Teaching Atlas of Mammography

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With the contribution of Tibor Tot

3rd revised and enlarged edition

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Contents

I. Anatomy of the Breast

This description is based upon the work of Wellings (48, 49, 50) and Azzopardi (4) who have done much to clarify the anatomic structure of the breast. Anatomically the breast can be subdivided into the following structural entities:

Lobe (Fig. I): The human breast contains 15-18 lobes. Each lobe has a main duct opening in the nipple.

Terminal ductal lobular unit (TDLU) (Fig. II-IV): The main duct branches and eventually forms the terminal ductal lobular unit (TDLU), consisting of the extralobular terminal duct and the lobule (48).

Lobule: The intralobular terminal duct and ductules surrounded by a special, loose intralobular connective tissue form a lobule (Fig. II). In some nomenclature the ductules correspond to acini (4).
The extralobular and intralobular terminal ducts can be identified by two characteristics:

- The extralobular terminal duct is surrounded by elastic tissue while the intralobular terminal duct and ductules are not.
- The extralobular terminal duct is lined by columnar cells while the intralobular terminal duct contains cuboidal cells (4).

The anatomic details are important since certain breast diseases arise from specific anatomic locations (4, 50):

Main duct and its branches:

a) Benign papilloma and malignant papillary tumors arise preferentially in the larger ducts.
b) duct ectasia is primarily a disease of the ducts.

Terminal ductal lobular unit (TDLU): According to Wellings (50), the terminal ductal lobular unit is of central importance because it is the site of origin of:

a) Ductal carcinoma in situ,
b) lobular carcinoma in situ,
c) infiltrating ductal carcinoma,
d) infiltrating lobular carcinoma,
e) fibroadenoma,
f) most components of fibrocystic change (cysts, apocrine metaplasia, various forms of adenosis, epitheliosis).
"It is our belief that the epithelial hyperplasias that are precancerous arise in the TDLU, within the lobular portion or in the terminal duct or both. Larger ducts can be ruled out as common origins of precancer and cancer" (50).
"Intraductal proliferative lesions most commonly affect the terminal ducts at the point where the elastic mantle surrounding the duct disappears and the duct joins the lobule" (10).
g) Cysts originate in the lobules; their size may range up to several centimeters. Apocrine transformation of the lobular epithelium results in increased fluid secretion. Blockage of the extralobular terminal duct by external fibrosis or internal processes (intraductal epithelial proliferation) leads to dilatation of the lobule into a tension cyst (4) (Fig. IV).

Explanation of terms:

Adenosis (Fig. V-VI): The glandular structures proliferate, resulting in the production of new ductules and lobules.
Epitheliosis: The epithelial cells proliferate within preexisting ducts and lobules.
Fibrocystic change (Cystic hyperplasia) (Fig. IX A-B): Includes epithelial cysts, fibrosis, apocrine metaplasia, various forms of adenosis and epitheliosis.

Fig. I: Diagram of the breast illustrating a single lobe.

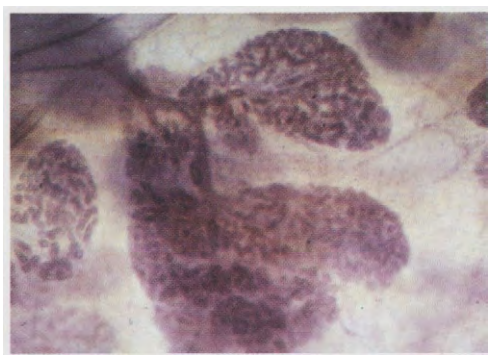


Fig. III: Thick section histology image of several terminal ductal lobular units (TDLUs).

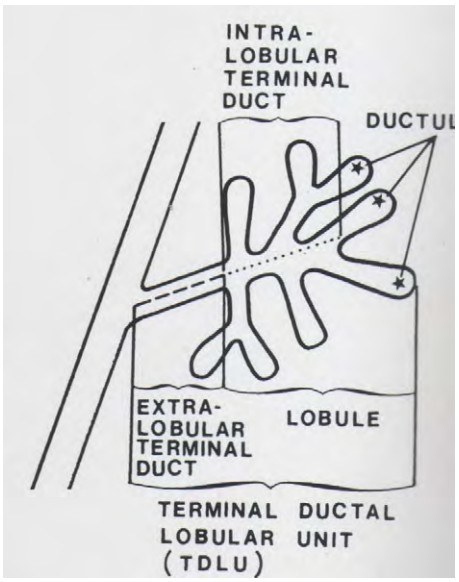


Fig. II: Diagrammatic illustration of the terminal ductal lobular unit (adapted from Wellings).

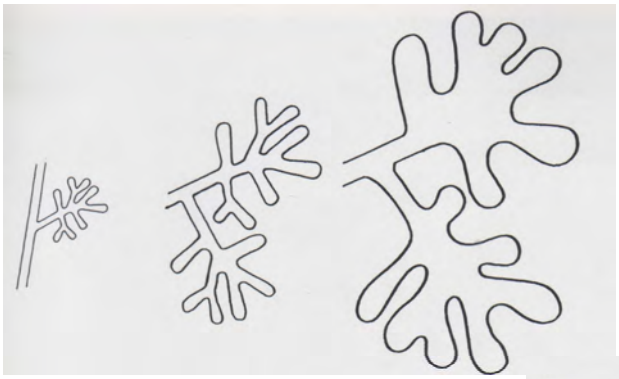


Fig. V: Development of adenosis.

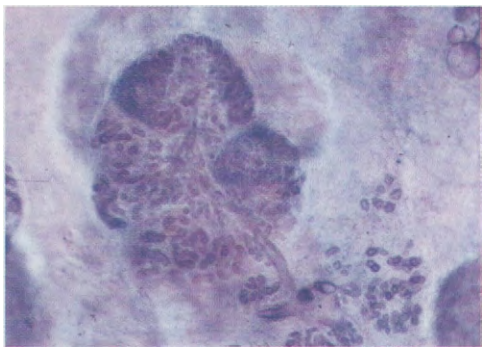


Fig. VI: Thick section histology image of adenosis, proliferation and hypertrophy of a TDLU.

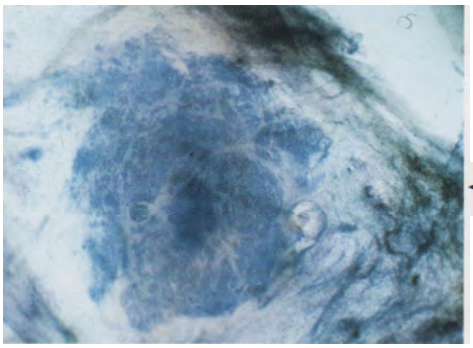


Fig. VII: Thick section histology image of sclerosing adenosis without calcifications.

Fig. IV: Thick section histology image of a subsegmental duct and normal TDLUs, the origin of pathologic entities.

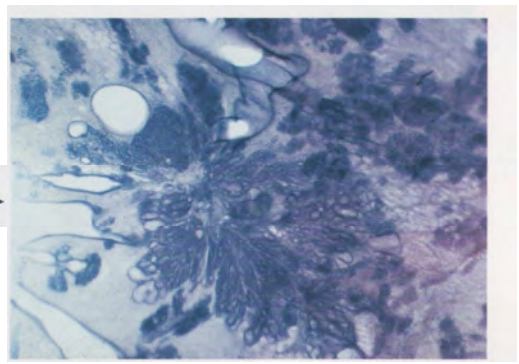


Fig. VIII: Thick section histology image of a radial scar.

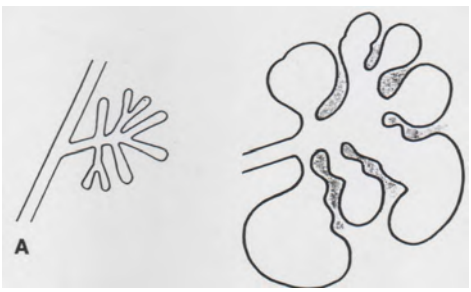


Fig. IXA: Development of fibrocystic change.

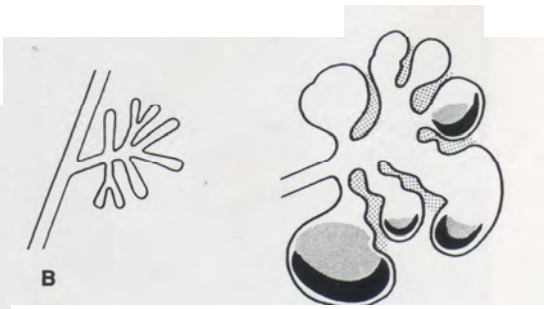


Fig. IX B: Development of fibrocystic change with calcifications.

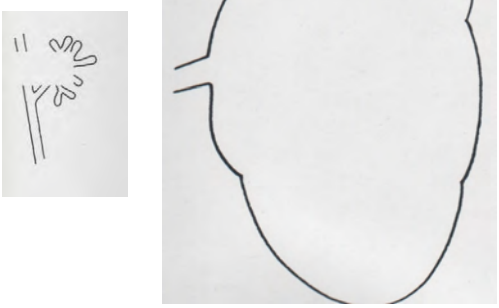


Fig. X: Transformation of a lobule and the subsegmental duct into a tension cyst

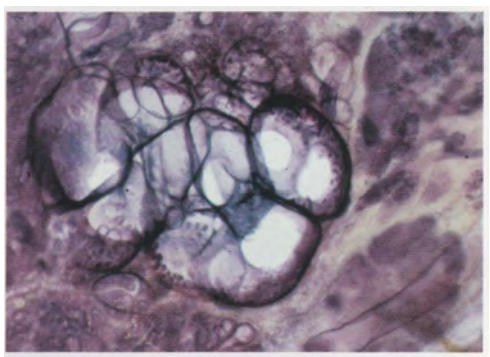


Fig. XI: Thick section histology image of a multiloculated cyst surrounded by normal TDLUs.

Systematic Viewing of Mammograms

A detailed comparison of the left and right breasts enhances the detection of structural asymmetries. Perception of subtle alterations can be accentuated by sequential viewing of restricted areas of the mammograms, as follows.

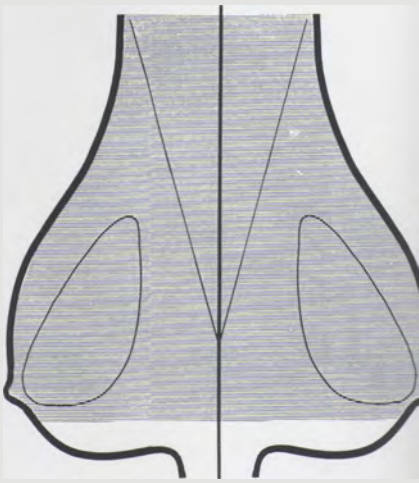
Masking:

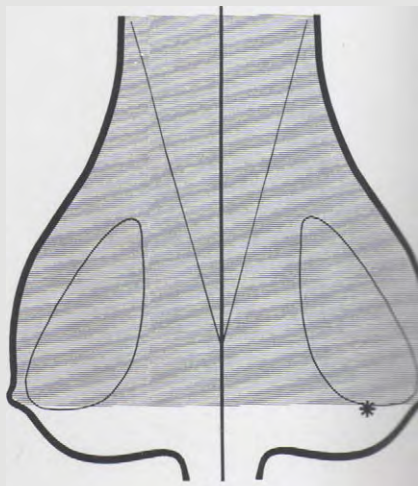
a) Horizontal masking: caudal (Fig. XIII) and cranial (Fig. XIV) aspects,
b) oblique masking: cranial (Fig. XV) and caudal (Fig. XVI) aspects.

The goal of perception is to:

a) Find **asymmetric densities** (Figs. XIV-XVI).
b) Detect **architectural distortion** (Fig. XVII).
c) Detect changes in the **parenchymal contour,** such as retraction (Fig. XVIII A—B and XIX A), the "tent sign" (Fig. XVIII C—G) and protrusion (Fig. XIX B).
d) Find calcifications on the mammogram

Fig. XII: Perception of small and/or low contrast lesions on the mammogram is enhanced by the use of a hand-held viewer, which effectively eliminates extraneous light.





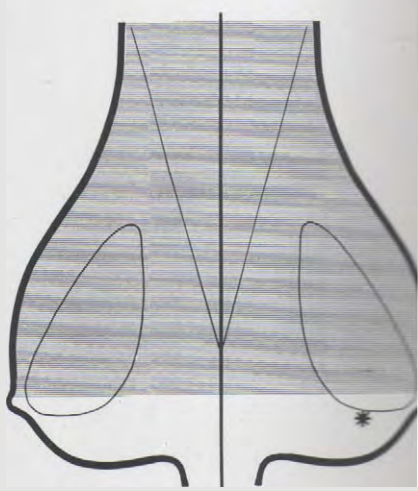


Fig. XIII: Horizontal masking, caudal **aspect 5** wise horizontal masking with the **edge cl** viewer facilitates the comparison of ing regions of the two breasts. The **shaded re** is covered by the viewer or by an **opaque she** cardboard, paper, or film, which **is grad** moved in the cranial direction **to expose** caudal border of the breast.

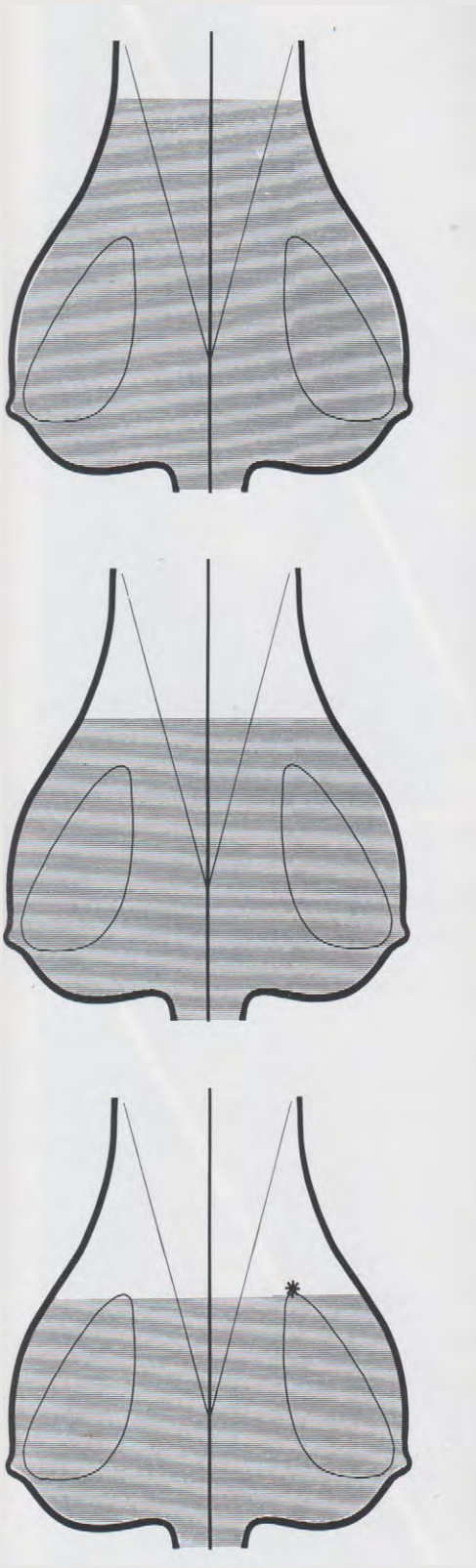


Fig. XIV A: Horizontal masking, cranial aspect. Right and left mammograms of the medio-lateral oblique (or latero-medial) projections are viewed. horizontal masking facilitates the of corresponding regions of the two

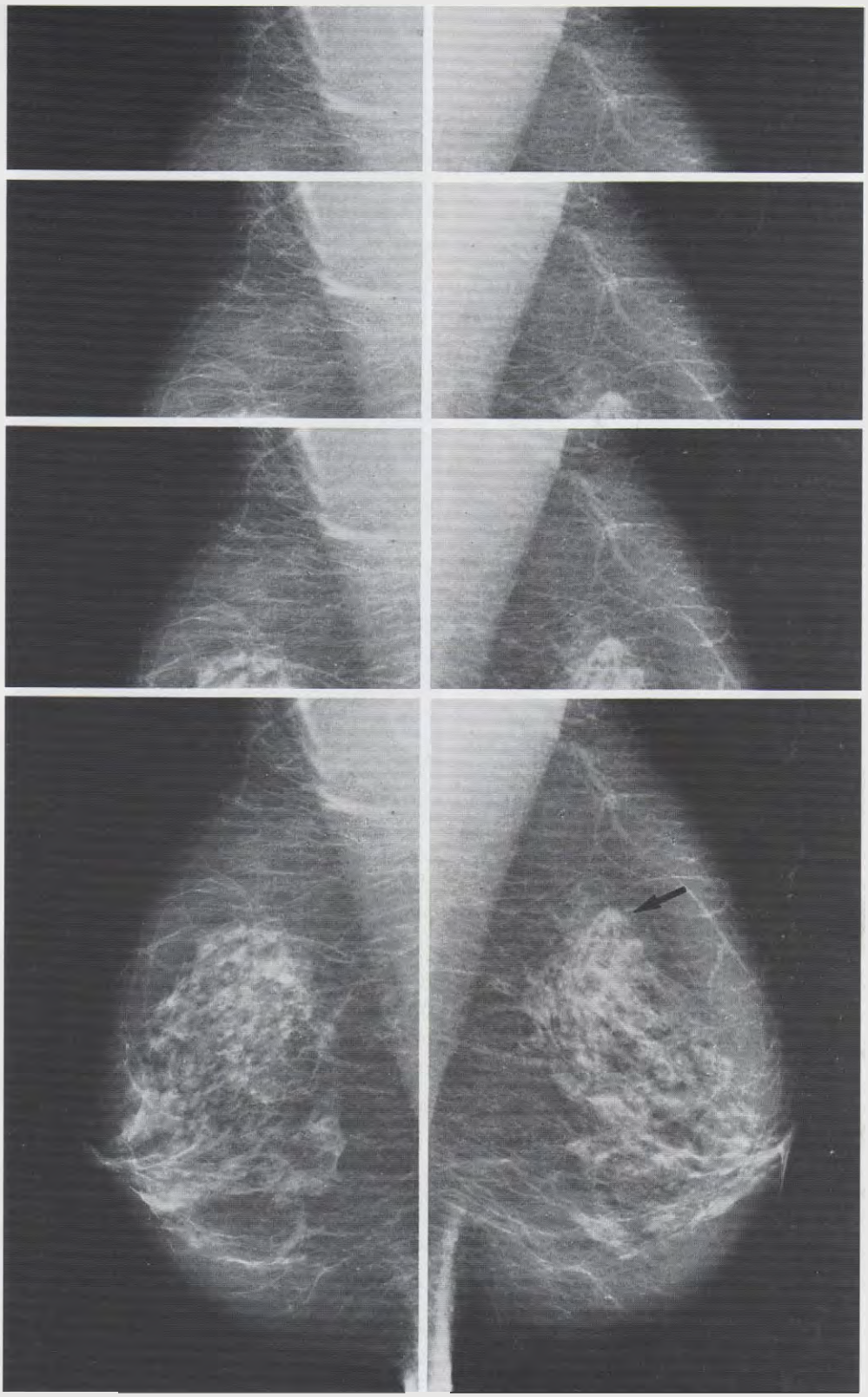
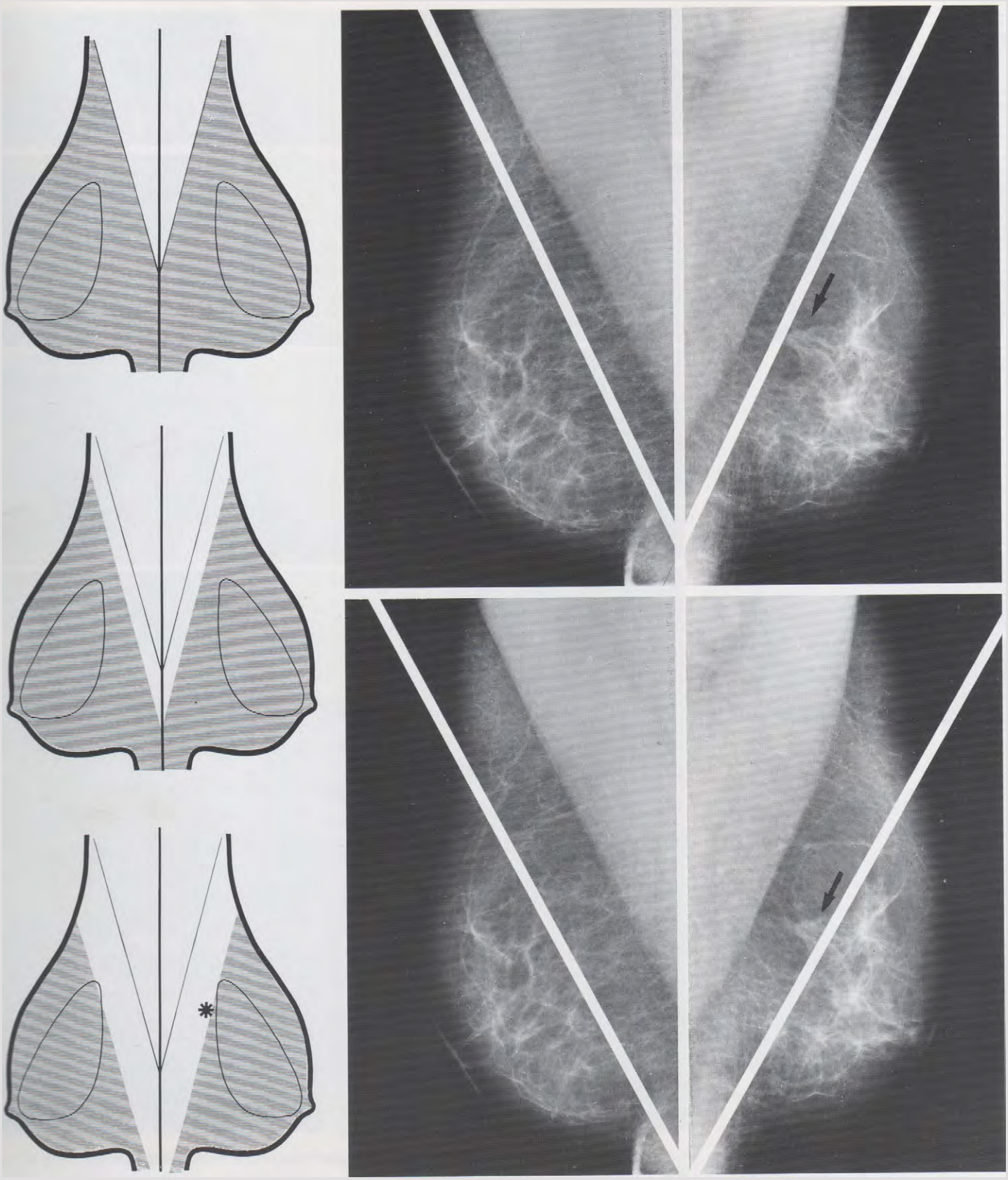
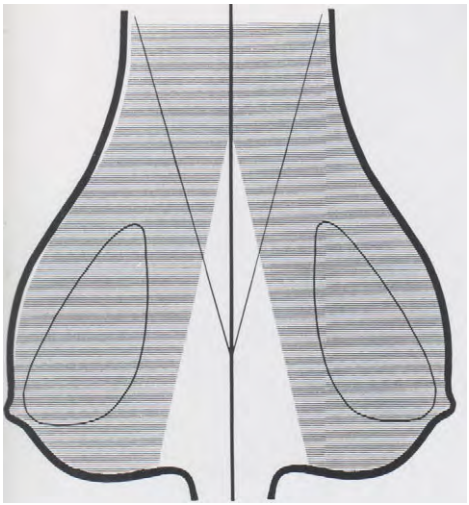


Fig. XIV B: Horizontal masking, cranial aspect, demonstrated on the medio-lateral oblique views of case 72.



A

Fig. XV A: Oblique masking, cranial aspect. Alternatively, attention is focused on the corresponding areas of the right and left breast using the viewer. Right and left breasts of the medio-lateral oblique (or latero-medial) projections are viewed as shown. The masks are initially placed along the border of the pectoral muscles. Symmetrical stepwise movement keeping the masks parallel to the muscle borders facilitates comparison of the corresponding regions on the mammograms. This is demonstrated in Fig. XV B (case 74). Oblique masking from the cranial aspect is also very helpful in cases 76, 78, 82.



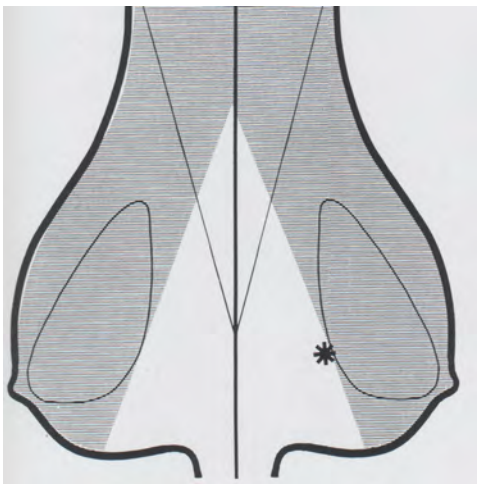
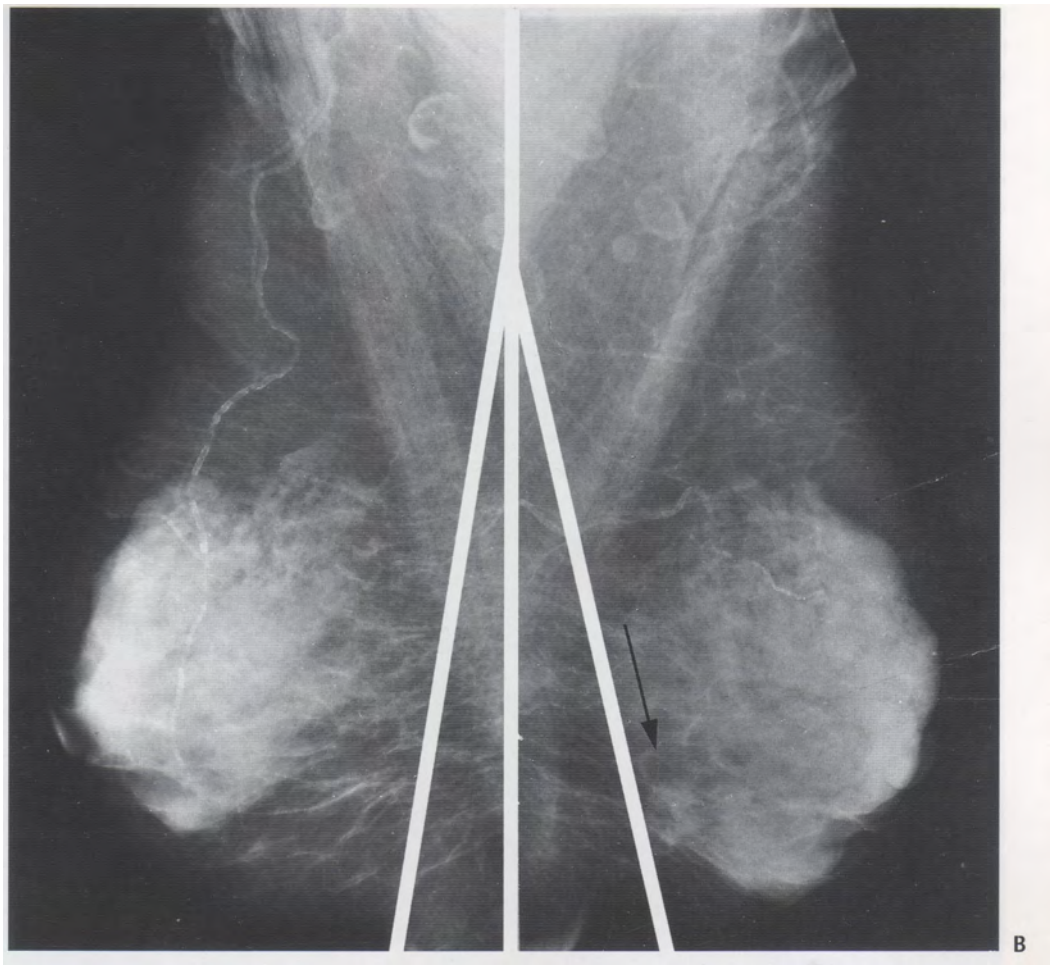


Fig. XVI A: Oblique masking, caudal aspect. The two masks are rotated outwards in a stepwise fashion, to make comparison of the corresponding areas easier.



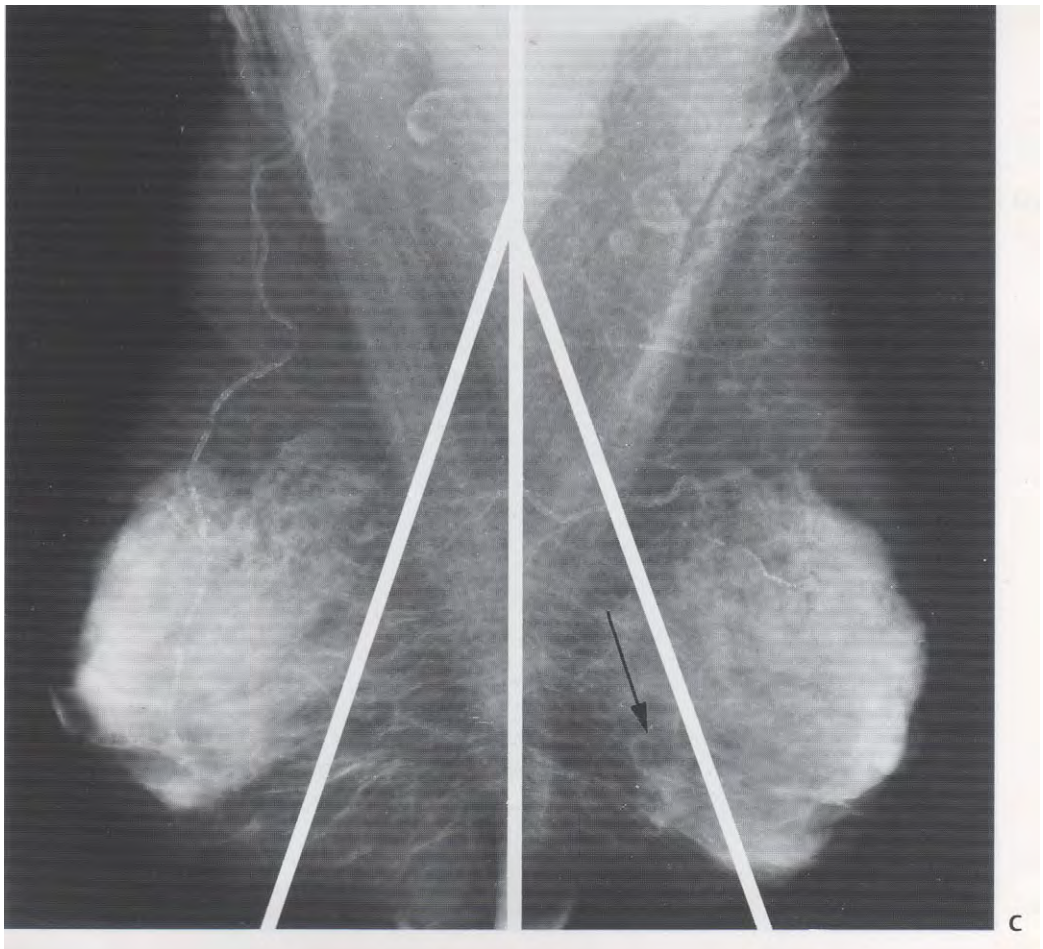


Fig. XVI B & C: Oblique masking, caudal aspect, demonstrated on mammograms.

Fig. XVII A: Diagrammatic illustration of parenchymal distortion. Asymmetries within the parenchyma, such as focally increased density or architectural distortion, may be the only signs leading to the detection of stellate lesions. Perception of such subtle changes requires careful, systematic comparison of corresponding regions of the parenchyma.

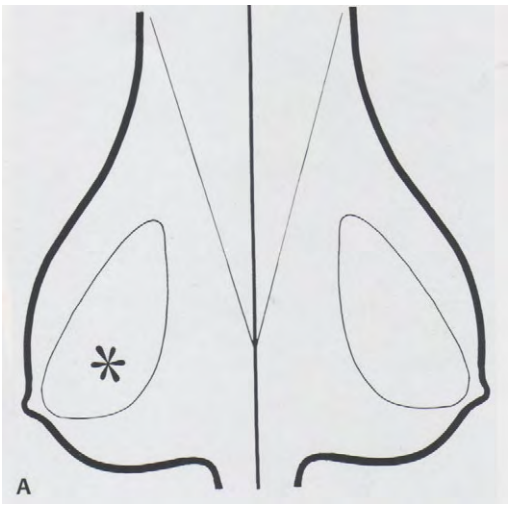
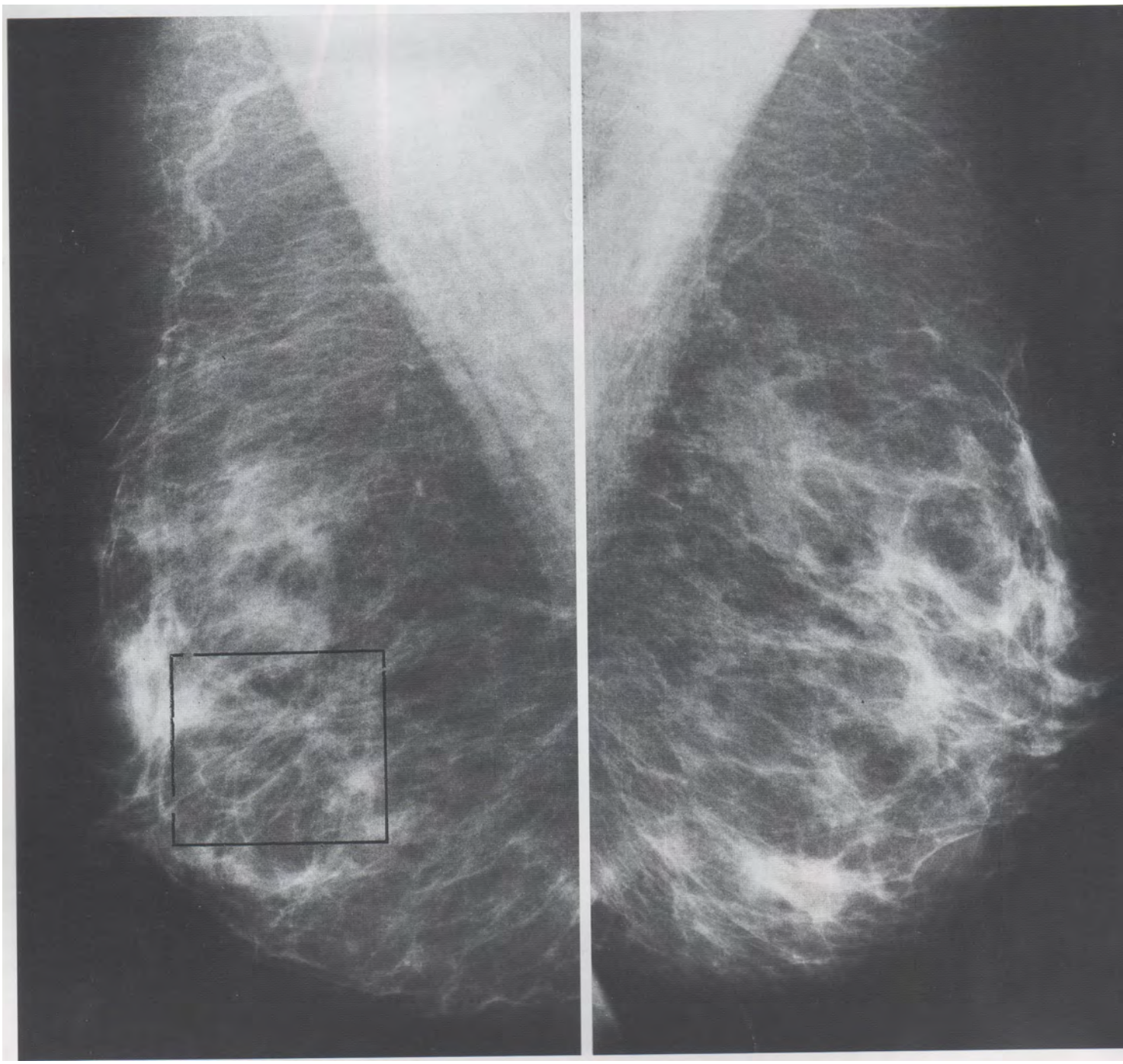


Fig. XVII B: Right and left mammograms, mediolateral oblique projections. A radiating structure is outlined in the right breast.



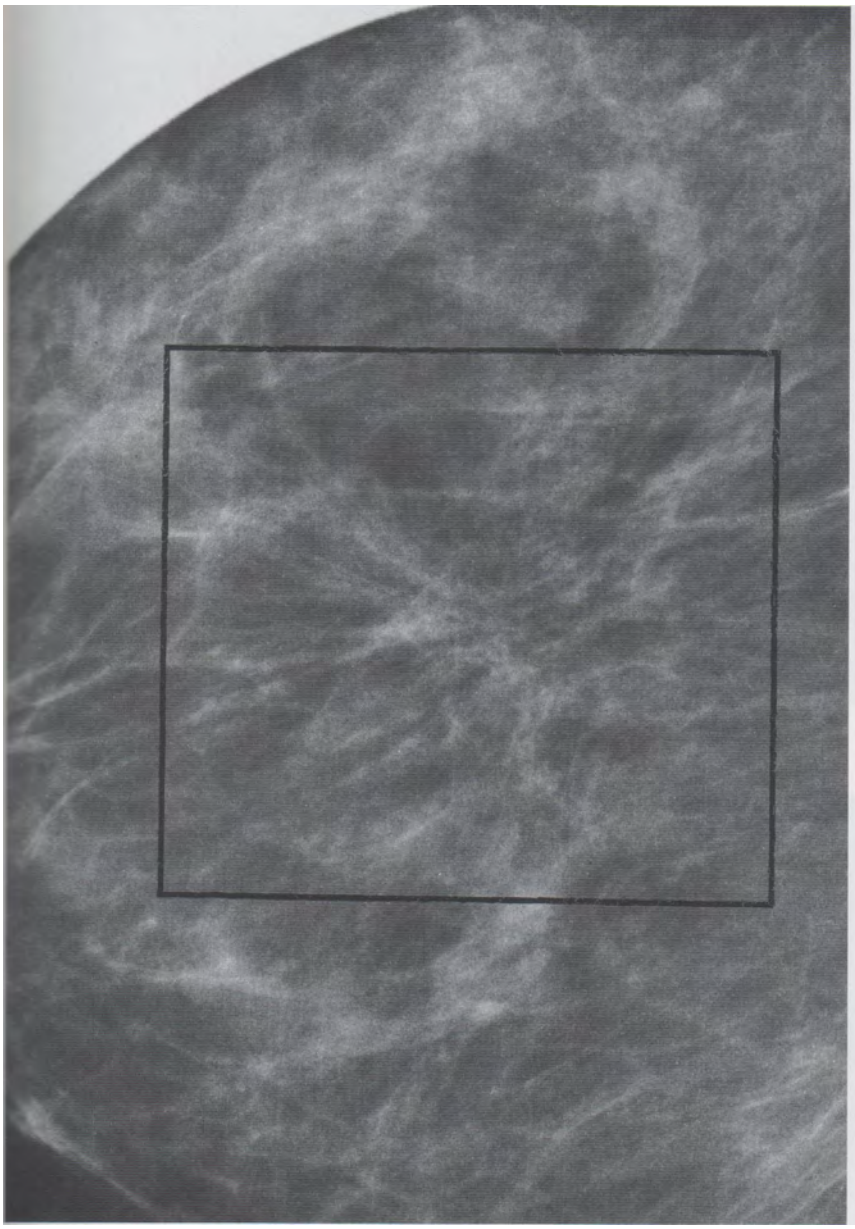
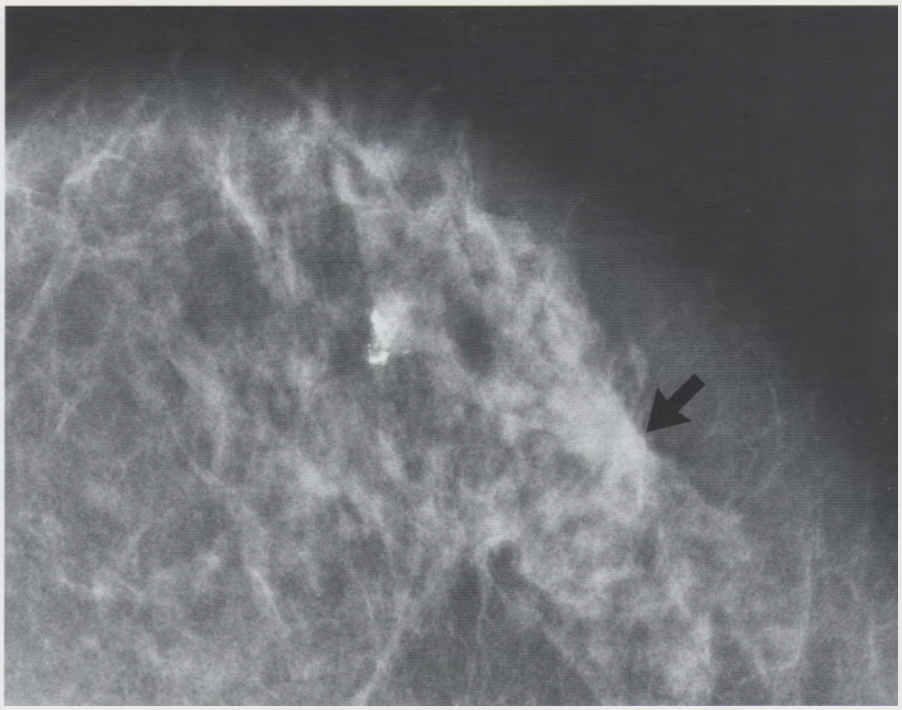


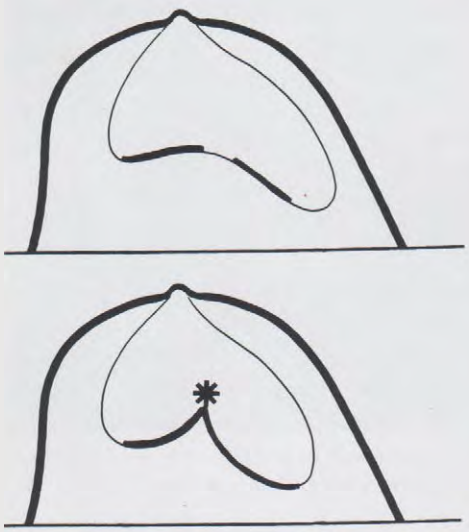
Fig. XVII C: Microfocus magnification view of the architectural distortion provides better analysis of the parenchymal distortion (case 61).

Fig. XVII D: Small stellate lesions may be detected by perception of disturbances within the structure (arrows) (case 70). See also case 77.

Fig. XVIII A: Schematic demonstration of parenchymal contour retraction in the cranio-caudal projection, along the lateral border of the parenchyma.

Fig. XVIII B: Mammographic illustration of parenchymal contour retraction (arrow) caused by a small carcinoma.





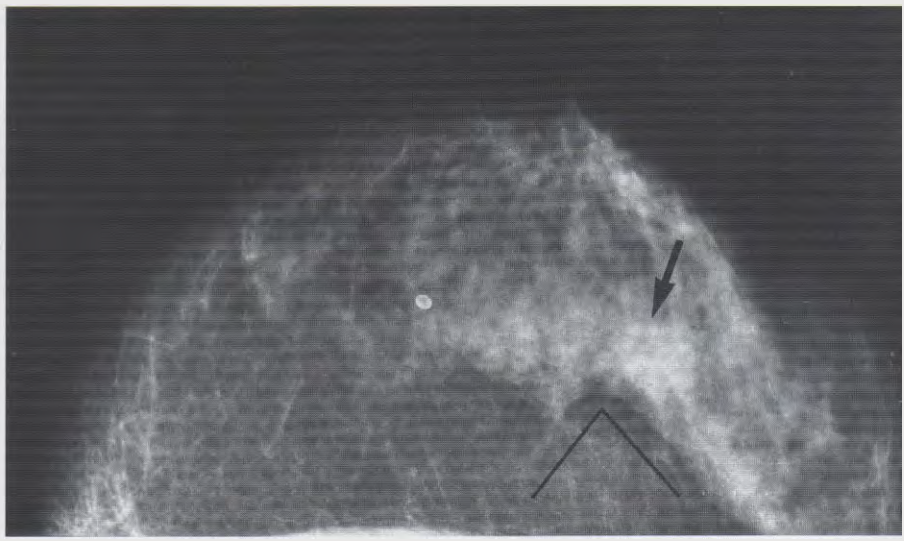


Fig. XVIII C: Retraction along the posterior border of the parenchyma in the cranio-caudal projection gives a special appearance. While the posterior border is normally smooth and usually concave, retraction may lead to a biconvex border resembling the peak of a tent ("tent sign").

Fig. XVIII D: Mammogram (case 71) demonstrating a tumor (arrow) causing the "tent sign." See case 80 as well.

Fig. XVI

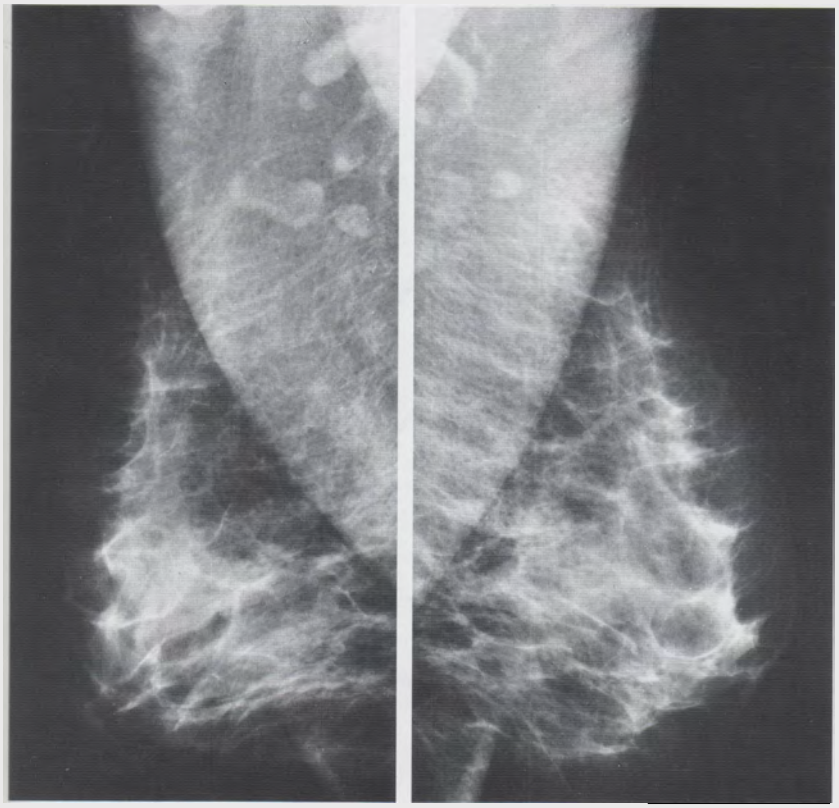


Fig. XVIII E: 35-year-old woman, right and left mammograms, medio-lateral oblique projections. No tumor is visible. Cranio-caudal projections on Fig. XVIII F & G.

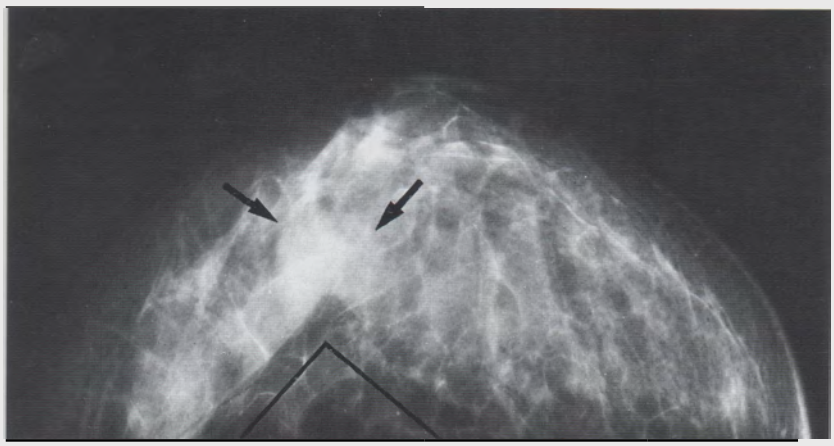


Fig. XVIII F: Right breast, cranio-caudal projection. Typical "tent sign" (retraction along the posterior border) is seen, caused by a carcinoma (arrows).

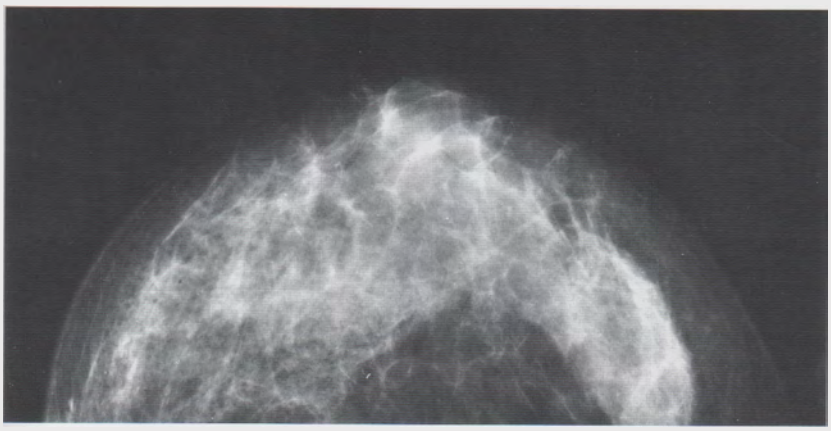


Fig. XVIII G: Normal left breast, cranio-caudal projection.

