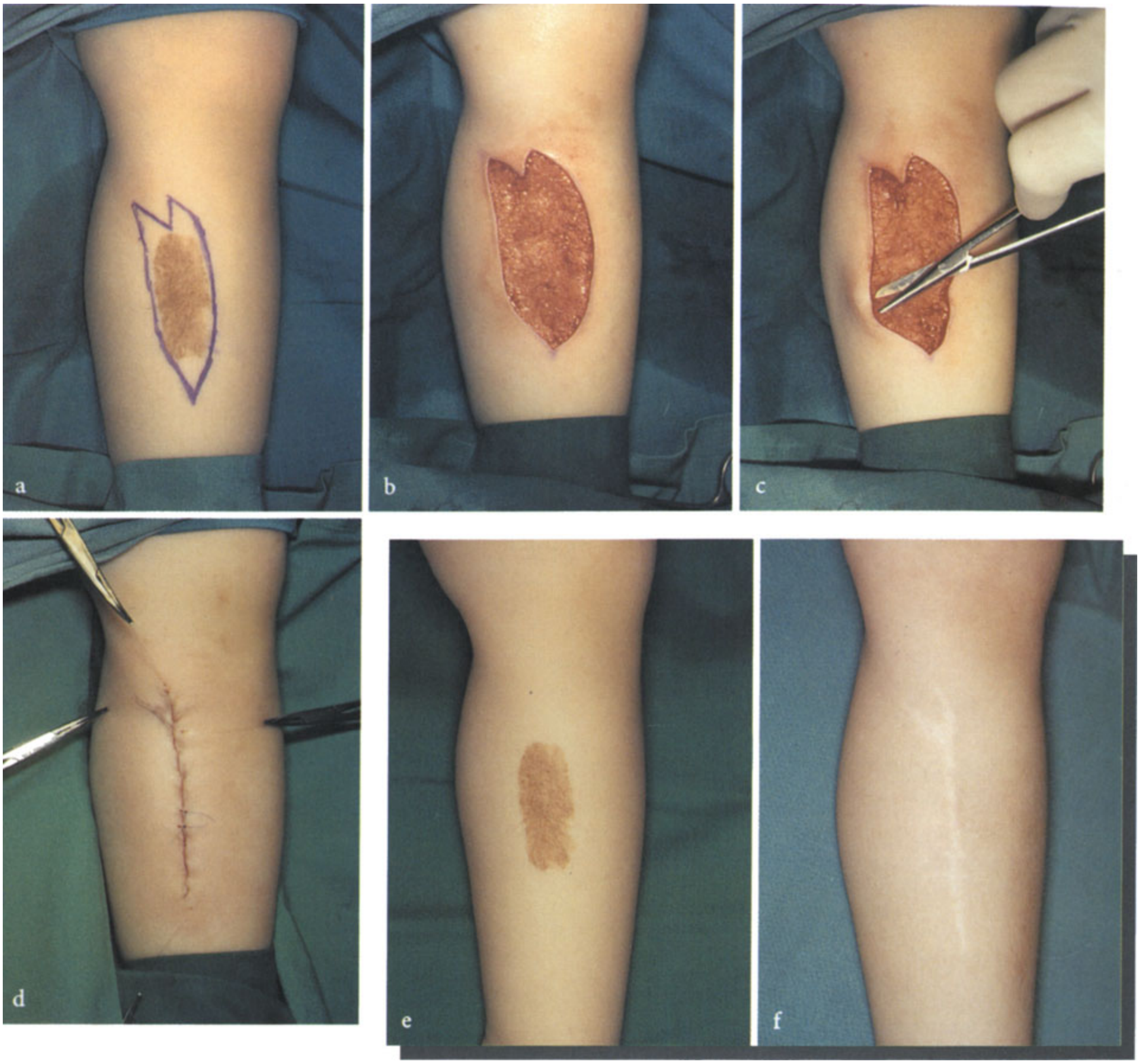

Fig. 422. VY-plasty
a Operative plan for excision of a congenital melanocytic nevus
b V-shaped excision
c Undermining
d End of operation
e Preoperative appearance
f Appearance after 1.5 years

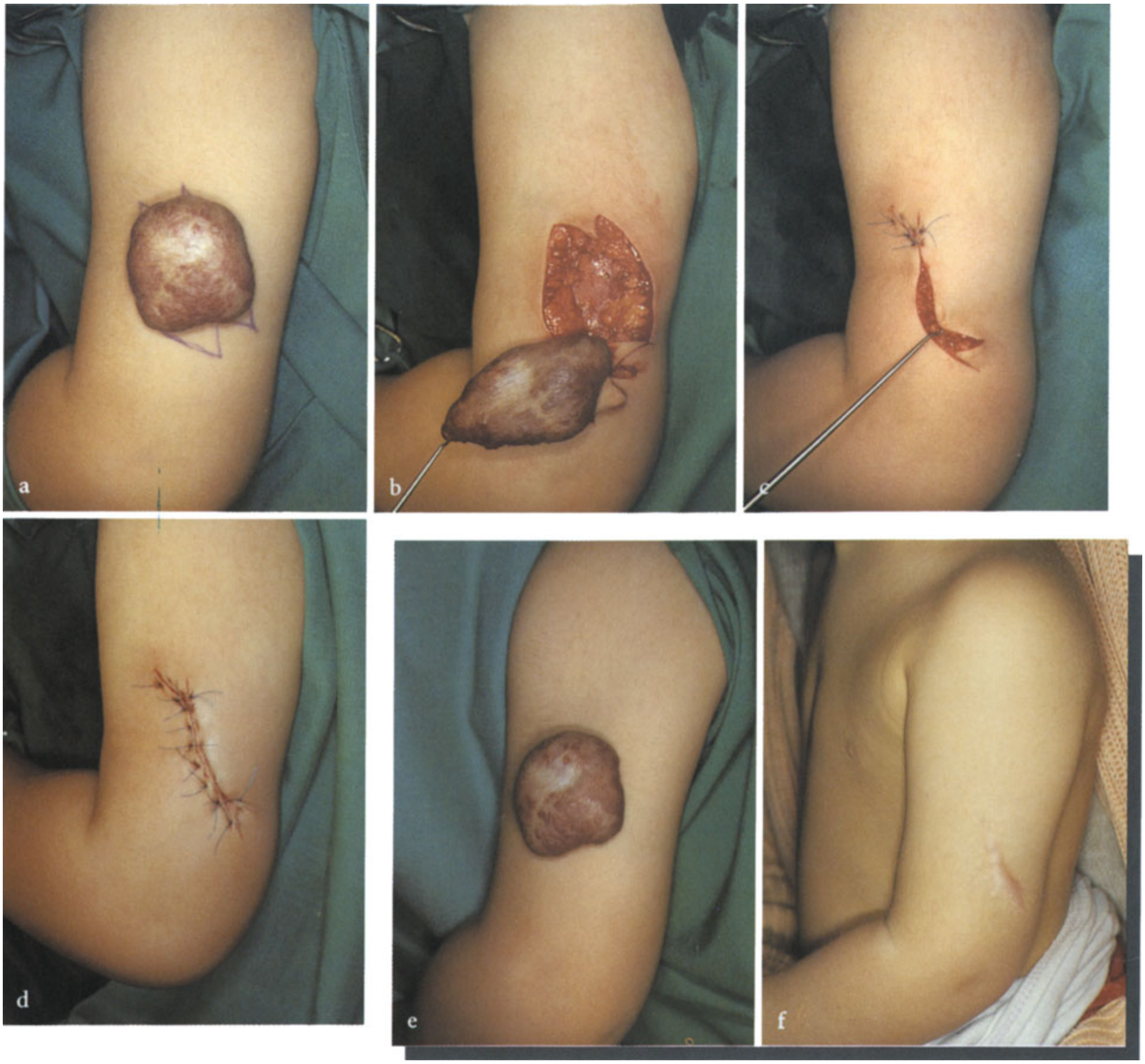

Fig. 423. Double WY-plasty
a Large hemangioma, with operative plan
b Excision with opposing W's
c Stepwise closure
d End of operation
e Preoperative appearance
f Appearance after 6 months

Fig. 424. Serial or staged excision
a Operative plan for VY-plasty as part of serial excision of a congenital melanocytic nevus, part of which has already been excised
b Another VY-plasty at a later date
c Final excision through yet another VY-plasty
d Skin closure after final procedure
e Preoperative appearance
f Appearance 6 years after final procedure; the trace residual pigment in the scar was later excised