Fig. XIX A: Detection of parenchymal contour retraction may lead to the diagnosis of small tumors in dense breasts in which the tumor itself may be hidden. Diagrammatic illustration of retraction of parenchymal contour on the mediolateral oblique projection.

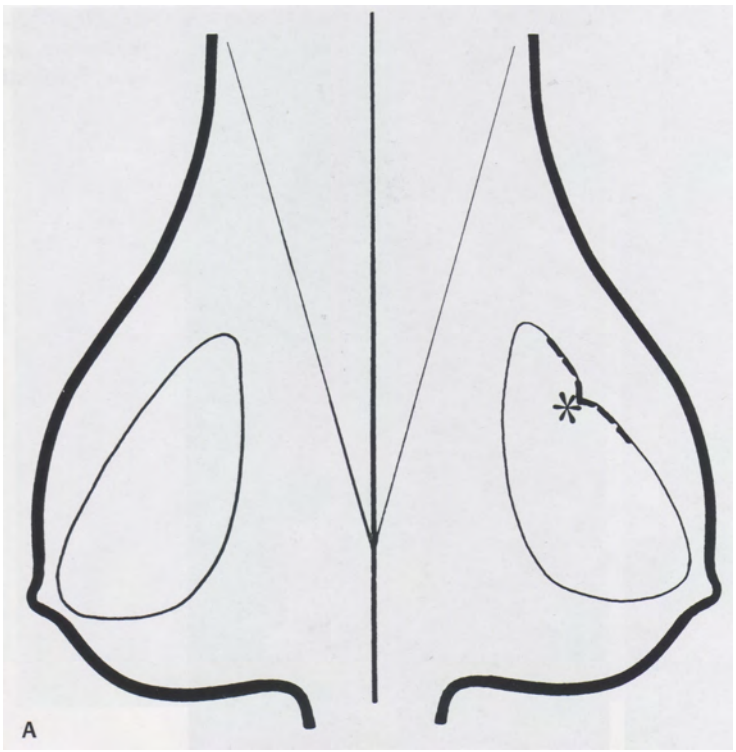
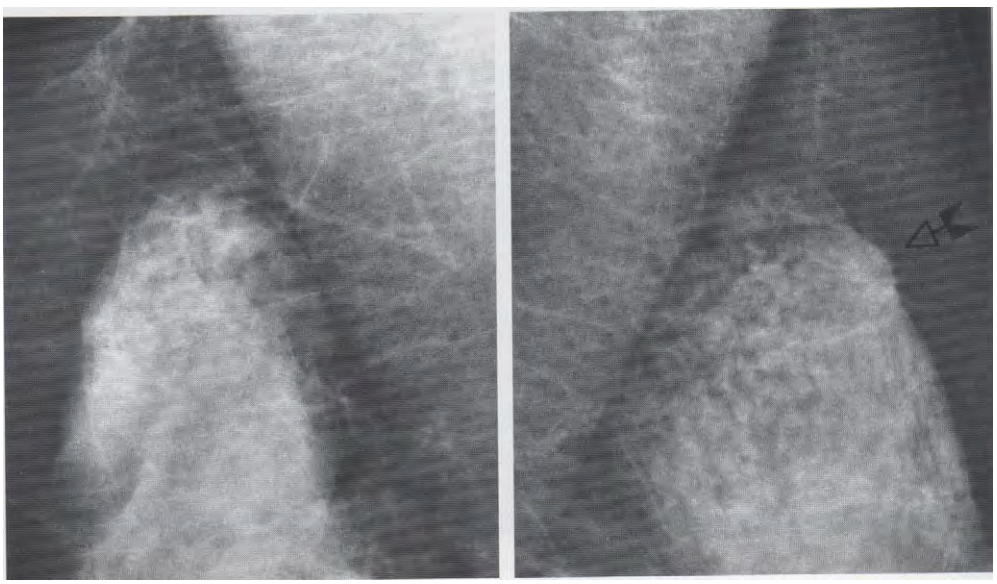


Fig. XIX B: Mammographic demonstration of focal retraction and protrusion of the parenchymal contour (arrow). Compare this contour with the corresponding region of the contralateral breast. See also case 80.



III. Approach to Mammographic Film Interpretation

When interpreting a mammogram, three steps must be taken:

a) *Determine whether the film is of diagnostic quality* with regard to positioning, exposure and processing. Poor quality mammograms or improper positioning often result in diagnostic errors.

b) *Search for a lesion.* Perception is improved by a systematic survey of the mammograms (see Chapter II). Do not stop looking after you have found one lesion. Remember the other breast, too.

c) *Each detected lesion should be carefully analyzed.*

First, place each lesion into one of the five following classification groups:

I. *Circular/oval lesions* that may be well or poorly outlined, circular, oval or lobulated, solitary or multiple.

II. *Stellate/spiculated lesions* that are radiating structures with ill-defined periphery.

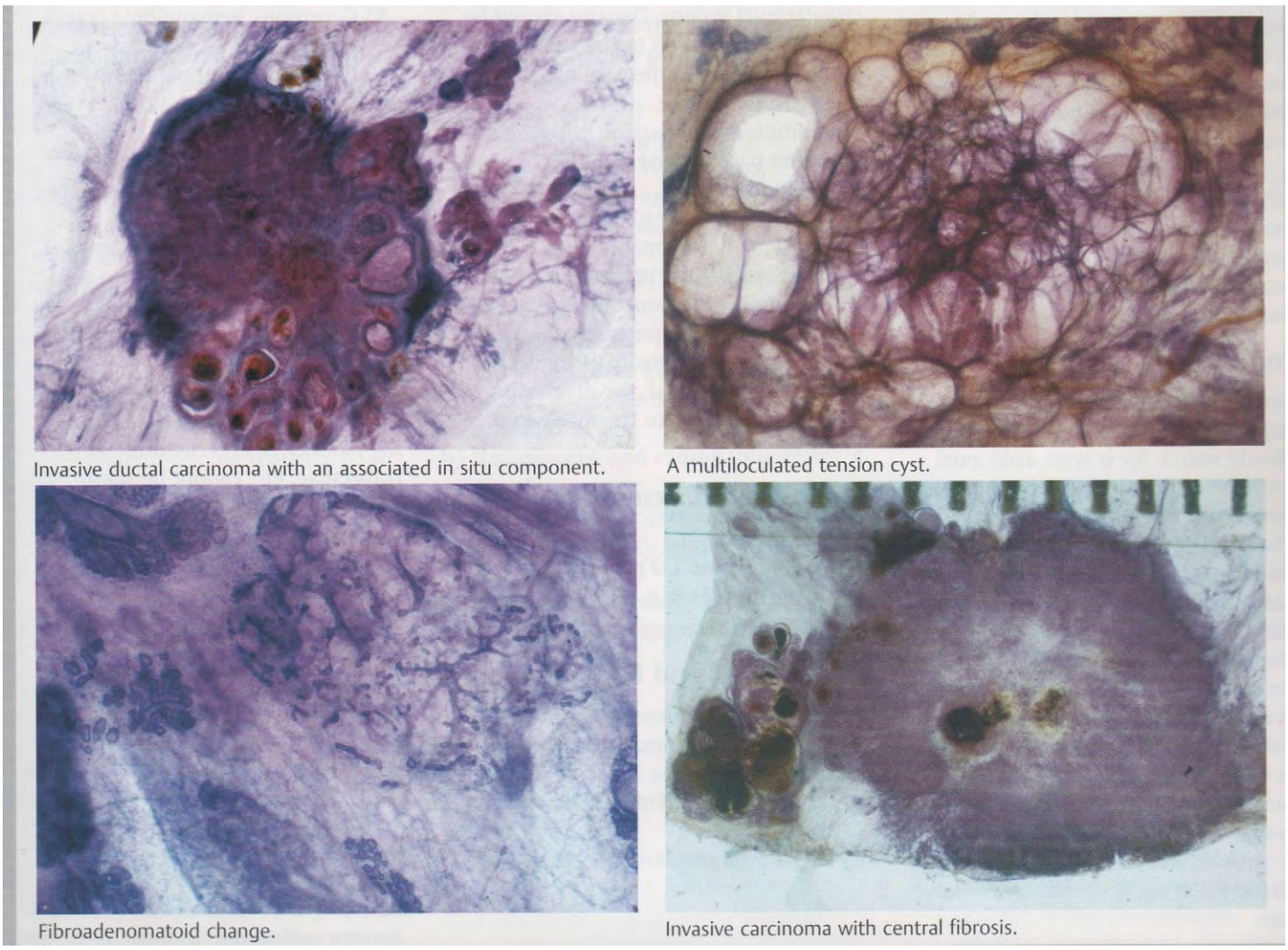
III. *Calcifications* that may or may not be associated with a tumor. One or more calcifications may constitute the entire radiologic abnormality.

IV. *Thickened skin syndrome* that presents with tickened skin over much or all of the breast, associated with an increased density and a reticular pattern.

V. *Any combination* of two or more of the above lesions.

Second, after finding the proper group, each detected lesion should undergo detailed *analysis* (see Chapters IV-VII).

IV. Circular/Oval Lesions



Invasive ductal carcinoma with an associated in situ component.

A multiloculated tension cyst.

Fibroadenomatoid change.

Invasive carcinoma with central fibrosis.

These may be sharply or poorly outlined; circular, oval or lobulated; solitary or multiple.
If a circular/oval lesion is associated with calcifications, the lesion is analyzed independent of the calcifications. The two analyses are then combined. The following four steps of analysis can rapidly lead to mammographic diagnosis:

Analyses of
- *1) Contour* — primary importance
  - a) sharply outlined — primary importance
    - halo sign — primary importance
    - capsule — primary importance
  - b) unsharp contour — primary importance
- 2) *Density* — primary importance
- 3) *Form, orientation* — secondary importance
- 4) *Size* — secondary importance

Signs of Primary Importance in Diagnosing Circular/Oval Lesions

A) Halo Sign or Capsule: Present of Absent

The *halo sign* is a narrow radiolucent ring or a segment of a ring around the periphery of a lesion characteristic of benign, growing circumscribed tumors (cases 17, 21, 49, 50, 52, 53, 56).
A *capsule* is a thin, curved, radiopaque line that is seen only when it surrounds lesions containing fat (cases 1, 3, 4, 5).
Both the halo sign and the capsule are characteristic of benign tumors. Their presence nearly always means that the lesion in question is benign. There are only three rare exceptions, malignant lesions which may have a halo sign:
- intracystic carcinoma,
- papillary carcinoma,
- carcinoma arising within a fibroadenoma (case 103).

Comments

a) Since the presence of a halo sign is suggestive of a benign lesion, one should search for it with additional projections, in particular with coned-down compressions views.
b) The most common circular/oval lesions are cysts and fibroadenomas. An easily visible, obvious halo sign encircling much or all of the lesion is characteristic of a cyst.
   Further differential diagnostic aids: cysts usually occur in women around menopause while fibroadenomas arise in younger women. Cysts are often painful to pressure while fibroadenomas are not.
c) A capsule, when present, has a diagnostic value equal to that of a halo sign.
d) Evaluation of the density of a circular/oval lesion should always accompany the search for a halo sign or capsule.
e) Breast ultrasound is the most valuable noninvasive adjunctive method for the evaluation of the circular/oval lesion.

B) Density of the Circular/Oval Lesion

The evaluation of density is of great importance in the differential diagnosis of circular/oval lesions. Density should be evaluated in relation to the surrounding parenchyma, or, in the case of fatty involution, to the nipple.
The tumor, in comparison with the surrounding parenchyma, is either
- radiolucent,
- radiolucent and radiopaque combined,
- low density radiopaque (equal to the surrounding parenchyma),
- high density radiopaque (greater than the surrounding parenchyma).

Once the relative density of the lesion has been determined, the diagnostic choices are limited to the following groups:

Radiolucent Circular/Oval Lesions

1) Lipoma (cases 1, 2)
2) Oil cyst (cases 3, 4, 139)
3) Galactocele

Radiolucent and Radiopaque Combined

1) Fibro-adeno-lipoma (cases 5, 6)
2) Galactocele (cases 7, 8)
3) Intramammary lymph node (cases 9, 10, 47, 123)
4) Hematoma (cases 11, 12, 46)

Low Density Radiopaque

The surrounding parenchymal structure (vein, trabeculae, etc.) can be seen "through" the lesion (superimposed).
1) Fibroadenoma (cases 13, 14, 15, 30, 34, 49, 50, 51)
2) Cyst (cases 17, 18, 19, 52, 53, 56)

Rarer lesions:
3) Giant fibroadenoma (case 21)
4) Sebaceous cyst (case 31)
5) Cavernous hemangioma (cases 23 151)
6) Papilloma, multiple papillomas (cases 27, 48, 127, 128)
7) Wart (cases 24, 25)
8) Abscess
9) Cystosarcoma phylloides (case 26
10) Papillary carcinoma
11) Mucinous carcinoma (cases 28, 44)

Note: These malignant lesions may lead to difficulties in diagnosis.

High Density Radiopaque

These are more dense than the ing parenchyma. Structures such as veins, trabeculae, etc. cannot be seen "throe the dense lesion.
1) Carcinoma (e.g. medullary, invasive ductal NOS) (cases 29, 33, 41, 54)
2) Sarcoma
3) Metastases to the breast (cases 36,
4) Cystosarcoma phylloides (case 37)
5) Hemorrhagic cyst (case 20)
6) Abscess (cases 38, 42)
7) Hematoma
8) Enlarged, pathologic lymph nodes (lymphoma, leukemia, rheumatoid thritis, metastases) (cases 43, 45)
9) Sebaceous cyst (case 22).

Note: All radiolucent, all radiolucent radiopaque combined, and most low-density radiopaque lesions are benigr

Signs of Secondary Importance in Diagnosing Circular/Oval Lesions

These serve to support the mammographic diagnoses that are made on the basis of contour and density analysis.

A) Form and Orientation of the Circular/Oval Lesions (Fig. XX)

A cyst is generally spherical or ovoid with smooth borders. Its orientation, when elongated, is usually in the direction of **the** nipple following the trabecular structure of the breast (cases 53, 56).
***A solid** tumor* (e.g. fibroadnoma, carcinoma) may be smooth or lobulated. Its orientation is random as it does not tend to be aligned along the trabecular structure of the breast (cases 49, 54).

B) Size

circular/oval lesions can be grouped into **three** categories according to size, providing for a certain degree of differential diagnosis.

Very Large Circular/Oval Lesions
(> 5 cm)

Few breast tumors grow this large; they **displace** much of the breast tissue. The **list** diagnoses can be limited to the following

a) Radiolucent
1 Lipoma (case 1)
b) Radiolucent and radiopaque combined
1) Fibro-adeno-lipoma (cases 5, 6)
c) Radiopaque
***Low** density radiopaque:*
1) Giant fibroadenoma (case 21)
2) Cyst (cases 17, 56)
3) Cystosarcoma phylloides (case 26)
4) Mucinous carcinoma (case 32)
High density radiopaque:
1) Carcinoma (case 54)
2) Sarcoma
3) Cystosarcoma phylloides (case 37)
4) Cyst
5) Abscess (cases 38, 42)
6) Lymph nodes (lymphoma, leukemia, metastases)

Intermediate Sized Circular/Oval Lesions
(on the order of 3-5 cm)

a) Radiolucent
1) Lipoma
2) Oil cyst (case 139)
b) Radiolucent and radiopaque combined
1) Fibro-adeno-lipoma
2) Hematoma (case 46)
c) **Radiopaque**
Low density radiopaque:
1) Fibroadenoma (cases 13, 49, 50, 55)
2) Cyst (cases 39, 52)
3) Sebaceous cyst
4) Mucinous carcinoma, which may cause diagnostic difficulties
High density radiopaque:
1) Carcinoma
2) Sarcoma
3) Metastases to the breast (case 40)
4) Cystosarcoma phylloides
5) Abscess
6) Cyst (case 20)
7) Sebaceous cyst (case 22)
8) Lymph nodes (lymphoma, leukemia, rheumatoid arthritis, metastases) (cases 43, 45)

Smaller Circular/Oval Lesions
(< 3 cm)

a) Radiolucent
1) Lipoma (case 2)
2) Oil cyst (cases 3, 4)
3) Galactocele
b) Radiolucent and radiopaque combined
1) Galactocele (cases 7, 8)
2) Intramammary lymph node (cases 9, 10, 47, 123)
3) Hematoma (cases 11, 12)
4) Fibro-adeno-lipoma (rare when small)
c) **Radiopaque**
Low density radiopaque:
1) Fibroadenoma (cases 14, 15, 16, 30, 34, 51)
2) Cyst (cases 18, 19, 53)
Rarer lesions:
3) Sebaceous cyst (case 31)
4) Intramammary lymph node
5) Papilloma, multiple papillomas (cases 127, 128)
6) Hemangioma (case 23)
7) Carcinoma, most frequently mucinous (cases 28, 44) or papillary
8) Wart (cases 24, 25)
High density radiopaque:
1) Carcinoma (cases 29, 33)
2) Metastasis to the breast (case 36)
3) Lymph nodes (metastases, leukemia, lymphoma, rheumatoid arthritis)

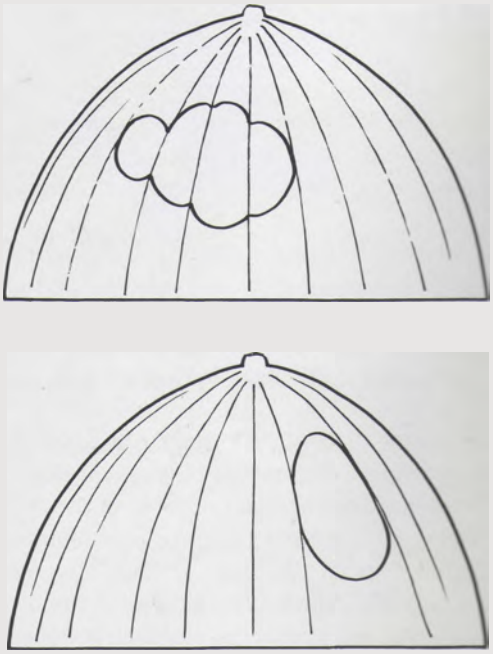
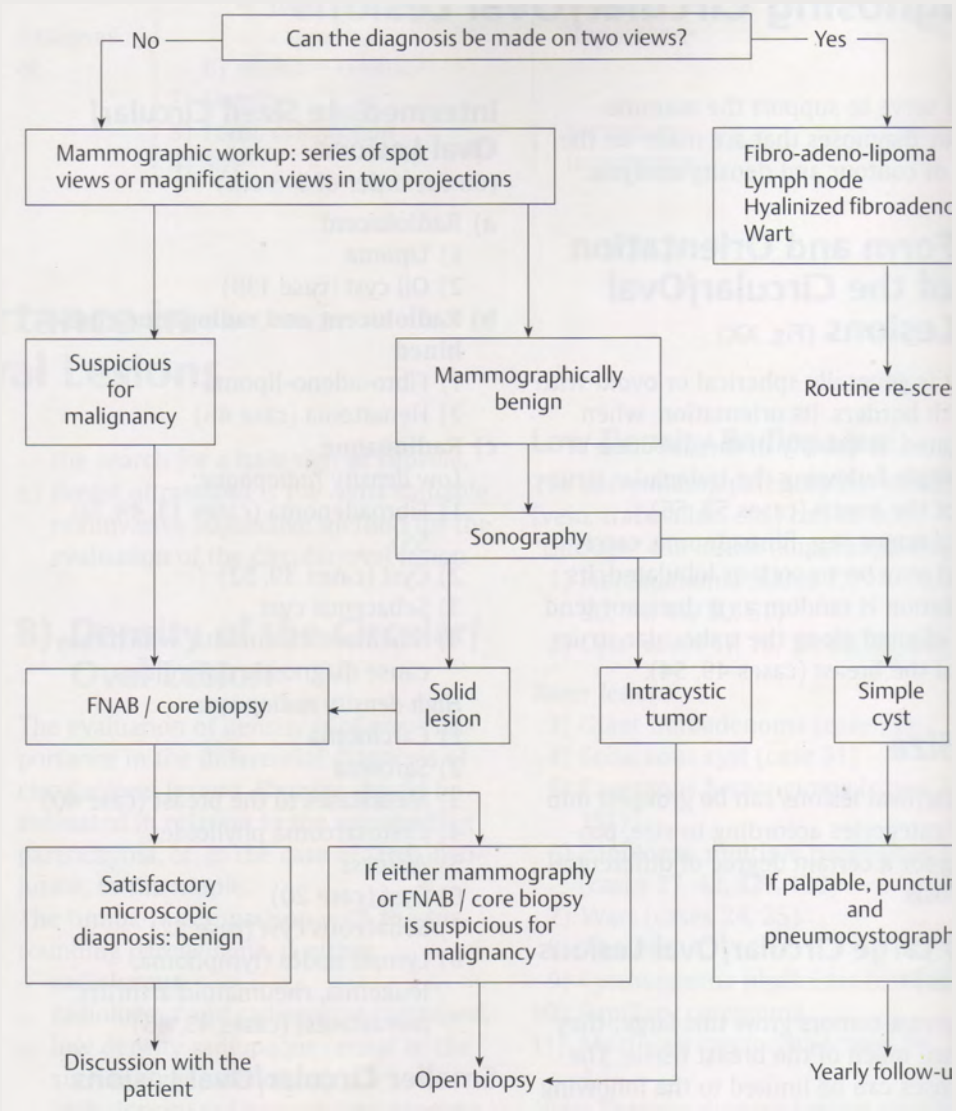


Fig. XX A & B: The orientation of solid tumors (fibroadenoma, carcinoma, etc.) is usually random as they tend not to be aligned along the trabecular structure of the breast (A), while the structure can influence the orientation of a cyst (B).

Strategy

After the four steps of analysis (contour, density, form and orientation, and size), one should have made a tentative mammographic diagnosis of benign or malignant.
The mammographic diagnosis of lipomas, fibro-adeno-lipomas, oil cysts, intramammary lymph nodes, and most of the fibroadenomas is highly reliable. Many nonpalpable circular/oval lesions will be found in asymptomatic women. The combined use of mammography, breast ultrasound, and needle biopsy will lead to definitive diagnosis in most of these cases, so that only a fraction will require referral to surgical biopsy.
Breast ultrasound is invaluable in the diagnostic workup of circular/oval lesions, particularly in the differentiation of cystic from solid lesions.
Microscopic diagnosis can be obtained using needle biopsy, most often under ultrasound guidance. The workup algorithm of a circular/oval lesion on the mammogram is outlined as follows:

Workup algorithm



Practice in Analyzing Circular/Oval Tumors

1

Age 85. First screening study, asymptomatic.

Physical Examination

A huge, soft, round tumor is palpable in the right breast.

Mammography

Fig. 1: Right breast, medio-lateral oblique projection. A huge, ancapsulated lesion occupies the whole breast. There are central calcifications.

Analysis

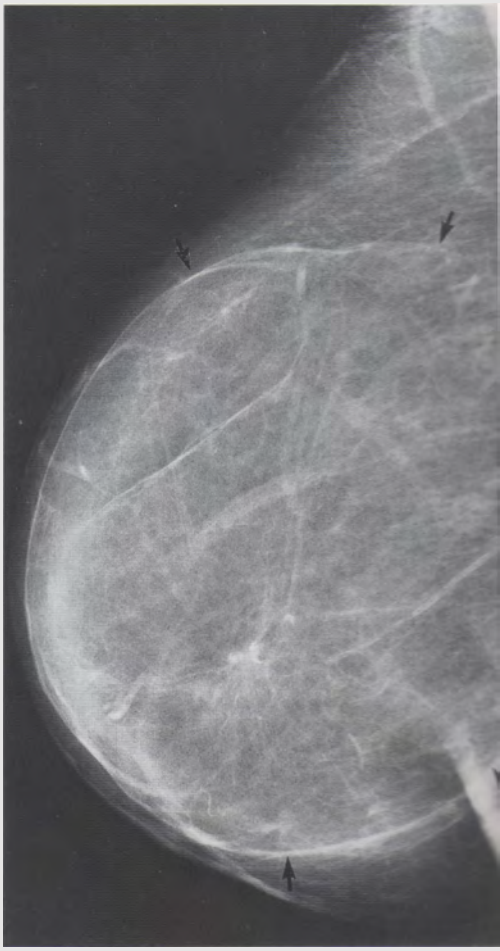
Form: circumscribed, circular
Contour: sharp; a capsule surrounds the lesion
Density: radiolucent
Size: huge, 12 x 12 cm

Conclusion

The only huge radiolucent breast tumor is a lipoma.

Comment

The central, ring-like and irregular calcifications, some with a radiolucent center, appear to be the result of fat necrosis (see page 199).



2

Age 34, referred for evaluation of breast pain.

Physical Examination

No palpable tumor.

Mammography

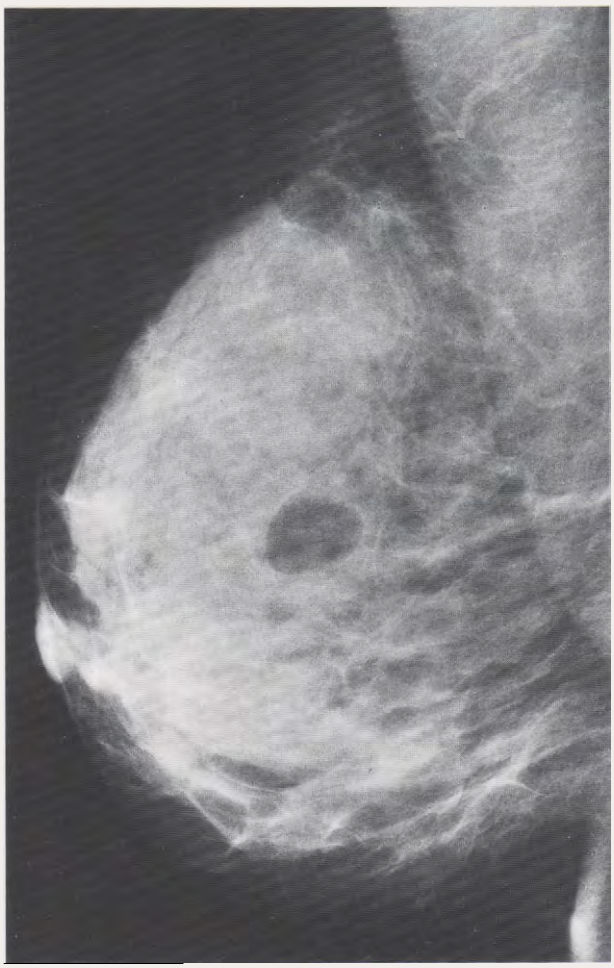
Fig. 2: Right breast, medio-lateral oblique projection. There is a solitary lesion 5 cm from the nipple in the upper medial quadrant. No associated calcifications.

Analysis

Form: circumscribed, oval
Contour: sharply outlined; the lesion is encapsulated
Density: radiolucent
Size: 20 x 15 mm

Conclusion

The density is the factor determining the mammographic and final diagnosis of a lipoma.



3

A 58-year-old woman previously operated for a benign lesion in the right breast.

Mammography

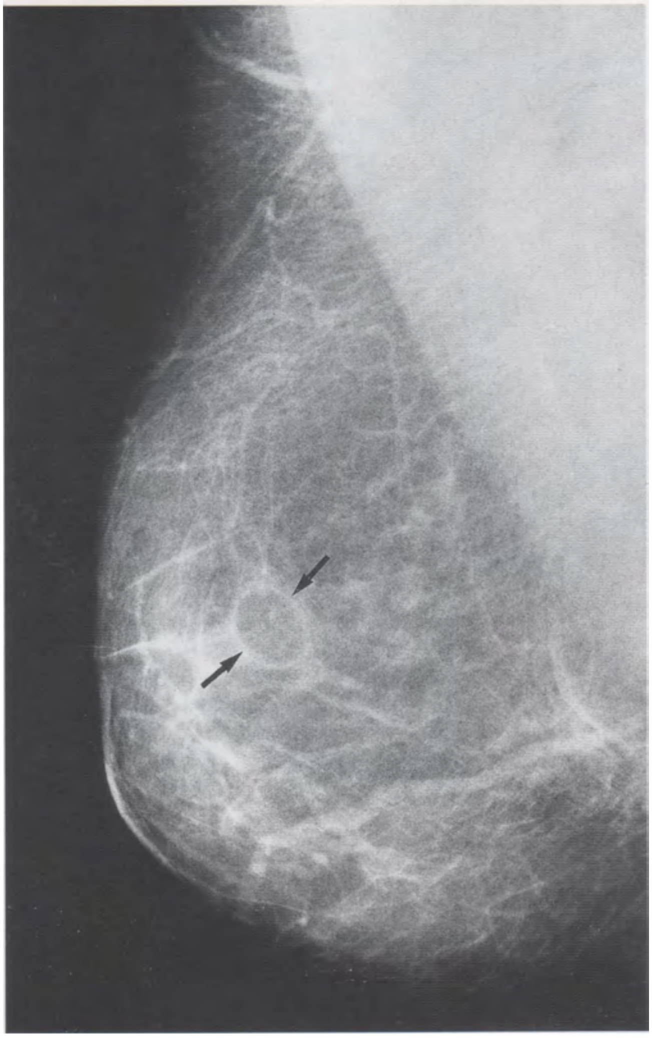
Fig. 3 A & B: Right breast, mediolateral oblique projection. An oval-shaped, encapsulated radiolucent lesion is seen centrally in the breast without associated calcifications. A scar is seen between the lesion and the skin (Fig. 3 B, arrow).

Analysis

Form: circumscribed, oval
Contour: sharp, no halo sign but a definitive capsule
Density: radiolucent
Size: 15 x 12 mm

Conclusion

The history of surgical biopsy at this site combined with the mammographic appearance is typical for an oil cyst (see page 199).

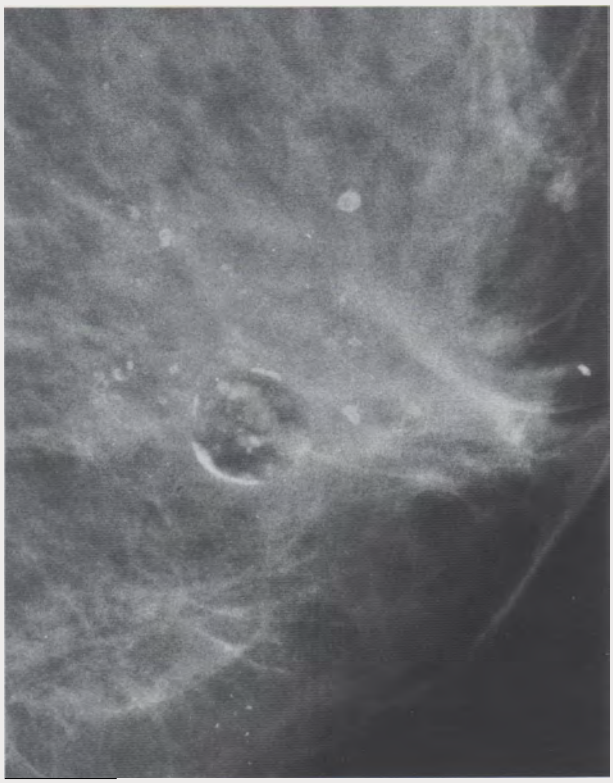


3A

3B

4

A 48-year-old woman with a history of excisional biopsy in the retroareolar region.



Mammography

Fig. 4: Detailed view of the mediolateral oblique projection of the left breast. There is a central, partly calcified radiolucent circular lesion.

An

Form: circumscribed, circular
Contour: sharp
Density: radiolucent
Size: 10 x 10 mm

Comment

There are also shell-like calcifications in the wall of the lesion.

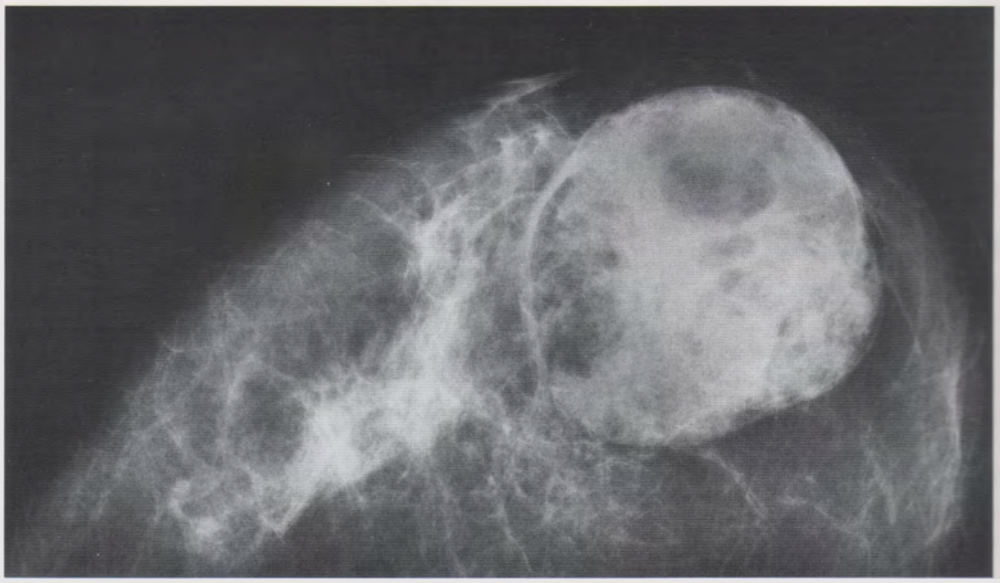
Conclusion

There are three possible circumscribed, radiolucent lesions, all benign (page 18). In this case, the history of biopsy leads to the diagnosis of an oil cyst. With a partially calcified capsule, it is known as liponecrosis macrocystica calcificans (see page 199). No further procedures are necessary.

Note

There are many ring-like calcifications near the oil cyst. These represent liponecrosis microcystica calcificans.

5



Right breast, cranio-caudal projection. There is a large, centrally-located tumor with no associated calcifications (Fig. 5).

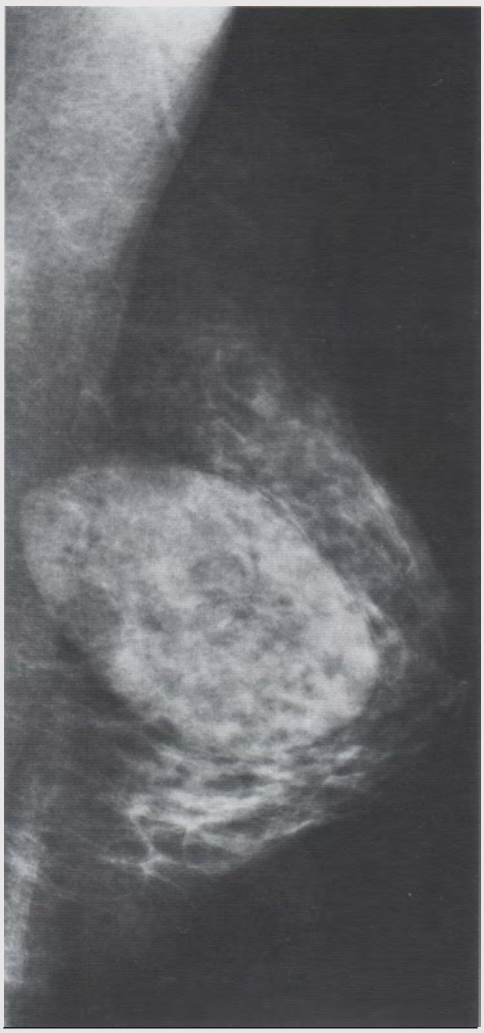
Analysis

Form: circular
Contour: sharp, capsule seen
Density: radiolucent and radiopaque combined
Size : 6 x 6 cm

Conclusion

A large, encapsulated lesion with mixed density is characteristic of a fibro-adenoma. There is no need for ultrasound or needle biopsy.

6



Left breast, medio-lateral oblique projection. A large tumor fills the central portion of the breast (Fig. 6).

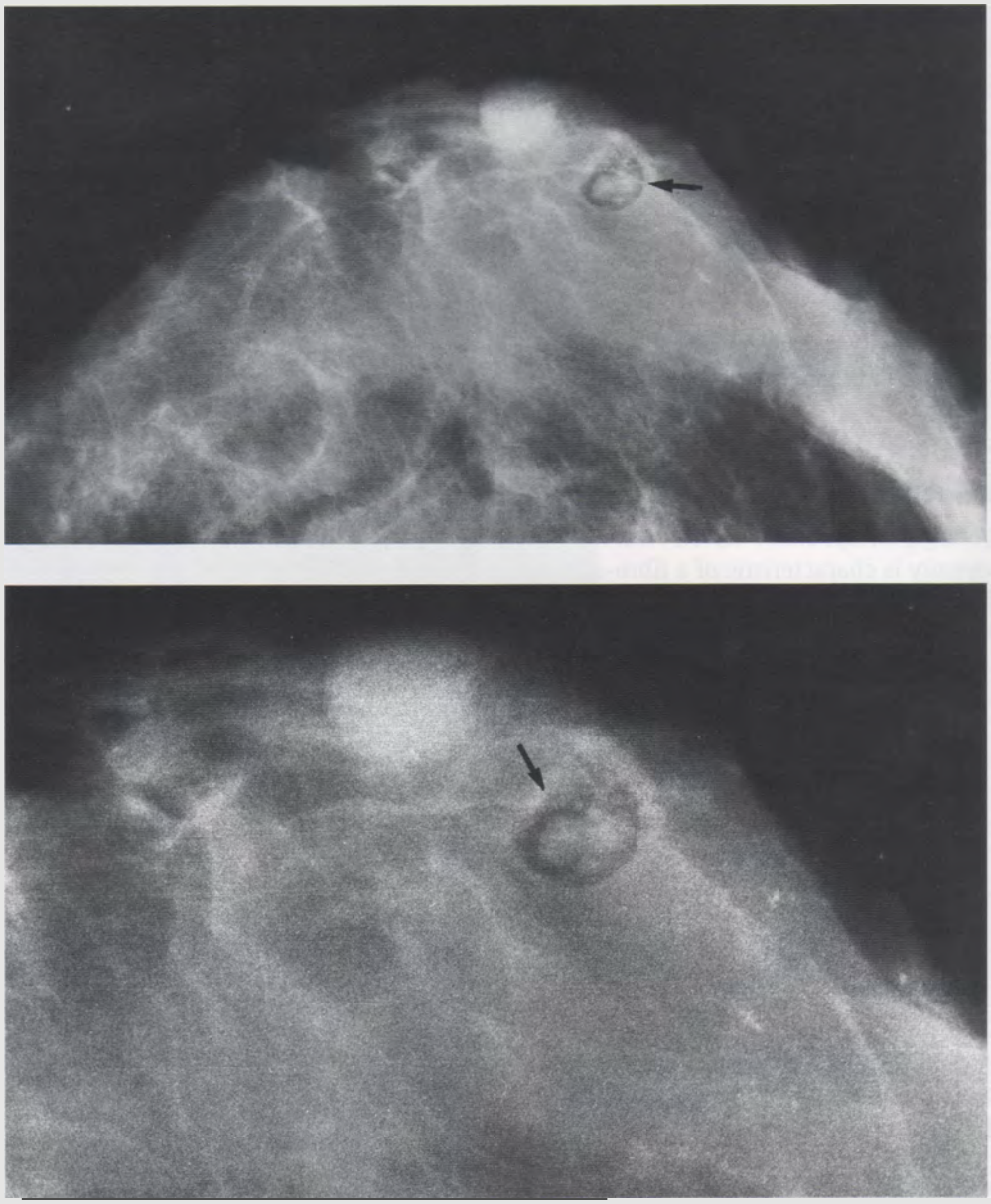
Analysis

Form: oval
Contour: sharply outlined, encapsulated; a halo sign is seen along the anterior border
Density: radiopaque and radiolucent combined (predominantly glandular components)
Size : 7 x 4 cm

Conclusion

Typical mammographic appearance of a fibro-adeno-lipoma, which is a mixture of adipose and fibroglandular tissue surrounded by a capsule. This is also called a "breast within a breast." The diagnosis needs no ultrasound or interventional procedures.

7



This 28-year-old woman noted a lump in her right breast during nursing.

Mammography

Fig. 7A: Left breast, cranio-caudal projection.
Fig. 7 B: Detailed view of the retroareolar region. A lesion with mixed density is seen (arrow).

Analysis

Form: circular
Contour: sharply defined
Density: radiolucent and radiopaque combined
Size: 12 x 10 mm

Differential Diagnosis

There are four possible diagnostic choices for a circular/oval lesion of mixed density:
a) small hematoma
b) galactocele
c) fibro-adeno-lipoma
d) intramammary lymph node
The history points to a galactocele. The small size helps to differentiate it from a fibro-adeno-lipoma that is practically always large.
The absence of trauma or previous breast surgery helps to exclude a hematoma or oil cyst.

Conclusion

The mammographic diagnosis is a benign lesion, as are all circular/oval lesions having a combined radiolucent and radiopaque appearance.
The history and mammographic appearance are consistent with a *galactocele,* which is a milk-filled cyst with a high fat content associat tion.

8

This 42-year-old woman noted a mass in her breast two months following the completion of nursing.

Mammography

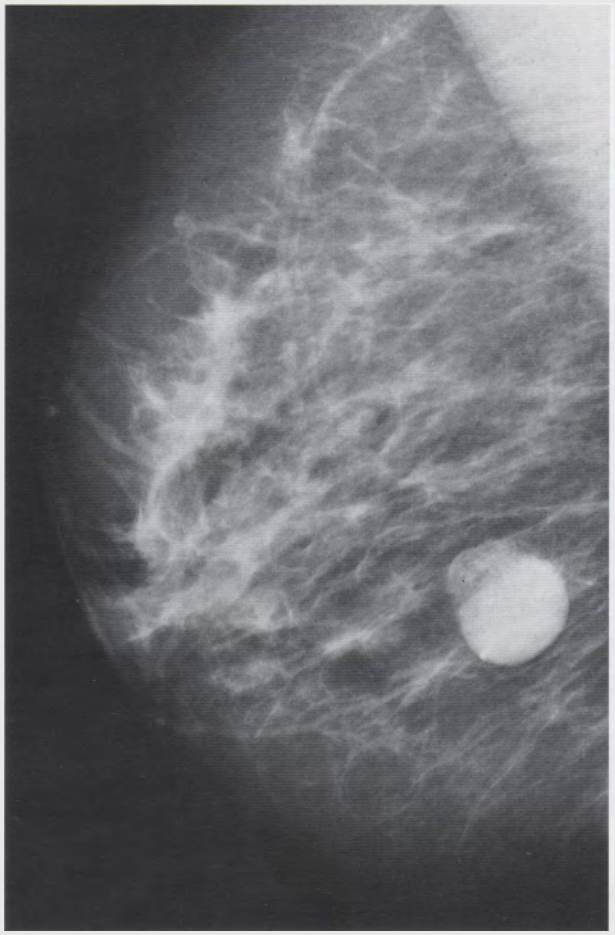
Fig. 8 A: Right breast, medio-lateral oblique projection. A tumor is seen 7 cm from the nipple.
Fig. 8 B: Magnification view.

Analysis

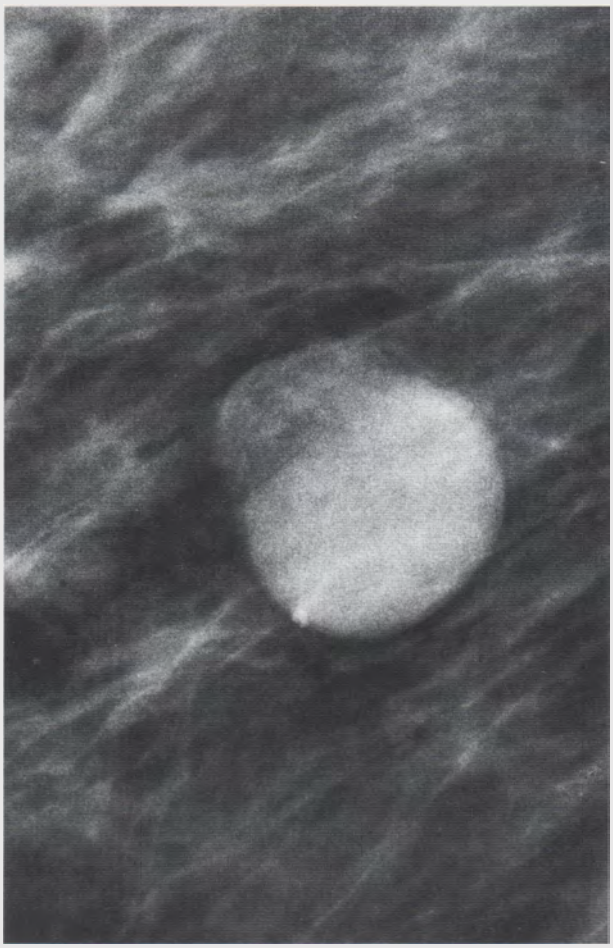
Form: oval
Contour: sharply defined
Density: radiolucent and radiopaque combined
Size: 25 x 20 mm

Conclusion

The history and mammographic appearance are typical of a galactocele. Breast ultrasound will not add any further information. Needle puncture, although not necessary for the diagnosis, will yield thick, yellow fluid.



8A



8B

9

Age 80. First screening examination, asymptomatic.

Physical Examination

A very soft, freely movable superficial lesion is palpable in the upper outer quadrant of the left breast, clinically benign.

Mammography

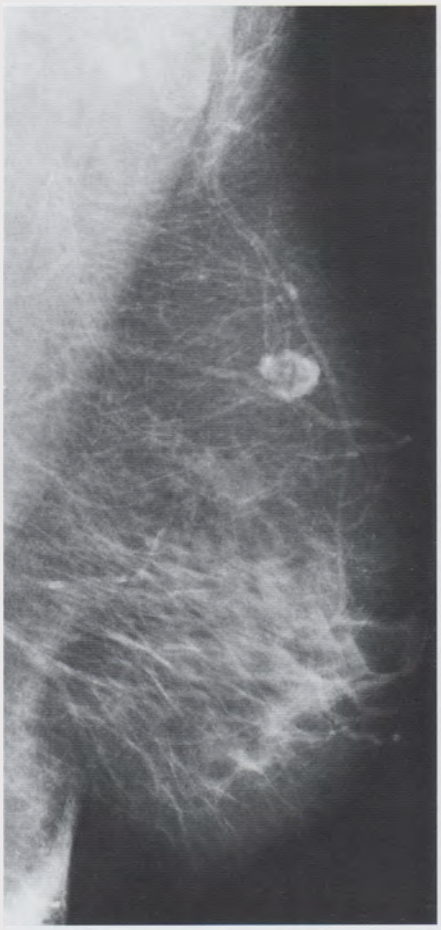
Fig. 9A: Left breast, medio-lateral oblique projection. A solitary lesion is seen in the upper outer quadrant.
Fig. 9 B: A photographic magnification of the lesion.

Analysis

Form: oval, lobulated
Contour: indistinct; no halo sign is seen
Density: radiolucent and radiopaque combined
Size: 15 x 10 mm

Conclusion

This is one of the four circular/oval lesions with combined radiolucent and radiopaque densities (see pages 18-19), all of which are benign. Further differentiation can be made as follows: a fibro-adeno-lipoma is practically always large, a galactocele is associated with nursing, and a hematoma is associated with trauma. This lesion is an intramammary **lymph** node with a typical central radiolucency corresponding to the hilus. No further procedures are necessary.



9A

9B

10

First screening examination of this 64-year-old asymptomatic woman.

Physical Examination

No palpable tumor.

Mammography

Fig. 10.A: Right breast, medio-lateral oblique projection. Small circular lesion is seen in the upper outer quadrant. No associated calcifications.
Fig. 10B: Magnification view of the lesion.

Analysis

Form: oval
Contour: sharply outlined
Density: radiopaque and radiolucent combined
Size: 6 x 5 mm

Conclusion

The mixed density is crucial in classifying this finding: small intramammary lymph node. The central radiolucent area corresponds to the hilus.
Intramammary lymph nodes can be found in any quadrant of the breast, although they are most often seen in the upper outer quadrant.

10A

10B

11

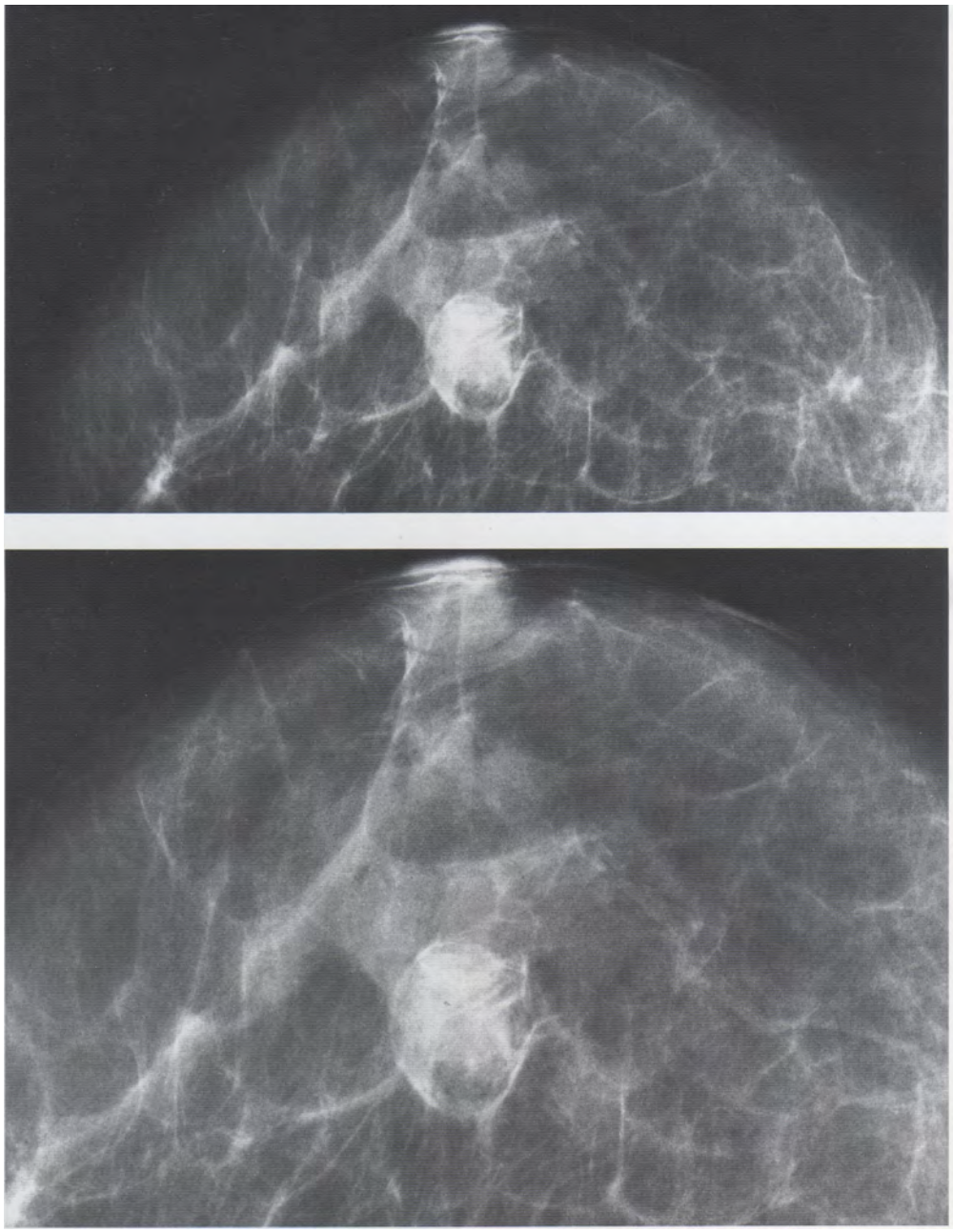
Age 65. Trauma to the right breast eight days earlier.