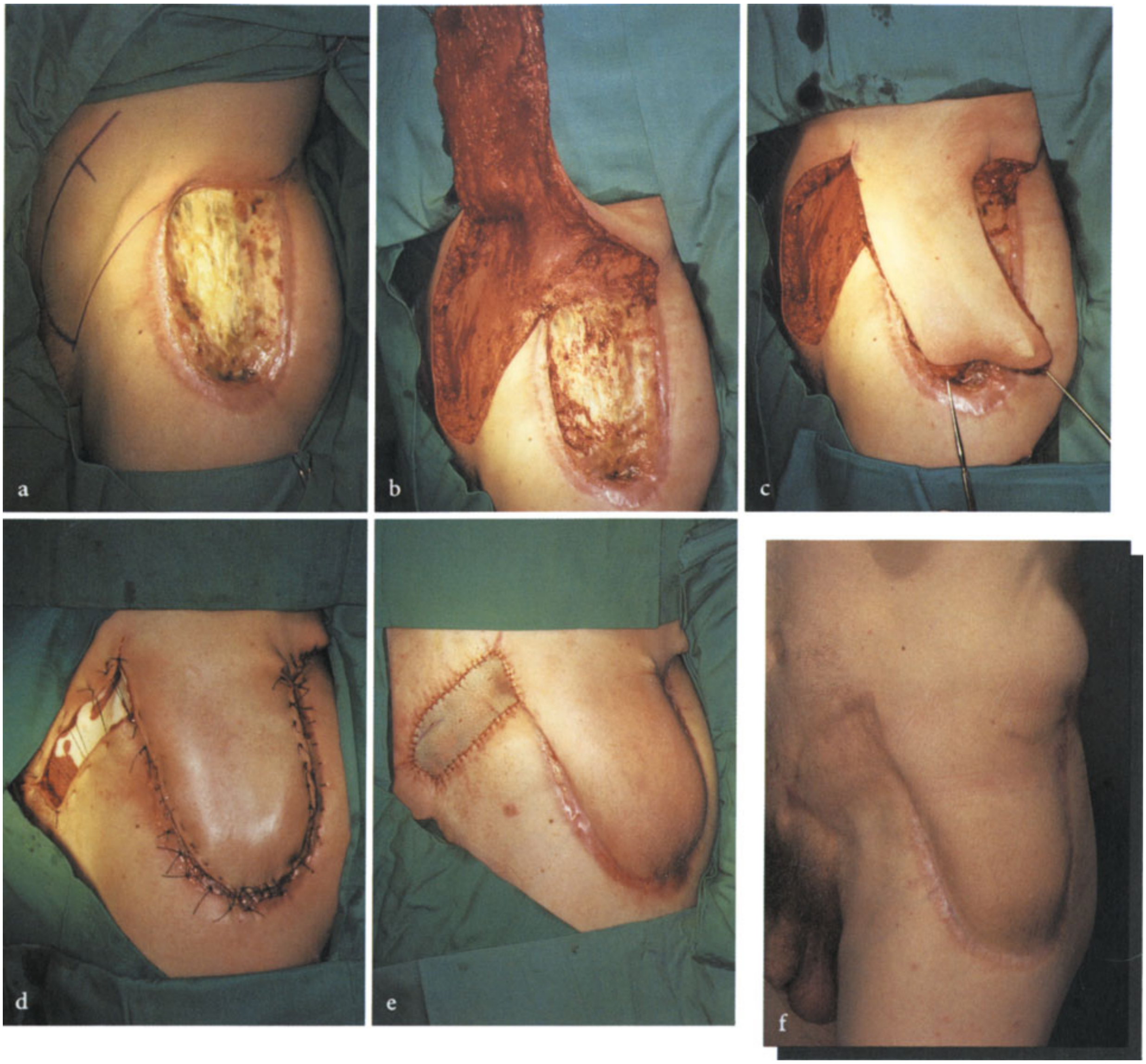

Fig. 425. Transposition flap
a Operative plan to excise large radiation ulcer
b Mobilization of flap from inguinal region
c Placement in defect
d Wound conditioning of secondary defect
e Secondary defect covered with split-thickness skin graft
f Appearance after 9 months

Fig. 426. Double subcutaneous pedicle flap
a Defect after excision of basal cell carcinoma, with operative plan
b Preparation of flaps, avoiding damage to subcutaneous vessels
c Moving the flaps together
d End of operation
e Preoperative appearance
f Appearance after 1.5 years

Fig. 427. Multiple Z-plasties
a Operative plan for revision of extensive burn scar
b Transposing the first Z-plasty
c One-by-one the Z-plasties are performed, moving onto the upper arm
d End of operation
e Preoperative appearance
f Appearance after 4 months

Fig. 428. Split-thickness skin graft
a Necrosis after 3° burn
b Appearance after excision of necrotic tissue and wound conditioning
c Defect covered by split-thickness skin graft with slits to avoid hematoma formation
d Appearance after 6 months

Fig. 429. Mesh split-thickness skin graft
a Excision of a large verrucous carcinoma
b Excision defect
c Clean, well-vascularized wound after conditioning
d Mesh split-thickness skin graft in place
e Preoperative appearance
f Appearance after 4 months

21.2 Hands, Feet, and Digits

The complicated functional anatomy limits the simple primary closure of wounds here to the smallest procedures. Little tissue is available as a reservoir.

21.2.1 Anatomy

The location of the sensory nerves is discussed above (see Sect. 3.2.2) and is shown in Figs. 430 and 431. In the fingers and toes the general fascia is mixed with the insertion fascia of the extensor and flexor tendons. The main problem is contractures; even a small scar in the wrong place may restrict function.

21.2.2 Anesthesia

Almost all procedures can be performed with local infiltration, digital block, or a hand or foot block. General anesthesia is needed when removing multiple verrucae, especially in children.

21.2.3 Planning the Operation

A preoperative tourniquet may be advisable. In general, one should use skin grafts rather than flaps, in order to retain normal motion as much as possible.

21.2.4 Surgical Techniques

Multiple verrucae can be removed by sharp curette. Even large accumulations can be removed in this simple way. We generally use Monsel's solution or 25% aluminum chloride tincture for hemostasis, for scarring from cautery is often unacceptable on the hands. Postoperative care consists of daily soaks with an astringent or antiseptic solution and the application of antibiotic ointments. Healing generally occurs almost without scarring. Close follow-up is needed to detect the frequent recurrences at an early stage.

Ellipses and VY-plasties should be performed with an curved incision, just as on the limbs.

One can sometimes employ a flap on the back of the hand or foot. Either an advancement flap with a back cut, a rotation flap, or a transposition flap can be used. A lobed flap on the fingers can be moved from the lateral to the dorsal surface. Other rotation flaps are also to be placed cautiously.

When skin grafts are used, they should always be full-thickness grafts. Such grafts do not shrink, are cosmetically more acceptable, and can better stand the normal trauma to which the hands and feet are exposed.