Mammography

Fig. 11 A: Right breast, cranio-caudal projection. An oval-shaped lesion with no associated calcifications is seen 4 cm from the nipple.
Fig. 11 B: Magnified view of the lesion.

Comment

There are four differential diagnostic choices for a circular/oval lesion with mixed density. In this case the history of recent trauma leads to the diagnosis of a hematoma.



12

Age 67. The patient experienced trauma to the right breast two weeks earlier. In addition to a superficial hematoma she noted a lump.

Mammography

Fig. 12 A & B: Right breast, mediolateral oblique and cranio-caudal projections. Superficial solitary tumor in the lower lateral quadrant. No associated calcifications.
Fig. 12 C: Magnified view of the tumor.

Analysis

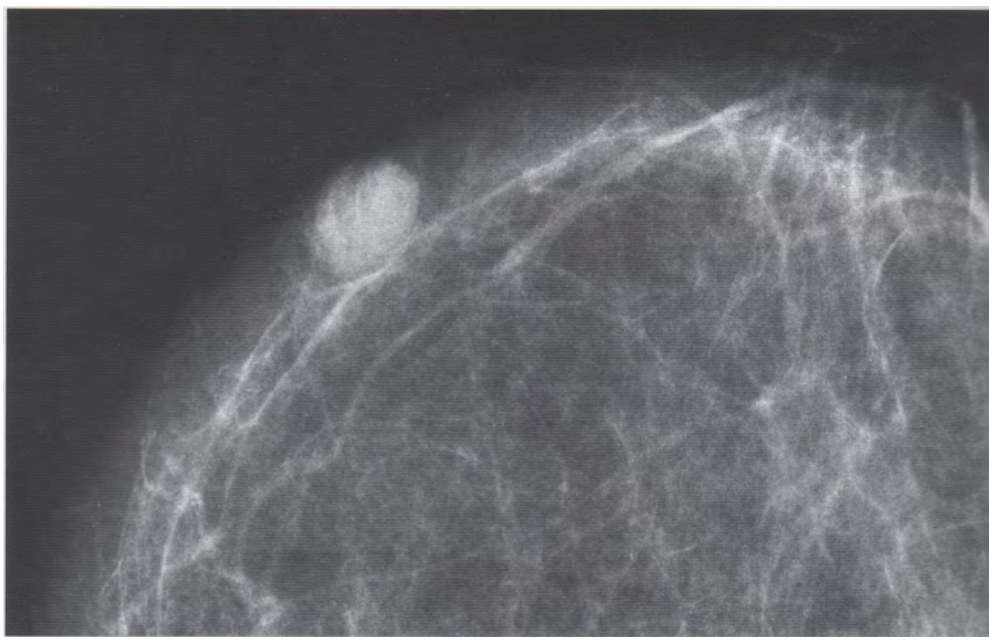
Form: oval
Contour: sharply outlined
Density: radiopaque and radiolucent co

[illegible] the magnified view
(arrow)
Size: 20 x 15 mm

Conclusion

Both history and mammographic appearance indicate a hematoma. This will eventually develop into an oil cyst.

12A



13

Age 52. First screening examination, asymptomatic.

Physical Examination

3 cm, firm, freely movable retroareolar tumor. Inverted nipple, no skin changes. Clinically benign.

Mammography

Fig. 13 A & B: Right breast, medio-lateral oblique and cranio-caudal projections. There is an oval-shaped, lobulated retroareolar tumor with no associated calcifications. A smaller circular lesion is seen in the upper outer quadrant 6 cm from the nipple.

Analysis

Form: oval, lobulated
Contour: sharply outlined
Density: low density radiopaque
Size: 30 x 15 mm

Comment

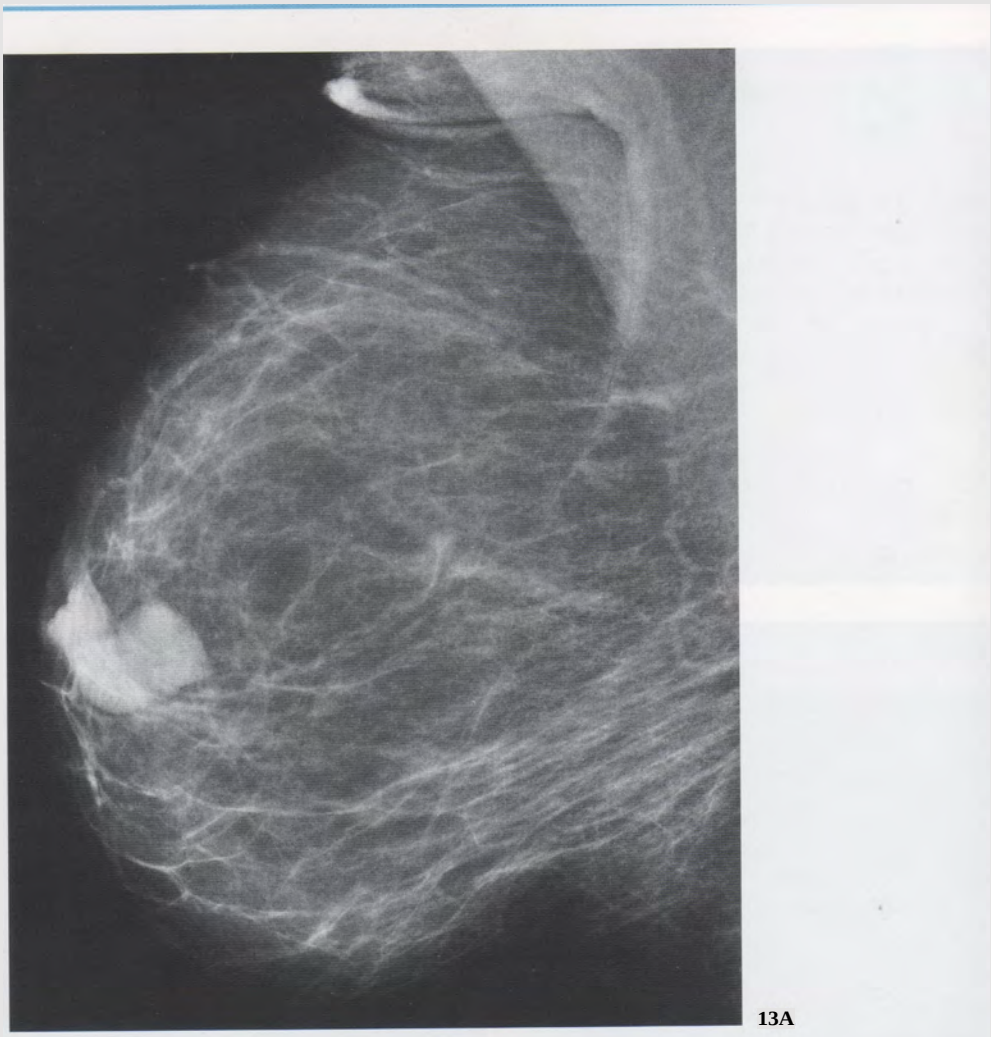
When a circular/oval lesion is low density radiopaque on the mammogram, *contour analysis* is the next step in the mammographic analysis. When present, a halo sign or a sharp contour indicates that the lesions in benign. Breast ultrasound may demonstrate a cyst or a solid lesion. If solid, ultrasound-guided needle biopsy will provide the microscopic diagnosis.
When a circular/oval lesion is either radiolucent or radiolucent and radiopaque combined on the mammogram, *density analysis* is decisive in arriving at a benign diagnosis.

Conclusion

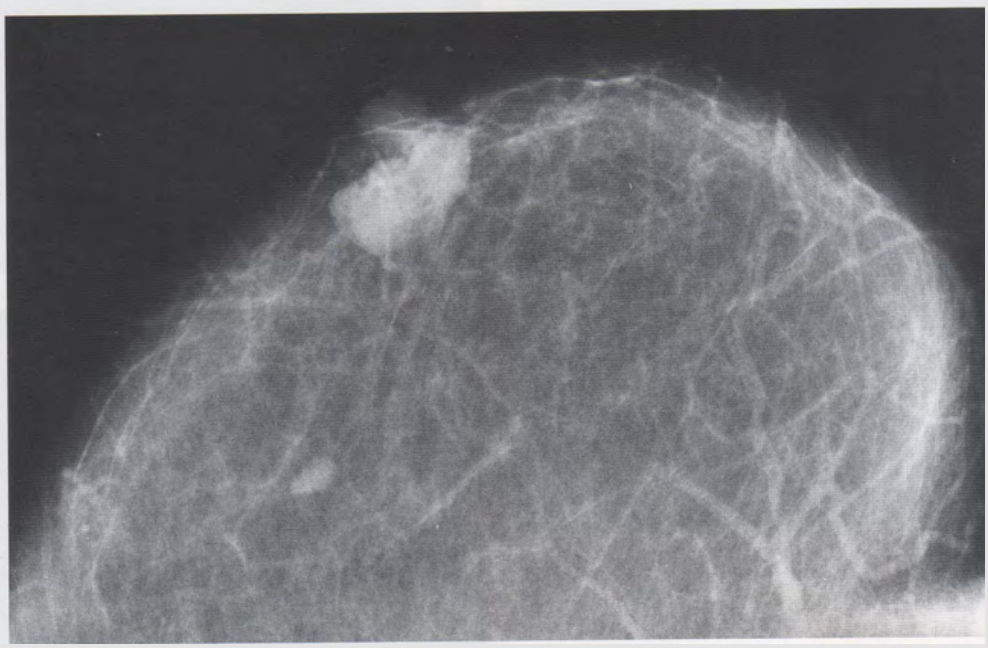
Mammographically benign tumor. The smaller lesion, 6 cm from the nipple, is also a sharply outlined, low-density lobulated tumor, and is also mammographically benign. Microscopic confirmation is necessary.

Histology

Two fibroadenomas.



13A



14

Age 42. First screening examination, asymptomatic.

Physical Examination

2 cm tumor in the upper inner quadrant of the right breast, clinically benign.

Mammography

Fig. 14A: Right breast, medio-lateral oblique projection. There is a tumor with no associated calcifications 6 cm from the nipple in the upper half of the breast. Fig. 14B & C: Enlarged views of the tumor in the medio-lateral and craniocaudal projections.

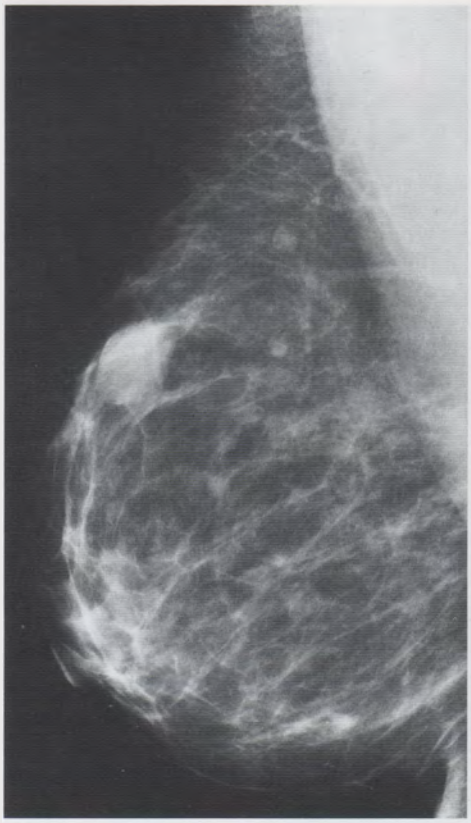
Analysis

Form: oval, lobulated
Contour: mostly sharp, but there are many disturbing overlying parenchymal shadows
Density: low density radiopaque with a superimposed vessel and parenchyma
Size: 2 x 2 cm

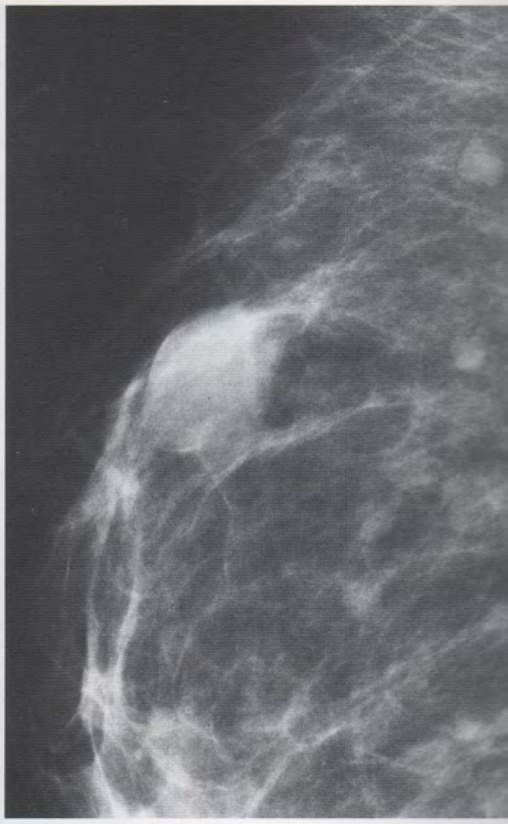
Conclusion

Mammography demonstrates this tumor but is not sufficient for reliable differential diagnosis. Microscopic diagnosis is necessary to differentiate between an ill-defined fibroadenoma and a low-density malignant tumor.

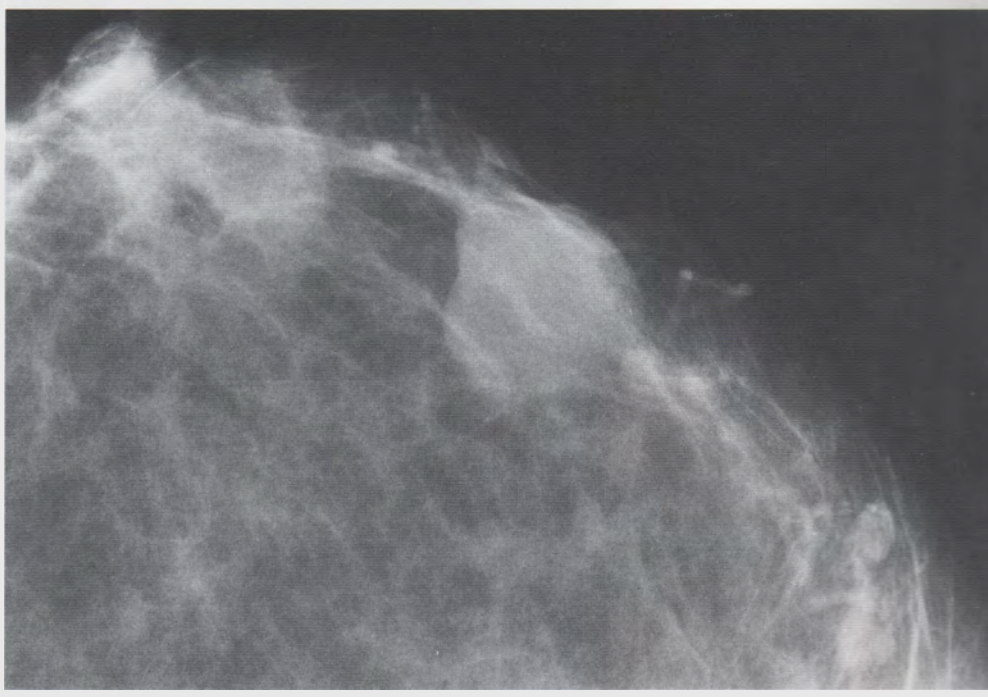
Histology



14A



14B



15

Asymptomatic 75-year-old woman, first screening study.

Physical Examination

Approximately 2 cm freely movable tumor in the lower outer quadrant of the right breast. No skin changes.

Mammography

Fig. 15 A & B: Right breast, cranio-caudal and medio-lateral oblique projections. Circular/oval tumor 7 cm from the nipple in the lower outer quadrant. No associated calcifications.
Fig. 15 C & D: Microfocus magnification views of the tumor in the cranio-caudal and medio-lateral oblique projections. A partially calcified artery is seen superimposed over the lesion in Fig. 15 D.

Analysis

Form: oval
Contour: mostly unsharp; no definite halo sign
Density: low density radiopaque
Size: 20 x 15 mm

Conclusion

A tumor with unsharp borders in a 75-year-old woman raises the suspicion of malignancy.

Cytology

Cells suspicious for malignancy.

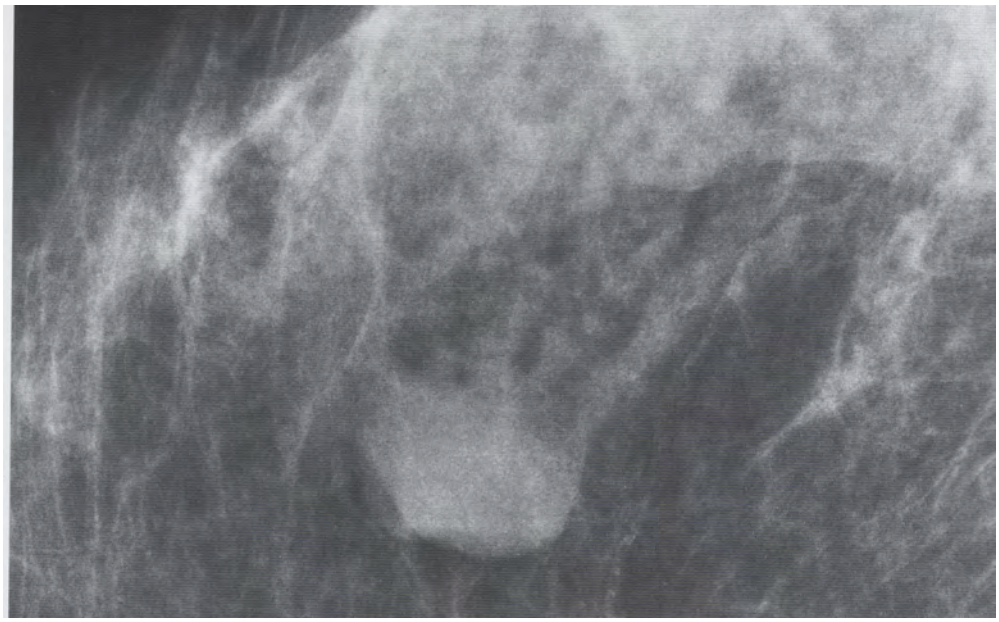
Histology

Fibroadenoma.

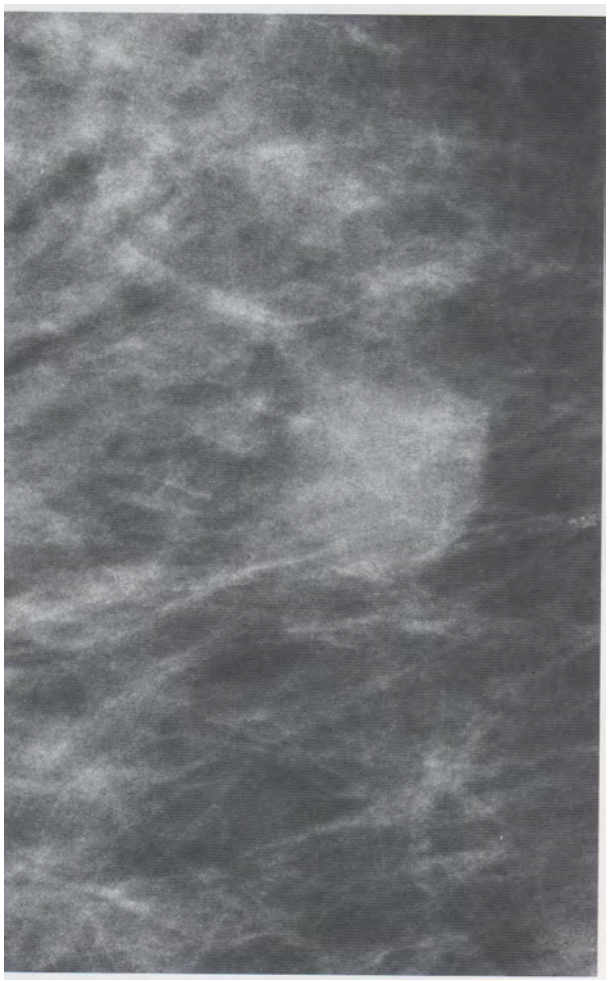
Comment

If part or all of a radiopaque circular/oval tumor is ill defined, microscopic diagnosis is mandatory.

15A



15C



15D

16

Age 33, referred for a self-detected tumor in the right breast.

Mammography

Fig. 16 A & B: Right breast, medio-lateral oblique and cranio-caudal projections.
Fig. 16 C: Spot compression view in the cranio-caudal projection, photographic enlargement.
A solitary tumor without associated calcifications is seen in the upper outer quadrant of the breast.

Analysis

Form: oval
Contour: only the posterior border is sharply outlined: there is a partial halo sign present on the compression view (arrows)
Density: low density radiopaque, equal to that of the surrounding parenchyma
Size: 15 x 15 mm

Conclusion

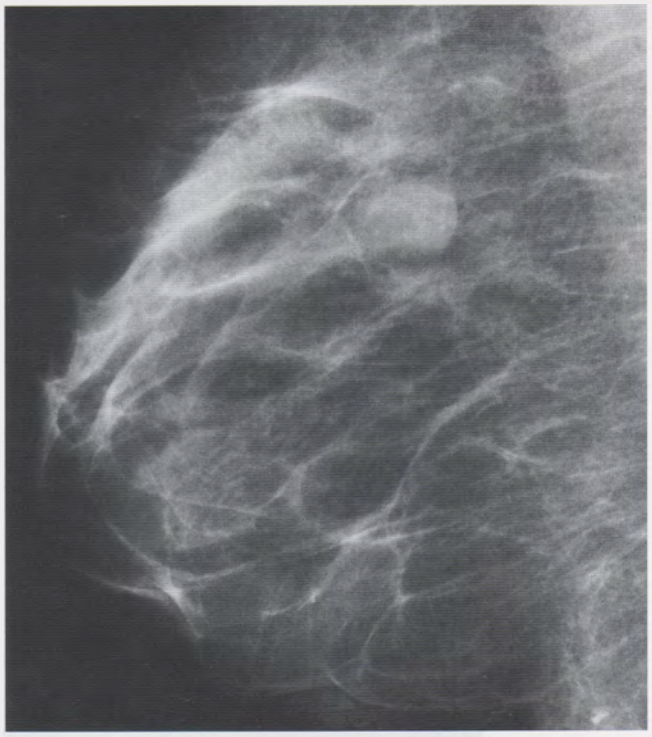
Mammographically benign tumor.

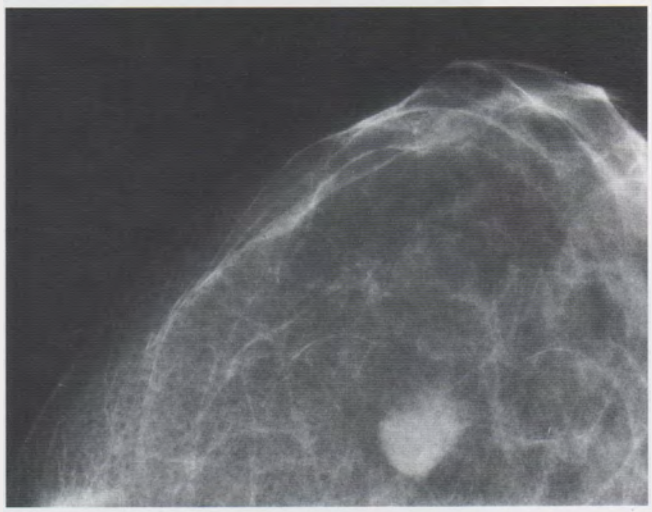
Histology

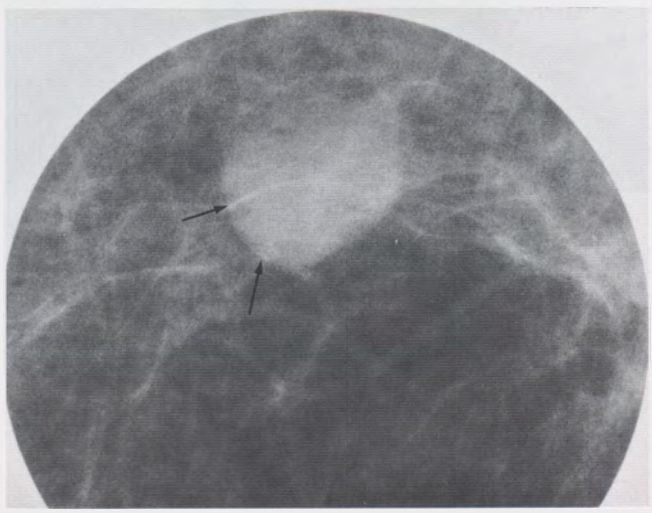
Fibroadenoma.

Comment

The halo sign detected on the spot compression view in combination with the radiopaque low density suggests the benign nature of this lesion. The unsharp borders make tissue diagnosis necessary.







17

Age 50. First screening examination. The patient was aware of a tumor in her left breast but did not seek medical advice.

Physical Examination

Tender, 5 cm, clinically benign retroareolar lesion.

Mammography

Fig. 17 A: Right breast, detailed view of the cranio-caudal image. There is a solitary retroareolar tumor with no associated calcifications.

Analysis

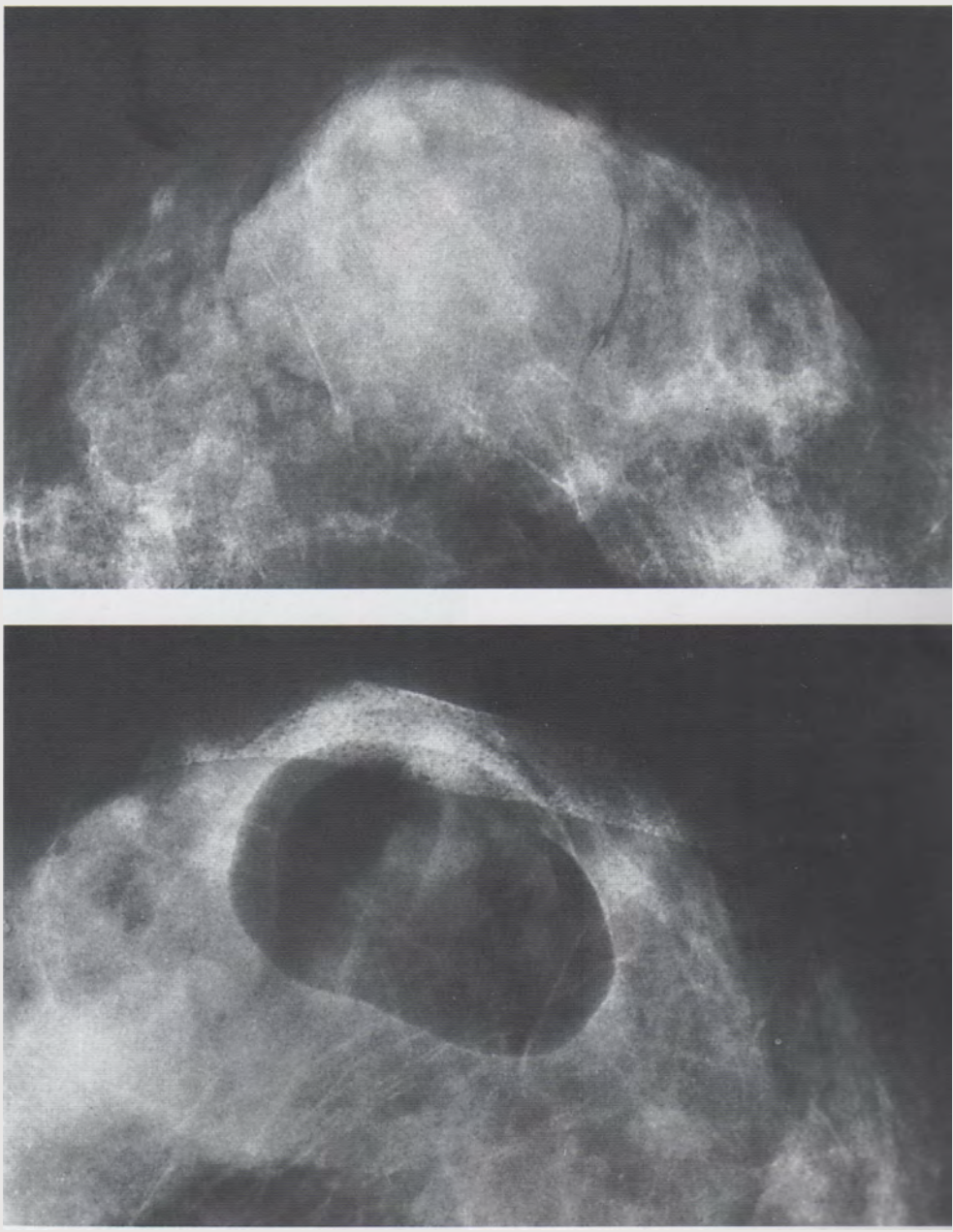
Form: oval
Contour: extensive halo sign
Density: low density radiopaque
Size: 5 x 5 cm

Conclusion

The low-density radiopaque nature of the lesion in combination with an extensive halo sign suggests the mammographic diagnosis of a benign lesion, most probably a cyst.
Fig: 17 B: pneumocystogram. Simple cyst, no intracystic tumor.

Comment

The halo sign may be extensive in cysts whereas in fibroadenomas the halo sign, when present, is usually short/partial and may be difficult to demonstrate. Ultrasound examination of the circular/oval lesion will differentiate a solid tumor from a cyst, and will assist in inter
edures.



18

Age 72. First screening study, asymptomatic.

Physical Examination

Retroareolar tumor, 3 cm diameter, clinically benign.

Mammography

Fig. 18 A & B: Left breast, medio-lateral oblique and cranio-caudal projections. Solitary retroareolar tumor. No associated calcifications.
Fig. 18 C: Microfocus magnification view, cranio-caudal projection.

Analysis

Form: oval, lobulated
Contour: a halo sign is seen along the anterior border (arrows); overlying parenchyma obscures the posterior border
Density: parenchymal structures can be seen through the low-density radiopaque tumor
Size: 3 x 3 cm

Conclusion

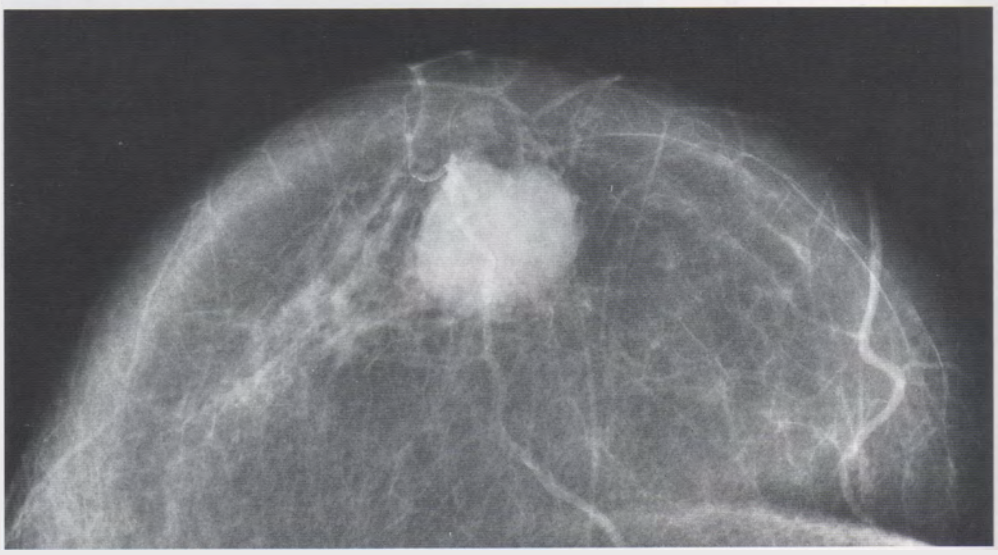
The combination of the low-density radiopaque appearance and the presence of a partial halo sign suggest a mammographically benign tumor. Ultrasound will differentiate a cyst from a solid tumor.

Puncture and Pneumocystography

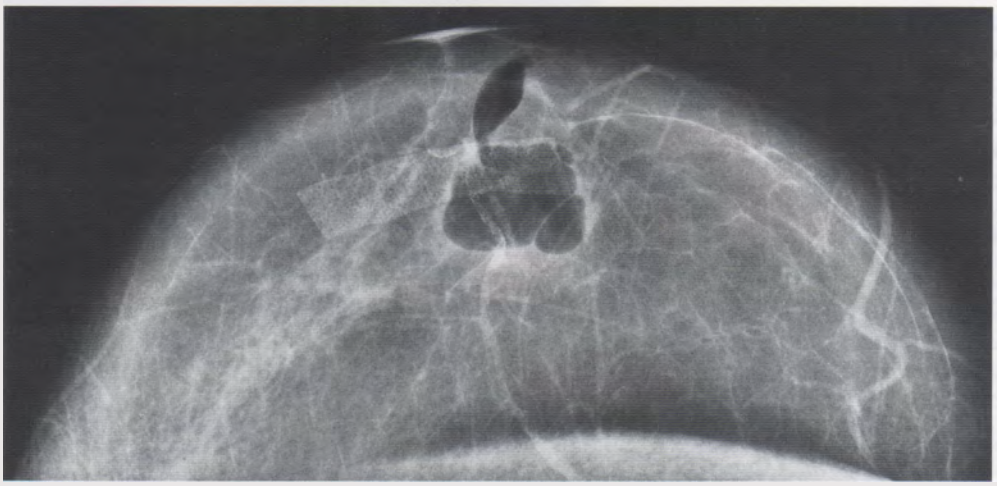
(Fig. 18 D)

Cranio-caudal projection. Simple cyst with no intracystic tumor. Air in the needle track.

18A



18C



18D

19

Asymptomatic, 68-year-old woman, first creening study.

Physical Examination

No palpable tumor.

Mammography

Fig. 19A & B: Right breast, medio-lateral oblique and cranio-caudal projections. A small solitary tumor with no associated calcifications is seen in the upper outer quadrant.
Fig. 19 C & D: Microfocus magnification views, medio-lateral and cranio-caudal projections.

Analysis

Form: circular
Contour: mostly illdefined
Density: low density radiopaque; a vein can be seen through the tumor (Fig. 19 D).
Size: 6 x 5 mm

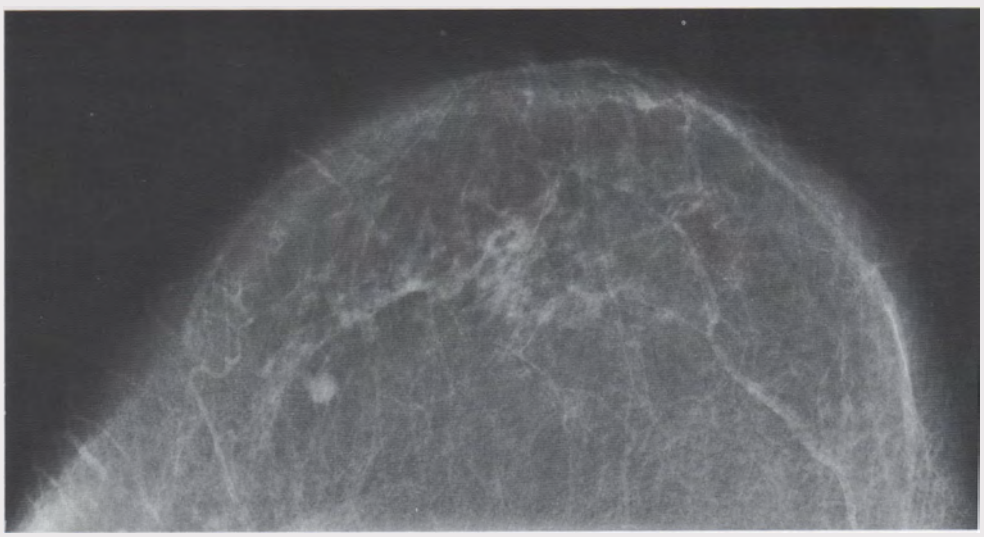
Conclusion

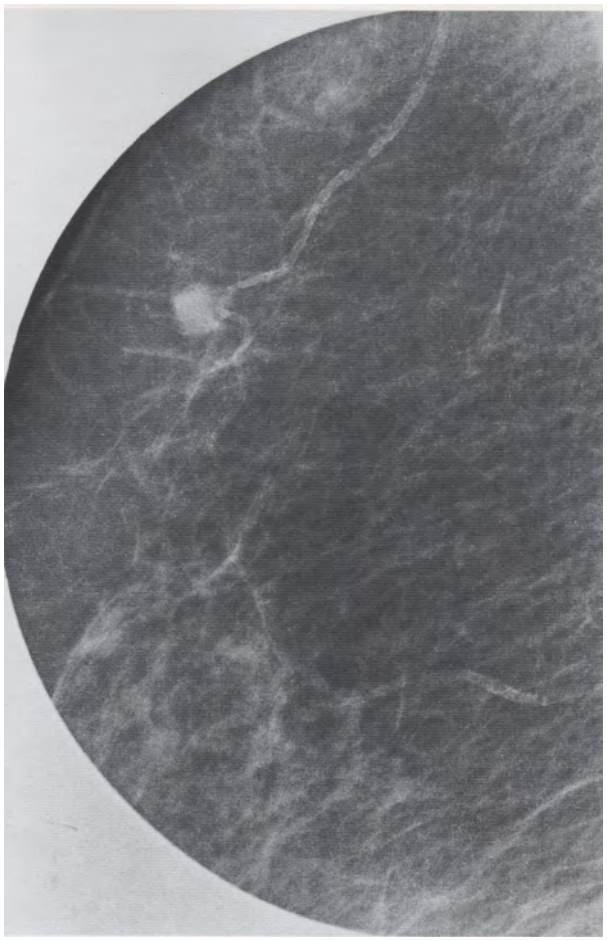
Although the lesion is of low density, the lack of a halo sign and the partially unsharp borders raise the suspicion of malignancy in this 68-year-old woman. The benign options include a small papilloma or cyst. Small lesions surrounded by a considerable amount of adipose tissue may be difficult to convincingly demonstrate with breast ultrasound. Stereotactic guidance will then be necessary for microscopic diagnosis.

Histology

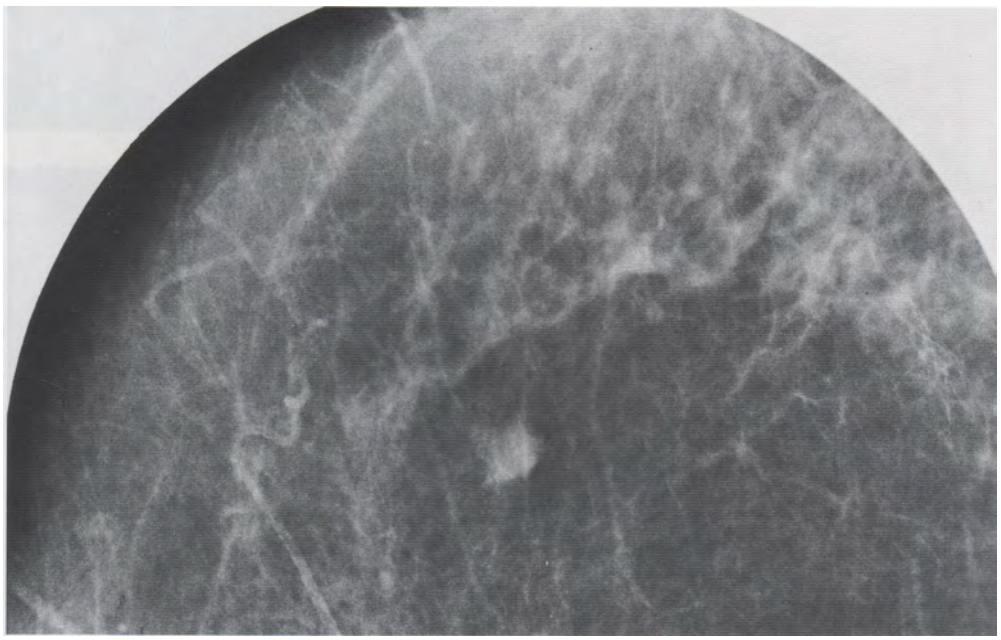
Simple cyst, no evidence of malignancy.

19A





19C



19D

20

54-year-old woman, referred for a lump in the right breast, first noted one week earlier.

Physical Examination

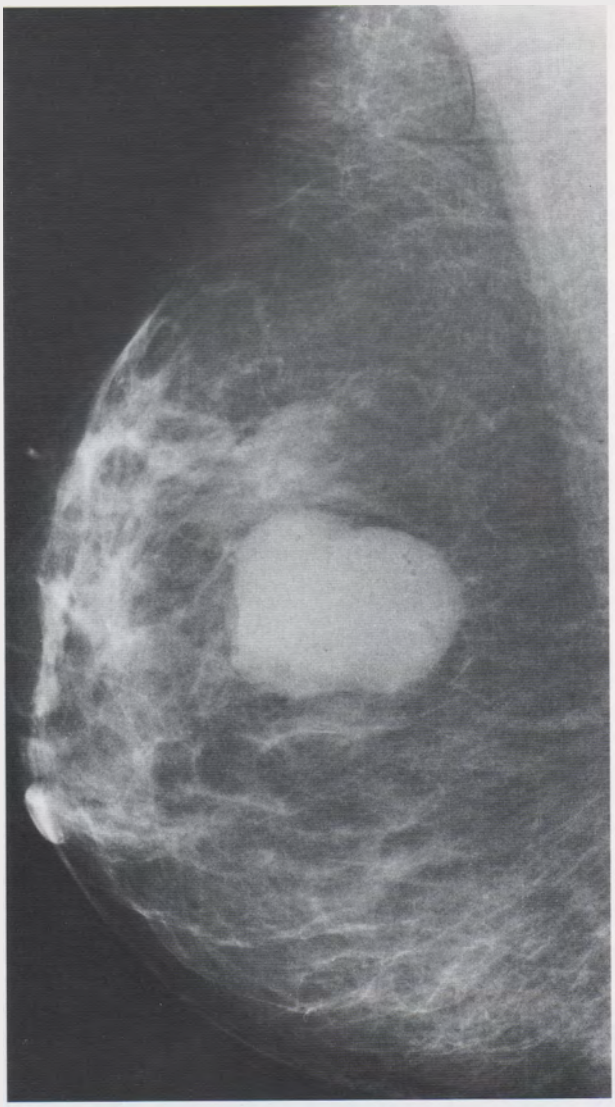
Freely movable, hard lump in the lateral portion of the right breast, clinically suspicious for malignancy.

Mammography

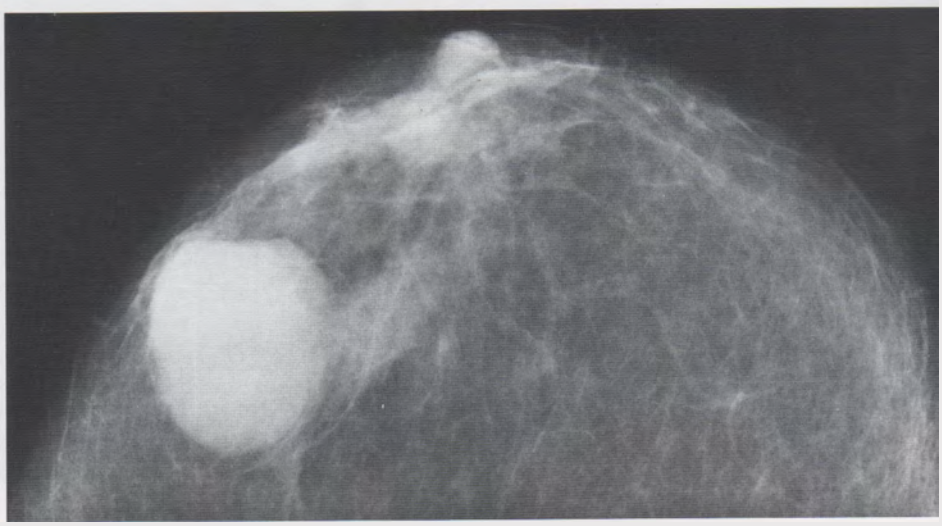
Fig. 20A & B: Right breast, medio-lateral oblique and cranio-caudal projections. Solitary tumor with no associated calcifications.

Analysis

Form: oval, lobulated
Contour: segments of a halo sign; overlying parenchyma obscures portions of the border
Density: high density radiopaque
Size: 5 x 3 cm



20A



Conclusion

Although the presence of a halo sign suggests that the tumor is benign, the high density makes a cancer, cystosarcoma phylloides, intracystic tumor, or, seldom, a cyst the diagnostic options. Clinical and mammographic examination have a wide range of differential diagnostic options.

Strategy

Ultrasound is the first ancillary method of choice to narrow down the differential diagnosis. Ultrasound-guided intervention will lead to the final diagnosis.

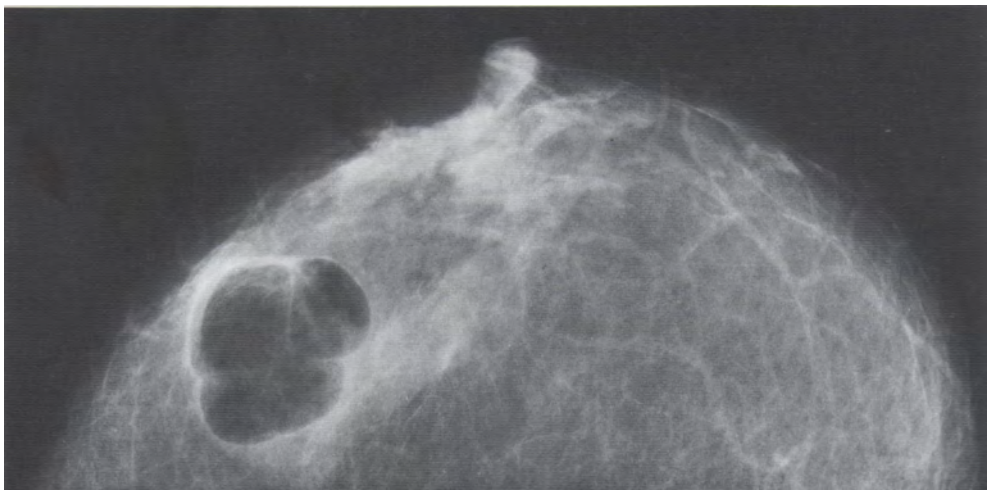
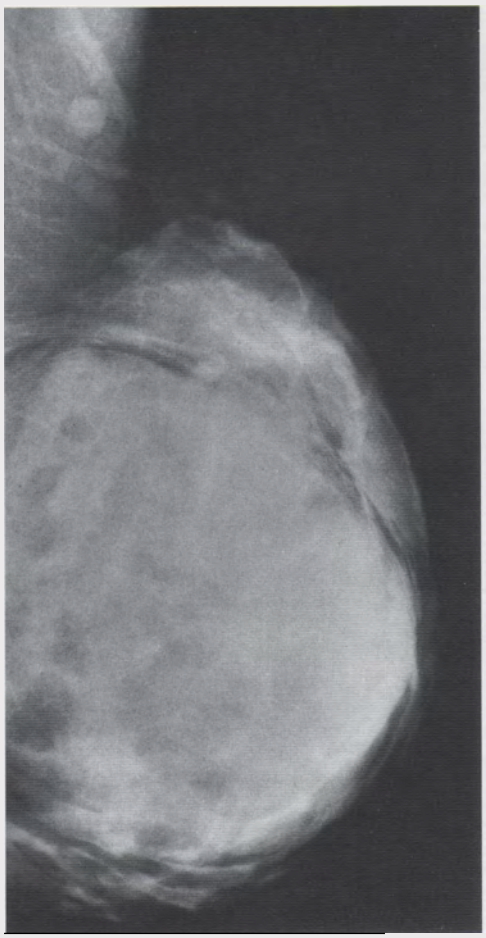


Fig. 20C: Pneumocystogram. Simple cyst, no intracystic tumor.

2



Age 21. The patient detected a large tumor in her left breast.

Physical Examination

Huge, approximately 10 cm, firm but movable tumor filling most of the left breast.

Mammography

Fig. 21: Left breast, medio-lateral oblique projection.

Analysis

Form: oval
Contour: sharply outlined; extensive halo sign
Density: low density radiopaque, equal to parenchyma
Size: 11 x 8 cm

Conclusion

The presence of a very extensive halo sign in combination with the low-density radiopaque appearance, despite the large size, suggests a mammographically benign tumor. In a patient this young the description is characteristic of a giant fibroadenoma.

Histology

Giant fibroadenoma.

22

67-year-old woman, first noted a tumor in her right breast many years ago but had not sought medical help. First screening examination.

Mammography

Fig. 22 A & B: Right breast, medio-lateral oblique and cranio-caudal projections. A solitary tumor is located in the upper outer quadrant, immediately under the skin. No associated calcifications.

Analysis

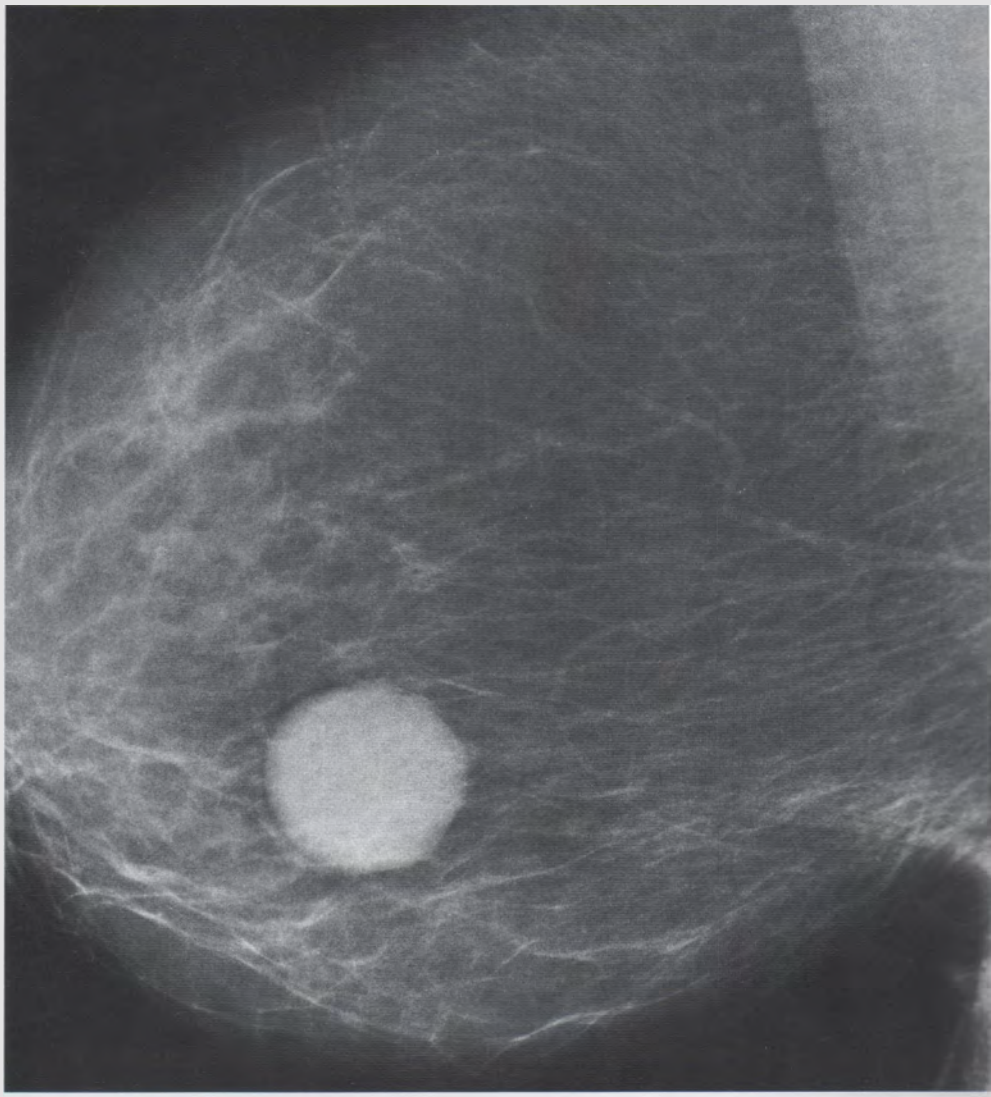
Form: circular
Contour: sharply outlined; the presence of an air pocket suggests that this lesion is protruding from the skin surface
Size: 3 x 3 cm
Location: intra- and subcutaneous; the overlying skin is not thickened.

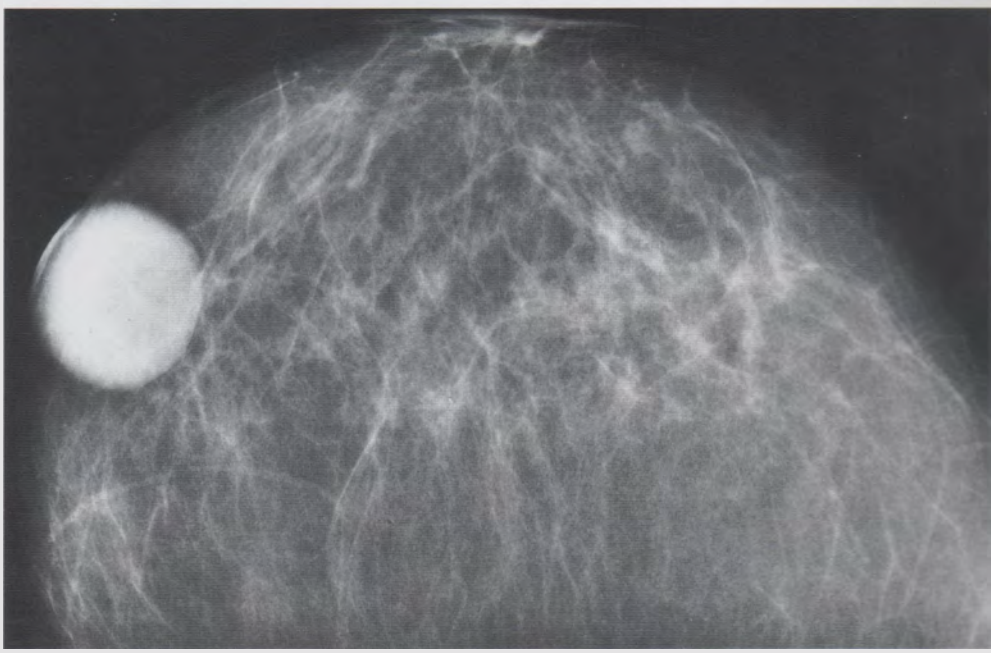
Conclusion

Mammographically this is a typical benign tumor. Clinical examination reveals a sebaceous cyst.

Histology

Sebaceous cyst.





23

Asymptomatic 63-year-old woman. First screening study.

Physical Examination

No palpable tumor.

Mammography

Fig. 23 A: Left breast, medio-lateral oblique projection. A solitary tumor is located in the lower half of the breast.
Fig. 23 B & C: Microfocus magnification views in the medio-lateral oblique and cranio-caudal projections. Numerous microcalcifications are seen in the tumor.

Analysis of the Tumor

Form: round, lobulated
Contour: sharply outlined
Density: low density radiopaque
Size: 12 x 15 mm

Analysis of the Calcifications

Form: round and elongate, smooth bordered
Density: high, uniform
Size: small, variable
Distribution: within the tumor

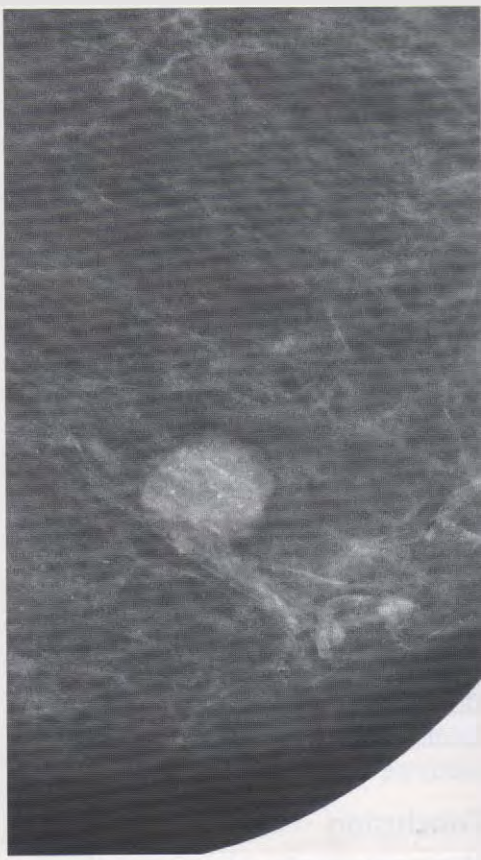
Conclusion

Mammographically benign tumor, containing calcifications of varying size and form.

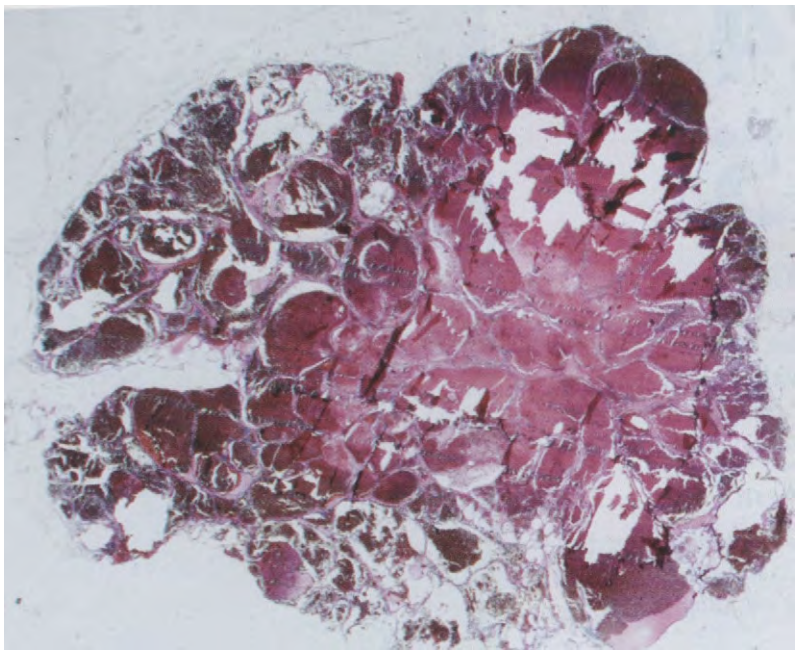
Histology

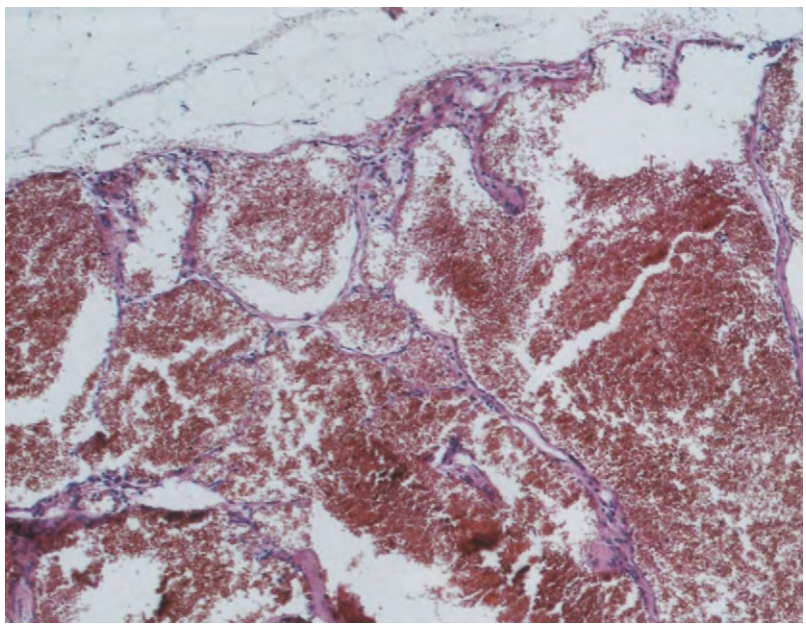
Cavernous hemangioma.
Fig. 23 D: Low-power view of the lesion showing the typical structure of a cavernous hemangioma. (H & E, 12.5 x)
Fig. 23 E: High-power view of the lesion's periphery demonstrating its cavernous structure. (H & E, 200x)

23A



23B





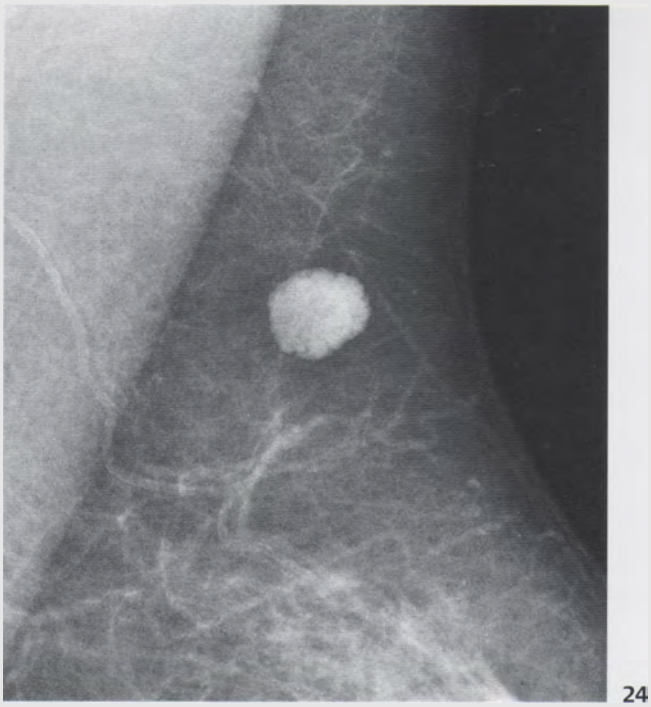
3E

24 & 25

Figs. 24 & 25: Two cases of warts. Most warts give a typical mammographic appearance. The borders are sharply outlined with a multilobulated contour. The air outlining the fine, papillary surface emphasizes its structure.

Comment

Well-trained technologists are familiar with skin lesions and should always inform the radiologist of their presence.



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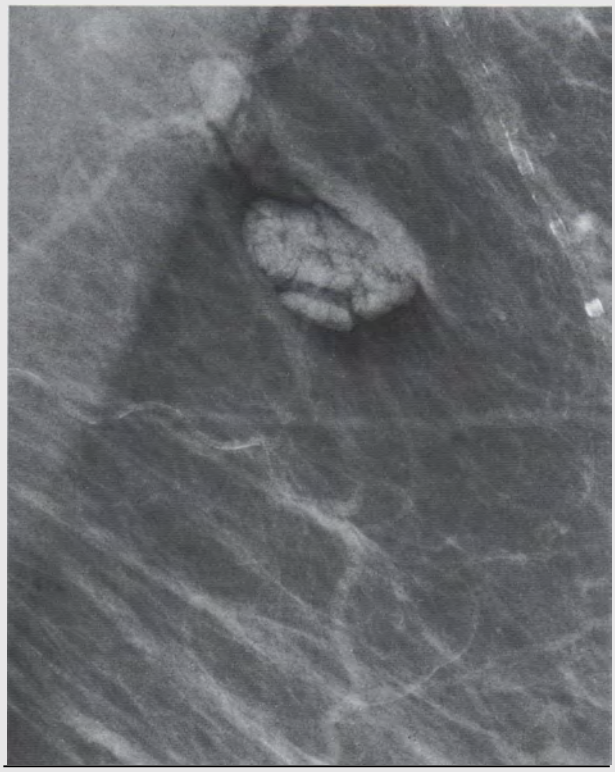


25

26

Asymptomatic 37-year-old woman. First screening examination.

Physical Examination

A freely movable tumor, 7 x 6 cm, fills the upper outer quadrant of the left breast. No skin retraction.

Mammography

Fig. 26 A & B: Left breast, medio-lateral oblique and cranio-caudal projections. A large tumor is seen in the upper outer quadrant associated with coarse calcifications.

Analysis of the Tumor

Form: oval
Contour: sharply outlined; extensive halo sign in Fig. 26A
Density: Equal to that of the parenchyma
Size: 7 x 6 cm

Analysis of the Calcifications

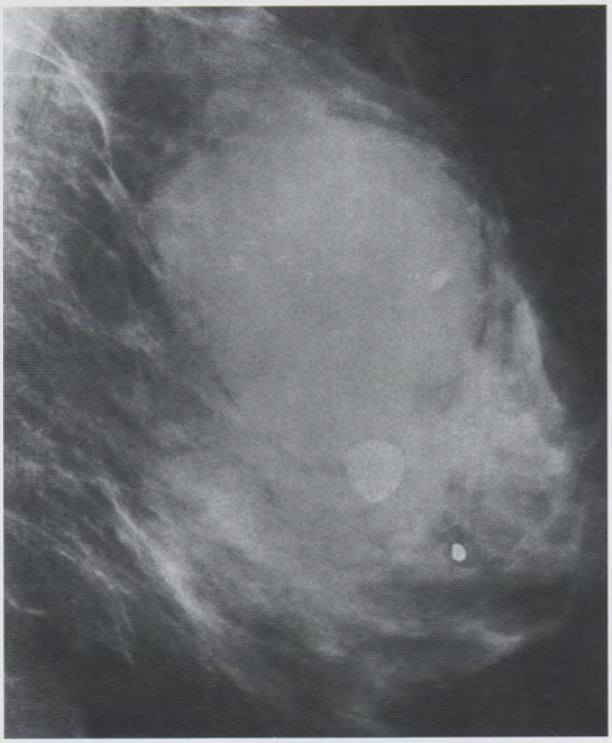
Coarse, high density, mammographically benign type.

Comment

Huge, sharply outlined radiopaque tumors in women around menopausal age are characteristic of cystosarcoma phylloides or, rarely, cysts. In this case the calcifications indicate the diagnosis of cystosarcoma phylloides.

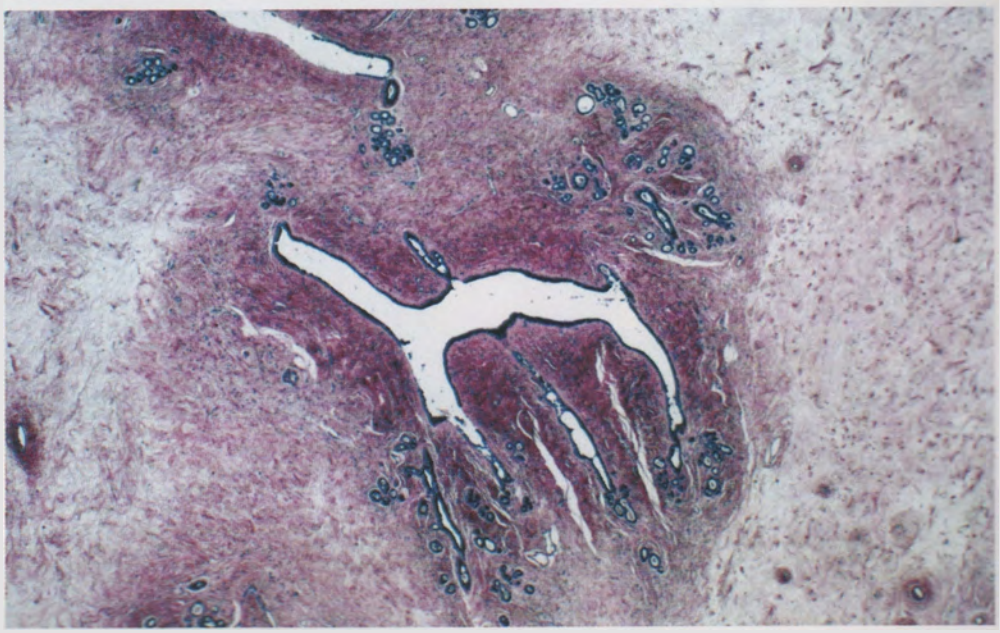
Histology

Benign cystosarcoma phylloides (phylloides tumor).
Fig. 26 C: Typical leaf-like (phylloides) projection of a duct-like structure into the lumen. There are large variations in the cellularity of the stromal component. (H &E, 100x)



26A

26B



27

73-year-old woman, first felt a tender mass behind the left areola one week earlier.

Mammography

Fig. 27A & B: Right breast, medio-lateral oblique and cranio-caudal projections. The are several retroareolar tumors, the largest containing a single, benign-type calcification.

Analysis

Form: round and oval
Contour: sharply defined, except for the one with the calcification
Density: low density radiopaque; a vein is well seen superimposed over the tumors (Fig. 27 B).
Size: 0.5-2.0 cm
Location: retroareolar

Conclusion

The tumors with sharp borders and low density are mammographically benign, but the mammographic diagnosis of the largest tumor is uncertain. Blood was expressed from the nipple at mammography. Galactography may assist in the diagnosis.

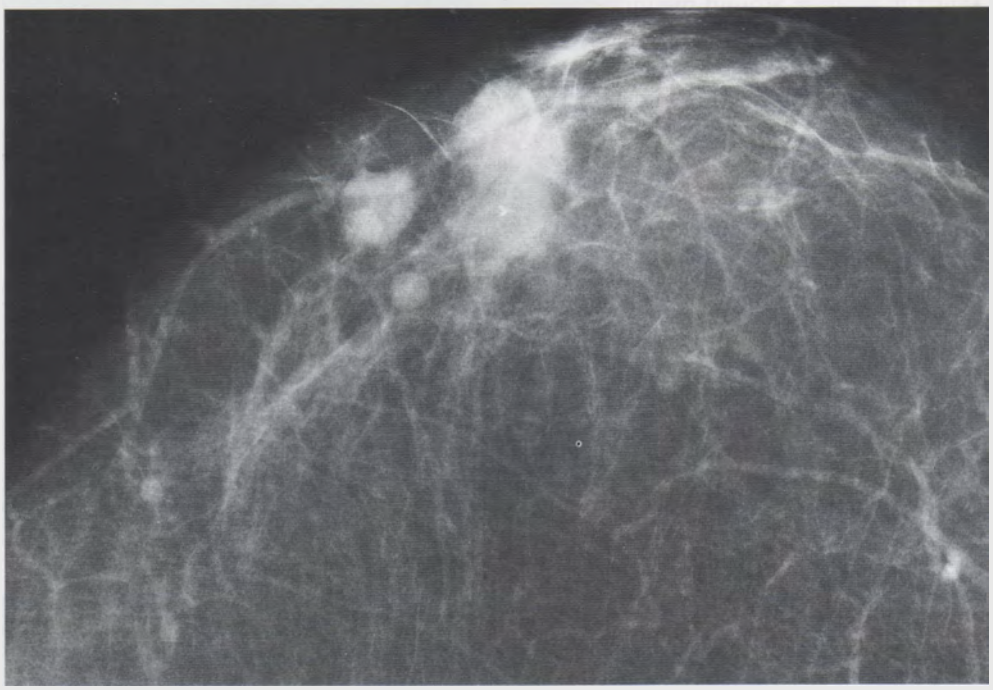
Galactography

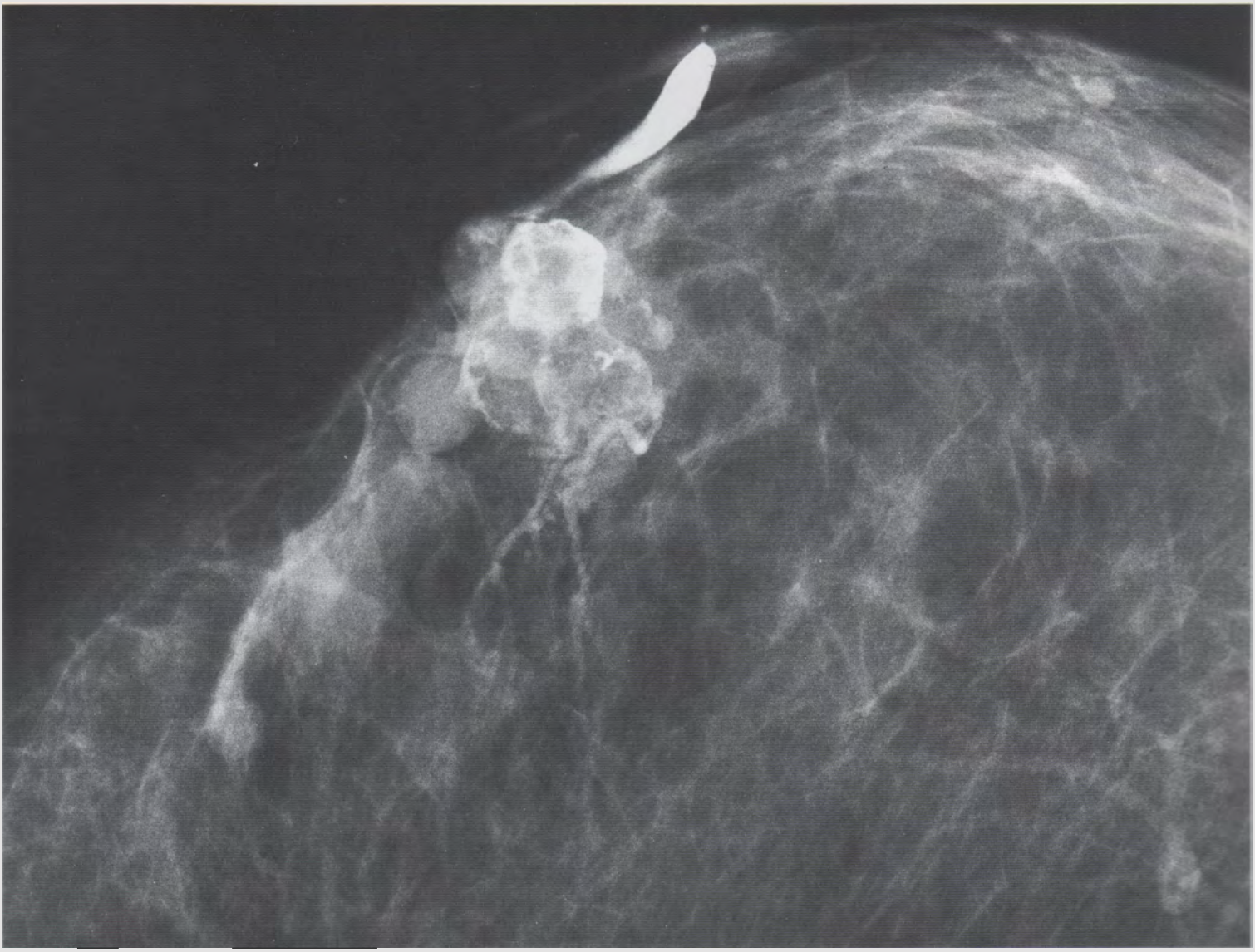
(cranio-caudal projection, Fig. 27 C)
A dilated duct leads to the tumors which are seen as intraductal filling defects.
Radiologic diagnosis: multiple papillomas (55).

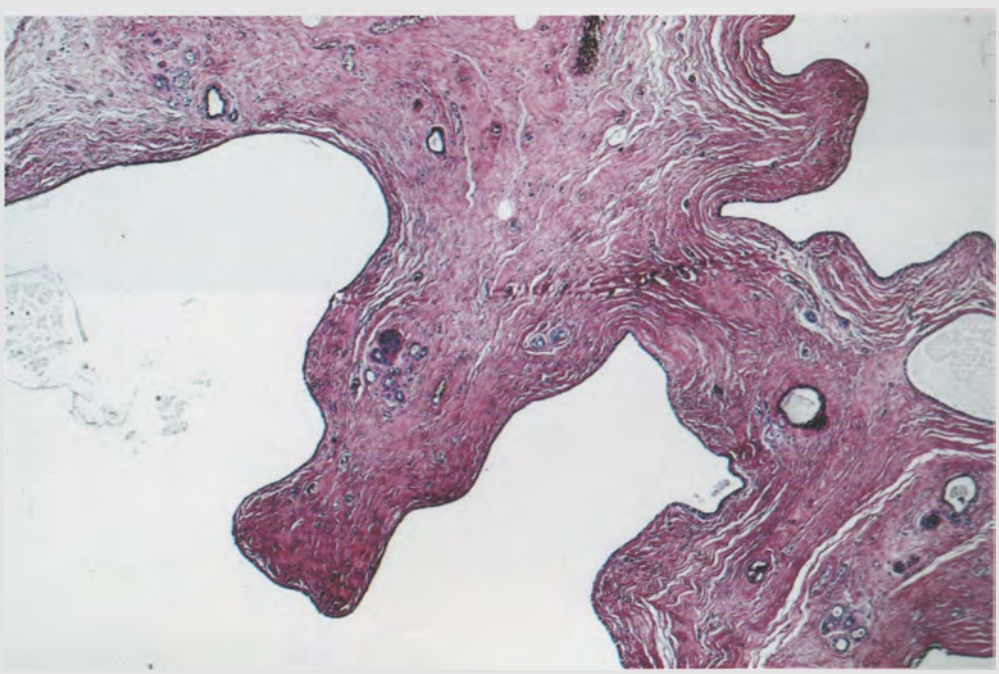
Histology

Multiple papillomas. No evidence of malignancy (Fig. 27 D).

27A







28

Asymptomatic 80-year-old woman. First sreening study.

Mammography

Fig. 28A: Right breast, medio-lateral oblique projection. Normal mammogram. *Seven months later* the patient felt a lump in the lower half of the right breast.

Repeat Mammography

Fig. 28 B: Right breast, medio-lateral oblique projection. Four cm from the nipple (arrows) there is an ill-defined tumor, not present in the previous study.
Fig. 28 C: Microfocus magnification view in the medio-lateral oblique projection. The tumor (arrows) has no associated calcifications.

Analysis

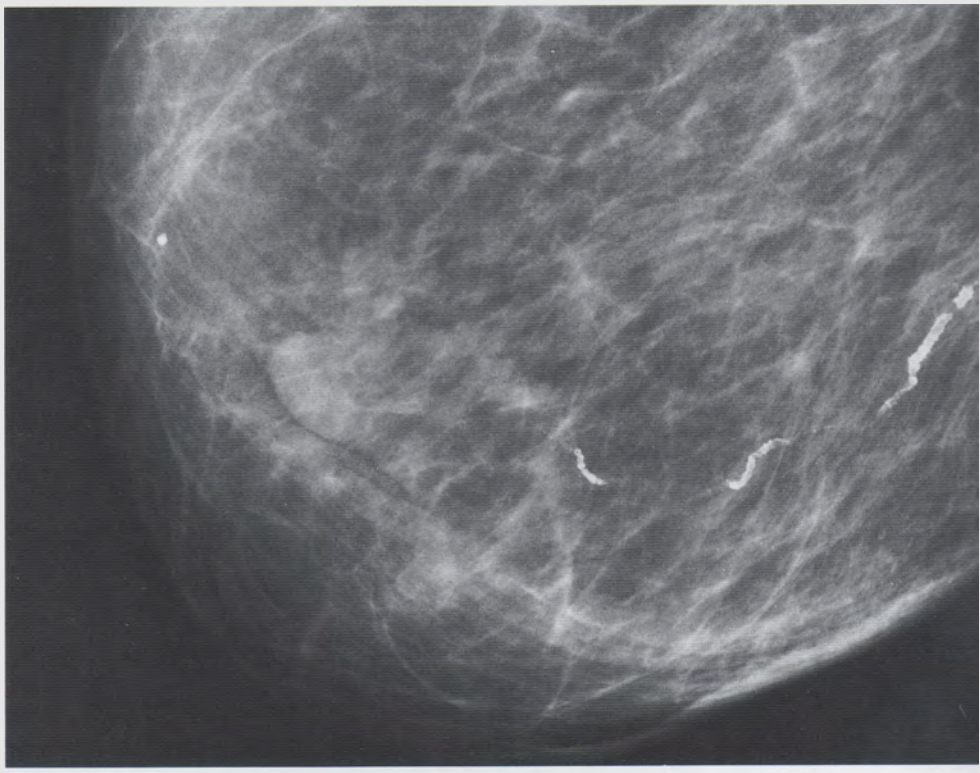
Form: ovoid, highly lobulated
Contour: partially unsharp, no halo sign
Density: low density radiopaque
Size: approximately 1 x 1 cm

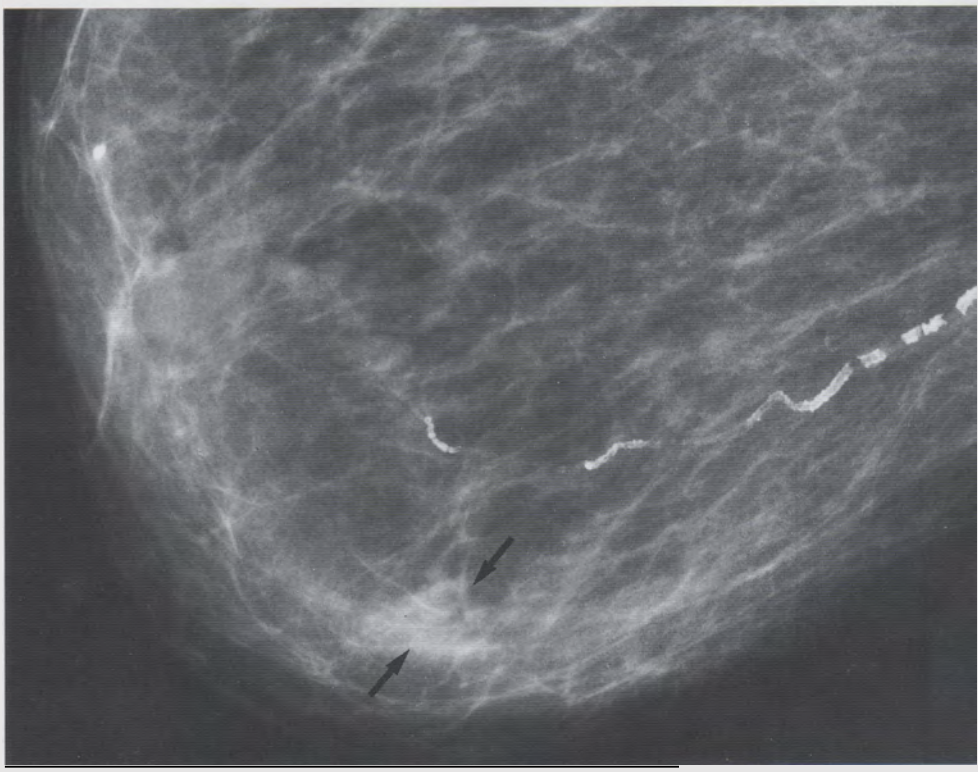
Comment

Although this circumscribed tumor has low density, the contours are unsharp, which raises the suspicion of malignancy. This suspicion is strengthened by the fact that this tumor has developed within a short time in an 80-year-old woman. Mucinous and papillary carcinomas may have low density at mammography.

Conclusion

Any circumscribed radiopaque tumor with unsharp borders and no demonstrable halo sign should lead to the suspicion of malignancy, regardless of the density.





Histology

Mucinous carcinoma. No lymph node metastases.

Follow-up

The woman died five years, 10 months later from cerebral infarction at age 86. There was no evidence of breast cancer.

28C

29

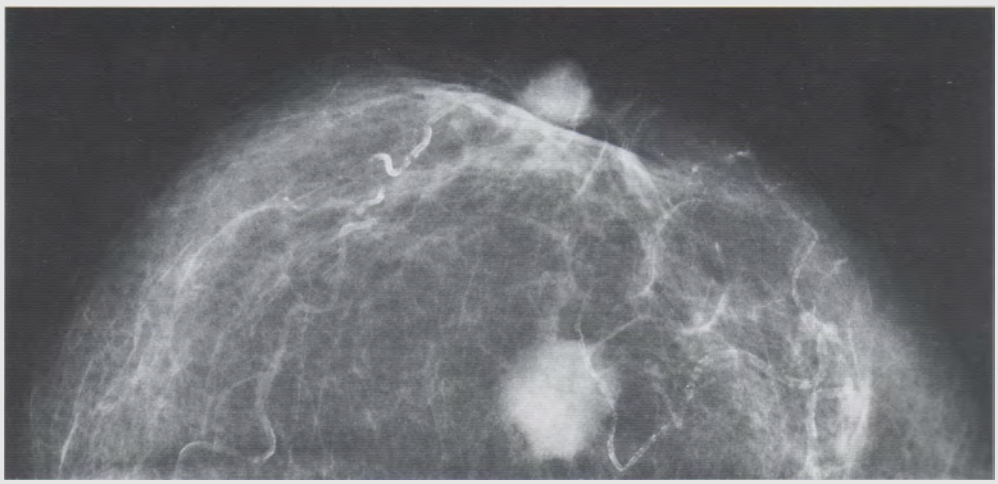
Age 74. The patient observed a slowly growing lump in the right breast over the past year.

Physical Examination

The palpable tumor in the right breast is clinically malignant.

Mammography

Fig. 29: Right breast, cranio-caudal view. A circular/oval tumor is seen 5 cm from the nipple in the central portion of the breast. There are no associated calcifications.



Analysis

Form: round, partially lobulated
Contour: ill-defined, spiculated
Density: high density radiopaque
Size: 2 x 2 cm

Conclusion

Mammographically malignant tumor.

Histology

Well-differentiated ductal carcinoma. No lymph node metastases.

30

40-year-old asymptomatic woman. First screening study.

Physical Examination

No palpable tumor.

Mammography

Fig. 30 A: Right breast, cranio-caudal projection. An oval-shaped lesion is located in the medial half of the breast. No associated calcifications. Fig. 30 B & C: Microfocus magnification mammography in the cranio-caudal and latero-medial projections. Fig. 30 D: Specimen radiograph.

Analysis

Form: oval
Contour: sharply outlined, no definite halo sign
Density: low density radiopaque
Size: 1 x 1 cm

Comment

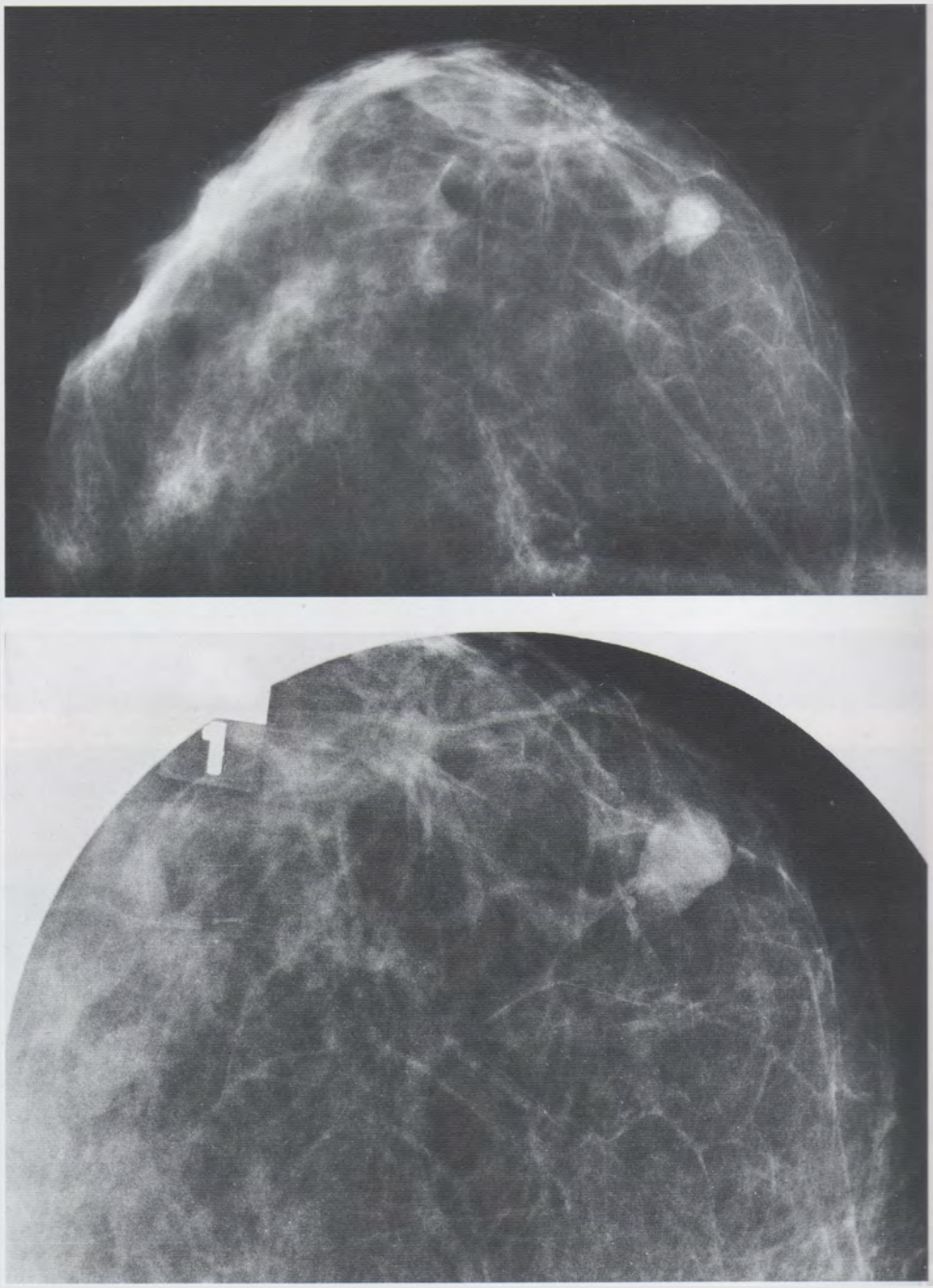
Overlying parenchyma partially obscures the sharp borders of the tumor.

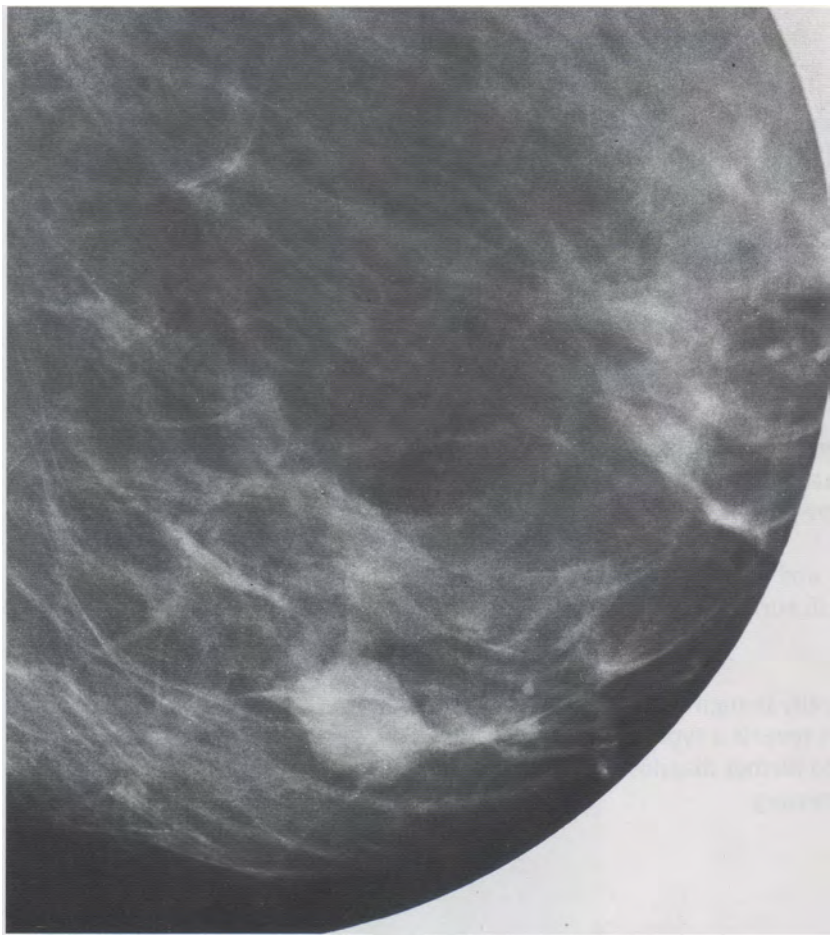
Conclusion

Mammographically benign tumor. Microscopic confirmation can be obtained under ultrasound guidance.

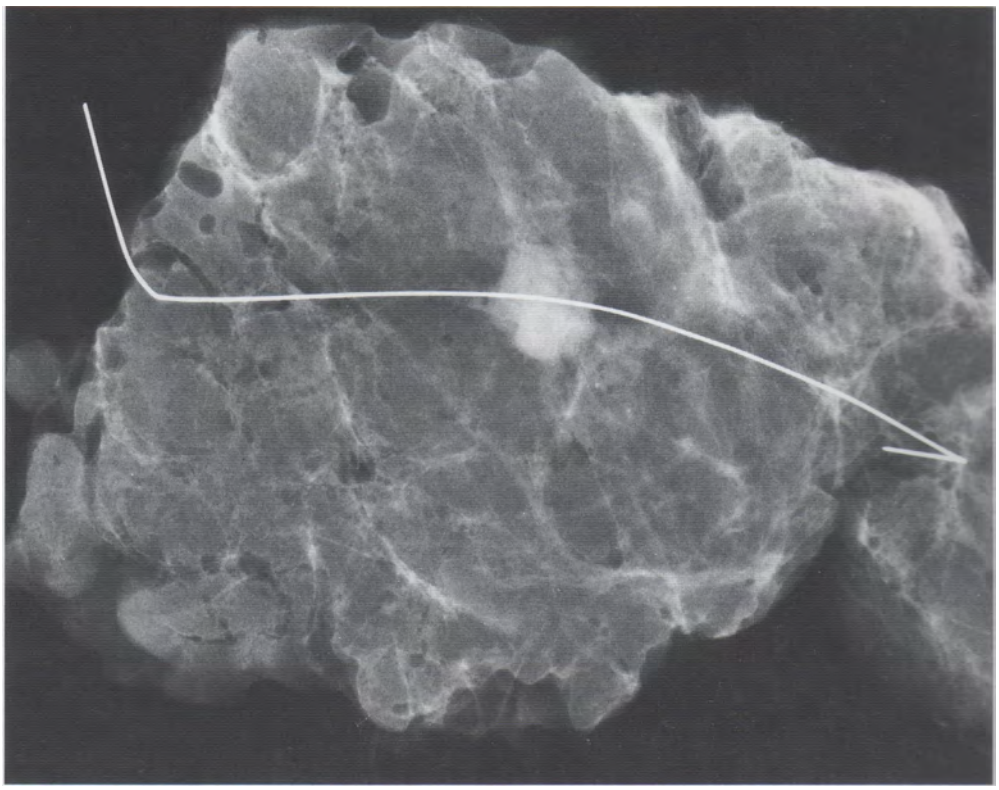
Histology

Fibroadenoma.





30C



31

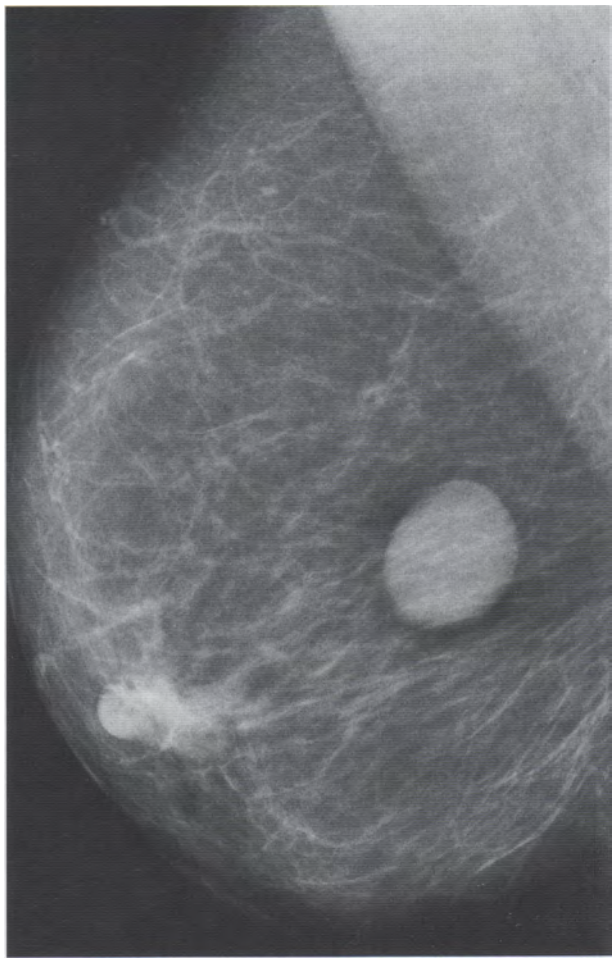
Fig. 31 A & B: Right breast, medio-lateral oblique and cranio-caudal projections. There is a solitary tumor in the upper outer quadrant. No associated calcifications.

Analysis

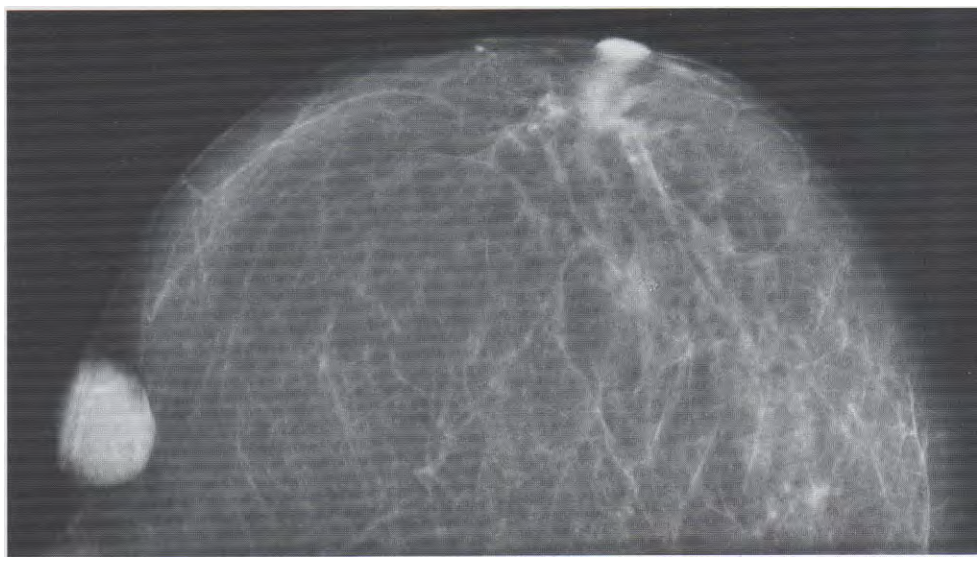
Form: oval
Contour: sharp
Density: low density radiopaque; a vein and parenchymal structures can be seen superimposed over the tumor
Size: 2 x 3 cm
Location: intra- and subdermal, protruding from the skin surface

Conclusion

Mammographically benign tumor. Clinical examination reveals a typical sebaceous cyst. No further diagnostic procedures are necessary.