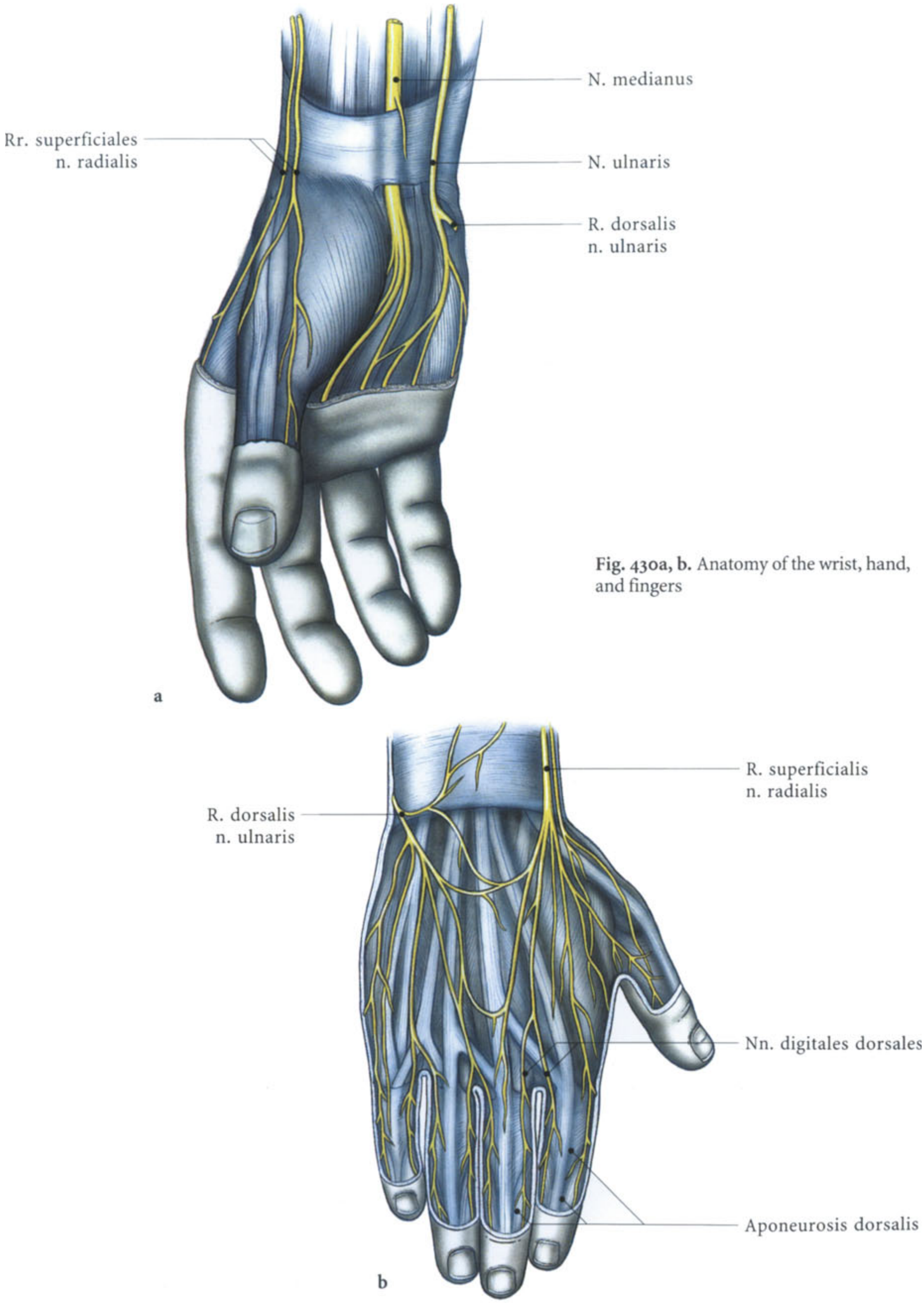

Fig. 430a, b. Anatomy of the wrist, hand, and fingers

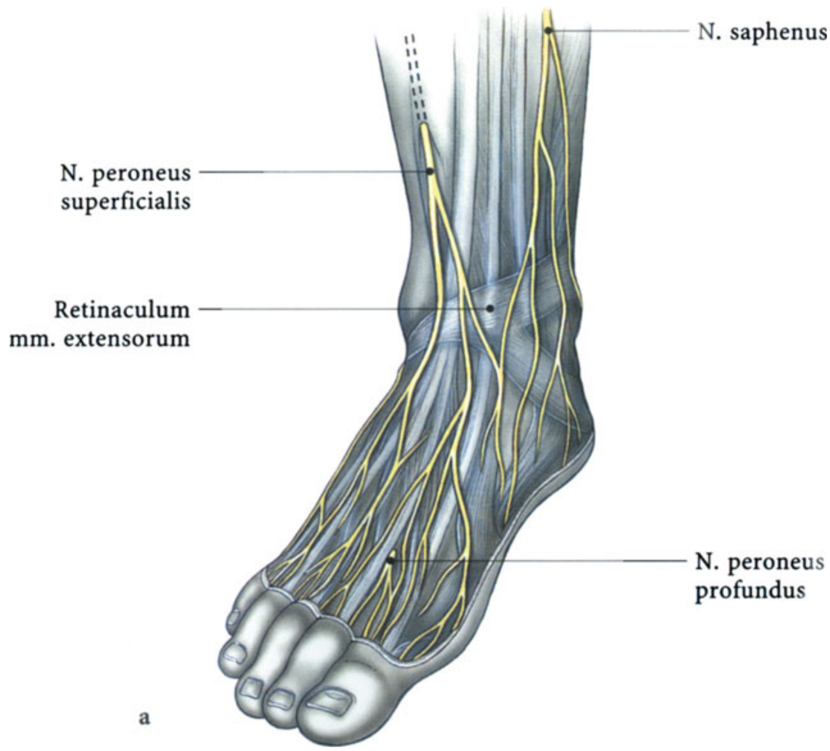

Fig. 431a, b. Anatomy of the ankle, foot, and toes

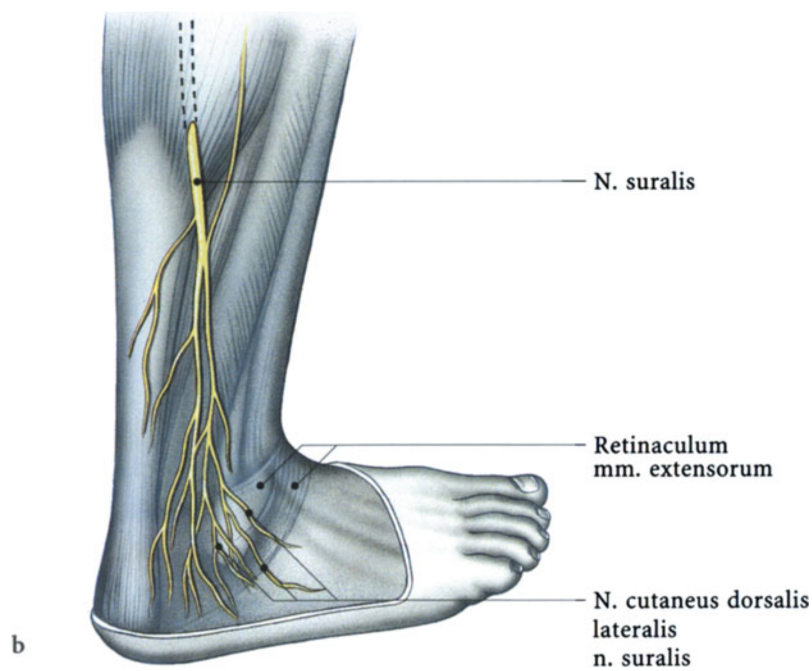

Fig. 432. Advancement flap with back cut
a Operative plan for excision of squamous cell carcinoma with repair
b Excision defect and mobilization of flap
c Advancement of flap
d End of operation
e Preoperative appearance
f Appearance after 4 months

Fig. 433. Double advancement flaps with back cuts
a Defect after excision of squamous cell carcinoma with plan for first advancement flap
b First flap advanced into place; plan for second flap
c Mobilization of second flap
d Moving second flap into residual defect
e End of operation
f Appearance after 10 months

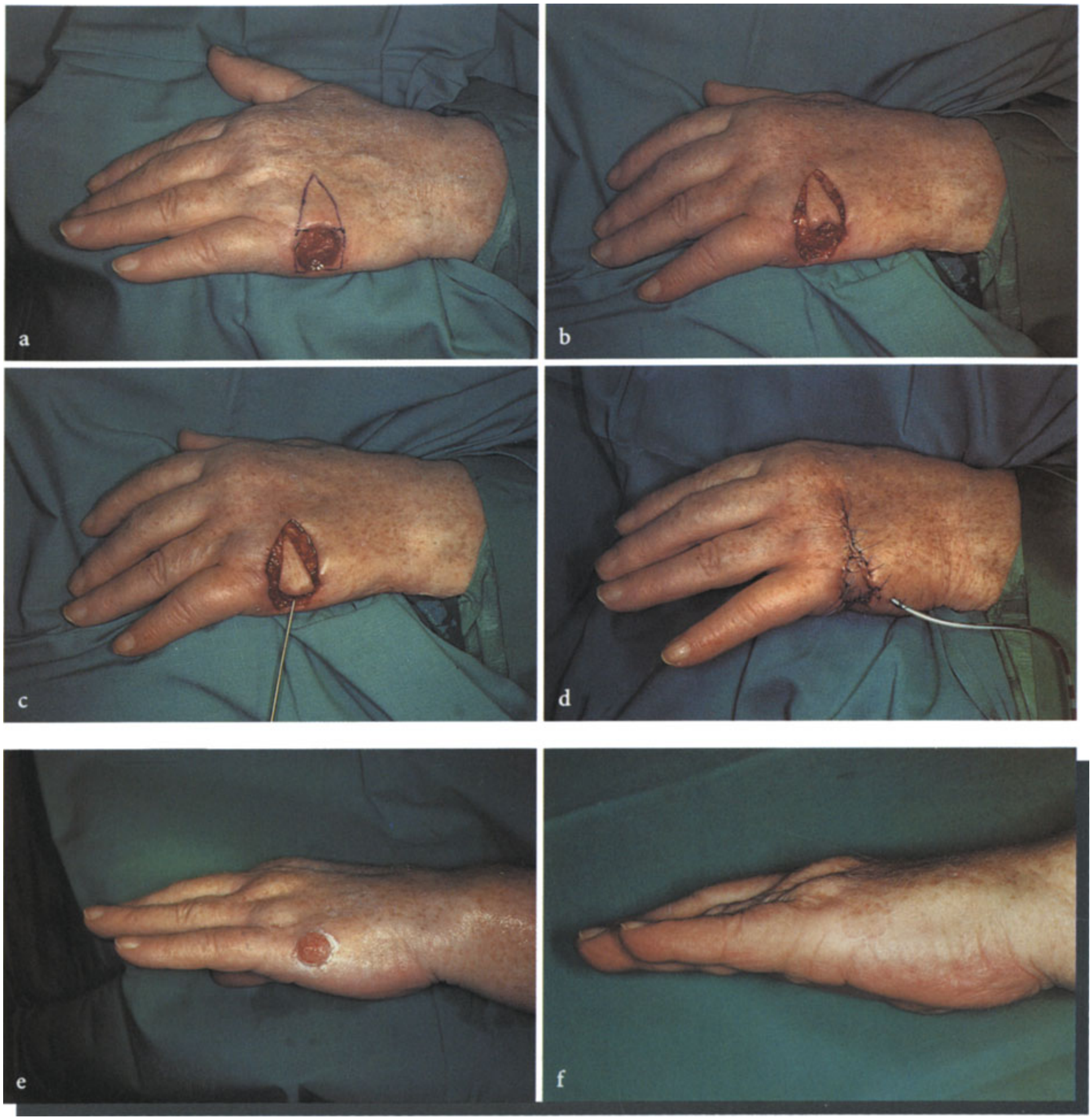

Fig. 434. Subcutaneous pedicle flap
a Defect after excision of squamous cell carcinoma, with operative plan
b Preparation of subcutaneous pedicle flap
c Moving flap into place
d End of operation
e Preoperative appearance
f Appearance after 15 months