31A



32

65-year-old woman, discovered a hard lump in the right breast one week earlier.

Physical Examination

6 x 6 cm freely movable tumor, hard at palpation. No skin changes.

Mammography

Fig. 32A & B: Right breast, detailed views of the medio-lateral oblique and cranio-caudal projections show a large, solitary tumor with no associated calcifications.

Analysis

Form: circular, lobulated
Contour: irregular, no halo sign
Density: low density radiopaque; structural elements can be seen through the tumor
Size: 5 x 5 cm

Conclusion

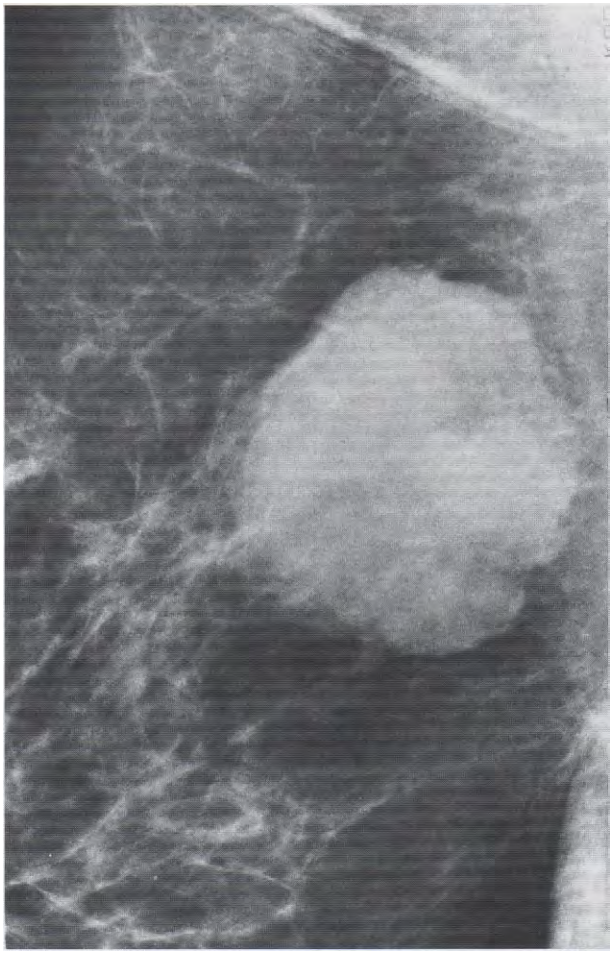
Although this tumor is of low density, it is not sharply outlined and there is no halo sign, suggesting a malignant tumor in this 65-year-old woman. A ductal carcinoma of this size would have a much higher density. The combination of older age, low-density radiopaque appearance despite the large size, the irregularly lobulated shape, and partially ill-defined contour suggest mucinous carcinoma.

Histology

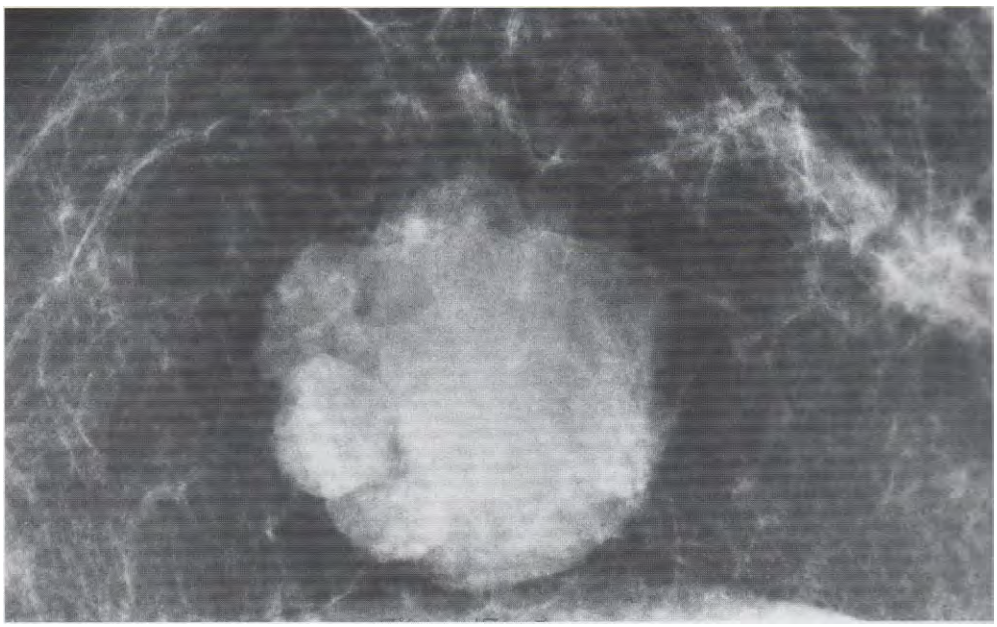
Mucinous carcinoma. No axillary metastases.
Fig. 32 C: High-power magnification of the mucinous carcinoma near the tumor border. (H & E, 200 x)
Fig. 32 D: Clusters of well-differentiated cancer cells floating in a mucinous background (400 x).

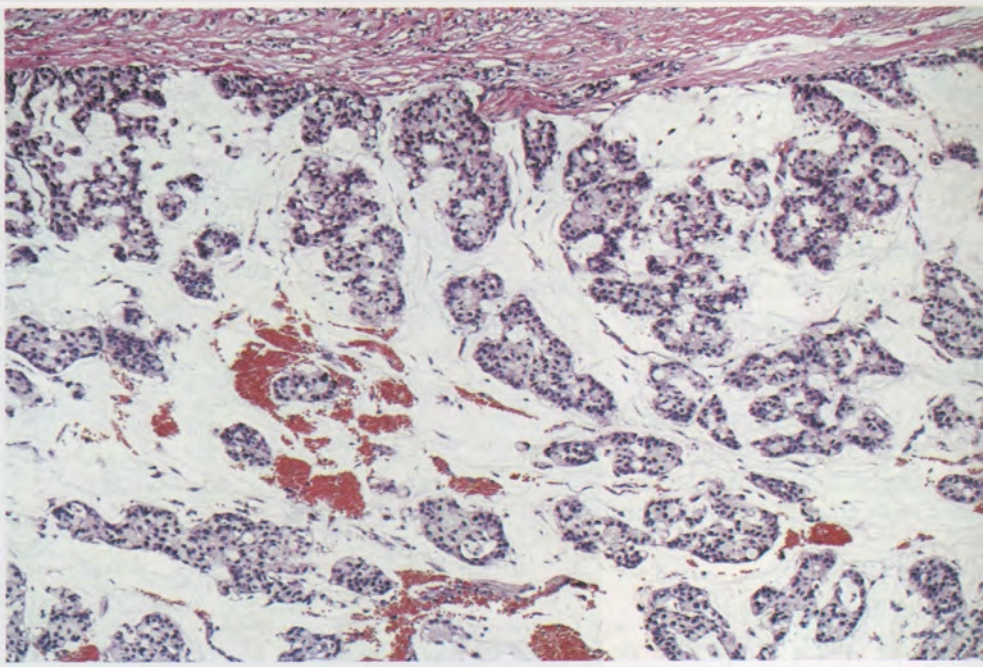
Follow-up

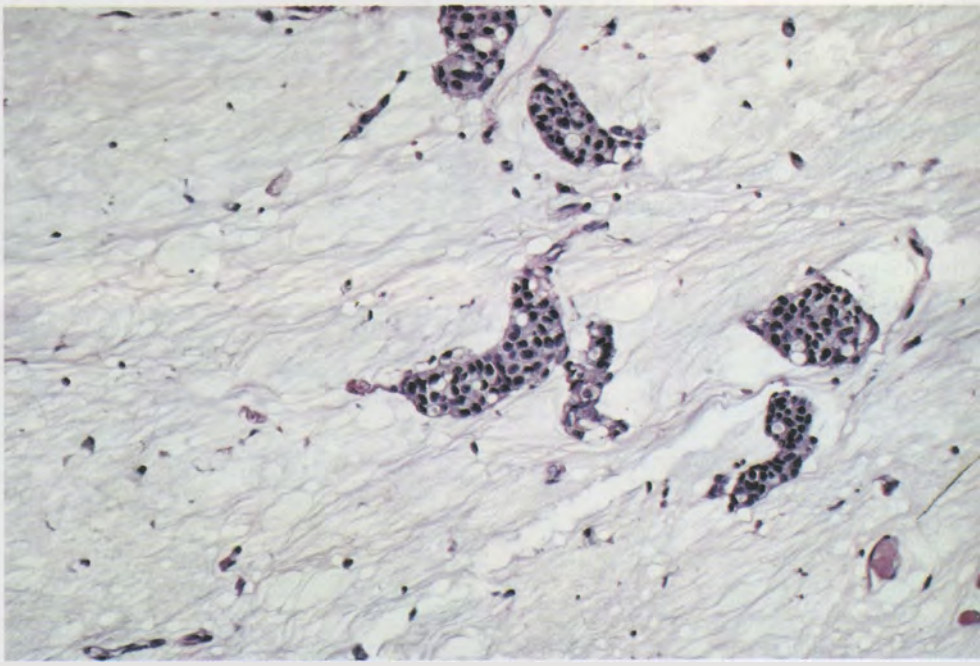
The woman was still alive 20 years later with no evidence of breast cancer.



32A







33

Asymptomatic 65-year-old woman. First screening study.

Physical Examination

No palpable tumor.

Mammography

Fig. 33A & B: Left breast, medio-lateral oblique and cranio-caudal projections. A solitary tumor is seen in the upper outer quadrant. No associated calcifications.
Fig. 33 C & D: Microfocus magnification views in the medio-lateral oblique and cranio-caudal projections.
Fig. 33 E: Latero-medial view with biopsy localization plate.
Fig. 33 F: The hook localizes the tumor for biopsy.

Analysis:

Form: oval
Contour: partly unsharp; an obvious comet tail is seen extending from the tumor in an anterior and caudal direction in A.
Density: high density radiopaque

Conclusion

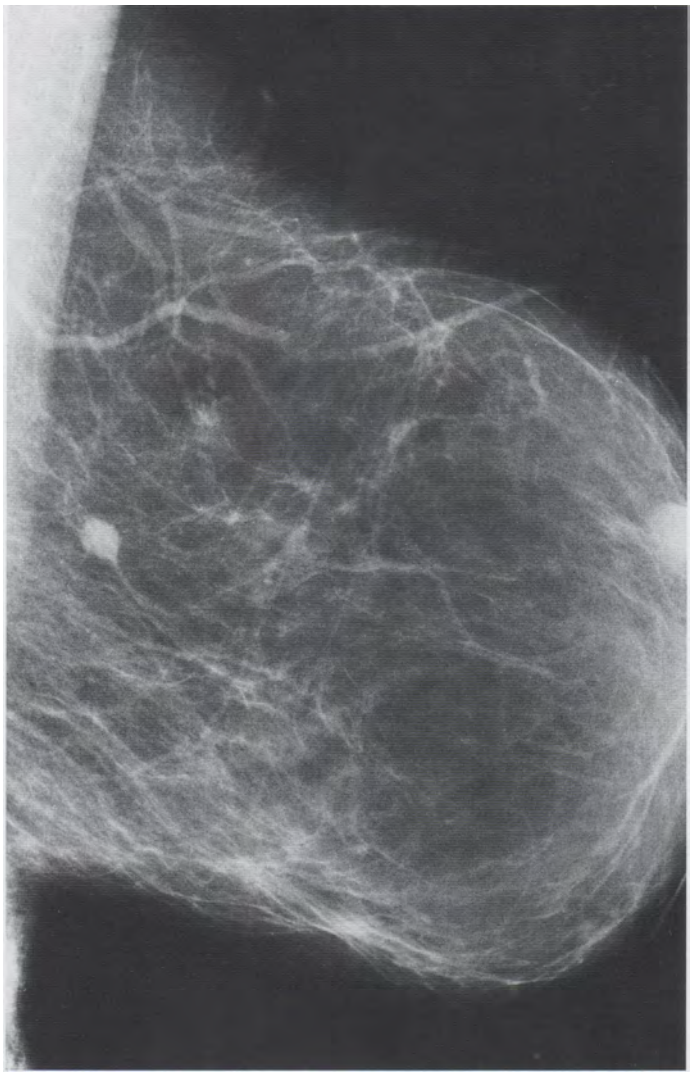
This small, oval-shaped tumor has high density and a reproducible comet tail sign. These signs are characteristic of a mammographically malignant tumor.

Histology

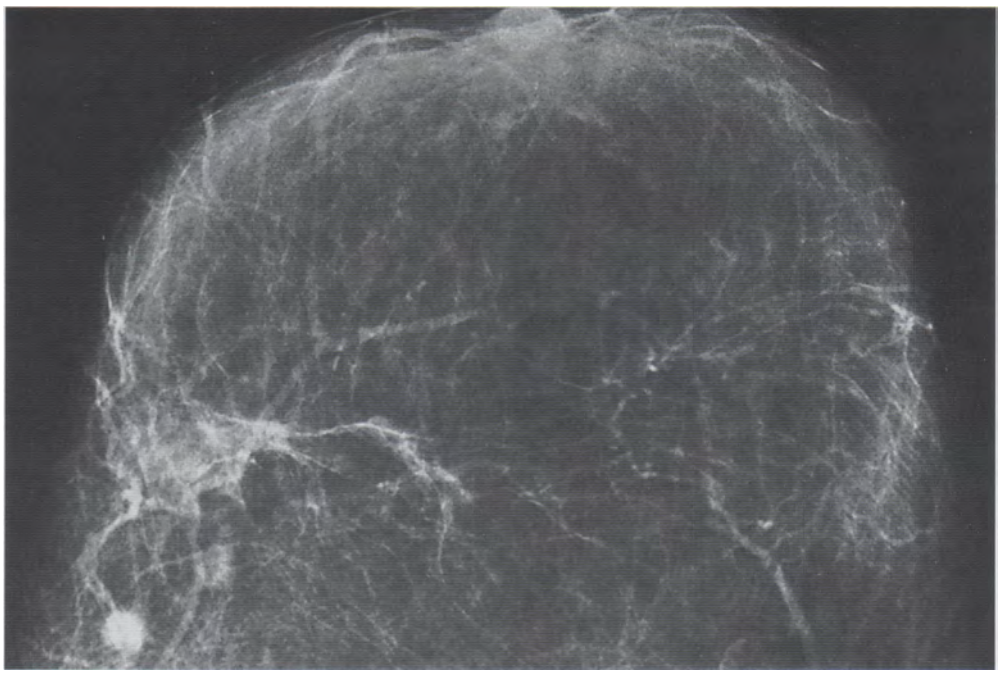
Well differentiated ductal carcinoma, 7 x 6 mm. No axillary lymph node metastases.

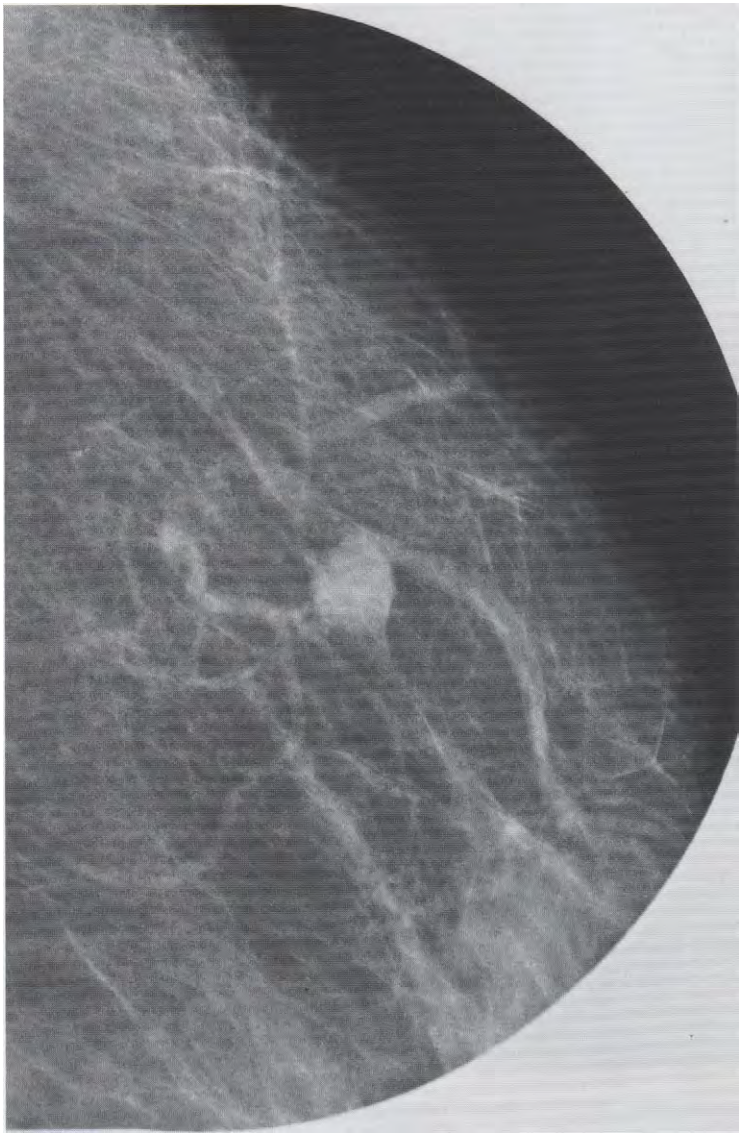
Follow-up

The woman died 16 years later from cardiovascular disease. There was no evidence of breast cancer.

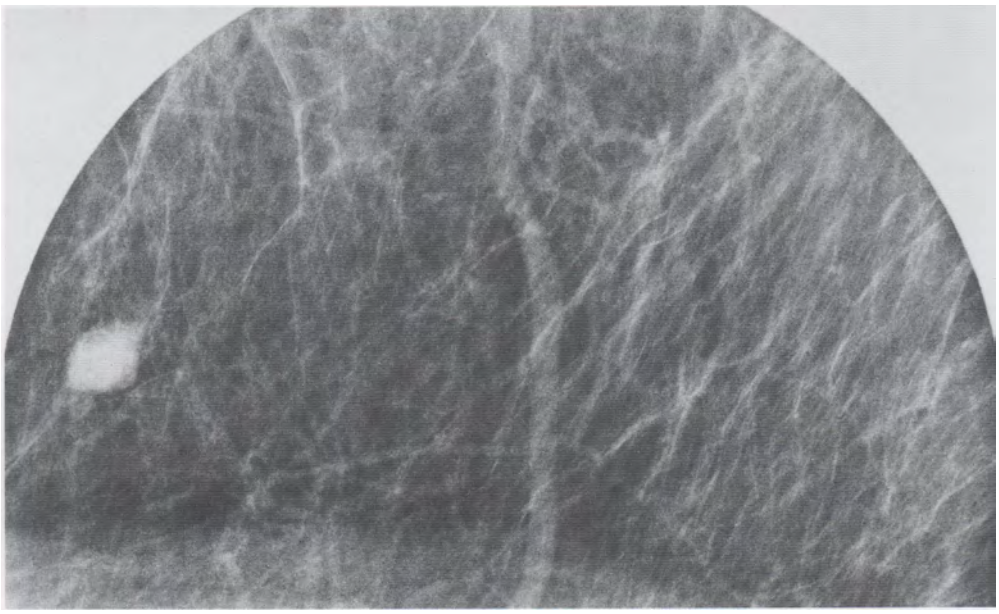


33A

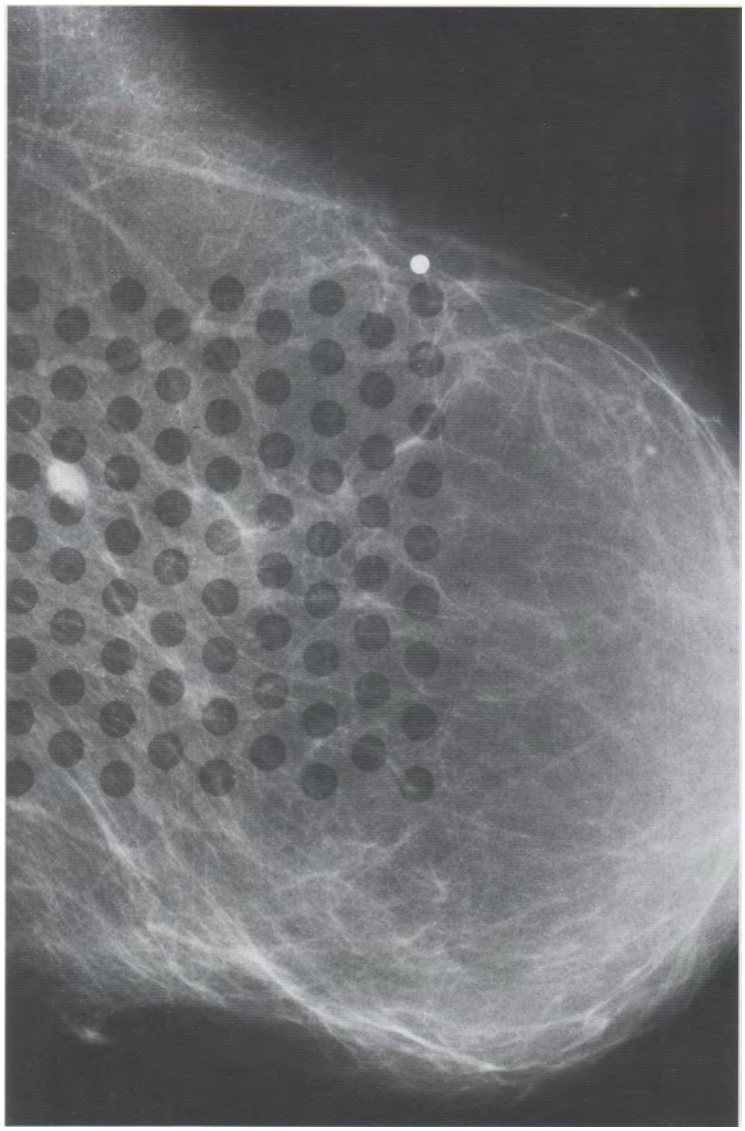


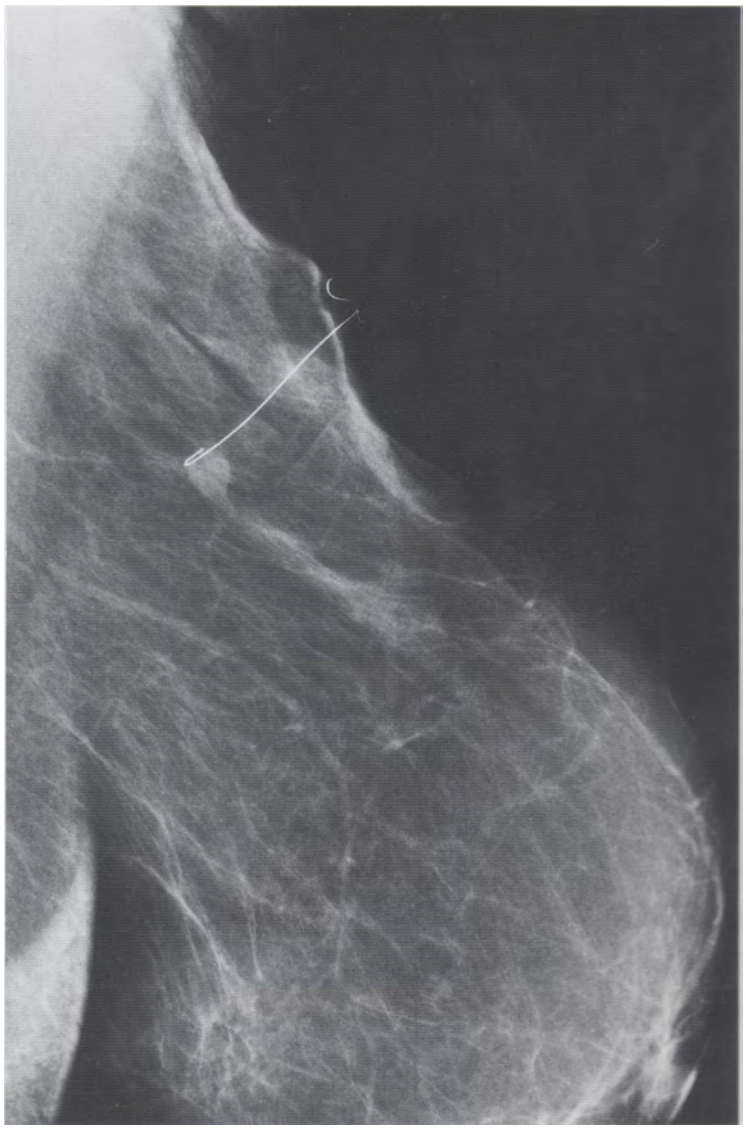


33C



33D





34

A 38-year-old woman with a history of multiple breast abscesses noted a small, hard lump in the lower medial quadrant of the left breast.

Physical Examination

A solitary, superficial lump in the subcutaneous tissue measures about 1 cm in diameter.

Mammography

Fig. 34A & B: Left breast, mediolateral oblique and craniocaudal projections. 3 cm from the nipple in the lower outer quadrant there is a solitary, high-density, circular lesion 7 mm in diameter. No associated calcifications.
Fig. 34 C: Microfocus magnification in the craniocaudal projection. The high-density lesion has ill-defined borders; mammographically malignant.
Fig. 34 D: Ultrasonography confirms the mammographic findings.

Conclusion

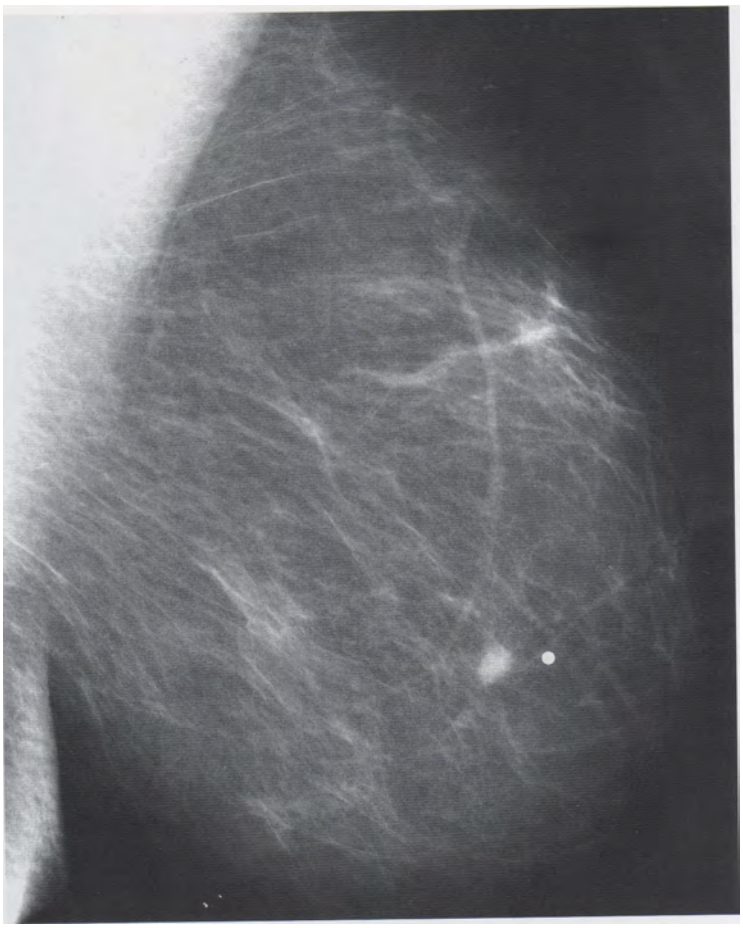
Mammographically malignant tumor.

Cytology

Malignant cells.

Histology

10 x 7 mm grade 2 ductal carcinoma. There is also lobular carcinoma in situ over a 40 x 30 mm region surrounding the lesion.



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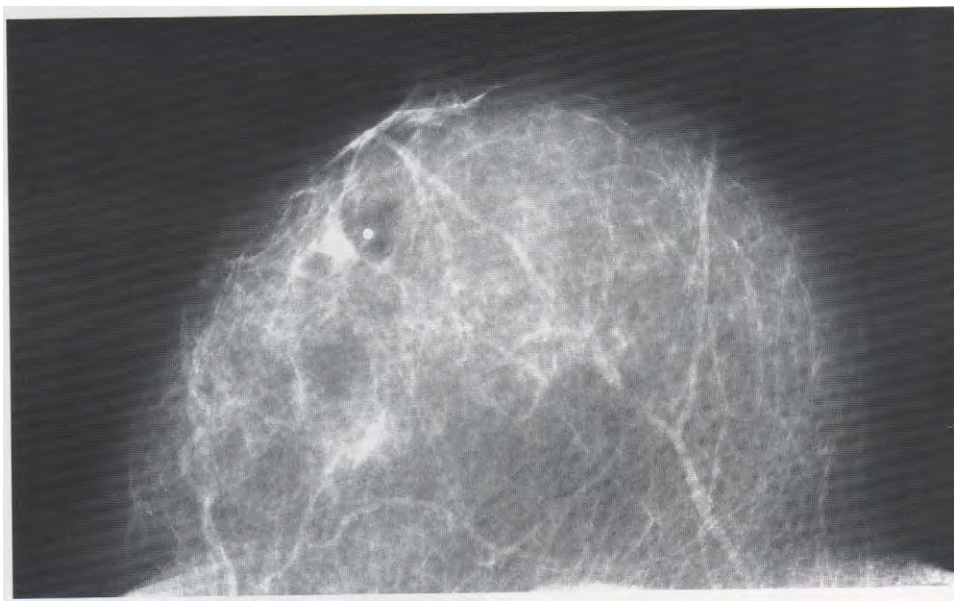

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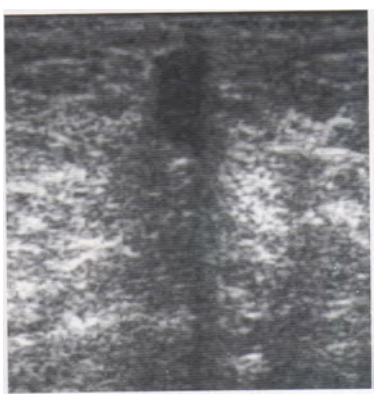


340

35

57-year-old asymptomatic woman, first screening study.

Mammography

Fig. 35 A: Left breast, detail of the mediolateral oblique projection. No mammographic abnormality.
Fig. 35 B-D: Second screening examination. Left breast, details of the mediolateral oblique and cranio-caudal projections. Four cm from the nipple there is a 6 mm, de novo lobulated, tumor in the upper half of the breast.

Analysis

Form: circumscribed, lobulated
Contour: unsharp, no halo sign
Density: low density radiopaque
Size: 6 x 4 mm

Comment

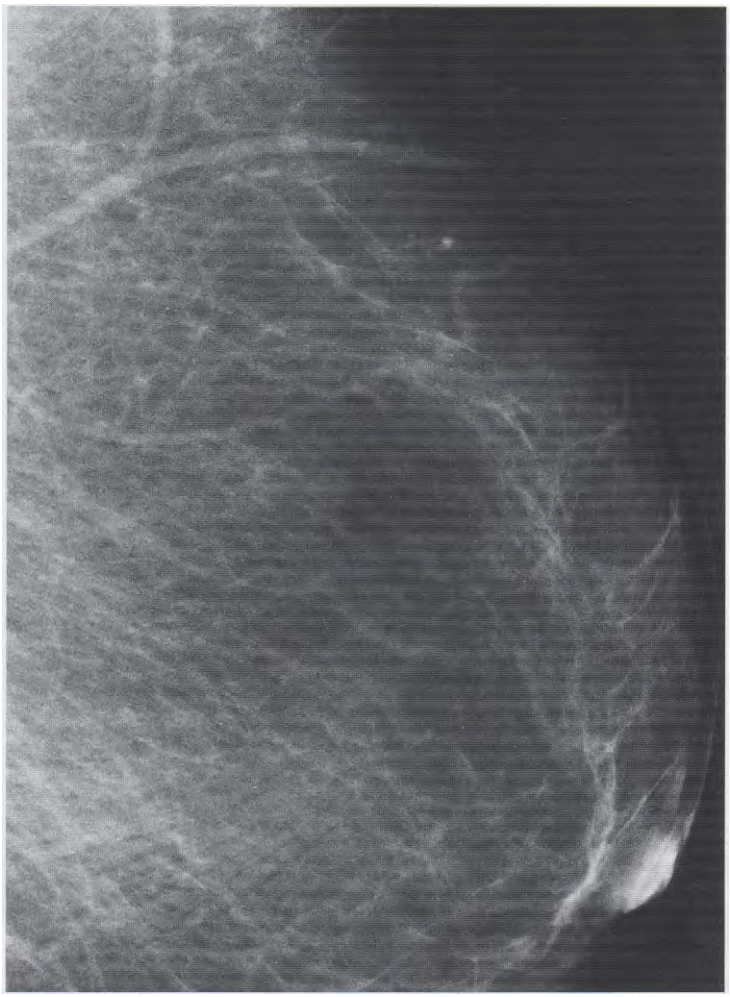
De novo appearance of an unsharp, lobulated, circumscribed tumor in a 60-year-old woman leads to the suspicion of malignancy. The benign differential diagnostic option is a papilloma.

Histology

Noninfiltrating intraductal carcinoma, diameter 6 mm.

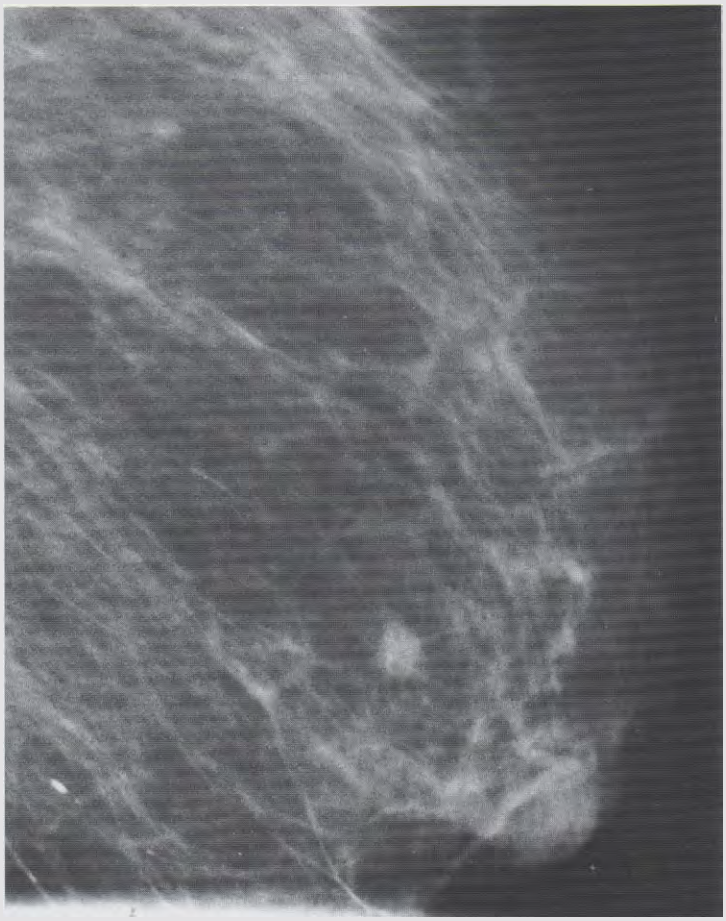
Follow-up

The woman died seven years, eight months later from myocardial infarction. There was no evidence of breast cancer.



35A

35B



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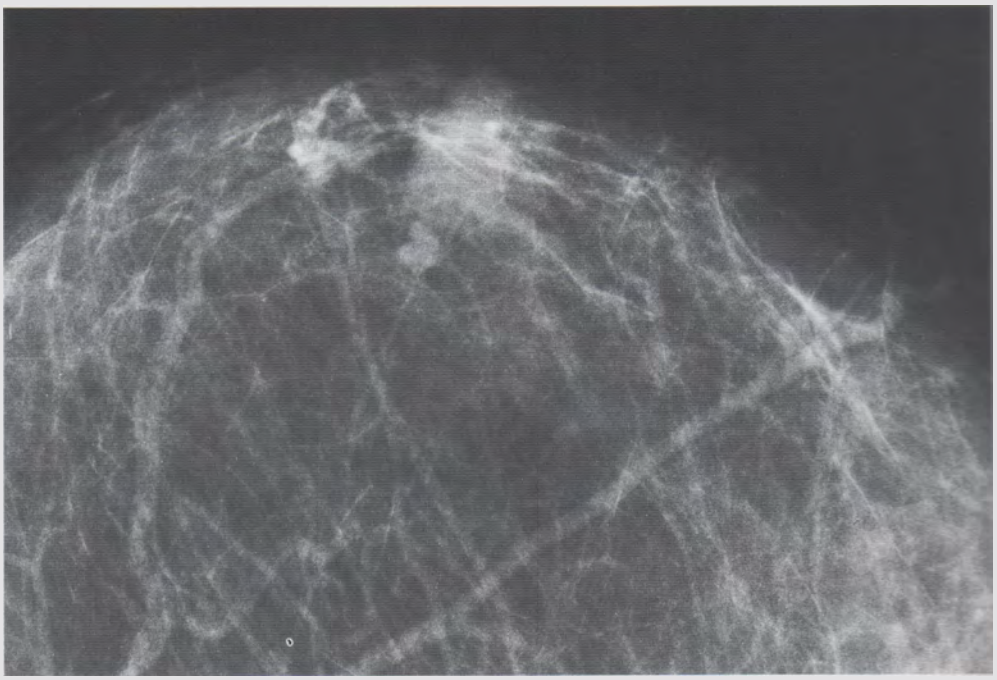


36

66-year-old asymptomatic woman. First screening study.

Mammography

Fig. 36A: Right breast, medio-lateral oblique projection. Normal mammogram. Two years later the patient presents with a two-month history of a mass in the axillary portion of the right breast and a mass in the right iliac fossa.

Repeat Mammography

Fig. 36 B: Right breast, medio-lateral oblique projection. A tumor is seen high up in the axillary portion of the breast. No associated calcifications.

Analysis

Form: oval, lobulated
Contour: partly sharply outlined, but there are also short spicules extending from the tumor periphery
Density: high density radiopaque
Size: 3 x 2,5 cm

Conclusion

This tumor has developed within two years, is highly dense, and has unsharp borders with short spicules. Mammographically malignant tumor.

Histology

Lymphoma (both in the breast and in the iliac fossa).

Follow-up

The woman was still alive 18 years later at age 84.

36A

36B

37

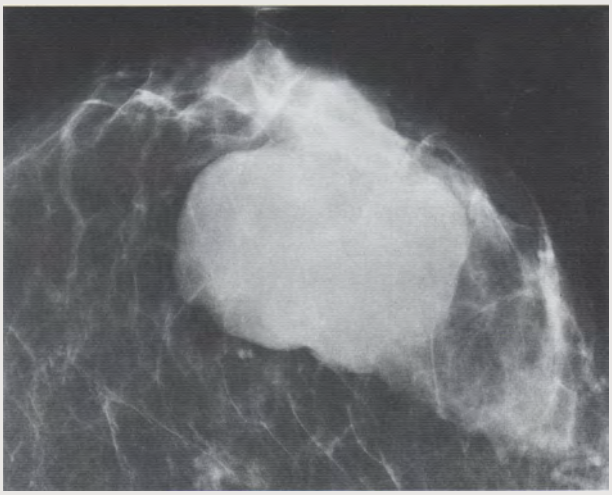
49-year-old woman with a 6 x 4 cm hard, centrally located, freely movable tumor in the left breast.

Physical Examination

Benign tumor.

Mammography

Fig. 37 A: Left breast, cranio-caudal projection. A large centrally located tumor with no associated calcifications.



37A

Analysis

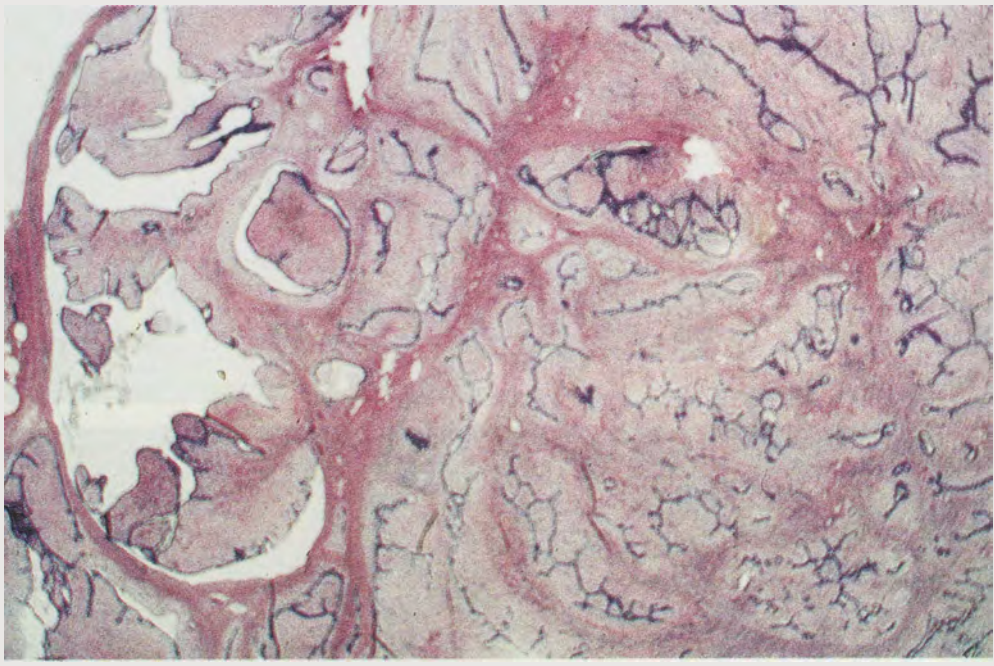
Form: oval, lobulated
Contour: sharply outlined (part of the contour is obscured by the retroareolar fibrosis) no halo sign
Density: high
Size: 6 x 5 cm

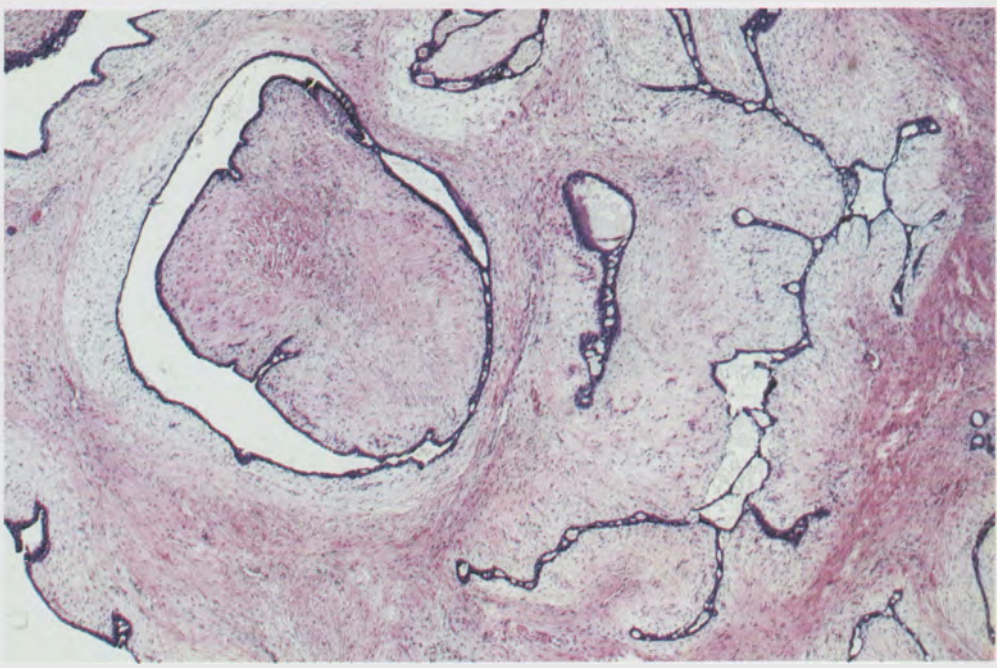
Comment

A huge, sharply outlined, radiopaque tumor in a woman of menopausal age raises the suspicion of a cyst or cystosarcoma phylloides. Ultrasound can easily differentiate between the two. Solid tumors should be subjected to microscopic diagnosis.

Histology

Benign cystosarcoma phylloides.
Fig. 37 B: Low-power view showing the leaf-like structure typical for cystosarcoma phylloides (H & E, 100 x)
Fig. 37 C: Detail of Fig. 37 B (H & E, 100 x)





38

40-year-old woman, first noted a rapidly growing retroareolar tumor of the left breast four weeks earlier, associated with fever, pain, tenderness and periareolar erythema.

Physical Examination

Inspection: 7 x 6 cm area of periareolar erythema and extensive *peau d'orange.*
Palpation: Left breast heavier than right. Warm, tender, large retroareolar tumor. Enlarged axillary lymph nodes.
The patient is febrile.

Mammography

Fig. 38A & B: Medio-lateral oblique and cranio-caudal projection. There is a large, 7 x 6 cm, dense retroareolar tumor with unsharp borders. It is associated with nipple retraction and skin thickening over the areola and lower portions of the breast.

Comment

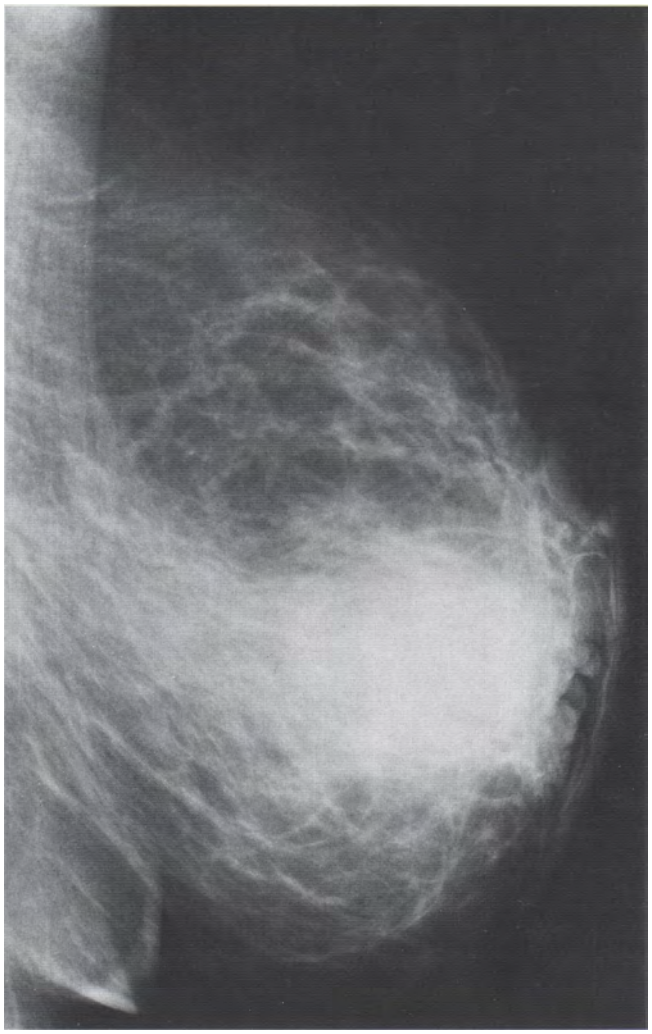
An inflammatory carcinoma and a huge retroareolar abscess could both produce this clinical picture. However, an inflammatory cancer would result in an extensive reticular pattern on the mammogram caused by axillary lymphatic obstruction. Ultrasound is not the primary diagnostic procedure of choice since necrosis, if present within a large carcinoma, can mimic the ultrasound image of an abscess cavity. Ultrasound-guided needle puncture can establish the correct diagnosis.

Puncture

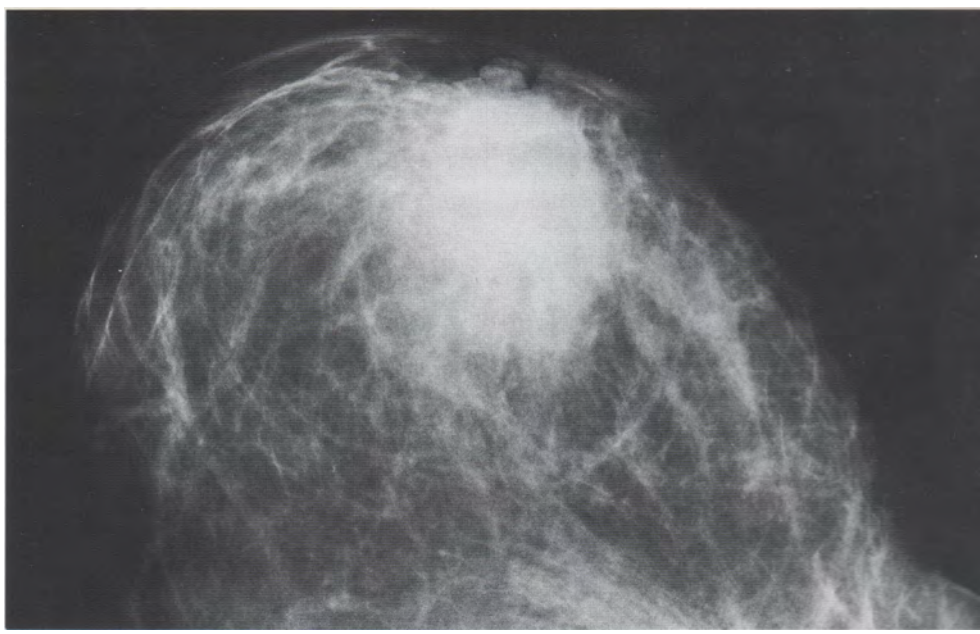
Large bore needle 60 ml pus aspirated.
Fig. 38C: Mammography of the left breast after puncture and air insufflation: A small amount of air is seen in the much contracted abscess cavity (arrow).