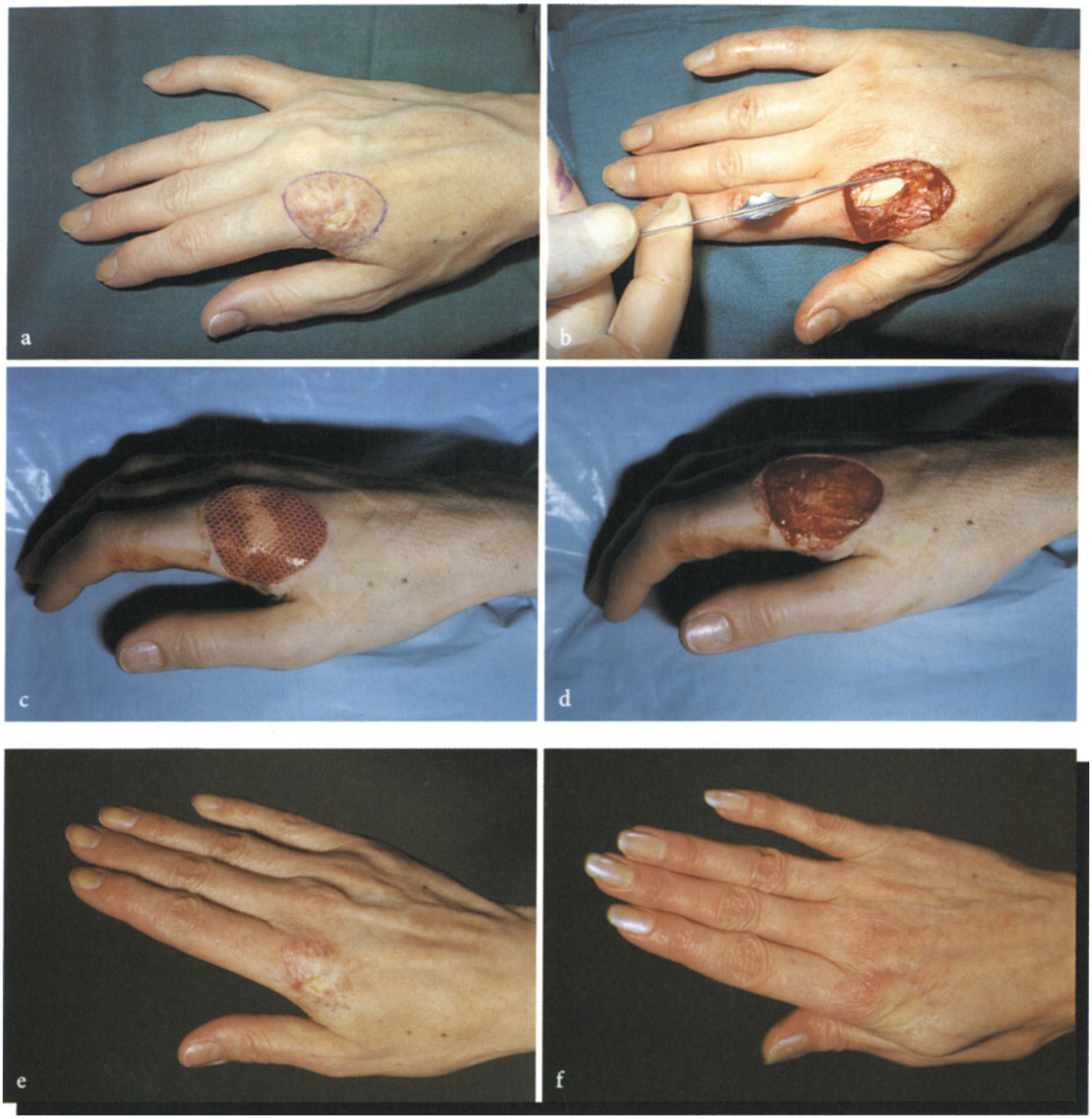

Fig. 435. Full-thickness skin graft
a Ulcerated radiation dermatitis with exposed extensor tendon
b Excision defect
c Wound conditioning with polyurethane gauze
d Now the granulation tissue has completely covered the exposed tendon and a full-thickness skin graft can be placed
e Preoperative appearance
f Appearance after 3 years

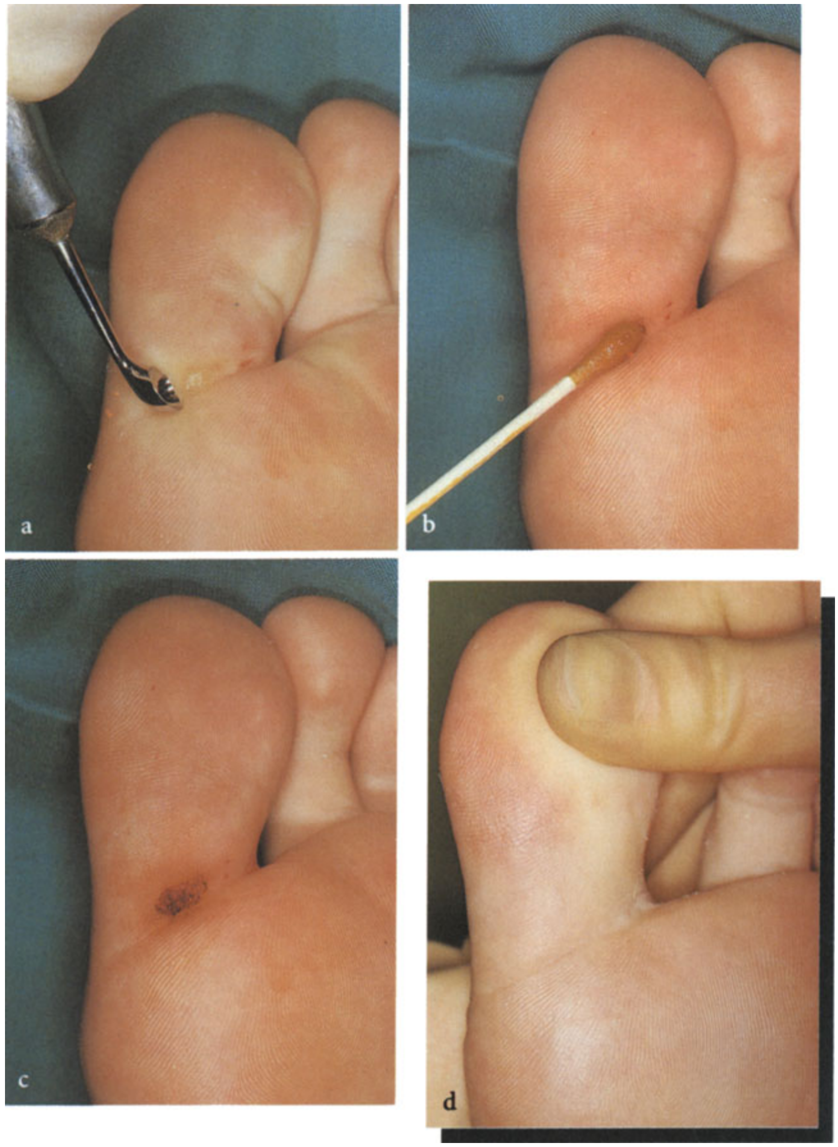

Fig. 436. Curettage of plantar wart
a Curettage removal
b Hemostasis with Monsel's solution
c End of procedure
d Appearance after 6 months

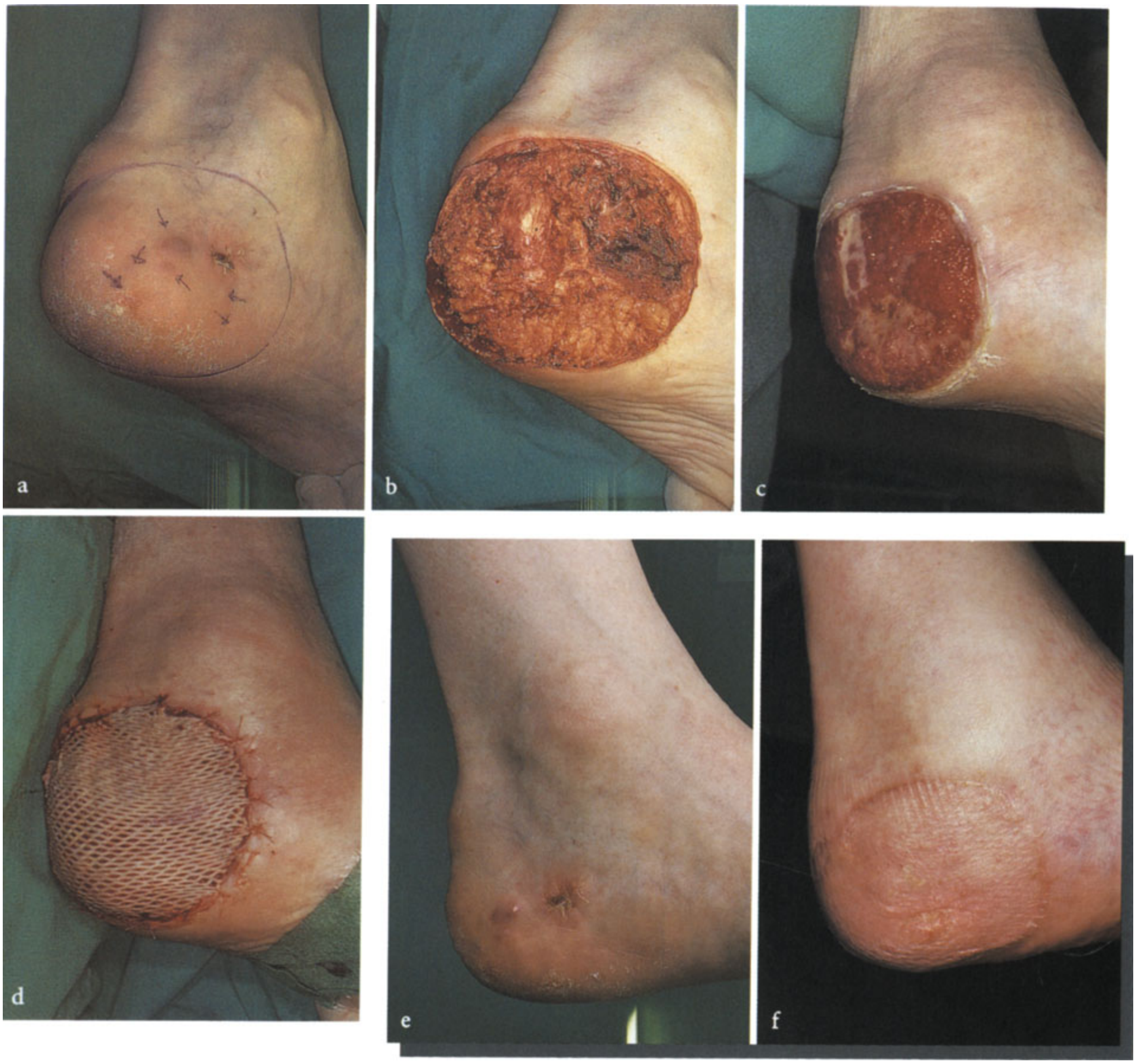

Fig. 437. Mesh split-thickness skin graft
a Wide local excision of biopsy-confirmed acral lentiginous malignant melanoma with satellite metastases
b Excision defect
c Granulation tissue after wound conditioning
d Mesh split-thickness skin graft in place
e Preoperative appearance
f Appearance after 9 months

Fig. 438. Advancement flap with back cut
a Operative plan for excision of melanocytic nevus
b Excision defect and preparation of flap
c Advancing flap into place
d End of operation
e Preoperative appearance
f Appearance after 9 months

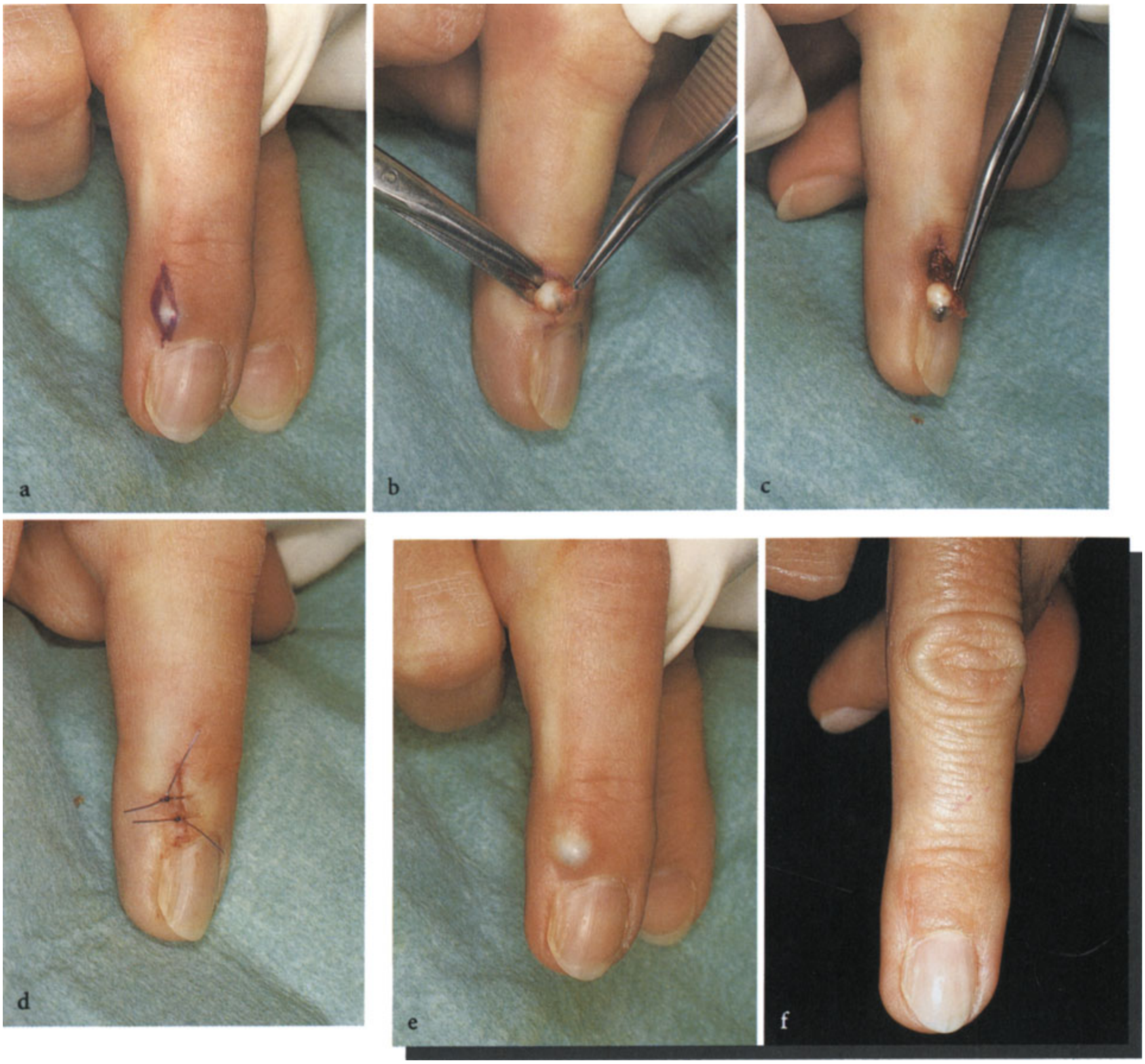

Fig. 439. Primary closure with undermining
a Spindle-shaped excision of epidermoid cyst
b Freeing the cyst
c Removing the cyst
d End of operation
e Preoperative appearance
f Appearance after 6 months

Fig. 440. Advancement flap
a Operative plan for excision of radiation keratosis and reconstruction by classic Burow's flap
b Mobilization of flap
c Moving the flap into place
d End of operation
e Preoperative appearance
f Appearance after 3 months

Fig. 441. Advancement flap with back cut
a Operative plan for excision of a pyogenic granuloma with closure
b Mobilization of flap
c Advancement of flap
d End of operation
e Preoperative appearance
f Appearance after 2 years

Fig. 442. Rotation flap
a Operative plan for excision of melanocytic nevus
b Excision defect and mobilization of flap
c Rotation of flap
d End of operation
e Preoperative appearance
f Appearance after 4.5 years