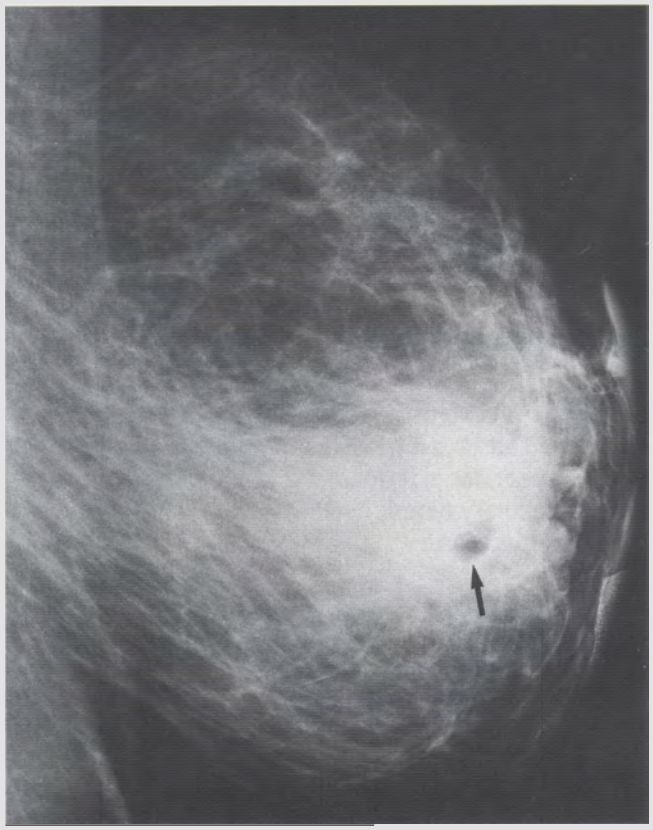
Follow-up

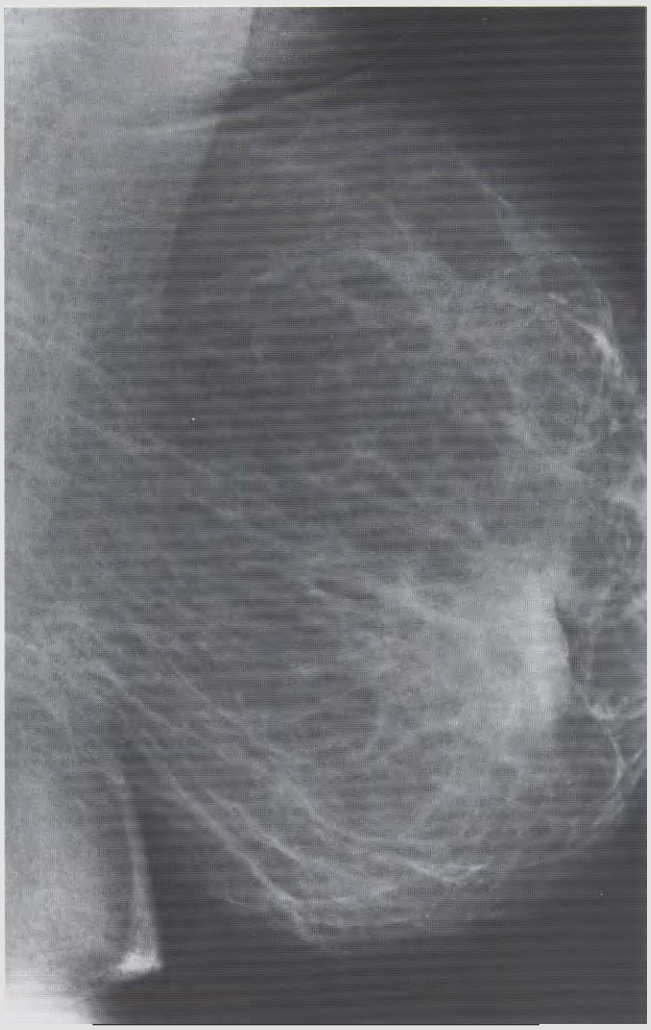
The patient was placed on oral antibiotics and nine days later the abscess was incised and drained. Afternatively, abscesses can be successfully drained and irrigated when they are in a more acute stage, and surgery can often be avoided. *Repeat* mammography in the cranio-caudal projection (Fig. 38 D) five weeks later shows only a slight degree of fibrosis and no underlying tumor.



38A







39

Age 36. The patient discovered a lump in her right breast two weeks earlier.

Physical Examination

2 cm freely movable tumor in the upper inner quadrant of the right breast. No skin changes.

Mammography

Fig. 39A & B: Right breast, medio-lateral oblique and cranio-caudal projections. There is an oval-shaped tumor in the upper inner quadrant with no associated calcifications.

Analysis

Form: oval shaped
Contour: mostly ill-defined; there is a short segment of halo sign (arrows)
Density: low density radiopaque
Size: 3 x 2 1/2 cm

Conclusion

The mostly ill-defined tumor margin leads to the suspicion of malignancy in spite of the short halo sign. Needle biopsy is recommended.

Puncture

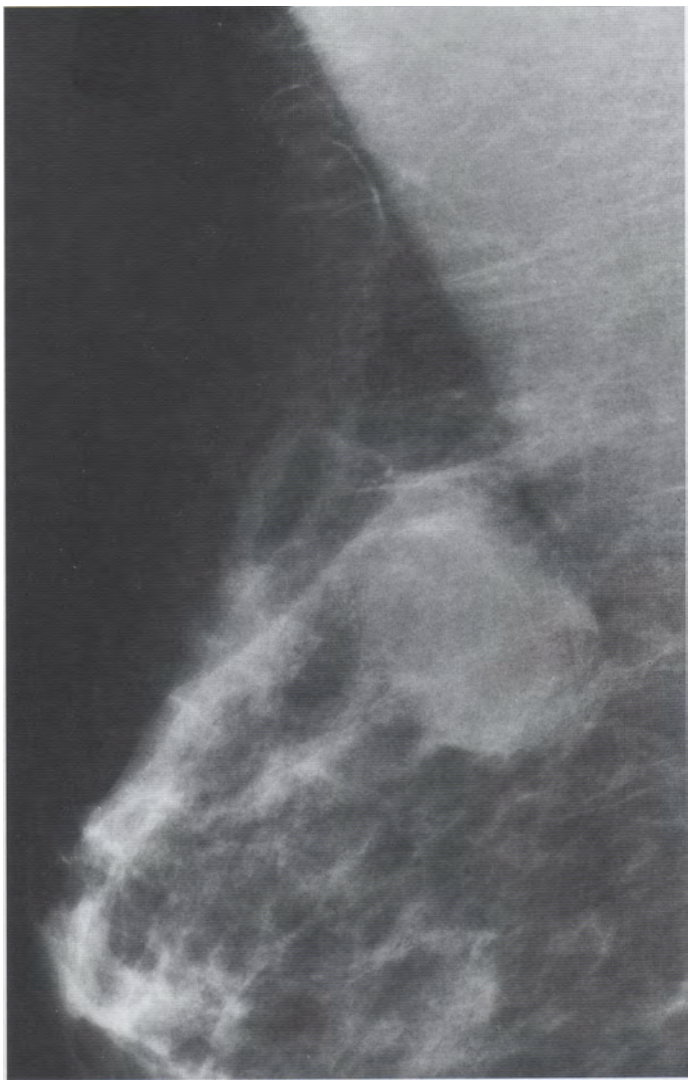
5 ml straw-coloured fluid aspirated.

Cytology

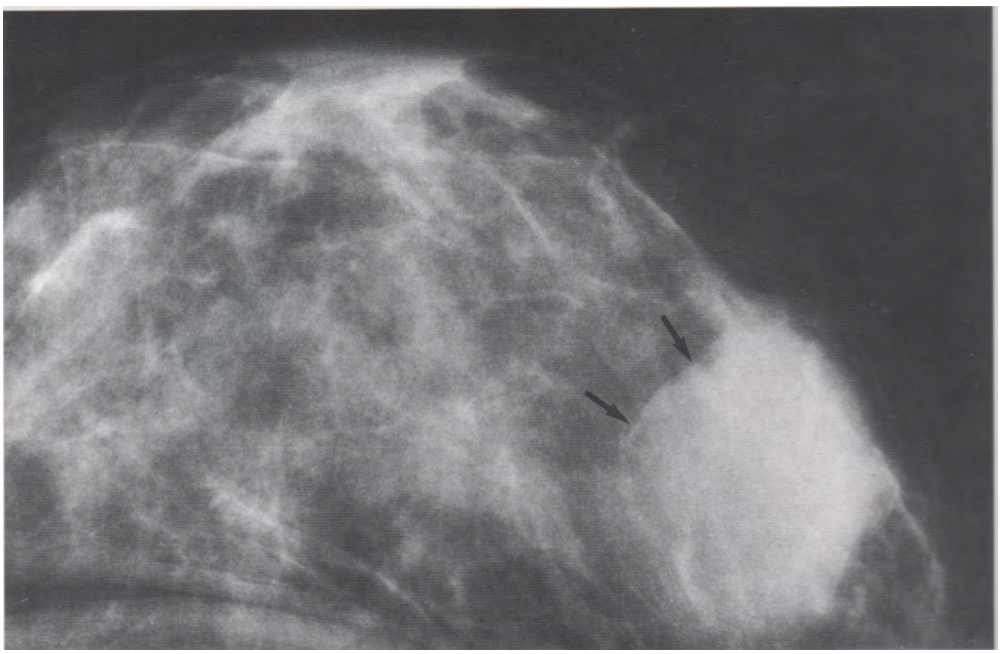
Inflammatory cells. No malignant cells. Abscess? Inflamed cyst?
Fig. 39C & D: Pneumocystography. The inferior and anterior wall of the cyst is sharp, but the upper and posterior wall is irregular and thickened, best seen on the cranio-caudal projection (Fig. 39 D). Tumor in the cyst wall?

Histology

Medullary cancer in a 2-cm segment of the wall of a cyst.
Fig. 39E: Cystic degeneration of a medullary cancer with a thin rim of viable tumor tissue. (H & E, 20 x)
Fig. 39 F: Typical histologic picture of a medullary carcinoma with poorly differentiated cancer cells and intense lymphoplasmocytic infiltration. (H & E, 400 x)
Fig. 39G: The very high proliferation rate of the tumor cells is demonstrated by immunohistochemical staining for Ki-67 antigen. There is a tripolar mitosis (arrow). (400 x)



39A

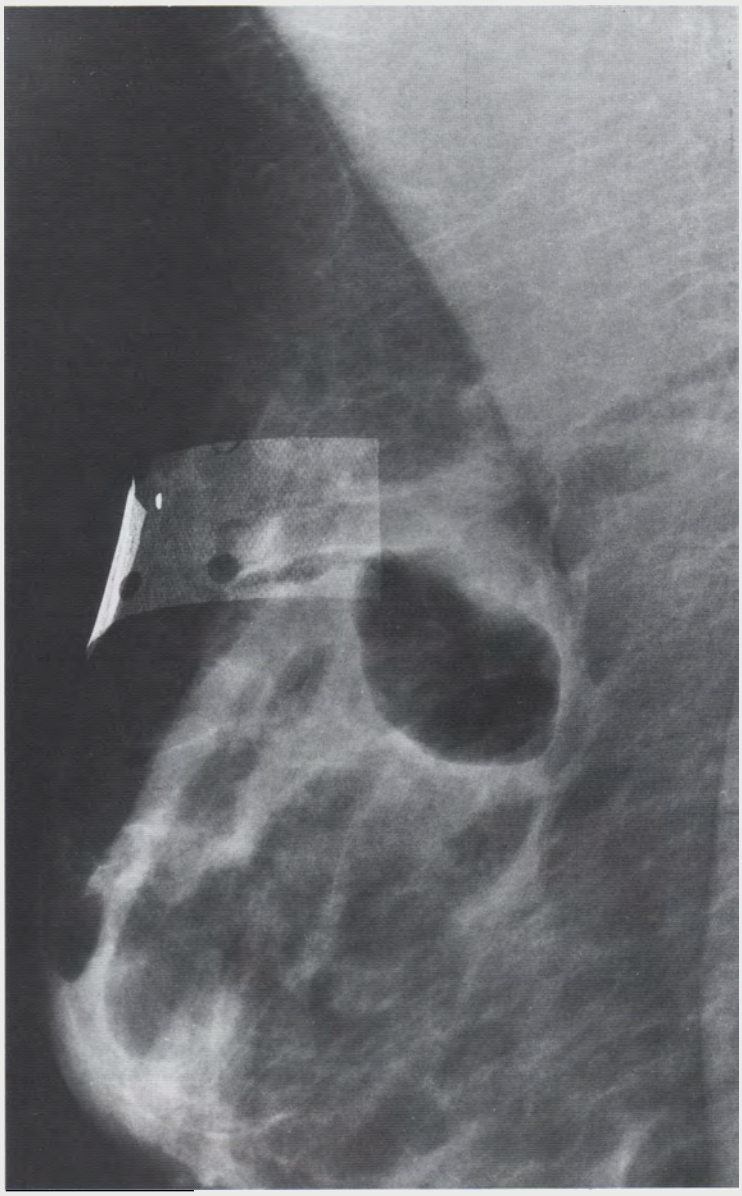


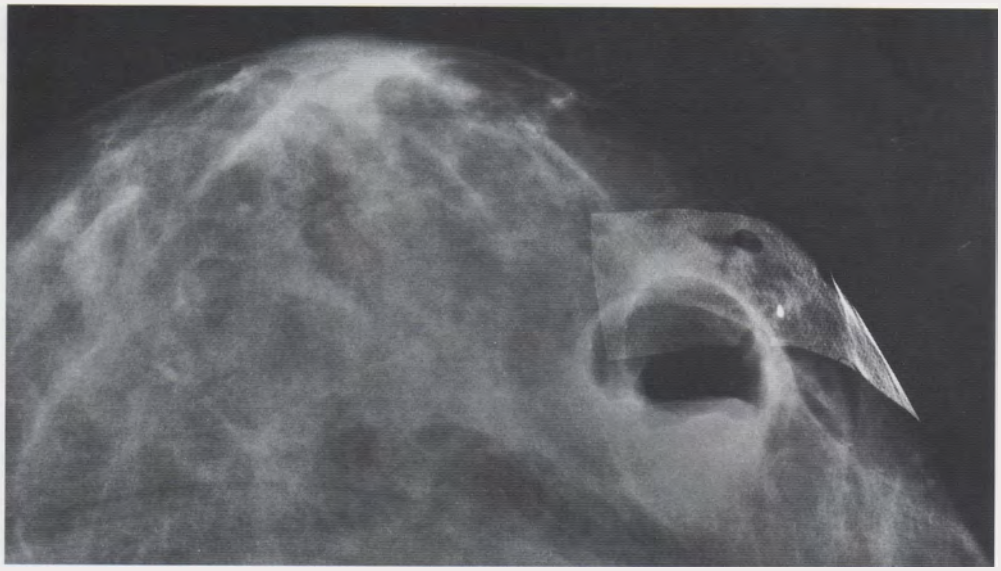
Comment

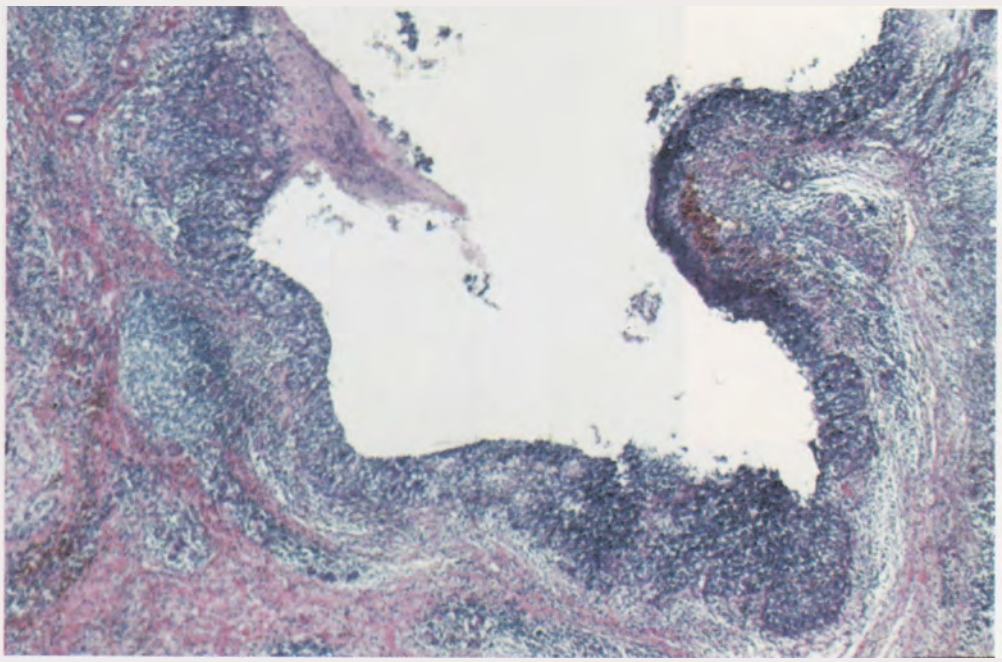
Needle puncture without imaging guidance can be misleading.

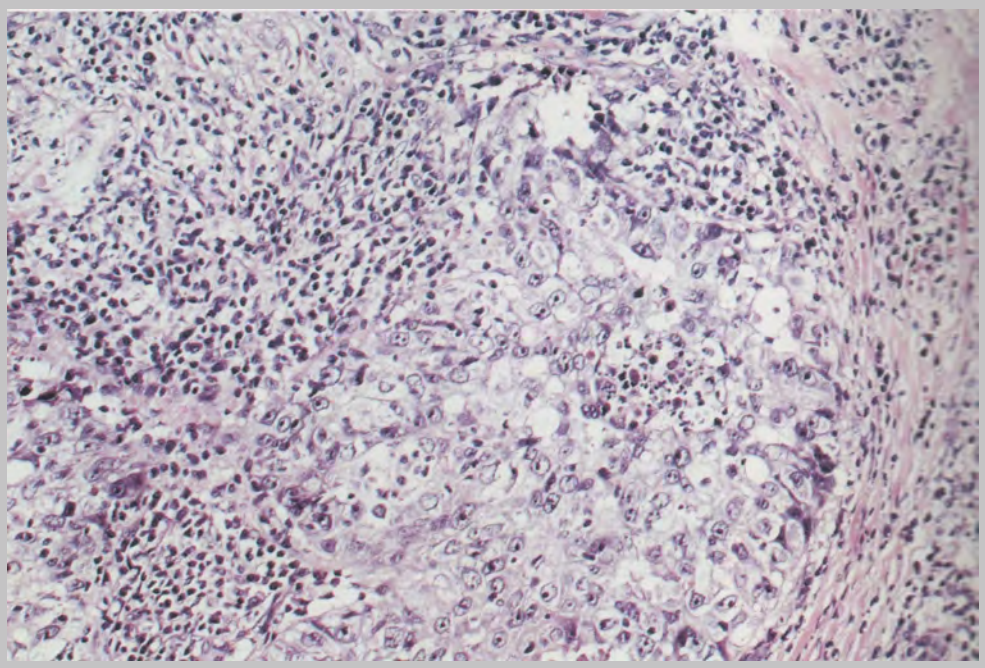
Follow-up

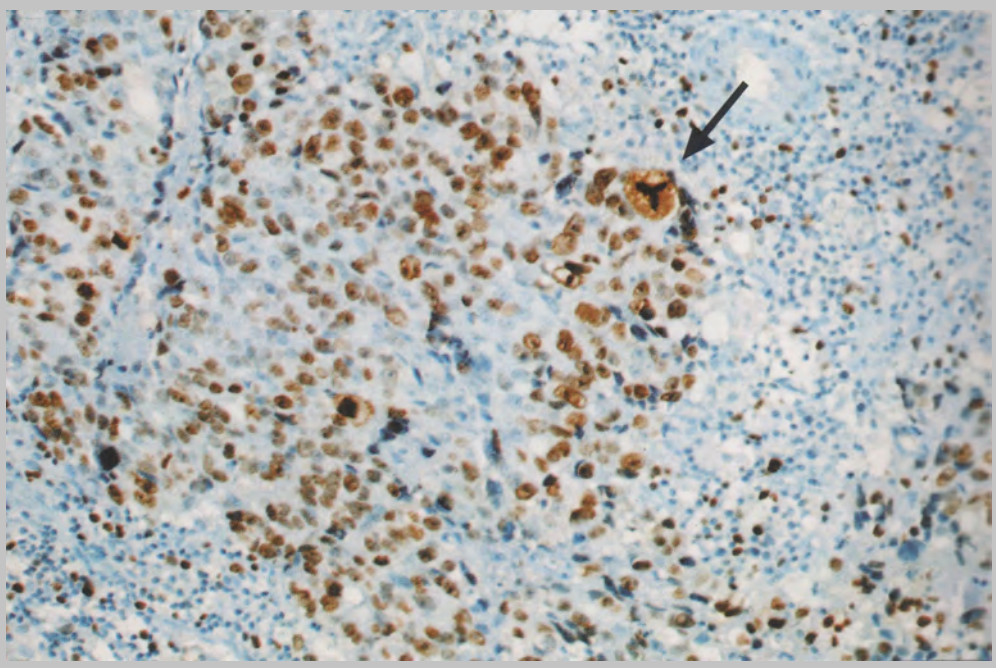
The patient died 16 years, five months later of metastatic breast carcinoma at age 52.











40

49-year-old woman with an 18-month history of malignant melanoma. She now seeks medical attention for a mass in the right breast and in both axillas.

Physical Examination

There is a hard, freely movable lump in the lateral half of the right breast, 10 cm from the nipple, and large axillary lymph nodes.

Mammography

Fig. 40: Right breast, medio-lateral oblique projection shows two oval-shaped tumors near the chest wall.

Analysis of the Larger Tumor

Form: oval, lobulated
Contour: unsharp
Density: high density radiopaque
Size: 4 cm

Conclusion

This is a mammographically malignant tumor.

Histology

Malignant melanoma metastases.

41

66-year-old woman referred for a selfdetected lump in the upper outer quadrant of the right breast, clinically suspicious for malignancy.

Mammography

Fig. 41 A: Right breast, medio-lateral oblique projection. There is a solitary tumor 4 cm from the nipple, in the upper half of the breast. No associated calcifications.
Fig. 41 B: Photographic enlargement of the spot compression view of the tumor.

Analysis

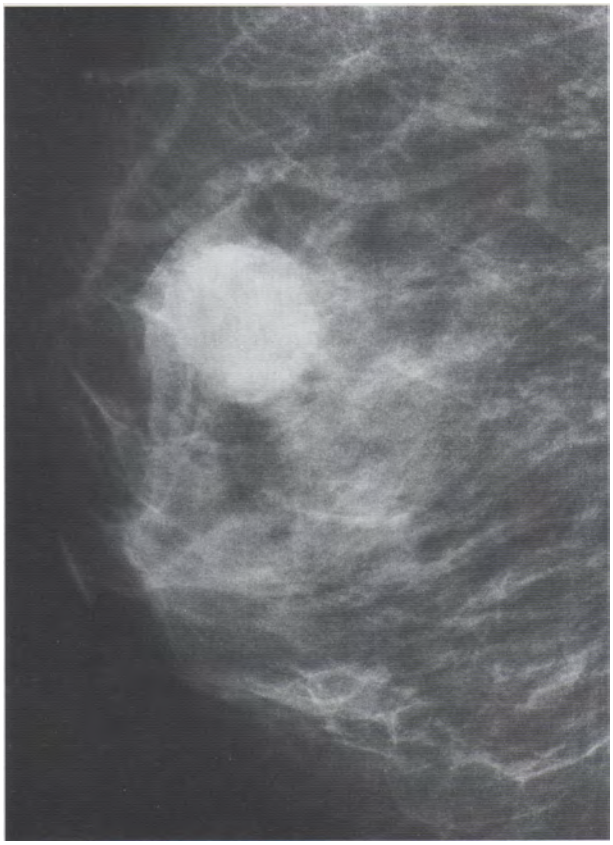
Form: circular
Contour: mostly ill-defined
Density: high density radiopaque

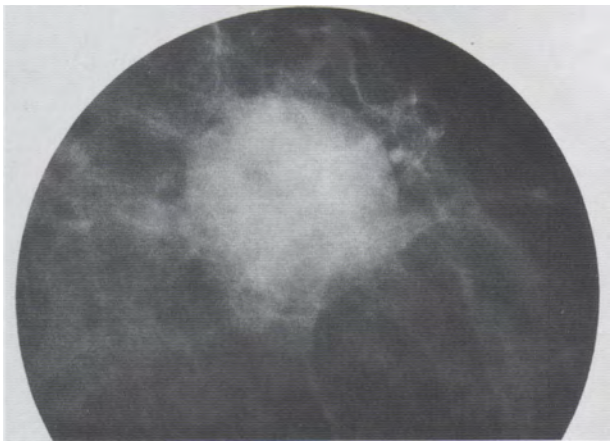
Conclusion

The combination of the high-density radiopaque appearance and the poorly defined contour leads to a mammographically malignant diagnosis.

Histology

Partly ductal, partly papillary carcinoma. No lymph node metastases.





42

45-year-old woman detected a lump in her left breast one month earlier.

Physical Examination

10 cm tumor located centrally in the left breast. *Peau d'orange* over the lower half of the breast but no signs of inflammation.

Mammography

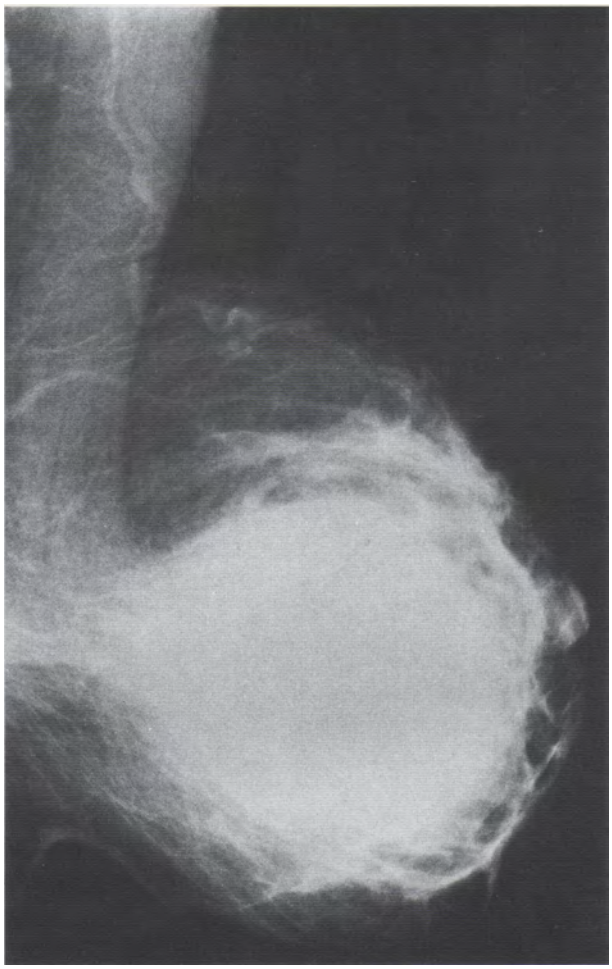
Fig. 42A & B: Left breast, medio-lateral oblique and cranio-caudal projections. A large, oval tumor fills in the central portion of the breast. No associated calcifications. The pectoral muscle appears to be infiltrated. There is a pathologically enlarged lymph node in the axilla, but there is no extensive reticular pattern on the mammogram.

Analysis

Form: oval
Contour: unsharp, no halo sign
Density: high density radiopaque
Size: 10x 10 cm

Comment

High-density, ill-defined circular/oval lesions localized behind the areola should raise the suspicion of an abscess, despite the presence of signs of malignancy. However, a malignant tumor of this size with associated enlarged axillary lymph nodes and *peau d'orange* would be expected to cause lymphedema (skin thickening and a reticular pattern) over much of the breast. The ancillary method of choice is ultrasound-guided needle aspiration. Failure to drain pus with a large bore needle should heighten the suspicion of malignancy.



42A

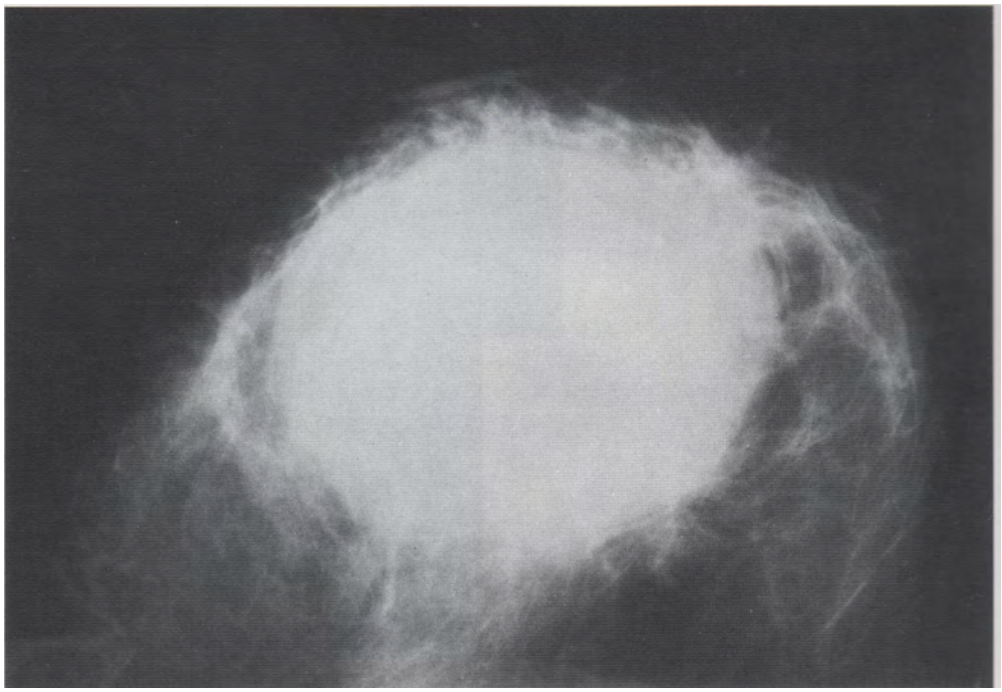


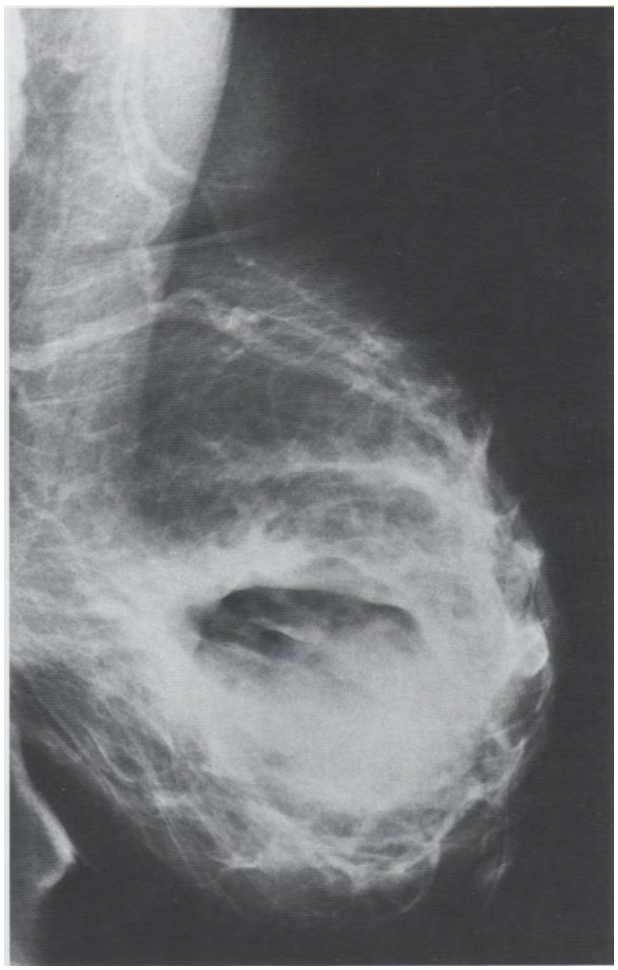
Fig. 42C & D: Left breast, medio-lateral oblique and cranio-caudal projections after *puncture,* removal of 80 ml pus, and insufflation of air.

Conclusion

Abscess with a thick irregular wall.

Histology

Abscess, no evidence of malignancy.



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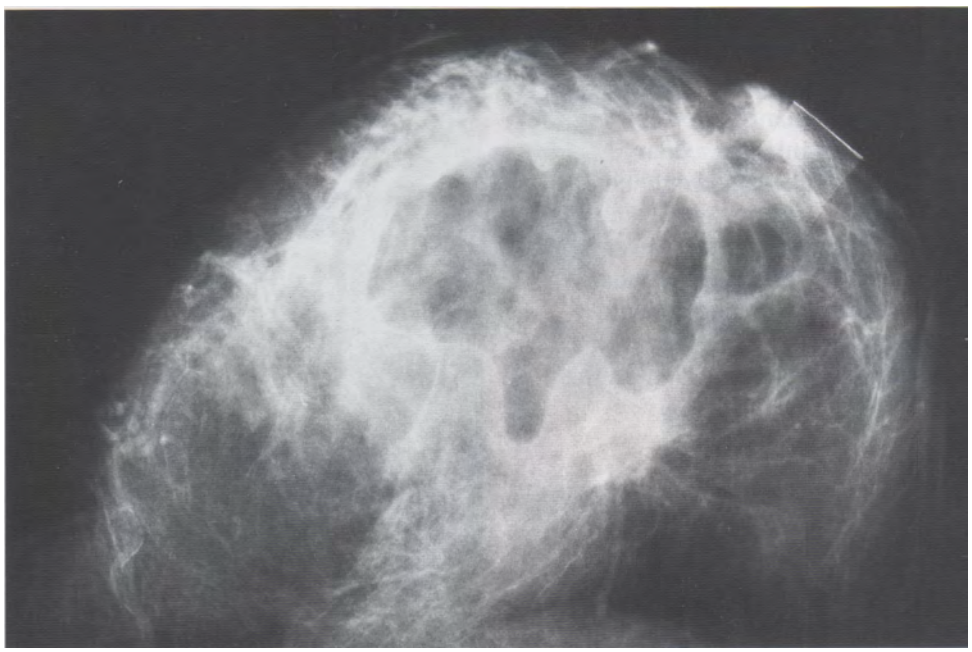


43

55-year-old asymptomatic woman. First screening study.

Physical Examination

No abnormalities in the breasts. Enlarged axillary lymph nodes bilaterally.

Mammography

Fig. 43A: Left breast, medio-lateral oblique projection. Normal breast. Enlarged, dense axillary lymph nodes.

Comment

When the axillary lymph nodes are enlarged and breast disease can be ruled out with certainty by physical examination, mammography and ultrasound, the following diagnoses should be considered: rheumatoid arthritis, psoriasis, eczema, lymphoma, and leukemia.

Magnification Immersion Radiography of the Left Hand

Radiographic changes in the soft tissues and bone, typical of rheumatoid arthritis (Fig. 43 B).

43A

44

82-year-old woman noticed a lump in her left breast.

Physical Examination

Freely movable tumor below the nipple, clinically benign.

Mammography

Fig. 44 A: Left breast, medio-lateral oblique projection, detailed view of the lower half of the breast.
Fig. 44 B: Left breast, cranio-caudal projection, detailed view.
Fig. 44 C & D: Left breast, microfocus magnification views in the medio-lateral oblique and cranio-caudal projections. There is a solitary tumor with no associated calcifications 5 cm from the sharply outlined nipple.

Analysis

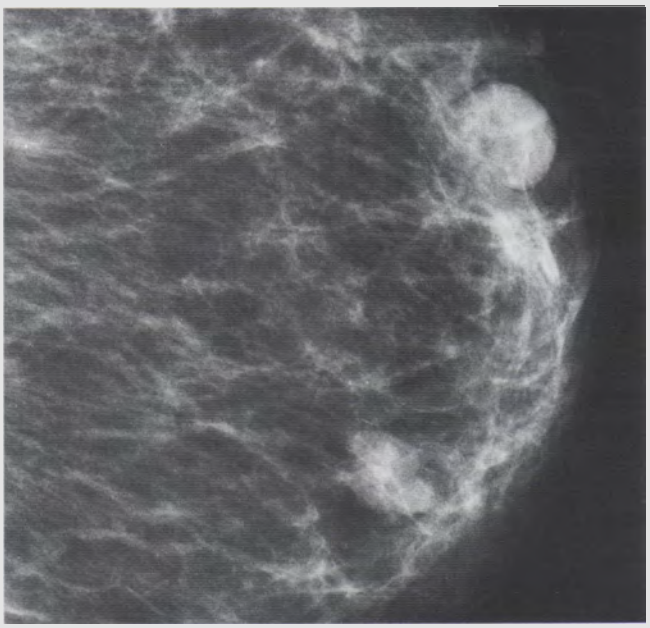
Form: ovoid, lobulated
Contour: unsharp, no halo sign; compare with the nipple, which is sharply outlined
Density: low density radiopaque
Size: 1 x 1 cm

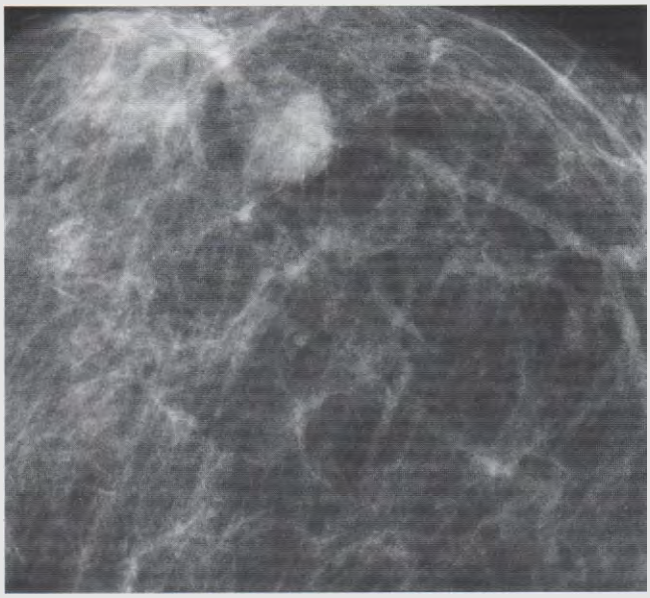
Conclusion

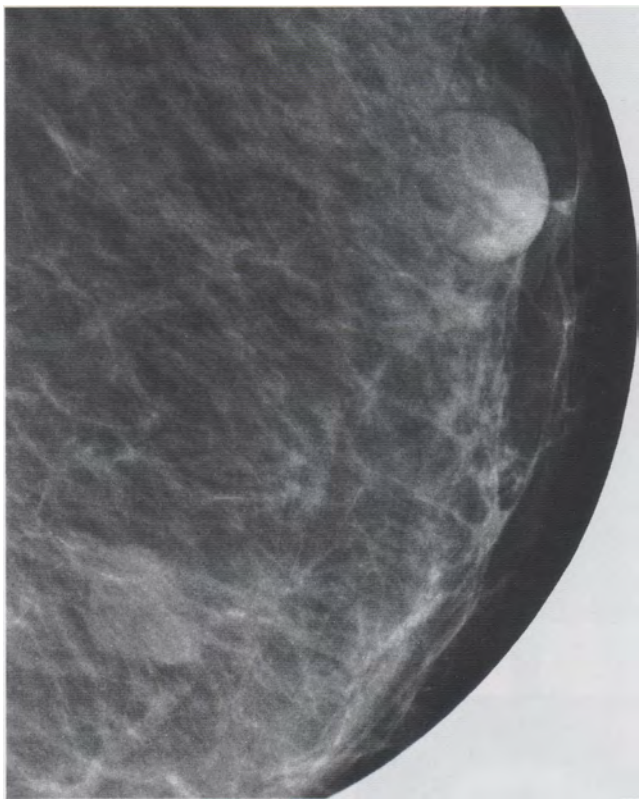
The unsharp borders and absence of a halo sign make this solitary tumor, newly occuring in an 82-year-old woman, suggestive of malignancy.

Histology

Mucinous carcinoma. No axillary metastases.







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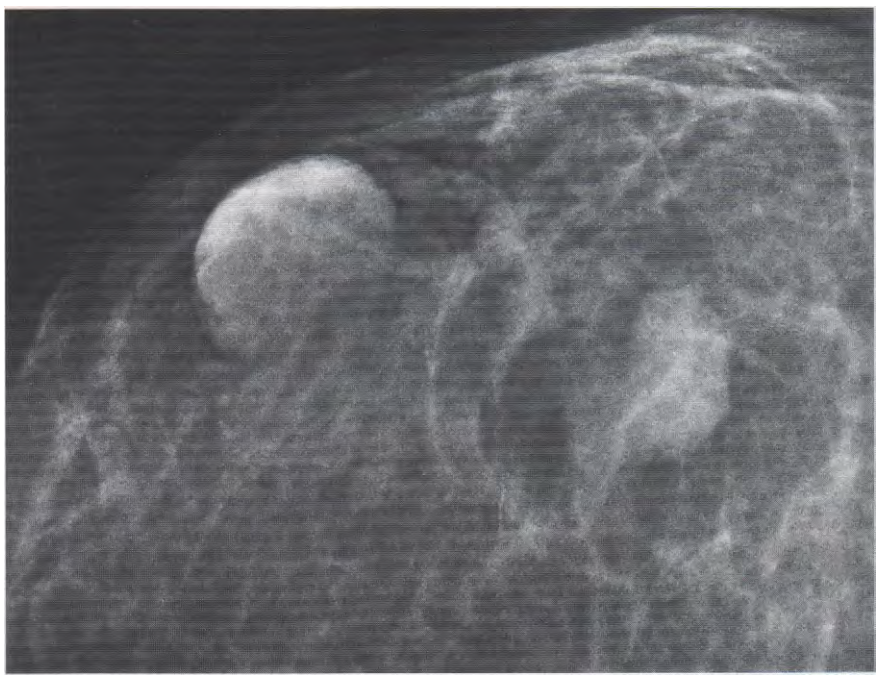


44D

45

Fig. 45A & B: Mammographic picture of pathologically enlarged axillary lymph nodes in a 68-year-old woman with chronic lymphatic leukemia.

45A

45B

46

63-year-old woman, asymptomatic, second screening examination.

Physical Examination

No palpable tumor.

Mammography

Fig. 46A: Right breast, medial protion of the cranio-caudal projection. A solitary tumor is seen 6 cm from the nipple. No associated calcifications.

Analysis

Form: oval, lobulated
Contour: the medial border is sharply outlined with a halo sign
Density: low density radiopaque
Size: 2 x 1 ^{1}/2cm

Conclusion

Mammographically benign tumor which has developed since the first screening examination.

Fine Needle Biopsy

Fig. 46B: Mammogram following fine needle aspiration biopsy shows the typical appearance of a hematoma, which hides the tumor completely.

Cytology

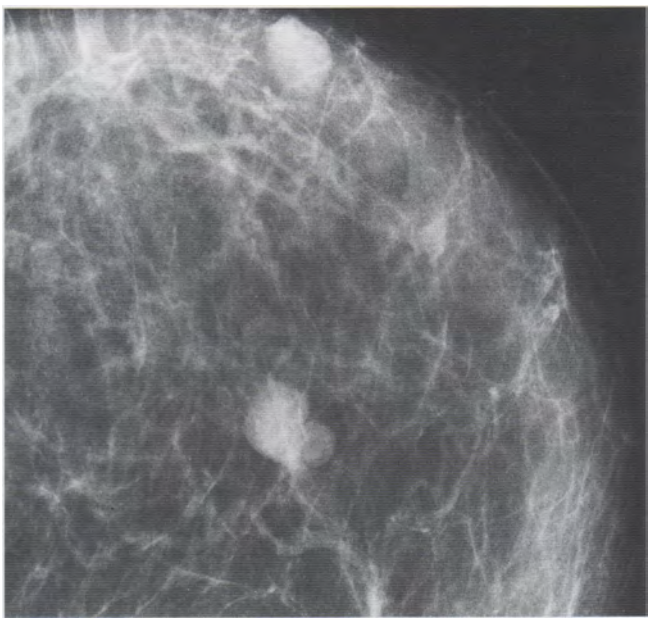
Benign epithelial cells.
Fig. 46C: Two weeks later, preoperative localization. The resolving hematoma still obscures the tumor.

Histology

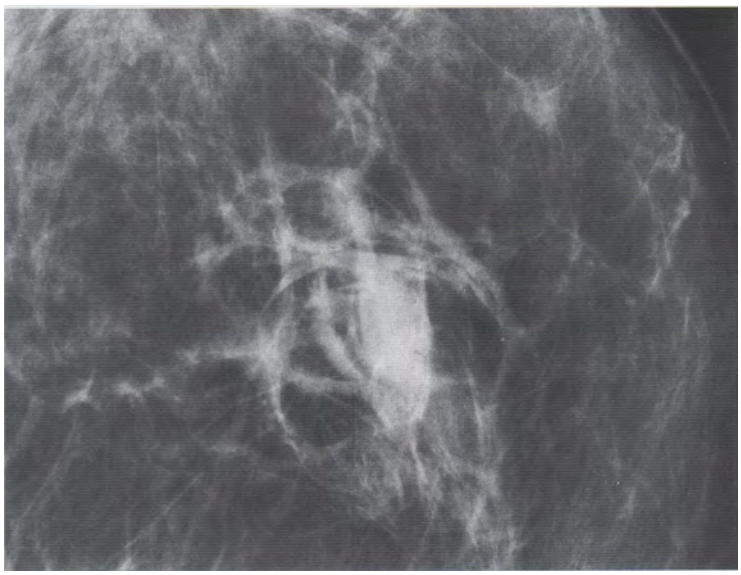
Benign intraductal papilloma and cystic hyperplasia.

Comment

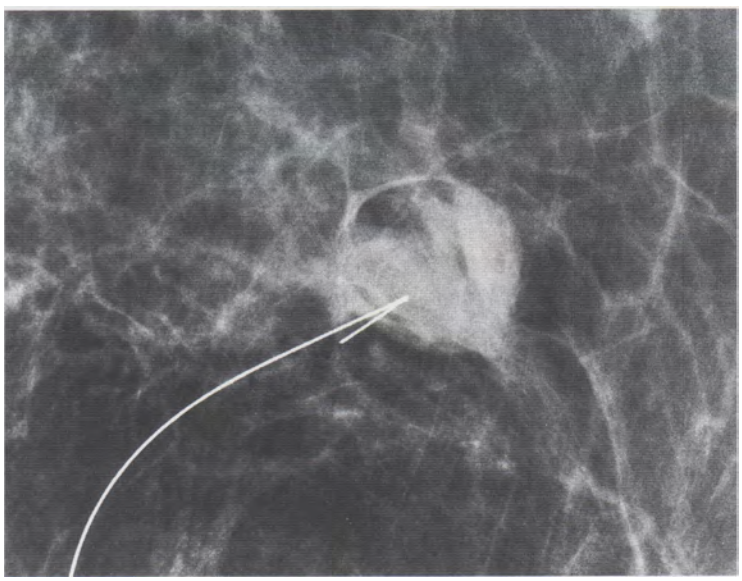
As this case demonstrates, a hematoma caused by needle puncture can completely obscure a lesion, making the mammographic diagnosis impossible. For this reason needle puncture should never precede mammography (54).



46A



46B



46C

47

47-year-old woman, asymptomatic. First screening study.

Physical Examination

No palpable tumor.

Mammography

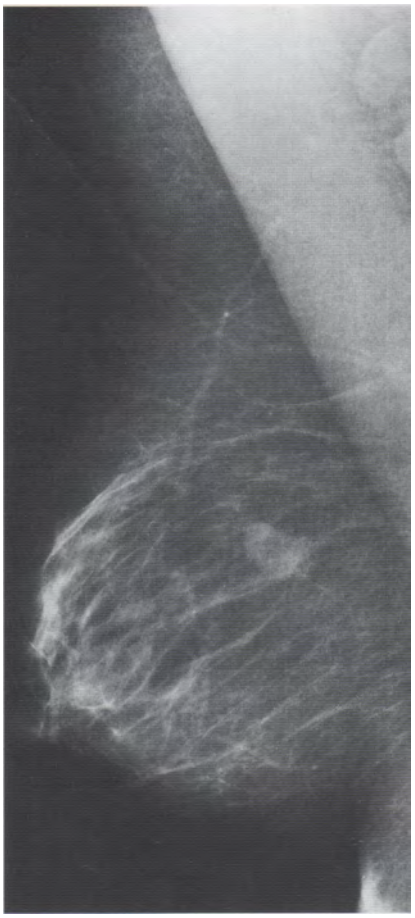
Fig. 47A: Right breast, medio-lateral oblique projection. A solitary lesion is seen in the upper half of the breast, 6 cm from the nipple.
Fig. 47 B: Microfocus magnification view.

Analysis

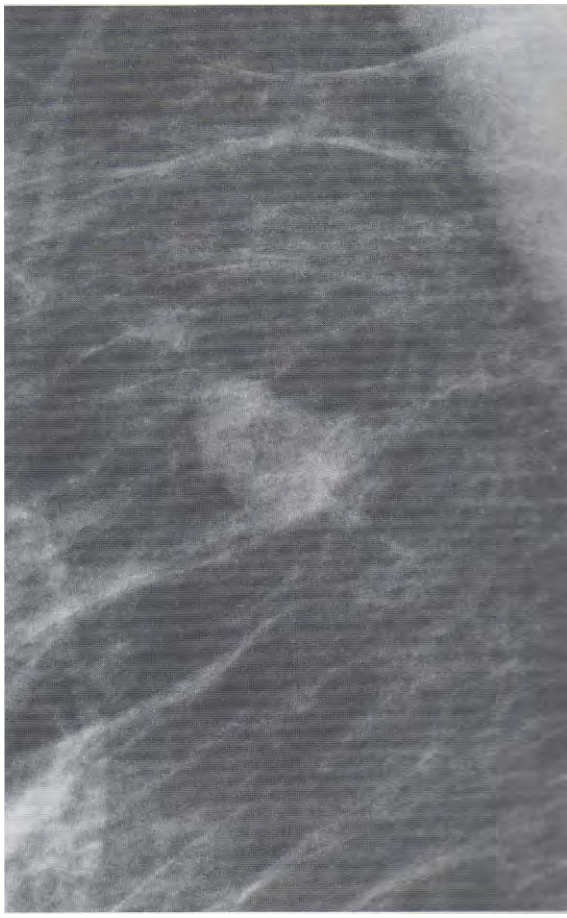
Form: oval, lobulated
Contour: partly unsharp, no halo sign
Density: radiolucent and radiopaque combined (central radiolucency)
Size: approx. 1 cm

Conclusion

The mixed density is the crucial factor determining the benign nature of this tumor. Further differential diagnosis follows that described in the Conclusion of case 9.
The radiolucent part corresponds to the hilus of this *intramammary lymph node.*
No further procedures are indicated.