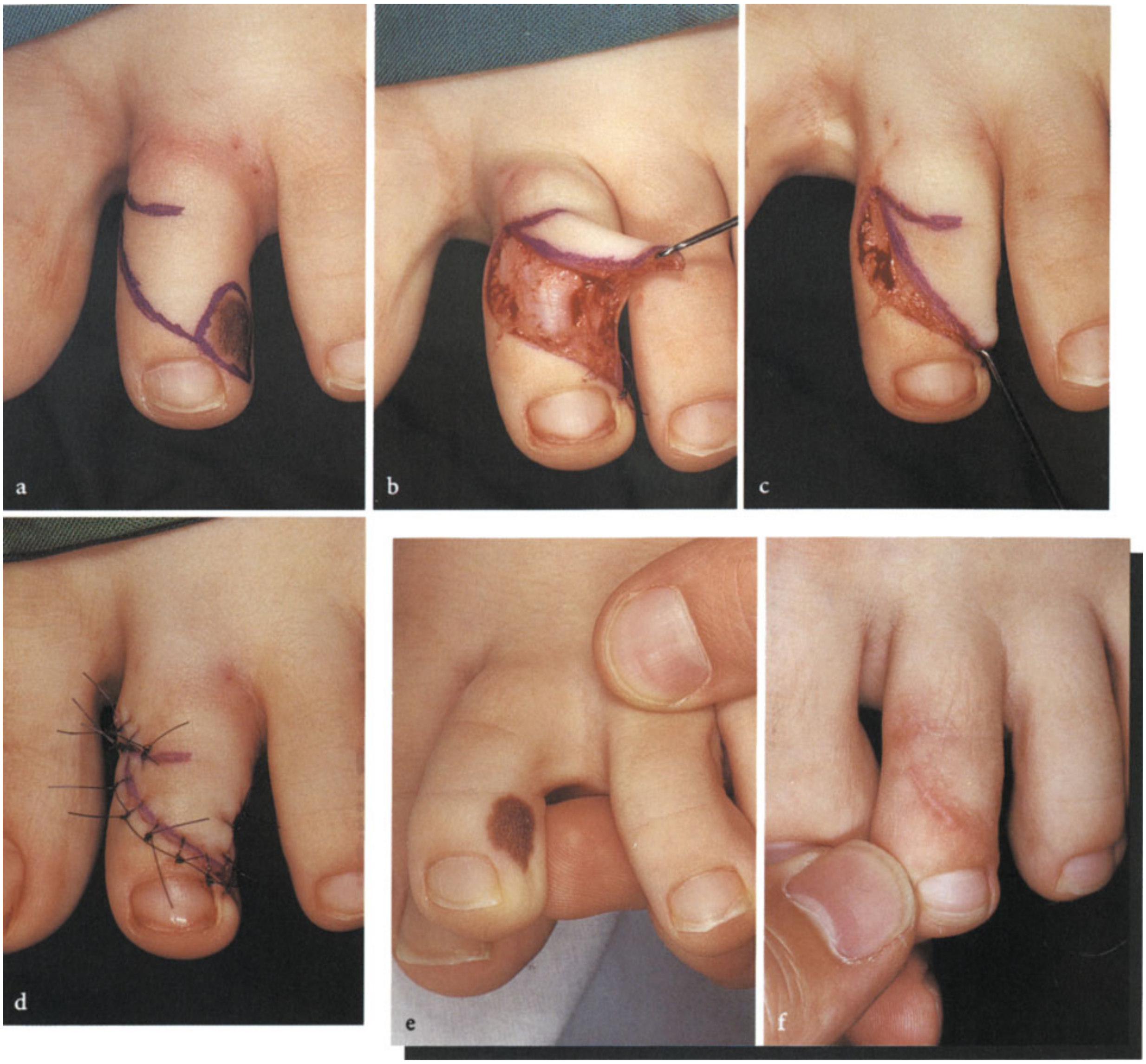

Fig. 443. Rotation flap with back cut
a Operative plan for excision of melanocytic nevus
b Mobilization of flap
c Back cut is performed after rotating flap
d End of operation
e Preoperative appearance
f Appearance after 5 months

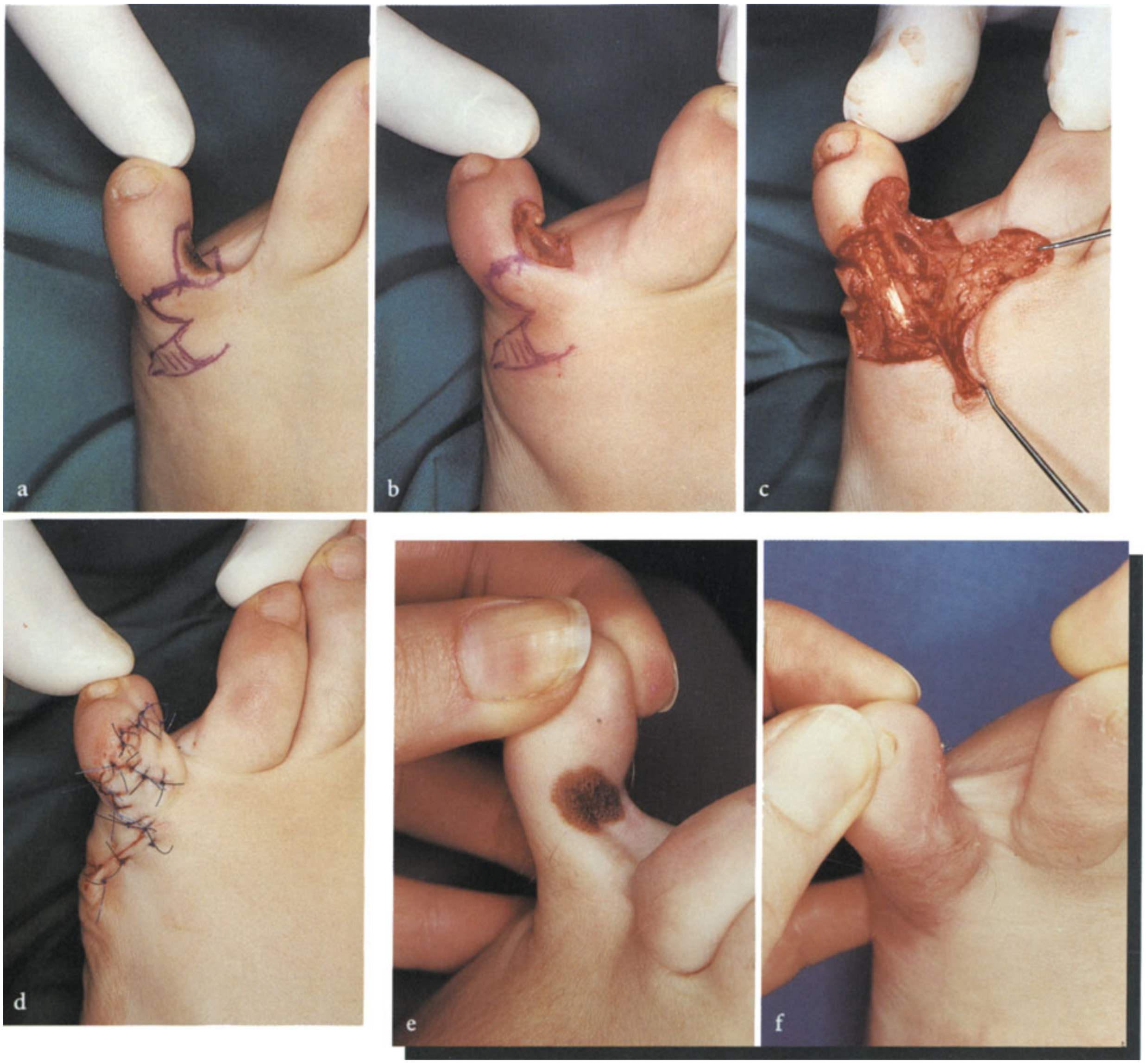

Fig. 444. Bilobed flap
a Operative plan for excision of melanocytic nevus
b Excision defect
c Preparation of both flaps
d Moving the flaps into place and closure
e Preoperative appearance
f Appearance after 4 months

Fig. 445. Full-thickness skin graft
a Pyogenic granuloma of thumb
b Excision defect
c After wound conditioning, freshening with curette
d Nicely approximated full-thickness skin graft from inner aspect of upper arm
e Preoperative appearance
f Appearance after 2 years

Fig. 446. Cross finger flap
a Operative plan for excision of melanocytic nevus
b Wound defect closed with broad-based flap from adjacent finger
c Appearance after closure
d After 2 weeks, pedicle is severed, flap fitted, and donor defect closed primarily after undermining
e Preoperative appearance
f Appearance after 6 months

21.3 Nails

The nails are useful tools, providing mechanical protection and expanding the tactile function of the digit. Any operation on the nail apparatus should be as conservative as the pathologic diagnosis allows in order to preserve function and retain an acceptable cosmetic appearance. Obviously these precautions are more important when dealing with fingers than with toes.

The main indications for surgery are pigmented lesions of the nail, other subungual tumors, and deformed nails, whatever the cause. Subungual lesions are always approached by removing the nail and then obtaining tissue for histologic diagnosis. Acute infections of nail fold and nail bed, known as paronychia, can be treated conservatively with systemic antibiotics and local antiseptic measures. If they do not improve in 24–48 h, they should be treated surgically. A smoldering nail bed infection can damage the nail matrix permanently. In addition, digital infections can spread not only locally to bones, joints, and soft tissue but also ascend along tendon sheaths.

21.3.1 Anatomy

The nature of the nail matrix with its proximal and lateral processes is especially important (Fig. 447). The nail extends 3–4 mm proximally under the nail fold. The vascular supply of the nail apparatus is rich, arising from the arcuate artery.

21.3.2 Anesthesia

A digital block is the best anesthesia for all nail surgery. Local infiltration must be avoided if there is any possibility of infection.