47A



47B

48

29-year-old woman, first detected a lump in the upper lateral quadrant of the left breast two months earlier.

Physical Examination

An elongated, firm, movable, nodular tumor extending from the nipple to the upper outer quadrant, clinically benign.

Mammography

Fig. 48A & B: Left breast, cranio-caudal projection, contact and magnification views of the lateral half of the breast. A 10 cm long, multinodular tumor resembling a set of rosary beads extends laterally from the nipple. There are associated calcifications.

Analysis of the Tumor

Form: elongate, multinodular
Contour: smooth, undulating
Density: low density radiopaque
Distribution: fills in an entire lobe.

Conclusion

The mammographic appearance is that of the dilated duct system of a single lobe

Analysis of the Calcifications

Form: irregular
Density: the largest calcification appears hollow and the smaller calcifications are very dense
Contour: smooth, regular
Location: within the dilated ducts

Comment

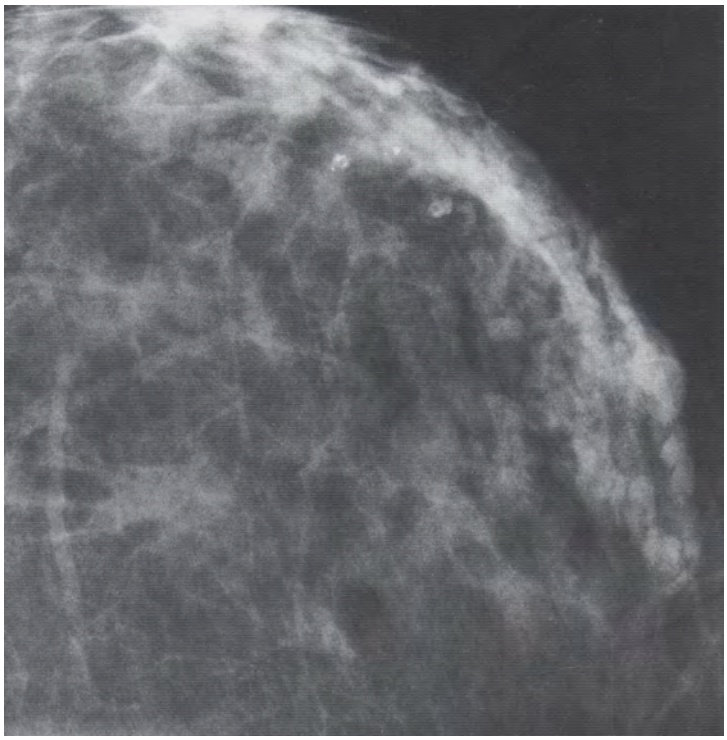
Mammographically benign-type calcifications, most likely within papillomas (see page 199).

Conclusion

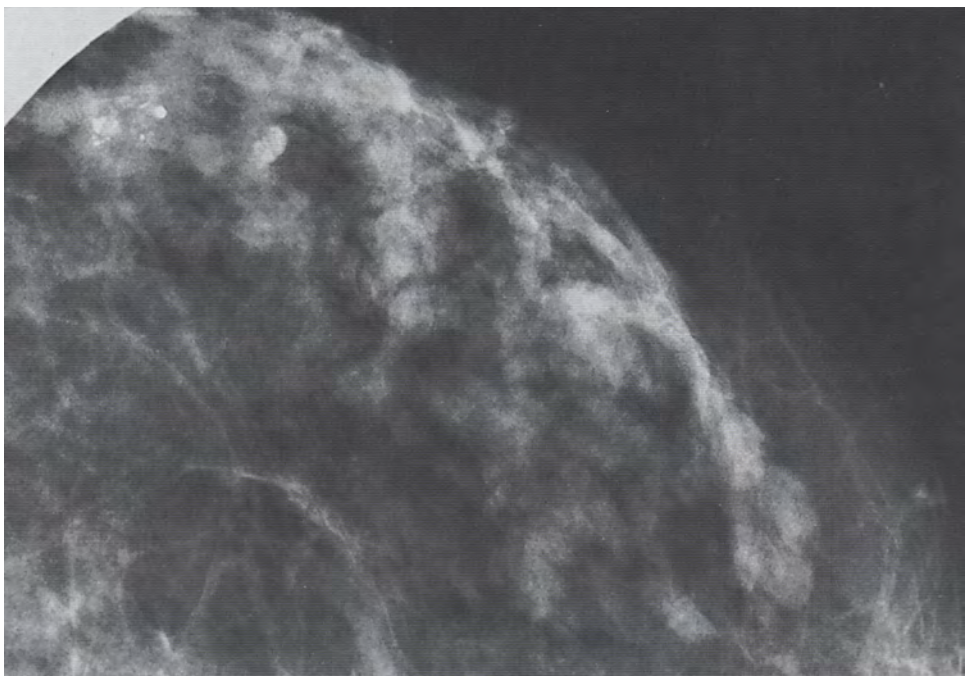
The multiple intraductal calcifications, typical of multiple papillomas, within an irregularly dilated duct system of a lobe in a young woman, suggest the diagnosis of juvenile papillomatosis (Swiss cheese disease).

Histology

Juvenile Papillomatosis.



48A



49

Fig. 49A & B: Right breast, detailed views from the medio-lateral oblique and cranio-caudal projections. Solitary tumor, no associated calcifications.

Analysis

Form: oval
Contour: halo sign over much of the border
Density: low density radiopaque, details of parenchymal structure can be seen superimposed on the tumor

Conclusion

Mammographically benign tumor. At needle biopsy the tumor was solid.

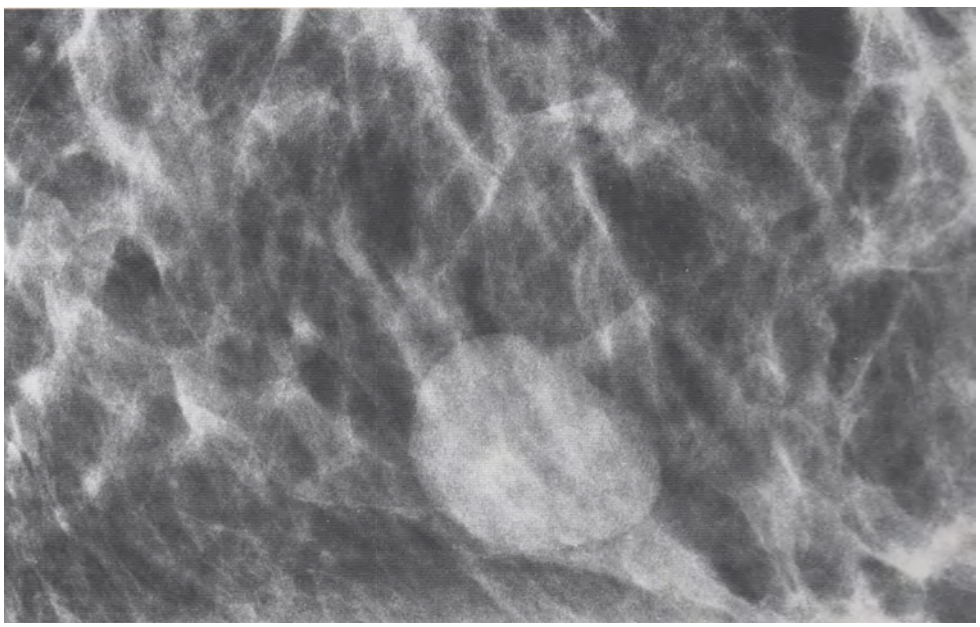
Cytology

Benign epithelial cells.

Histology

Fibroadenoma.

49A



50

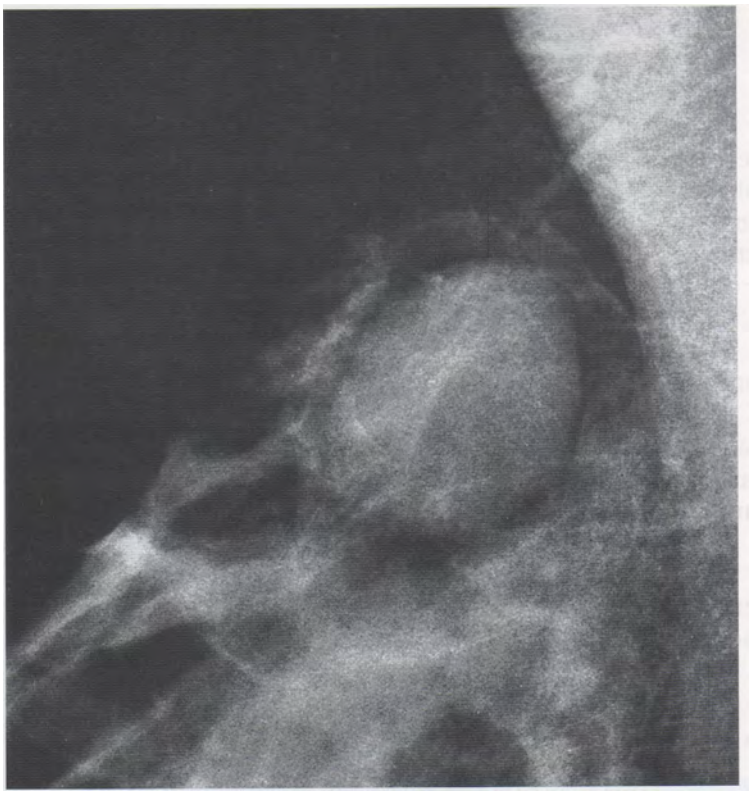


Fig. 50: Right breast, detail from the medio-lateral oblique projection. Solitary tumor, no calcification.

Analysis

Form: oval
Contour: sharply outlined, definite halo sign along the posterior border
Density: low density radiopaque; vein and parenchymal elements can be seen superimposed on the tumor.
Size: 4 x 3 cm

Conclusion

All mammographic signs indicate a benign tumor.

Histology

Fibroadenoma.

51

Fig. 51 A: Right breast, cranio-caudal projection. A 2-cm solitary tumor in the central portion of the breast with no associated calcifications.
Fig. 51 B: Spot compression microfocus magnification view of the tumor, cranio-caudal projection.

Analysis

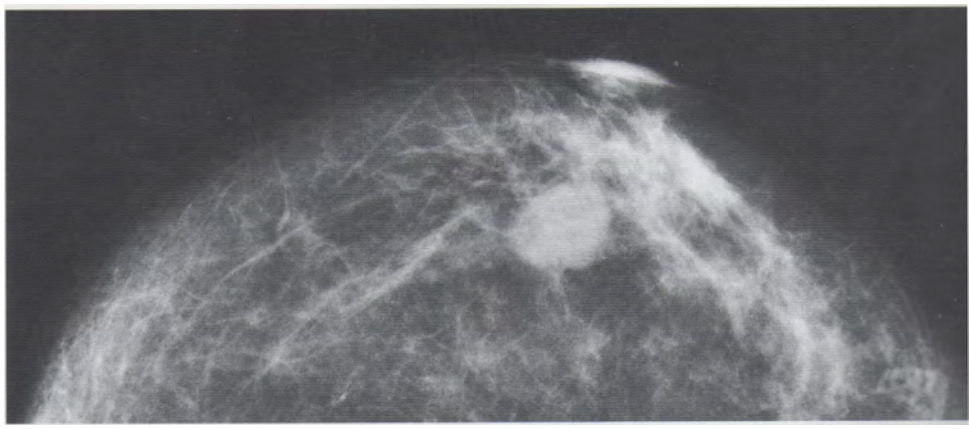
Form: oval
Contour: unsharp, poorly defined
Density: low density radiopaque; equal to that of the parenchyma
Size: 15 x 12 mm

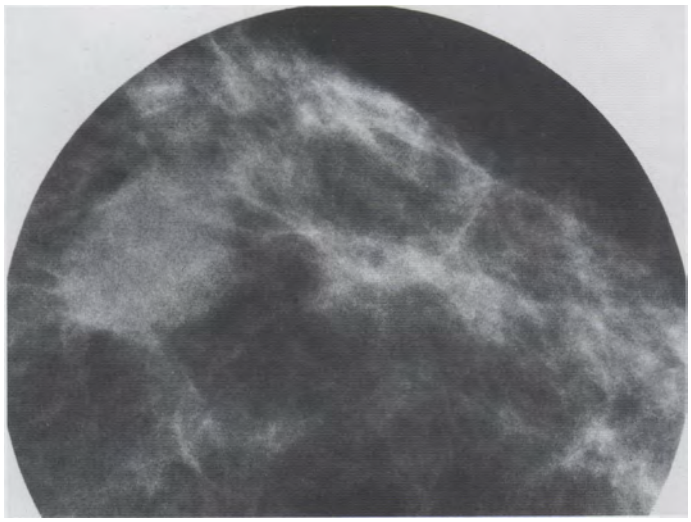
Conclusion

The poorly defined borders of the tumor raise the suspicion of malignancy, making microscopic examination mandatory.

Histology

Fibroadenoma. No evidence of malignancy.





51B

52

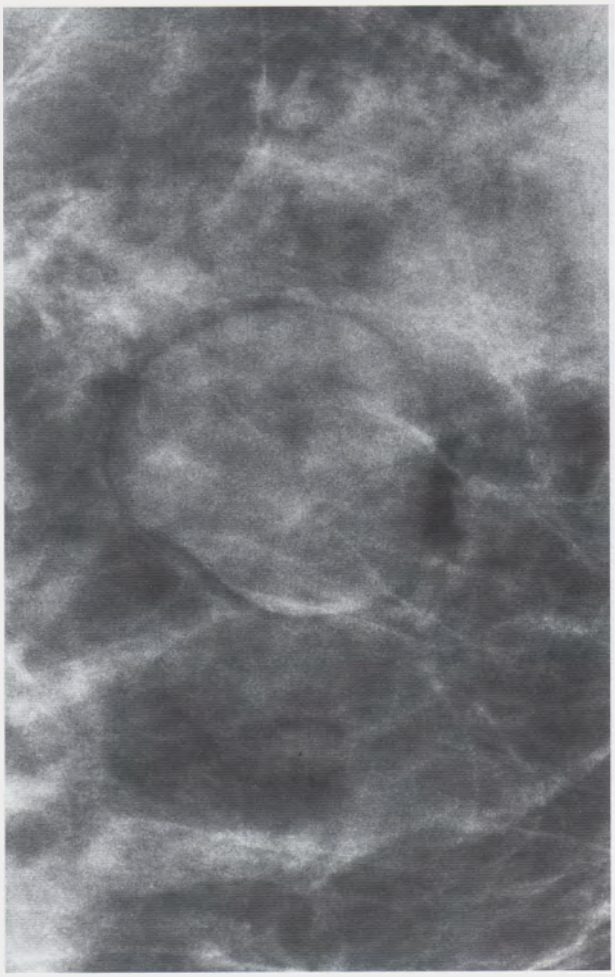


Fig. 52: Photographic enlargement from the medio-lateral oblique projection.

Analysis

Form: oval
Contour: sharply outlined, halo sign surrounding the entire tumor
Density: low density radiopaque, equal to that of the parenchyma; parenchymal elements are clearly seen overlying the tumor

Conclusion

Mammographically benign tumor. The combination of the low-density radiopaque appearance and the extensive halo sign suggest a tension cyst.

Comment

Extraordinarily prominent halo sign. Aspiration: 7 ml straw-coloured fluid. No intracystic tumor on pneumocystography.

53

Age 71, palpable tumor in the lateral half of the left breast, clinically benign.

Mammography

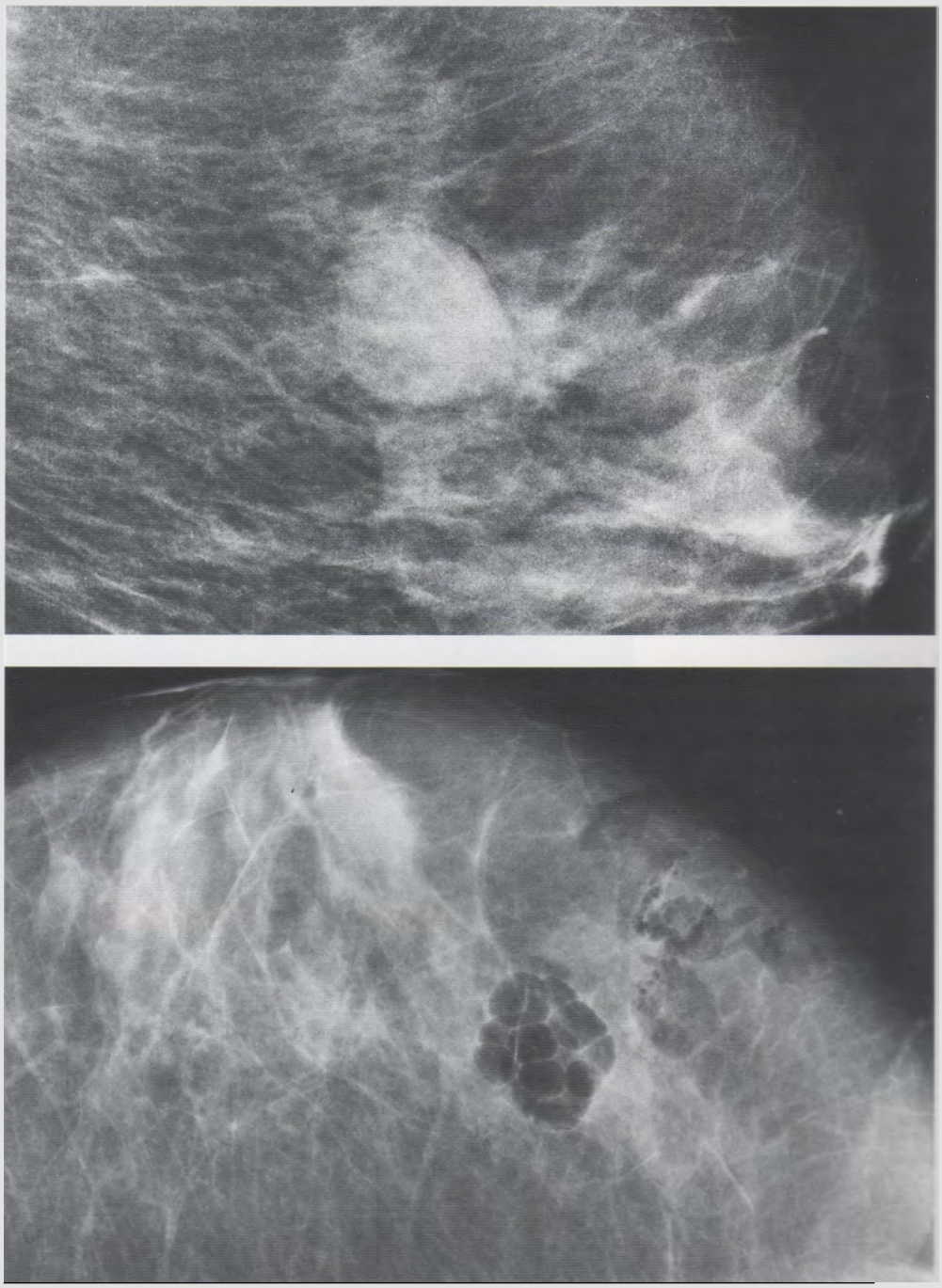
Fig. 53 A: Left breast, detailed view of the medio-lateral oblique projection. There is a solitary tumor in the breast with no associated calcifications.

Analysis

Form: oval
Contour: sharply outlined, extensive halo sign along the superior border
Density: low density radiopaque

Conclusion

Mammographically benign tumor, with a cyst as the most likely diagnosis. Ultrasound is the primary ancillary procedure of choice.
Fig. 53 B: Pneumocystogram. The cyst has been emptied and filled with air. There is no intracystic tumor (bubbles are seen in the remaining cyst fluid).



54

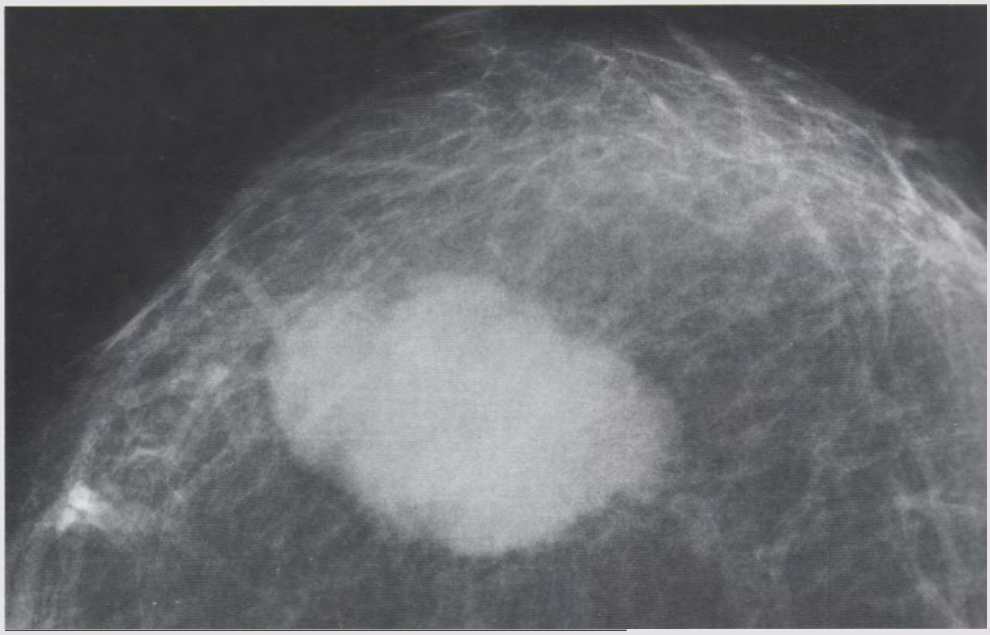


Fig. 54: Detailed mammogram in the cranio-caudal projection. 6 x 4 cm lobulated tumor without associated calcifications.

Analysis

Form: oval-shaped, lobulated
Contour: many short spicules make the contour ill defined
Density: high density radiopaque
Size: 6 x 4 cm

Conclusion

Mammographically typical malignant tumor.

Histology

Carcinoma.

Follow-up

The patient died two years, eight months later of metastatic breast carcinoma.

55

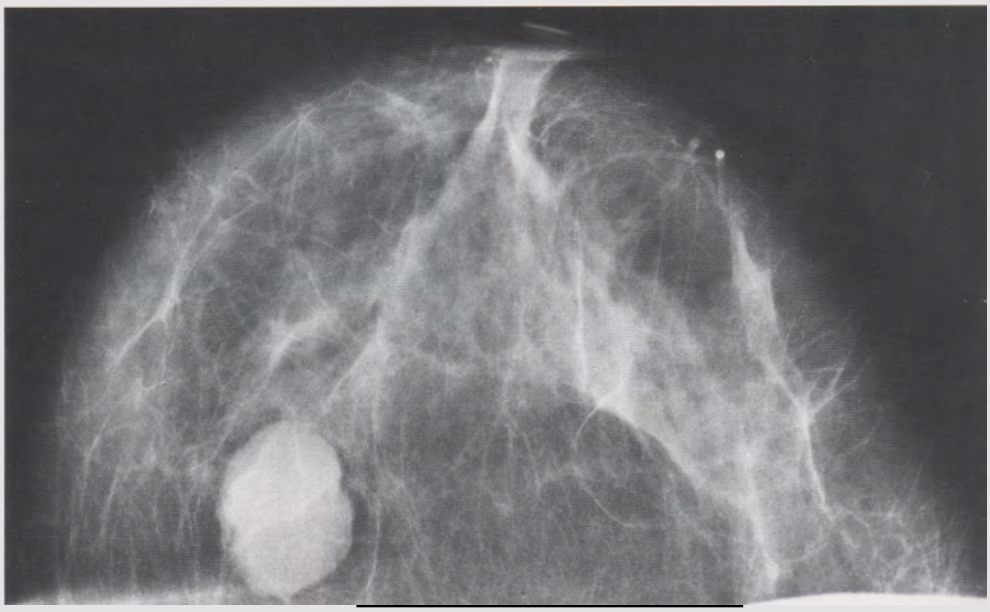


Fig. 55: Left breast, cranio-caudal projection. There is a tumor in the medial half of the breast, near the chest wall.

Analysis

Form: oval, lobulated
Contour: sharply defined
Density: low density radiopaque
Size: $3^{1}/2$ x $2^{1}/2$ cm

Conclusion

Mammographically benign tumor.

Comment

The most frequently occurring mammographically benign circular/oval lesions are cyst, fibroadenoma, and papilloma. Ultrasound examination with ultrasound-guided needle biopsy provide excellent differential diagnosis.

Histology

Fibroadenoma.

56

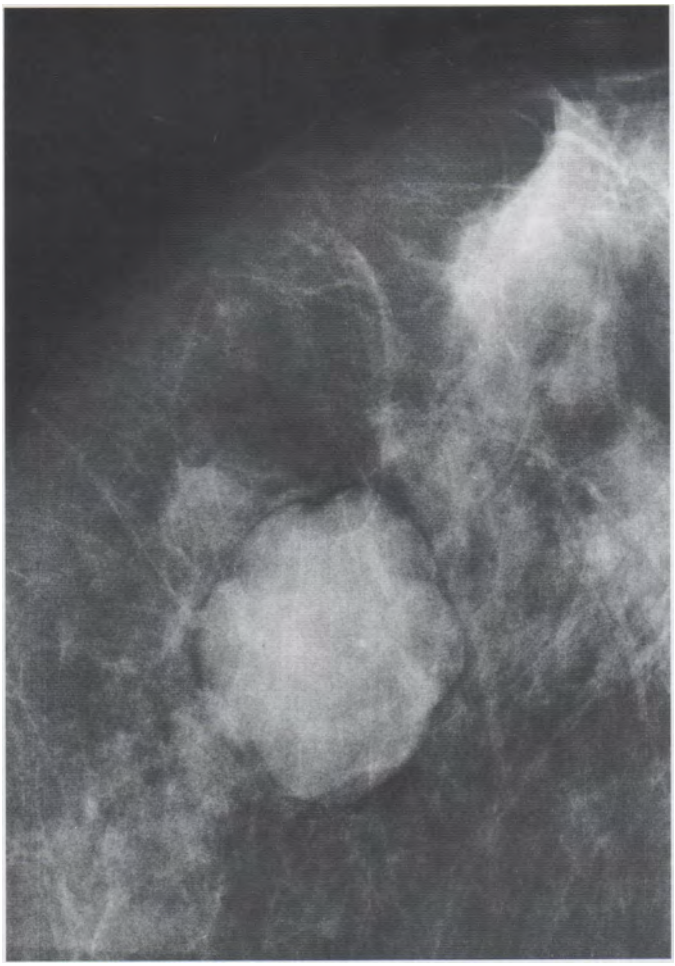
Fig. 56A: Right breast, detailed view of the cranio-caudal projection. A solitary tumor is seen without associated calcifications.

Analysis

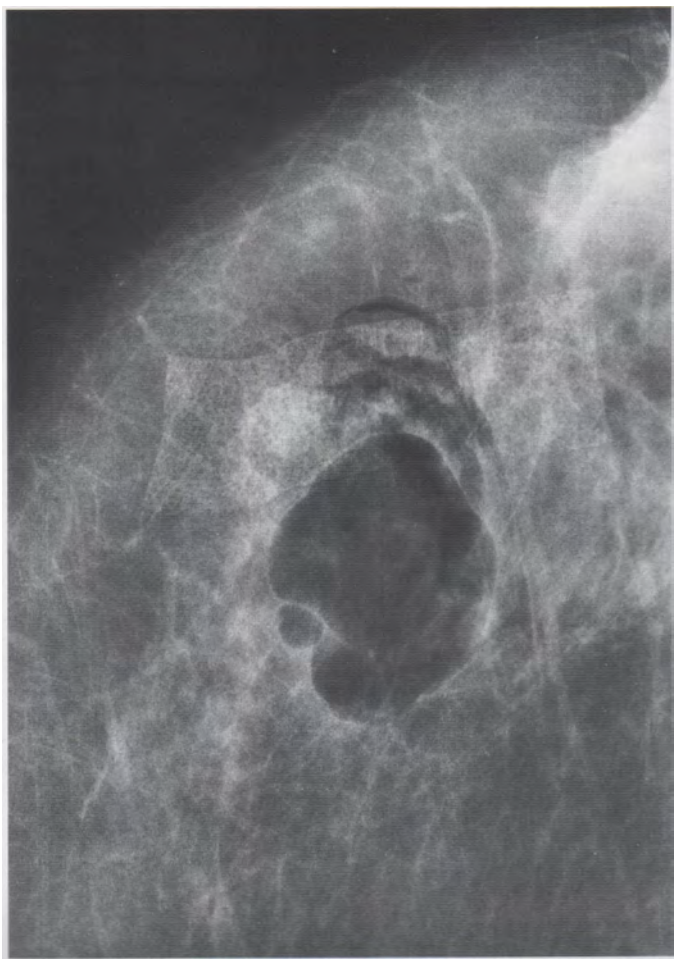
Form: oval
Contour: lobulated, smooth; extensive halo sign
Density: low density radiopaque

Conclusion

Mammographically benign tumor. The extensive halo sign suggests a cyst.
Fig. 56B: Pneumocystogram. Simple cyst; no intracystic tumor.

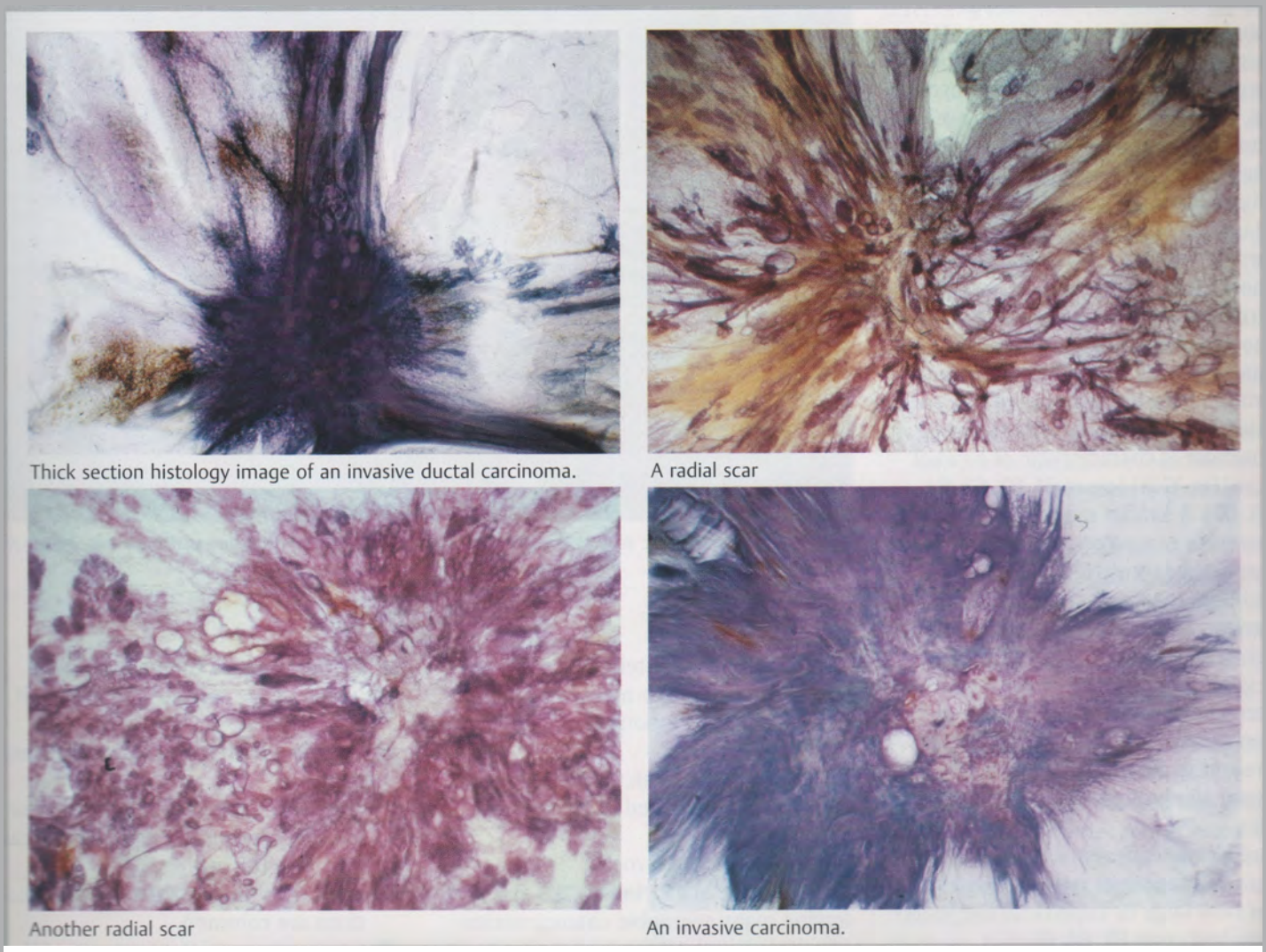


56A



56B

V. Stellate/Spiculated Lesions



Thick section histology image of an invasive ductal carcinoma.

A radial scar

Another radial scar

An invasive carcinoma.

Most breast carcinomas have the mammographic appearance of a stellate lesion, i. e. a radiating structure with ill-defined borders. Their *perception* may be [illegible]

Although mammographic differentiation of breast carcinoma from other stellate lesions can be highly accurate, definitive diagnosis can be made only by histology. When *analyzing stellate lesions* the following radiologic signs should be considered:

Tumor center

a) Is it a distinct mass?
b) Instead of a solid, distinct mass are there oval or circular radiolucent areas at the center of the radiating structure?

Note: Spot compression views are of great value in evaluating the tumor center:

Radiating structure consisting of spicules. Two basic patterns:

a) Sharp, dense, fine lines of variable length radiating in all directions are typical of invasive ductal, invasive lobular, and tubular carcinoma. The larger the central tumor mass, the longer the spicules (Fig. XXI) (cases 57, 58, 59, 60, 65). These spicules are composed of dense collagen, which is seen on a mammogram as a high-density radiopaque linear structure.
b) Many very fine linear densities may be bunched together like a broom or a sheaf of wheat. These fine linear structures are of lower density than the spicules in invasive carcinoma, since they are the image of dilated, proliferating ducts arranged in a radiating fashion. This type of radiating structure is characteristic of a radial scar (Fig. XXII) (cases 61, 62, 63, 64, 66, 67). A similar mammographic appearance can occasionally be seen in traumatic fat necrosis (case 68).

In addition, **localized skin thickening** and retraction over the lesion should be searched for:

a) It is often present in invasive ductal carcinoma, particularly in large or superficial lesions (case 60). It may be present in traumatic fat necrosis, especially postoperatively (cases 68, 69).
b) Radial scar is never associated with skin thickening or retraction, no matter how large or superficial the lesion may be (cases 62, 64, 66, 67).

Fig. XXI: Diaghrammatic illustration of invasive ductal carcinoma: the larger the central tumor mass, the longer the spicules.

The analysis of the stellate lesions, according to the above-mentioned signs, leads to a choice among the following diagnoses:

1) Invasive ductal carcinoma NOS (not otherwise specified)
2) Radial scar
3) Traumatic fat necrosis

Invasive ductal carcinoma has the following mammographic characteristics (Fig. XXI) (cases 57, 58, 59, 60, 65, 70, 71, 72, 73, 85):

a) Distinct central tumor mass from which dense spicules radiate in all directions.
b) Spicule length increases with tumor size.
c) Spicules that may reach the skin or muscle, causing retraction and localized skin thickening.
d) Associated malignant-type calcifications are common.

The mammographic appearance of the **small, usually nonpalpable invasive**

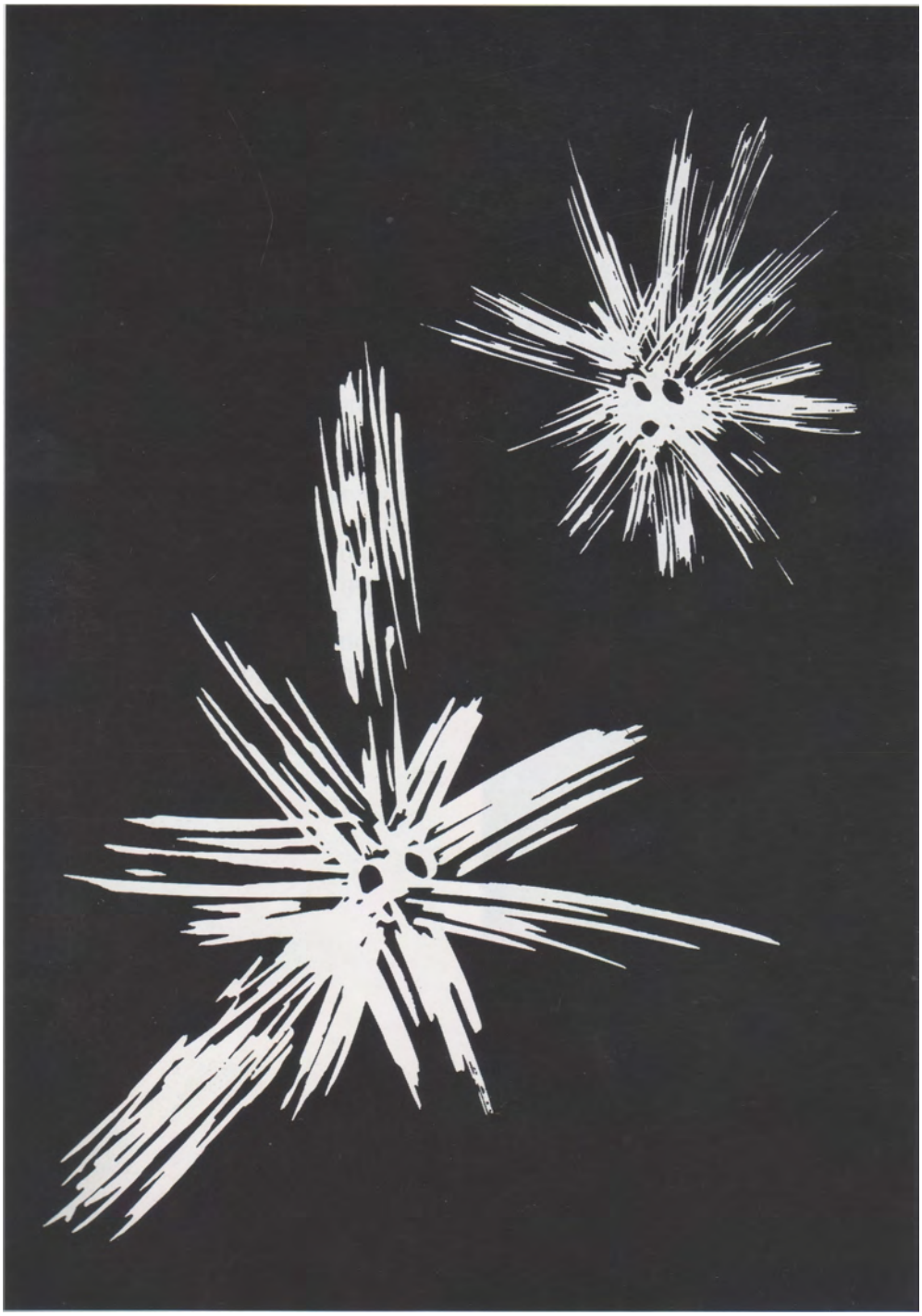


Fig.XXII: Illustration of the mammographic appearance of a radial scar.

ductal and tubular carcinomas may differ from the image described above:

a) The central tumor mass may be imperceptible; although small, it is almost always present.
b) Spicules may form only a lace-like, fine reticular structure which causes parenchymal distortion and/or asymmetry. These may be the only changes leading to detection.
c) The perception problem can be considerable.

Comment: Spot compression views combined with microfocus magnification may be necessary to distinguish small stellate lesions from the summation of parenchymal structures.

Radial scar (sclerosing duct hyperplasia). This benign, rarely palpable lesion may be mistakenly diagnosed as carcinoma; conversely, invasive lobular carcinoma may occasionally give the mammographic impression of a radial scar. Mammography screening has focused attention upon this lesion. A prevalence of 0.9 per 1000 was observed in our prevalent screening material. The occurrence of this cancer-imitating lesion in mammography screening makes it an important practical problem, since about one-third are associated with DCIS or tubular carcinoma.

Furthermore, the exact nature of this lesion is a subject of some controversy among pathologists and it has been given many different names (3, 4, 14, 15, 18, 21, 23, 32, 41).

The following mammographic characteristics help to differentiate radial scar from invasive carcinoma (cases 61, 62, 63. 64, 66, 67, 81, 82, 83) (Fig. XXII).

a) Radial scars vary in appearance from one mammographic projection to the other. Each view gives a somewhat different picture.
b) There is no solid, dense, central tumor mass of a size corresponding to the length of the spicules. Instead, there may be translucent, oval, or circular areas at the center of the radiating structure, which give it a striking appearance.
c) The radiating structures differ from those of invasive carcinoma. The longest are very thin and very long. Closer to the center of the lesion they may become much more numerous and are clumped together in thick aggregates.
d) There frequently appear to be radiolucent linear structures parallel to some

of the fine radiopaque linear densities. These radiolucencies can dominate the radiographic picture (cases 61, 64, 81).

e) There is never skin thickening nor retraction over the lesion.
f) There is a striking difference between the distingt mammographic findings and the nearly complete absence of a palpable lesion, no matter how large or superficial it may be.

Traumatic fat necrosis. Fat necrosis following trauma, including surgery, can result in at least two basic types of mammographic image: a circular/oval lesion (hematoma developing into an oil cyst) and a stellate lesion. Calcification may be associated with either of them (Chapter VI). Relevant patient history contributes to the diagnosis. The presence of ecchymosis is useful. Characteristic mammographic appearance, when the traumatic fat necrosis results in a stellate lesion, is as follows (cases 66, 68, 84):

a) Center of the lesion: there is seldom a distinct mass unless the necrosis has resulted from secondary healing. Typically translucent areas corresponding to small oil cysts are seen in the central portion. The older the lesion, the less solid the center (cases 68, 84).
b) Radiating structure: varies with the projection, particularly in spot compression views. Spicules are fine and of low density.
c) Localized skin thickening and retraction may be present (cases 68, 69, 84).

Strategy

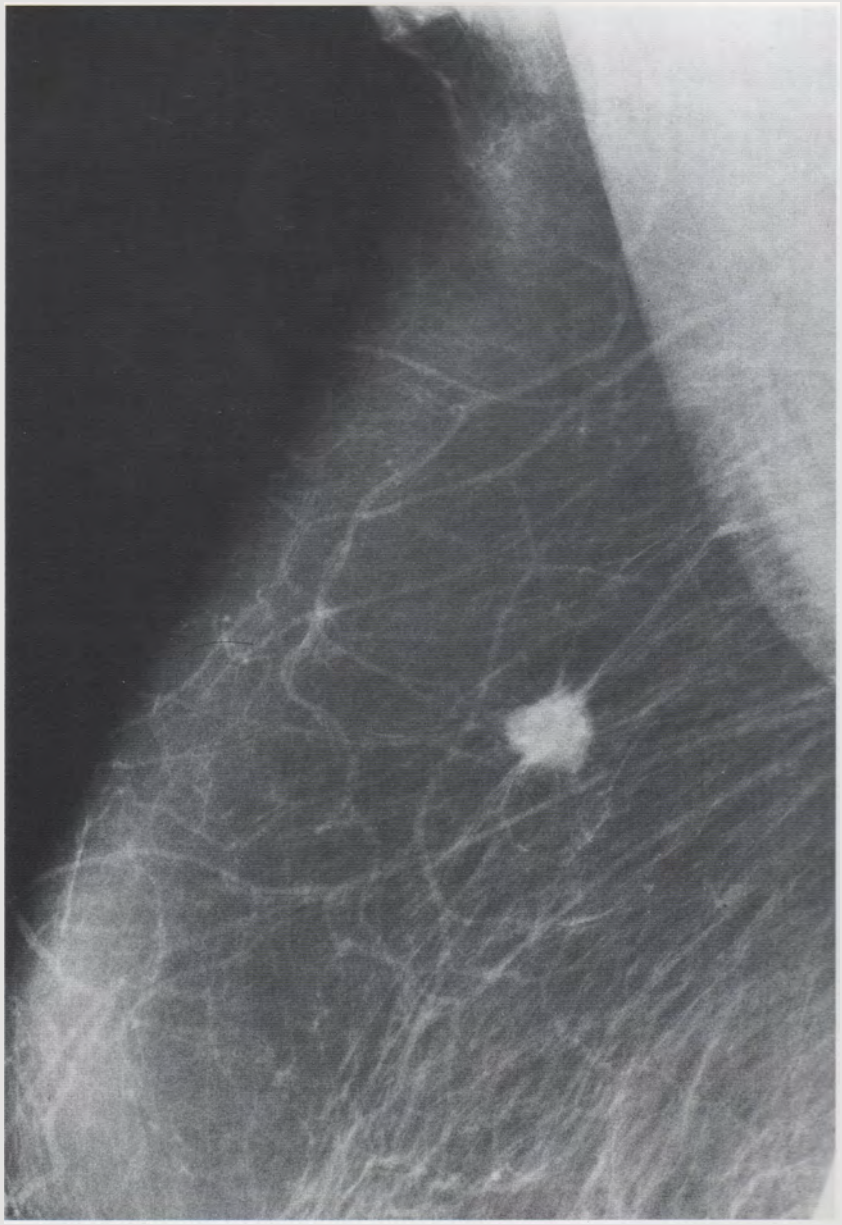
Although definitive diagnosis of stellate lesions requires histologic examination, the preoperative mammographic analysis is important, because of the differences in the management of the various stellate lesions. Over 90% of stellate lesions represent invasive breast cancer; the remainder are radial scars. Careful analysis of the mammographic signs should suggest the diagnosis of a radial scar. Differentiation between the malignant stellate lesions and the radial scar based on mammographic signs will have a significant influence upon the management of these lesions.

In stellate lesions suspicious for malignancy, preoperative needle biopsy should establish the diagnosis and will greatly facilitate the treatment planning (one-stage operation, sentinel node/axillary dissection, etc.). On the contrary, the use of preoperative needle biopsy of radial scars carries a considerable risk of over underdiagnosis and should be avoided. Complete surgical removal and thorough histological examination should be carried out when a radial scar is suspected. The diagnosis of traumatic fat necrosis can be established by the patient's history, characteristic mammographic findings, and, occasionally, by large core needle biopsy.

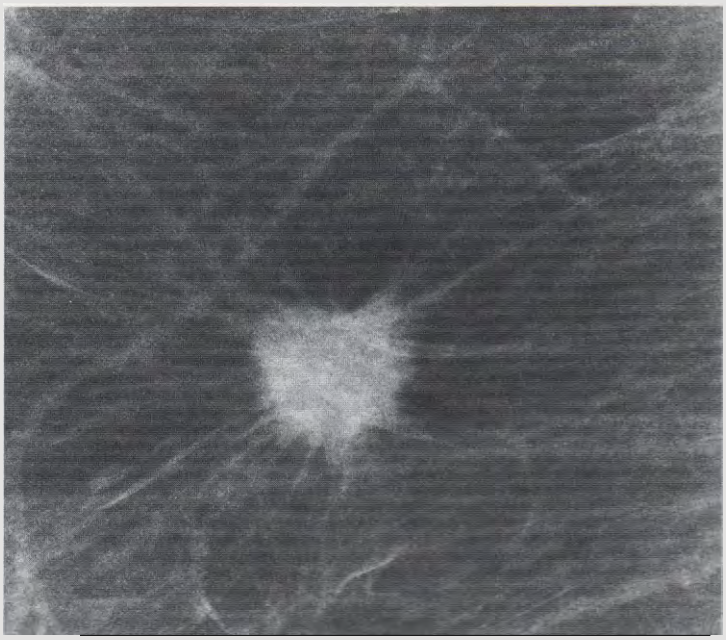
Key Case

57

This case is meant to demonstrate the characteristics of a typical malignant stellate tumor.
It is recommended that you refer to this case while analyzing other stellate lesions.
It is the presence of a central tumor mass with associated spicules that is typical of malignant stellate tumors. The spicules are dense and sharp, radiating from the tumor surface, usually not bunched together. When they extend to the skin or areolar region they cause retraction and local thickening. The larger the tumor mass the longer the spicules (Fig. XXI).



57A



57B

Practice in Analyzing Stellate Lesions

(Cases 58-85)

58

73-year-old asymptomatic woman. First screening study.

Physical Examination

No palpable tumor.

Mammography

Fig. 58 A: Right breast, medio-lateral oblique projection. A small tumor shadow is seen at coordinate Al.
Fig. 58 B: Right breast, cranio-caudal projection. The tumor is seen at coordinate Al. No associated calcifications.,
Fig. 58 C: Magnification view, me lateral oblique projection.