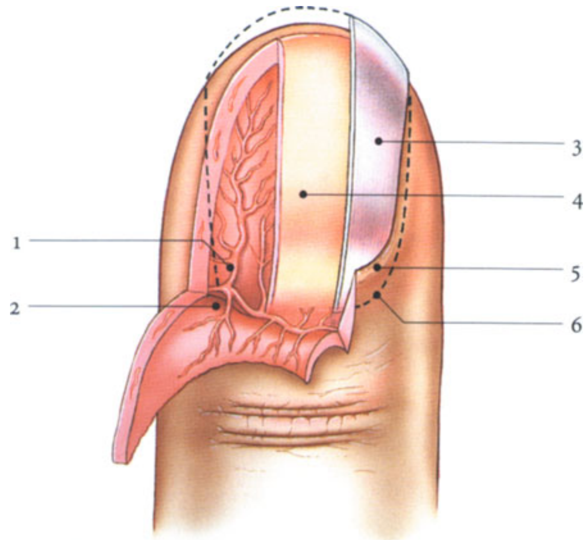

Fig. 447. Anatomy of the nail region:
1, arcuate artery
2, lateral horn of nail matrix
3, nail plate
4, nail bed
5, eponychium
6, proximal nail fold

21.3.3 Planning the Operation

All nail procedures should be preceded by the application of a digital tourniquet proximally at the base of the phalanx. When evaluating or removing peri- and subungual verrucae, one must pay particular attention to avoiding the nail matrix. Even minor injuries can lead to permanent dystrophies. For this reason we do not use electrocautery around the nail.

Infections in the area of the proximal nail fold can be opened with a horizontal incision, while those along the lateral nail fold are opened by a longitudinal incision. Often the lateral or medial aspect of the nail and hyponychium must be removed. If extensive subungual infection is present, the entire nail should be removed.

When treating onychogryphosis or the markedly deformed nails of the elderly, simple nail removal usually produces only transitory benefits. The nail matrix is generally involved, and in this case one must destroy it, producing a digit without nail. One should be sure that no underlying vascular problem is present, such as from diabetes mellitus or arterial insufficiency. Otherwise wound healing can present a difficult problem, often complicated by gangrenous changes.

Ingrown nails also require more than simple nail removal. If only this procedure is performed, the problem will recur as the nail regrows. We employ either a modified Emmert's procedure or Haneke's technique.

The complete removal of a subungual tumor should also include exposing and examining the underlying bone, especially if the mandatory preoperative radiologic evaluation suggests involvement. When dealing with malignant tumors, sometimes removing the entire nail apparatus is not sufficient, and amputation is needed, for example, in subungual malignant melanoma.

21.3.4 Surgical Techniques

The evaluation of pigmented changes of the nail region varies according to the exact location. Lesions in or beneath the nail plate can be evaluated by removing the involved part of the nail. This allows evaluation and biopsy of the nail bed, should pigment be seen here. If the pigment arises in the nail matrix, the nail plate is removed, and a longitudinal elliptical excision is made through the matrix. The defect should be closed carefully to reduce the risk of a nail dystrophy. A punch biopsy performed in the nail matrix region increases the risk of permanent nail damage if the defect is larger than 3 mm. We achieve better cosmetic results in the lateral region with a modified Emmert procedure, removing the nail and involved matrix.

This modified Emmert procedure is designed primarily for treating ingrown toenails, with or without secondary granulation tissue. An elliptical longitudinal wedge-shaped excision is performed, removing the lateral nail fold, ingrown nail, nail matrix, and granulation tissue down to the level of the phalanx. The lateral horn of the matrix must be included in the operation to avoid recurrences and spicule formation. The latter refers to tiny fragments of nail that grow from residual matrix, are of no functional value, and generally are annoying to the patient. For this reason we complete the destruction of the nail matrix with phenol (e.g. 40% phenolum liquefactum) before opposing the wound edges with several sutures or a butterfly closure.

Haneke's modification involves splitting the nail and removing the lateral ingrown component. After dissecting the area free only the lateral horn of the matrix is excised. The granulation tissue resolves spontaneously in 2–3 weeks. Alternatively, after exposing the lateral horn of the matrix, one can apply phenol for 1–2 min. The phenol must be applied to a clean, dry matrix; it can be inactivated by blood or granulation tissue.

Nail extraction can be considered for chronic, therapy-resistant onychomycosis, although today the procedure is used much less frequently than in the past. Sometimes the dystrophic nails prove difficult to remove even after undermining. We have found it helpful to split the nail lengthwise with a heavy nail clipper or scissors and then extract it piece by piece. The nail bed should be curetted to remove hyperkeratotic changes. Postoperatively, long-term topical and systemic antifungal therapy are recommended until the nail has regrown. Although more effective systemic antifungal agents are available today, the recurrence rate is still high. Patients tend to think that when the nail is removed, they are cured; the risk of recurrence must be stated explicitly prior to embarking upon a surgical "cure" for fungus.

Subungual exostoses commonly distort the nail plate, frequently causing pain. The nail plate must be removed, but the nail matrix can generally be avoided or spared. The exostosis must be excised or curetted from the phalanx. We allow the wound to heal secondarily, and generally the cosmetic results are good.

Another way in which to remove the matrix is to make a longitudinal incision at both

sides of the proximal nail fold and to reflect the skin back, exposing the matrix, after the nail is extracted. The matrix can be excised as desired and then re-covered with the proximal nail fold, almost as a natural flap.

Malignant tumors in the periungual or subungual region should be treated by the total excision of the nail apparatus. After secondary healing and wound conditioning the phalangeal tip can be covered with a full-thickness graft. If an invasive melanoma, carcinoma, or sarcoma is present, an amputation is usually necessary.

Fig. 448. Longitudinal wedge-shaped excision of the nail plate
a Operative plan for excision of nail plate to expose nail bed. The procedure was undertaken to rule out a malignant melanoma; the histologic diagnosis was subungual hematoma
b Specimen
c Secondary healing
d Appearance after 5 years with normal nail

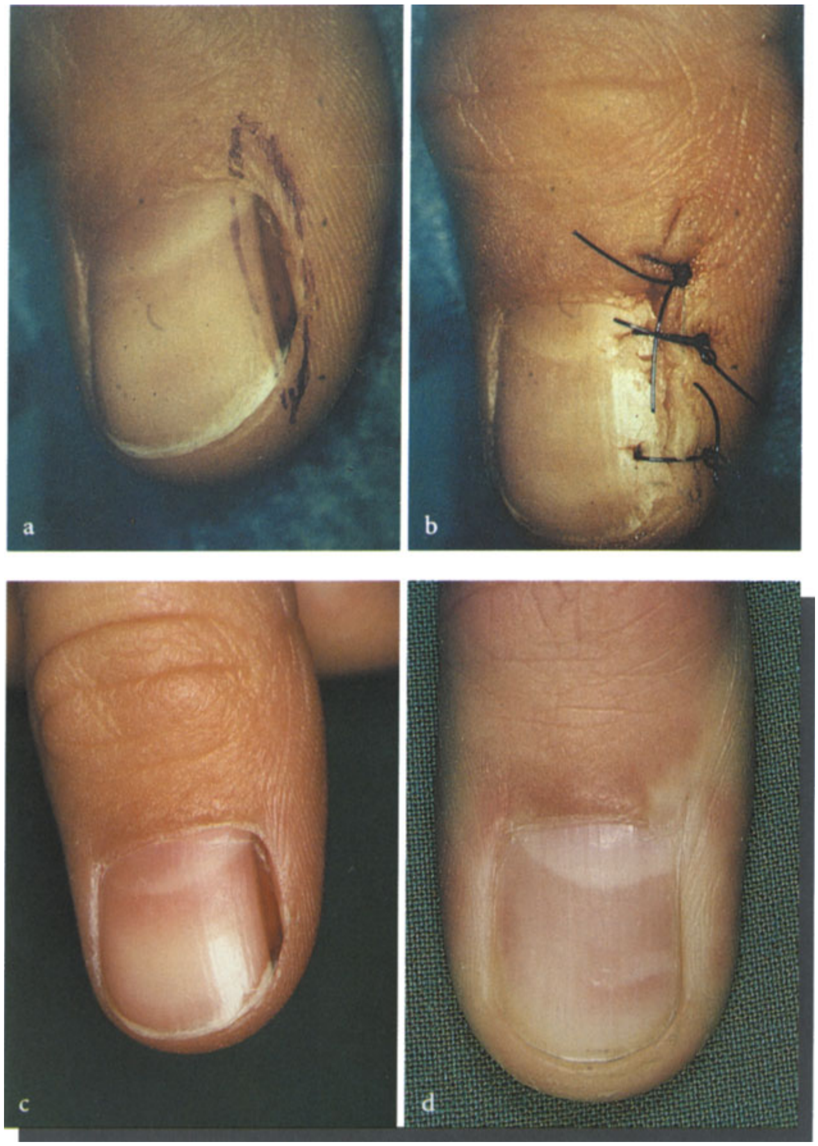

Fig. 449. Longitudinal excision
a Operative plan for excision of melanocytic nevus of nail matrix
b Appearance after spindle-shaped excision of lateral nail fold and nail matrix
c Preoperative appearance
d Appearance after 10 years

Fig. 450. Modified Emmert procedure for ingrown nail
a Spindle-shaped excision of the ingrown nail and lateral horn of the nail matrix
b Complete destruction of the involved nail matrix
c Application of phenol to matrix
d Skin closure with thick sutures
e Preoperative appearance
f Appearance after 1 year; in the interval, a similar procedure was performed medially

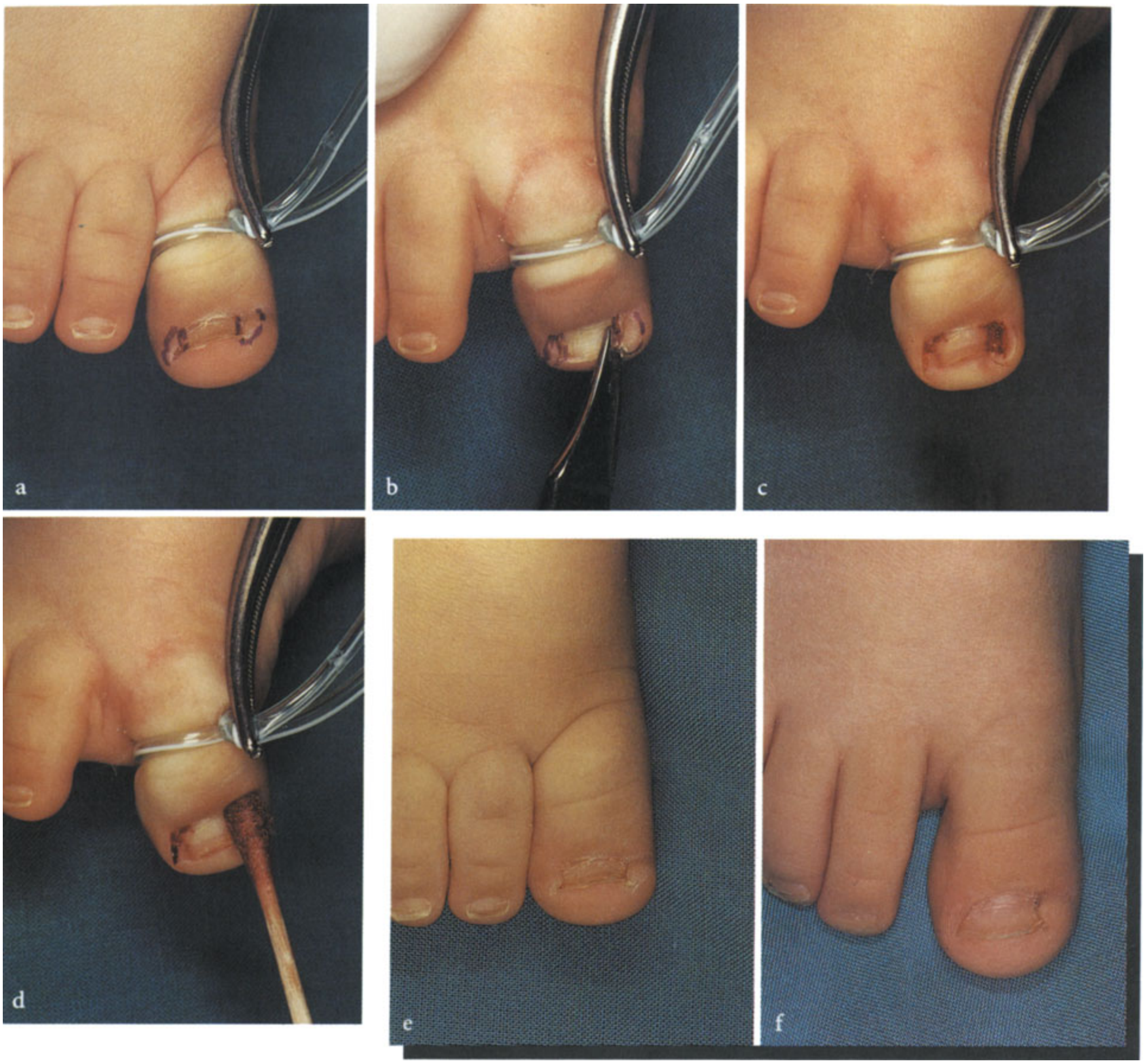

Fig. 451. Bilateral excision of the matrix horns (Haneke)
a Operative plan for bilateral ingrown nails; tourniquet is in place
b The nail is split longitudinally on both sides
c The lateral nail fragments have been removed and the matrix curetted
d Application of phenol
e Preoperative appearance
f Appearance after 3 years

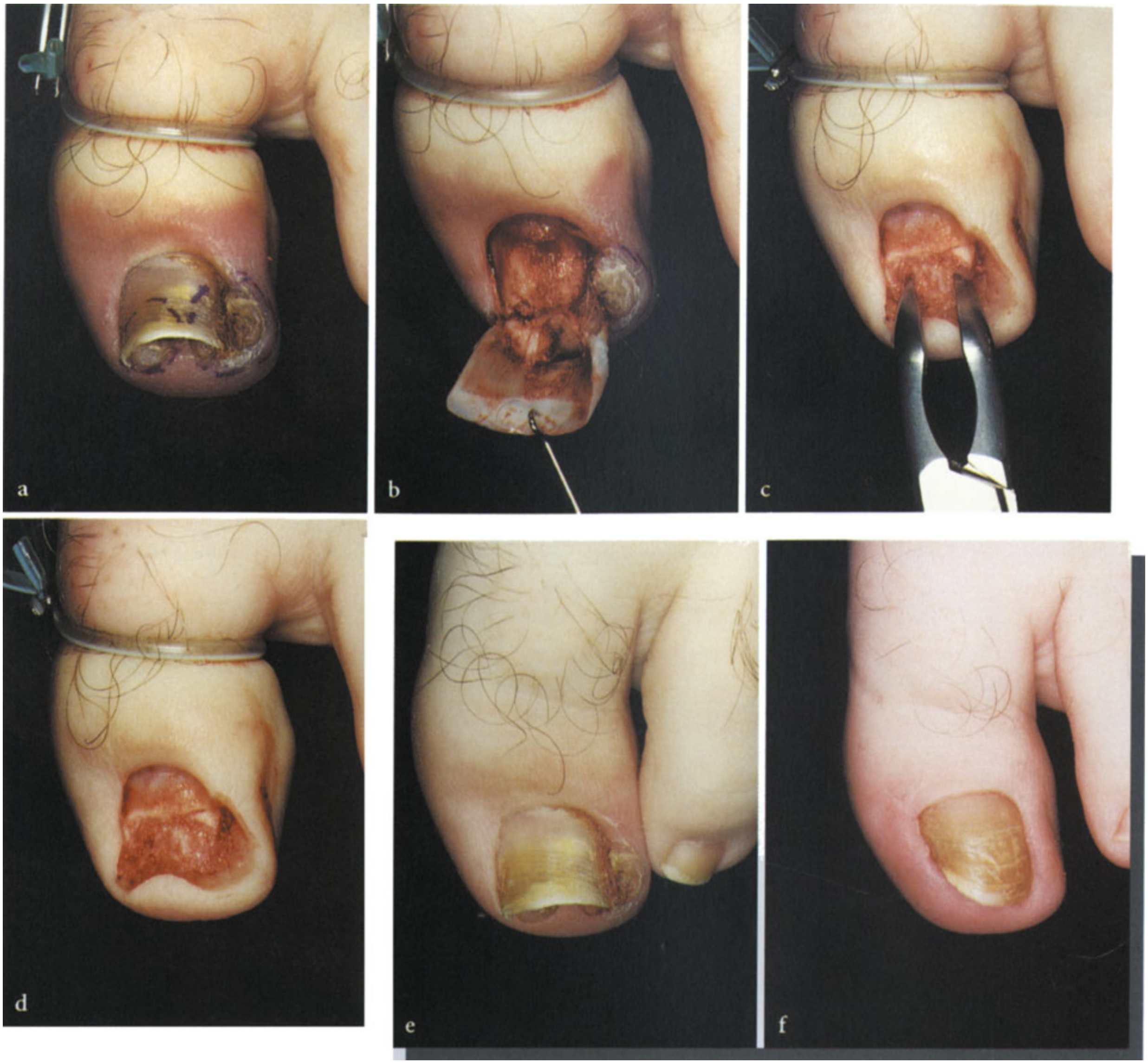

Fig. 452. Nail extraction
a Subungual osteoma formation
b Removal of the nail
c Curettage of nail bed and removal of osteoses
d Healing by secondary intention
e Preoperative appearance
f Appearance after 4 years with normal nail

Fig. 453. Nail extraction with destruction of matrix
a Operative plan for final nail destruction in patient with chronic onychomycosis, recurrent paronychiae and repeated nail extractions
b Removal of the nail and exposure of matrix
c Complete excision of matrix including lateral horns
d Covering of defect by replacing flap
e Preoperative appearance
f Appearance after 2 years

Fig. 454. Full-thickness skin graft
a Operative plan for excision of squamous cell carcinoma in situ of the nail bed
b Excision defect
c Wound after conditioning
d Eight days after full-thickness skin graft
e Preoperative appearance
f Appearance after 2 years

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6 Methods of Superficial Tissue Removal

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