Analysis

Form: small stellate tumor mass surrounded by spicules
Size: 4 x 4 mm

Conclusion

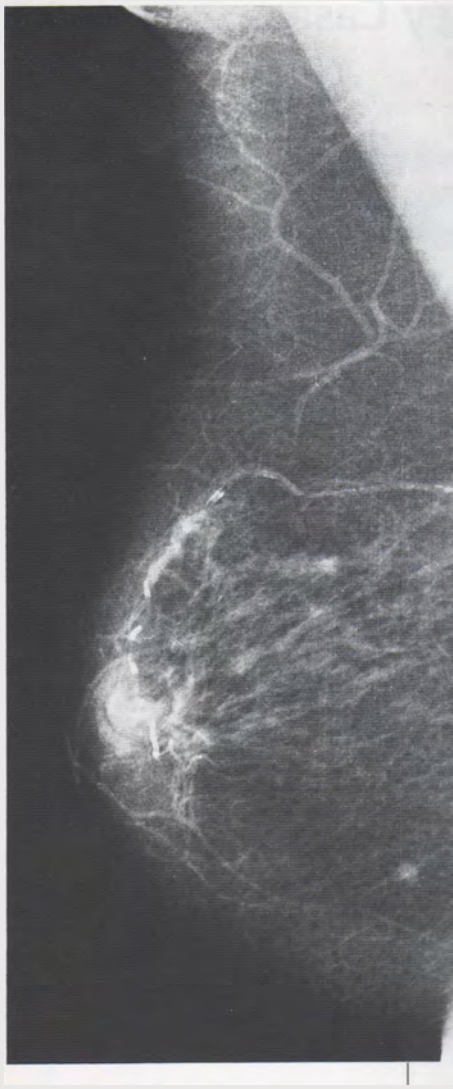
Mammographically malignant tumor.

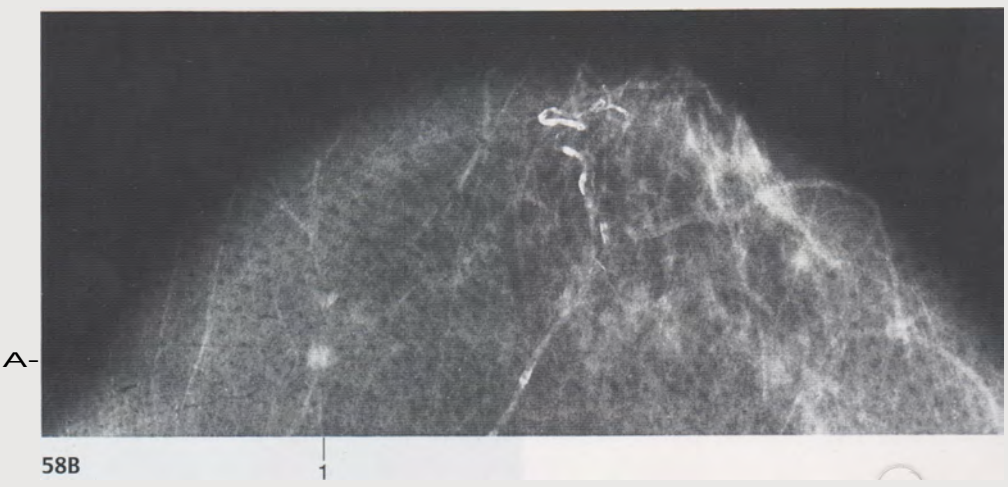
Histology

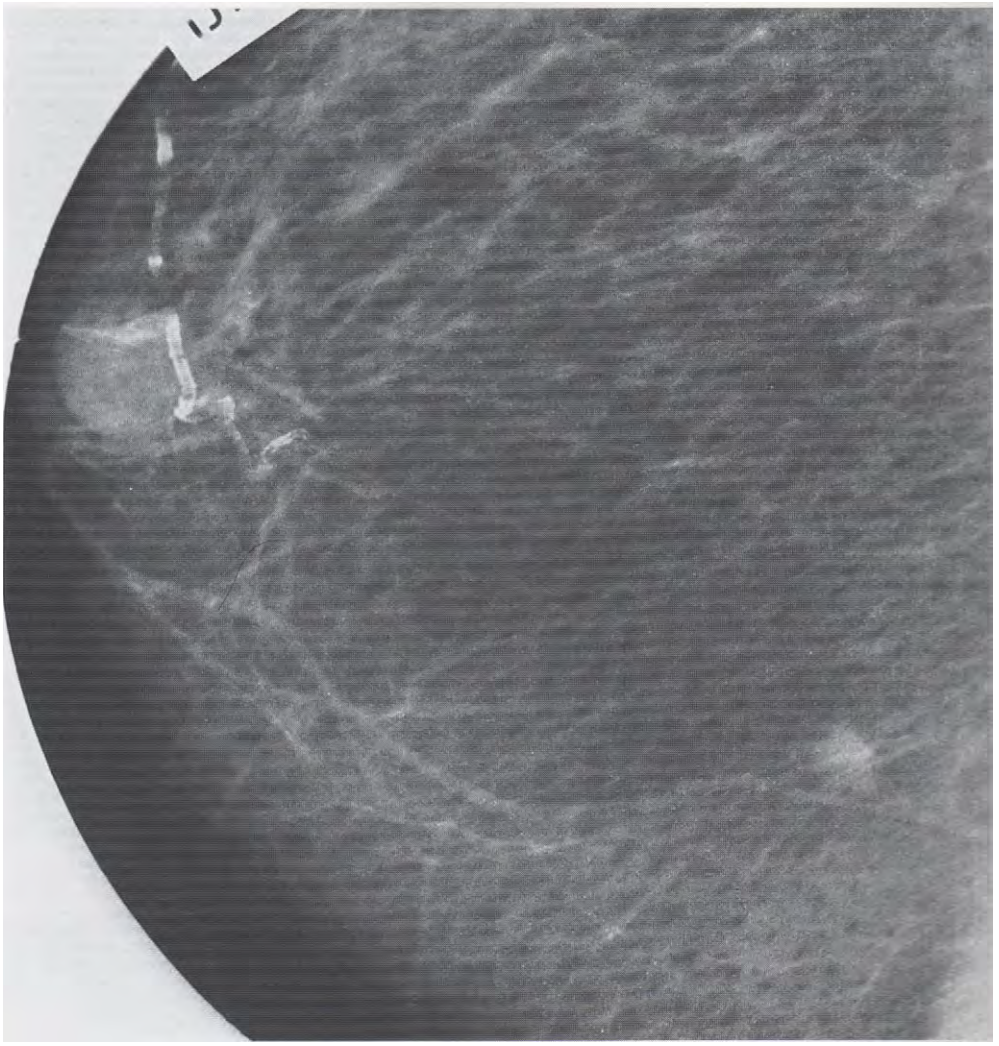
Infiltrating ductal carcinoma, size 4 x 4 mm. No axillary metastases.
Fig. 58 D: Specimen photograph.
Fig. 58 E: Overview of the tumor with staining for elastic fibers. (12.5 x).

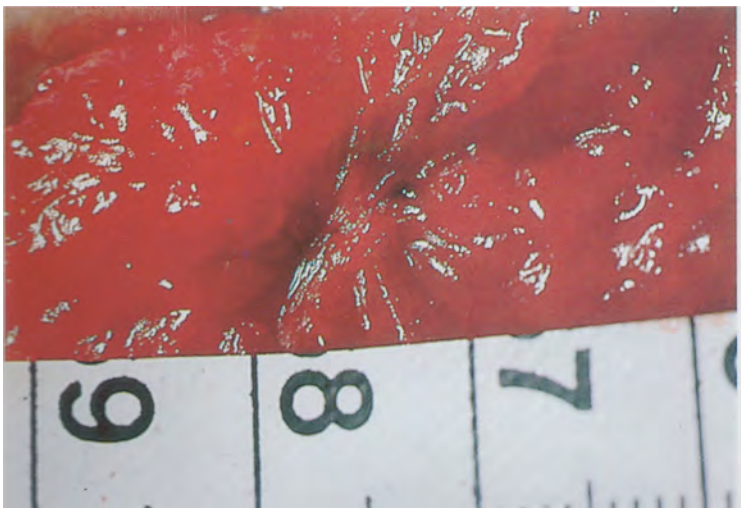
Follow-up

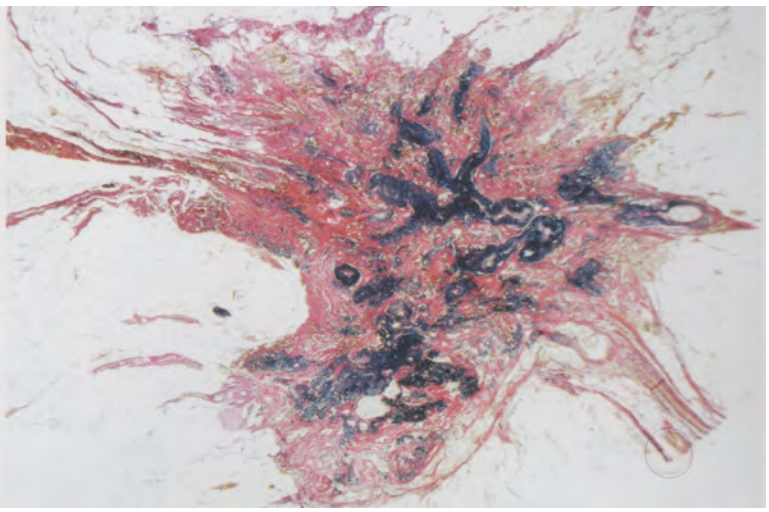
The woman died one year, 11 months later from pulmonary embolism at age 75. There was no evidence of breast cancer.











59

Age 63. First screening examination. Asymptomatic.

Physical Examination

No palpable tumor.

Mammography

Fig. 59A: Left breast, medio-lateral oblique projection.
Fig. 59 B: Magnification view in the medio-lateral oblique projection.
Fig. 59C: Left breast, cranio-caudal projection. A stellate tumor is seen in the upper inner quadrant, 7 cm from the nipple. No associated calcifications.

Conclusion

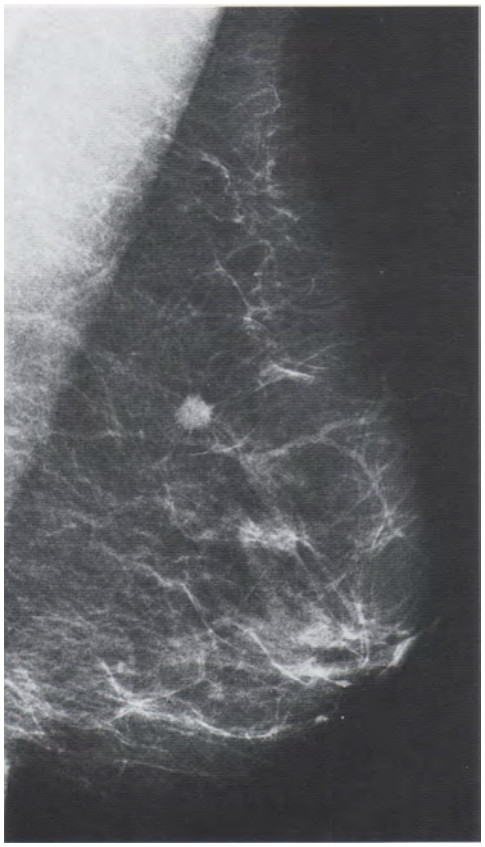
This tumor has the typical mammographic appearance of a malignant stellate breast tumor: solid center, radiating spicules.

Histology

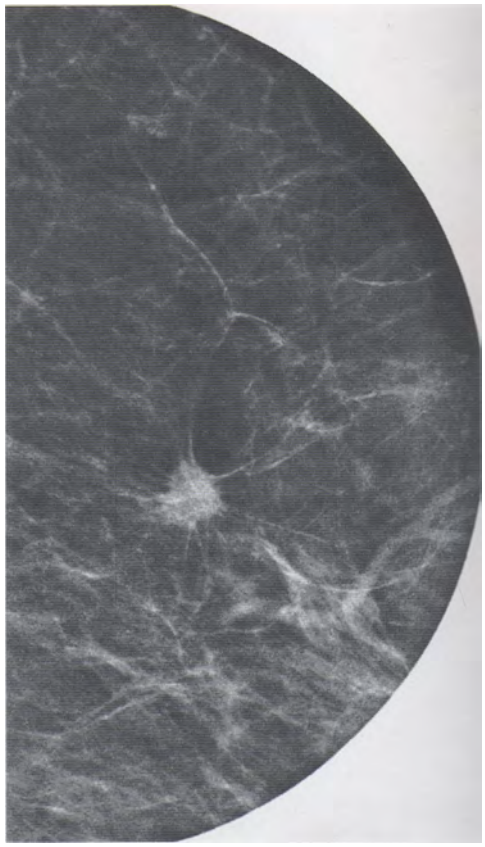
Invasive ductal carcinoma. Maximum diameter 7 mm. No lymph node metastases.
Fig. 59D: Specimen photograph

Follow-up

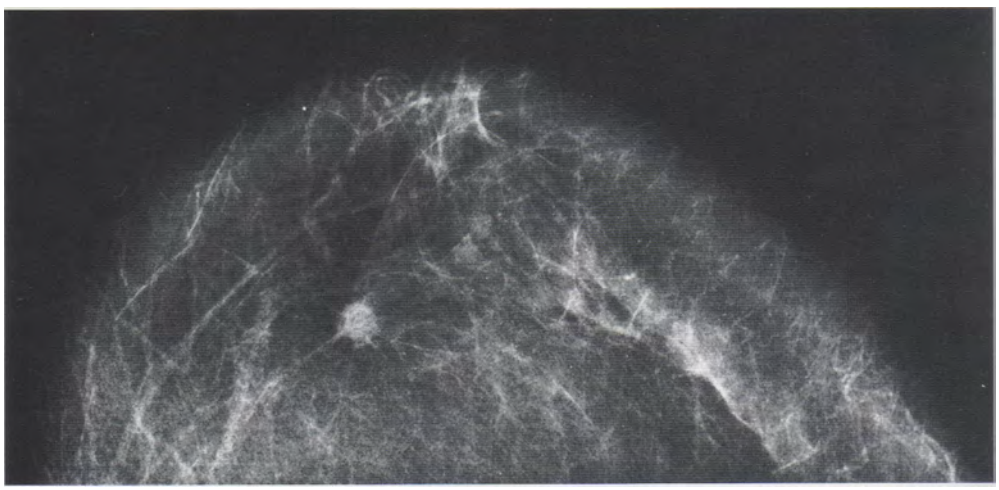
The woman died eight years, five months later from colon cancer. There was no evidence of metastatic breast cancer.

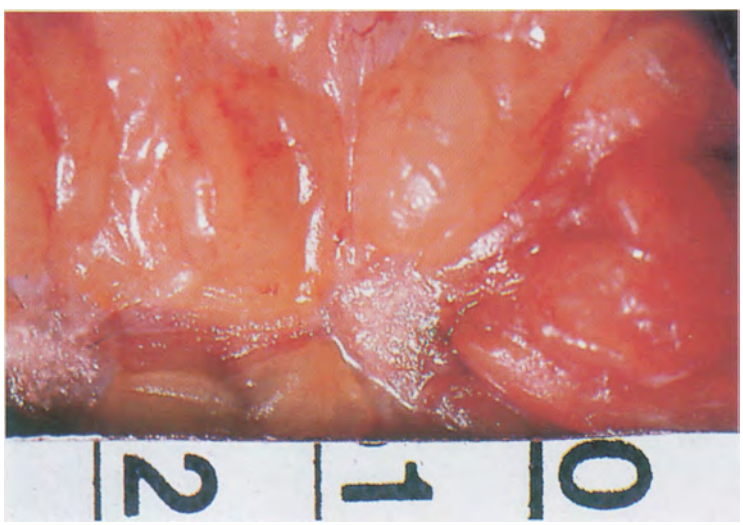


59A



59B





59D

60

Age 89, one-year history of a slowly growing tumor in the right breast.

Physical Examination

A large, obviously malignant tumor in the right breast.

Mammography

Fig. 60A & B: Right breast, medio-lateral oblique and cranio-caudal projections. Centrally located, large (5 cm diameter) stellate tumor. The nipple and areola are retracted. The skin is thickened and retracted over the lower and outer portions of the breast.

Comment

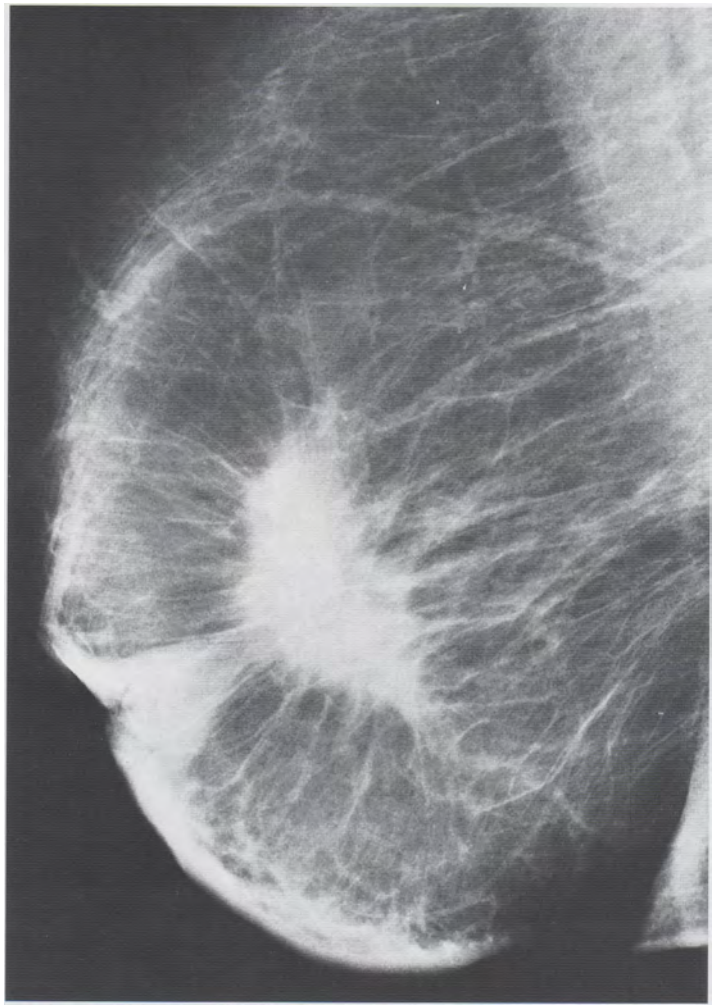
An illustrative example of an advanced stellate malignant breast tumor with a large central tumor mass and radiating spicules which retract the areola and skin.

Histology

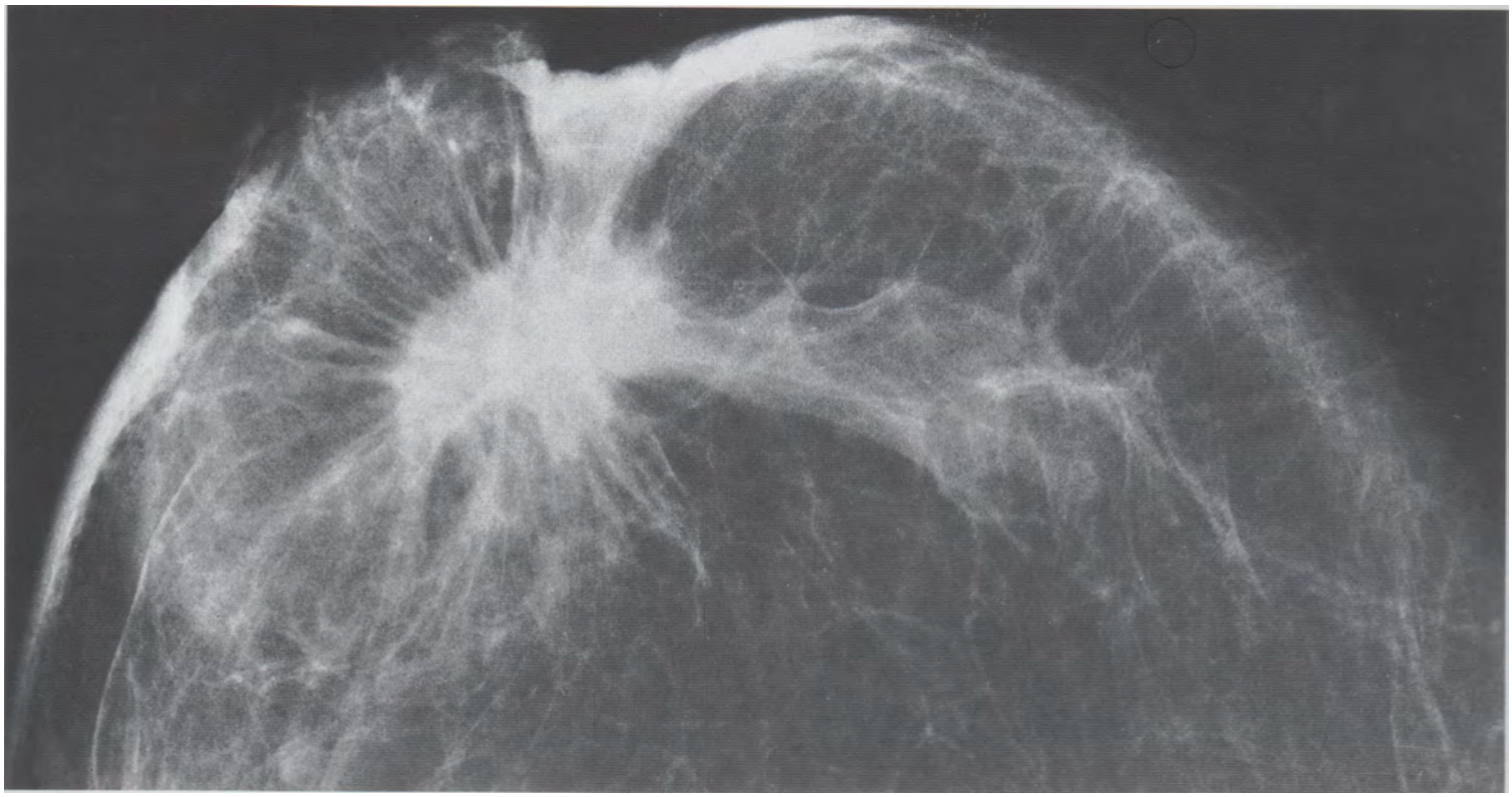
Infiltrating ductal carcinoma. The tumor infiltrates the lymph vessels.

Follow-up

The patient died one year, six months later of metastatic breast carcinoma.



60A



61

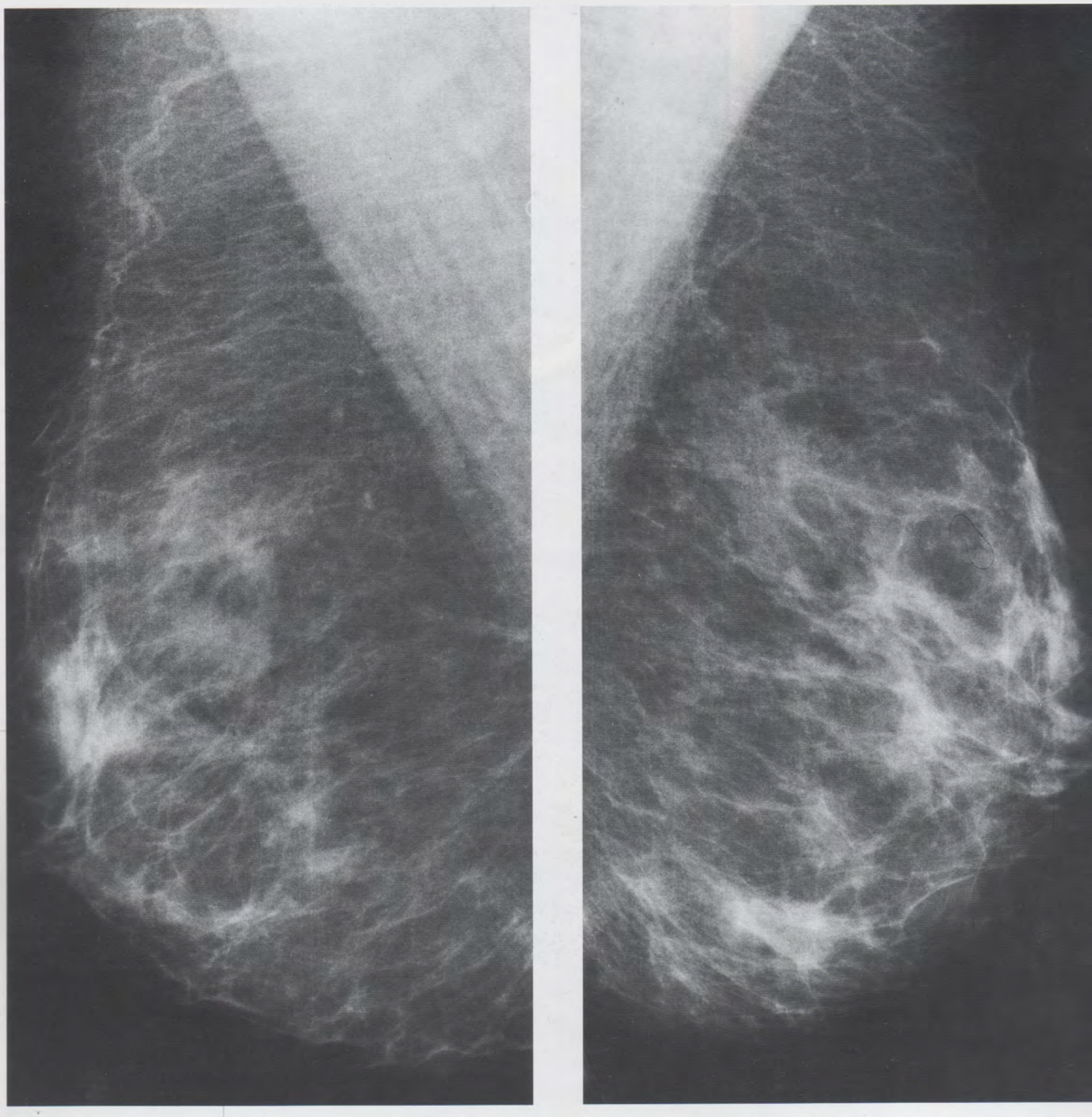
61-year-old woman, asymptomatic. First screening study.

Physical Examination

No palpable tumor, no history of trauma.

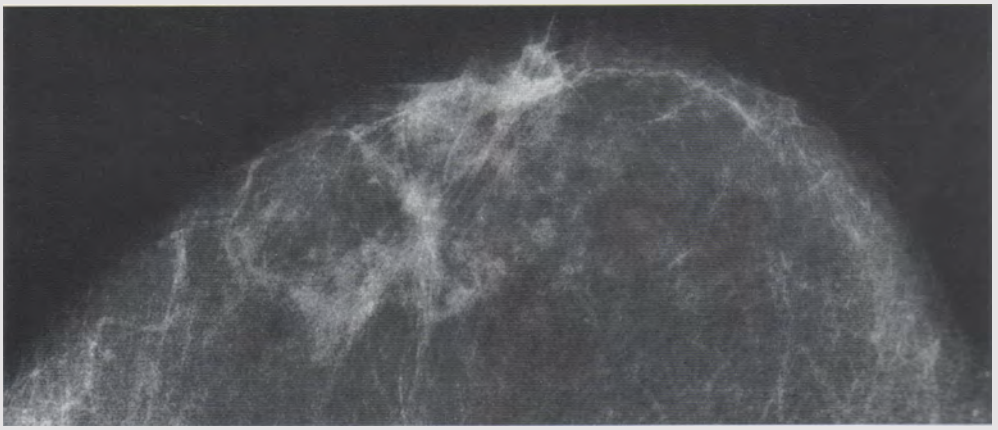
Mammography

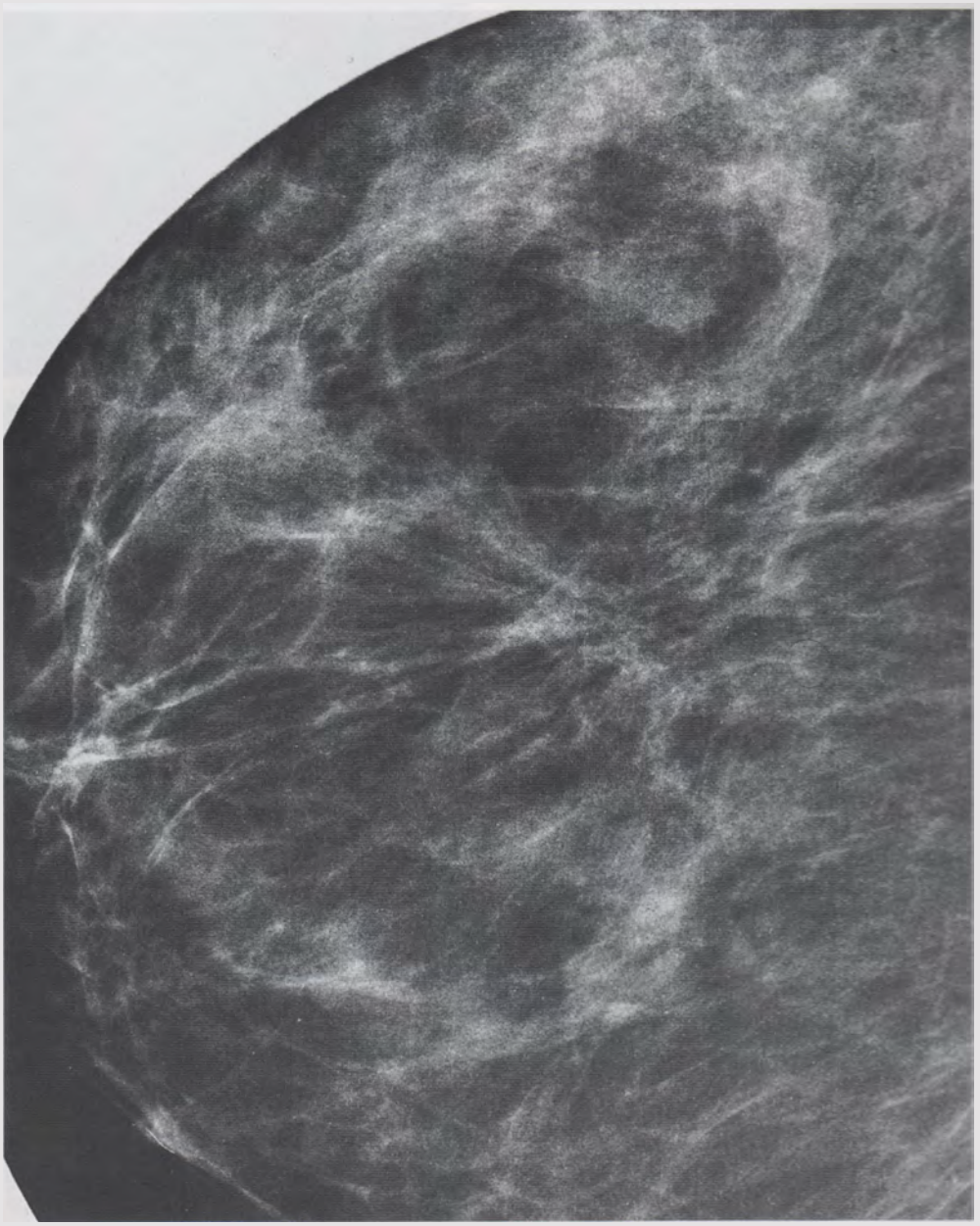
Fig. 61 A & B: Right (A) and left (B) breasts, medio-lateral oblique projections. Compare the lower halves of the right and left breasts. In the lower half of the right breast there is architectural distortion centered at coordinate A1.



61A

Fig. 61 C: Right breast, cranio-caudal projection.
Fig. 61 D: Right breast, microfocus magnification view, medio-lateral oblique projection. Compare Fig. 61 A with Fig. 61 C & D. Observe how the lesion has a different appearance in each projection.





Analysis

Form: radiating structure with no central tumor mass; the magnification view in particular shows the small radiolucencies at the center of the lesion; the spicules are fine, extremely long, bunched together and extended to the nipple, which is not retracted
Size: large, fills in much of the lower outer breast quadrant

Conclusion

This mammographic appearance is typical of a radial scar. The diagnosis is supported by the lack of palpatory findings. No further diagnostic procedures are indicated. In fact, needle biopsy is contraindicated (see page 96). The next step should be open surgical biopsy followed by careful histologic examination.

Histology

Radial scar (sclerosing duct hyperplasia). No evidence of malignancy.

Comment

An invasive ductal carcinoma of this size would have a large, dense, homogeneous central tumor mass dominating the picture. In radial scars the fine radiating structure forms the lesion and, in contrast to invasive ductal carcinoma, there are numerous central translucencies.

62

Age 63, asymptomatic. First screening study.

Physical Examination

No palpable tumor, no history of previous trauma.

Mammography

Fig. 62 A & B: Medio-lateral and cranio-caudal projections. A large stellate lesion is centered 4 cm behind the nipple. Note the change in appearance of the lesion with changes in projection. The two benign-type periductal calcifications are not associated with the tumor.

Analysis

Stellate lesion, no solid central tumor mass. Radiolucencies are seen at the center in both projections, particularly in Fig. 62A. Thick collections of fibrous strands form the radiating structure.

Comment

In spite of the large size of this lesion, it is not palpable and there is no skin thickening or retraction.

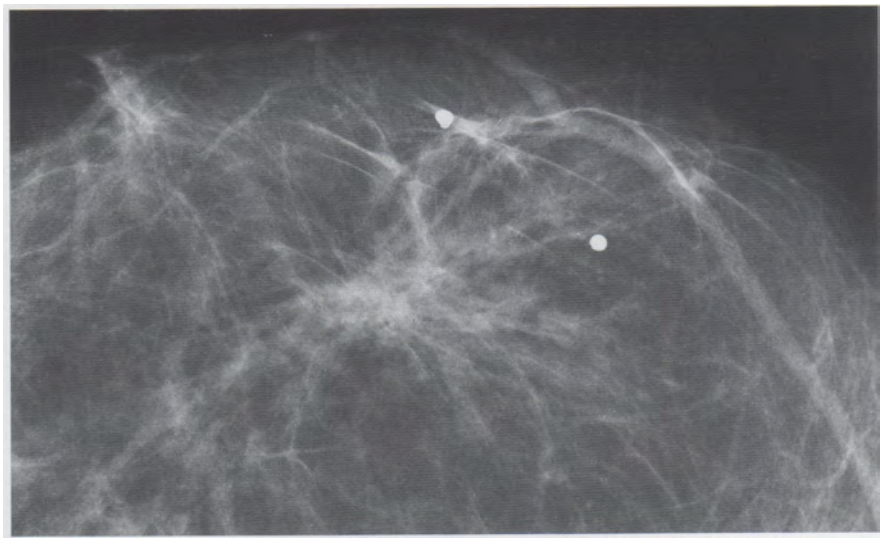
Conclusion

Typical mammographic and clinical picture of a radial scar. Complete surgical removal is recommended. There should be no preoperative needle biopsy (see page 96).

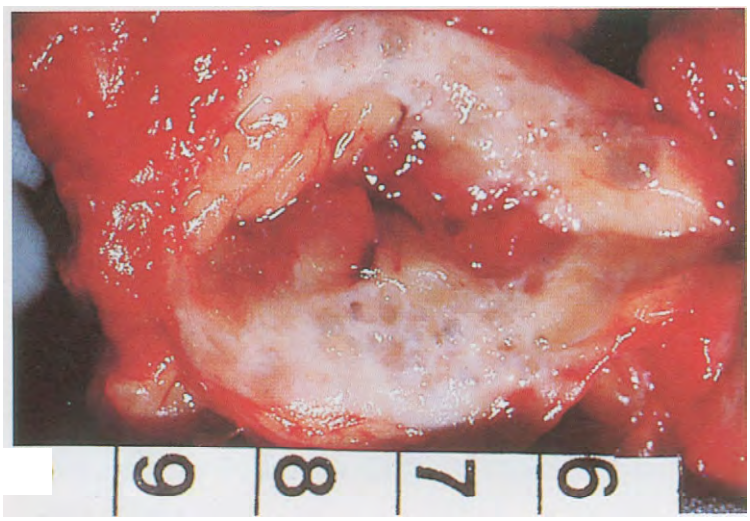
Histology

Radial scar (sclerosing duct hyperplasia). No evidence of malignancy.
Fig. 62 C: Operative specimen photograph.

62A



62B



62C

63

Asymptomatic 69-year-old woman. First screening study.

Physical Examination

No history of trauma, no palpable tumor.

Mammography

Fig. 63 A: Left breast, detailed view of the medio-lateral oblique projection. There is a large radiating structure in the upper half of the breast.
Fig. 63 B & C: Left breast, magnification views, medio-lateral oblique and cranio-caudal projections.

Analysis (Best from the Magnification Views)

Stellate lesion. No solid tumor center. Numerous longitudinal, oval and circular radiolucencies within the tumor. The radiating structure consists of thick collections of fine linear densities bunched together. Alternating with them are radiolucent linear structures parallel to these strands. No associated calcifications.

Conclusion

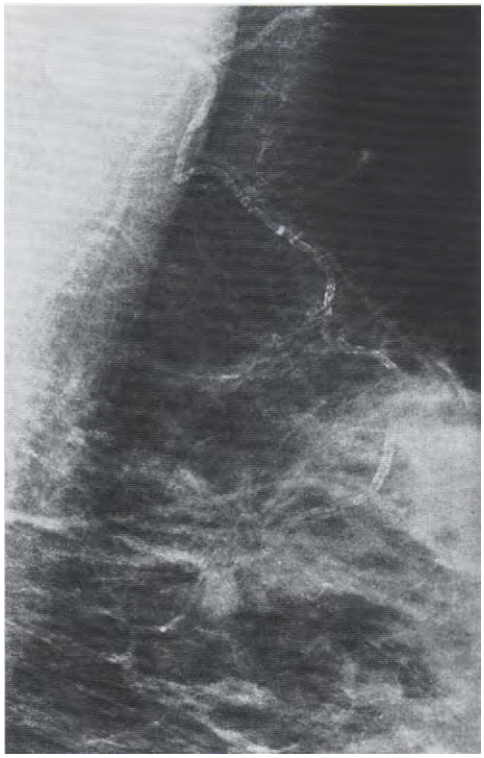
Typical mammographic appearance of a radial scar.

Comment

Even with such a large, superficial lesion, no tumor could be palpated. This supports the diagnosis of a radial scar.

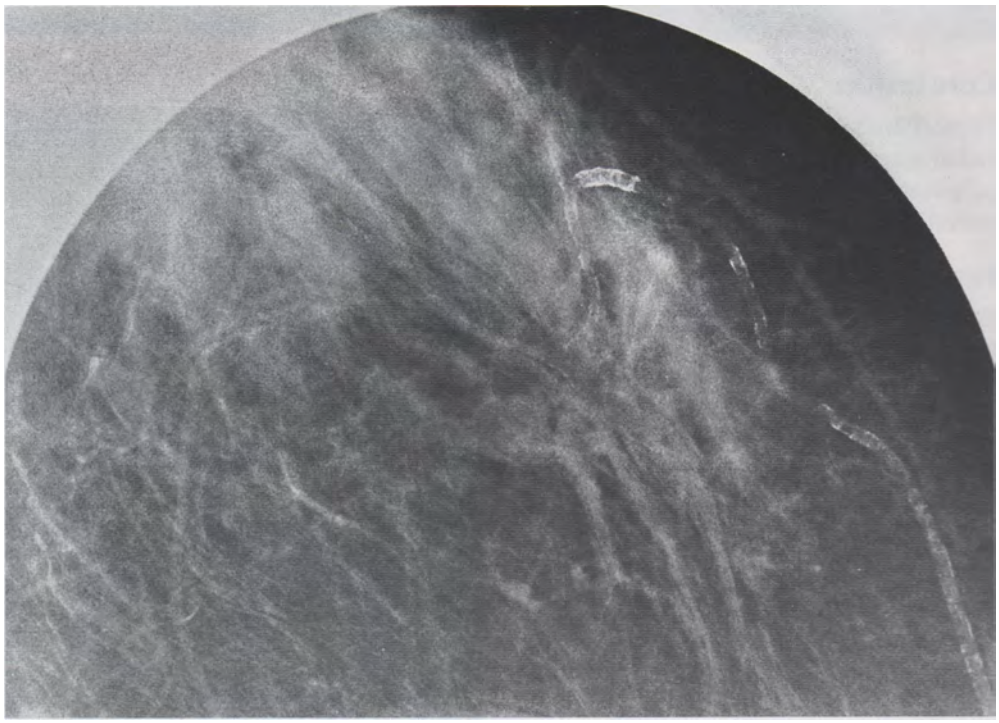
Histology

Radial scar. No evidence of malignancy.



63A

63B



63C

64

Age 52, referred for pain in the right breast.

Physical Examination

No palpable tumor in either breast.

Mammography

Fig. 64 A: Right breast, medio-lateral oblique projection. 7 cm from the nipple at coordinate Al there is a stellate lesion.
Fig. 64B: Right breast, cranio-caudal projection. The stellate lesion is seen at coordinate Al.
Fig. 64 C: Right breast, enlarged view of the medio-lateral projection.

Analysis

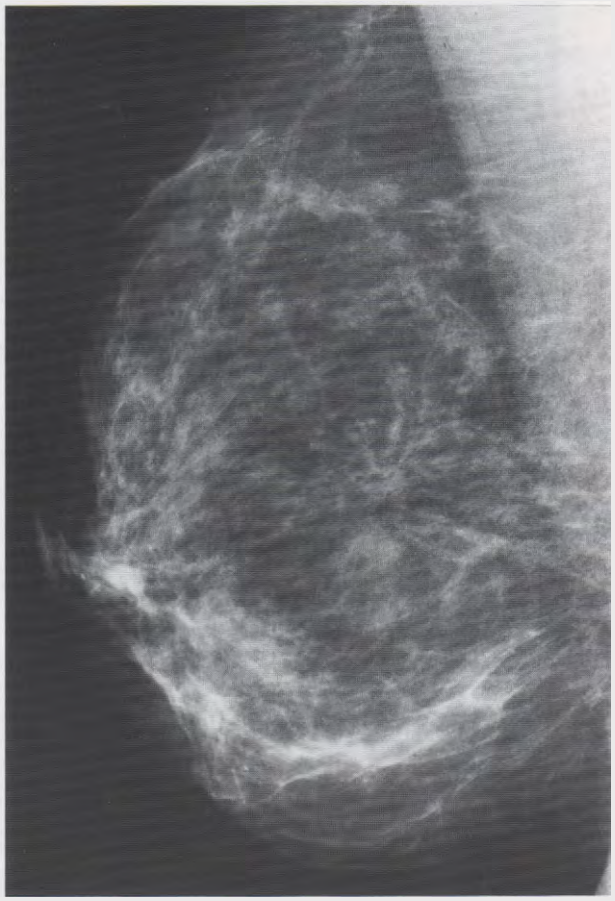
Stellate lesion. No solid tumor center. The appearance of the lesion changes remarkably with the projection. The radiating structure consists of fine linear radiopaque densities bunched together and alternating with linear translucencies.

Conclusion

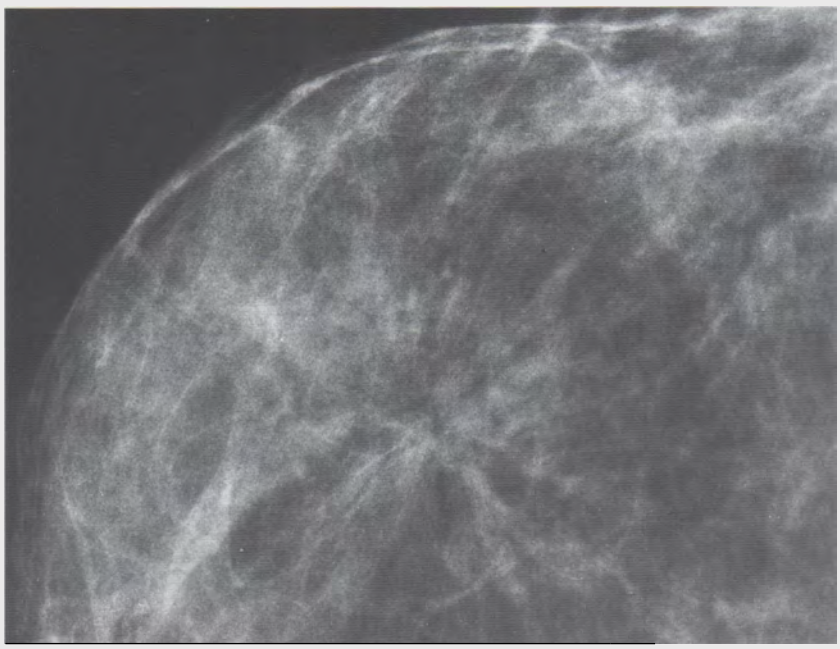
Typical mammographic appearance of radial scar, supported by the absence of palpatory findings. Complete surgical removal is the treatment of choice.

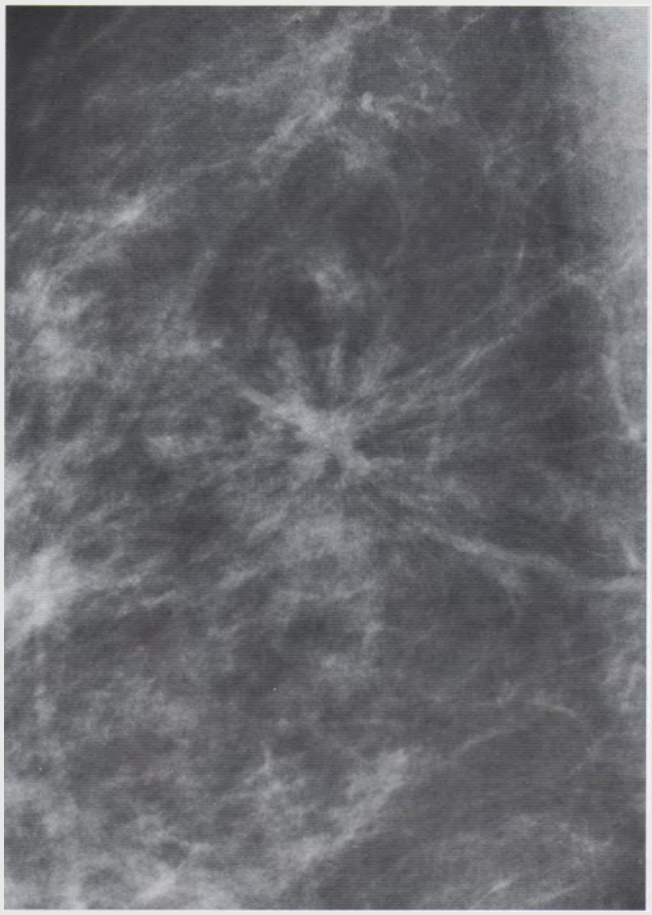
Histology

Radial scar (sclerosing duct hyperplasia). No evidence of malignancy.



64A





64C

65

Asymptomatic 63-year-old woman. First screening examination.

Physical Examination

No palpable tumor in the breasts.

Mammography

Fig. 65 A: Right breast, medio-lateral oblique projection.
Fig. 65 B: Right breast, cranio-caudal projection.
Fig. 65 C: Coned-down view of the cranio-caudal projection.
A stellate tumor is seen 6 cm from the nipple in the lateral half of the breast. No associated calcifications.

Conclusion

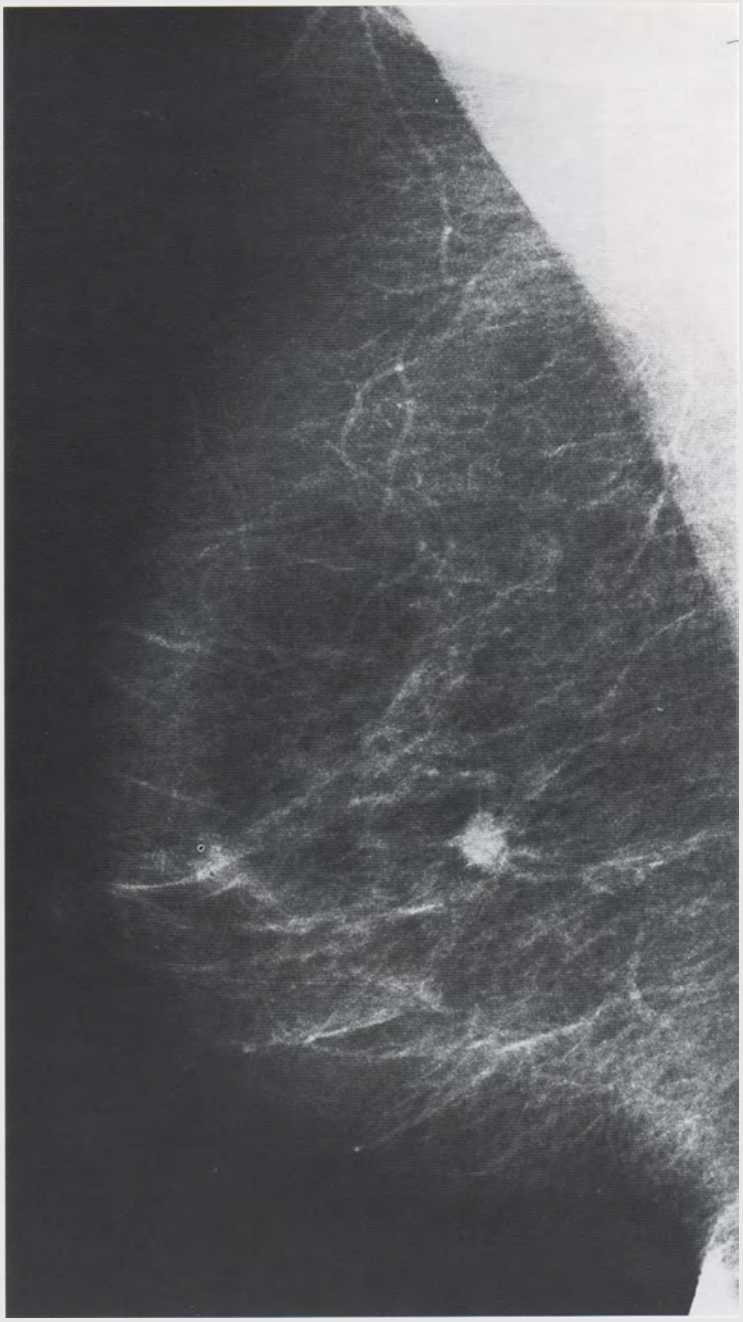
Typical mammographic picture of a small invasive carcinoma. Solid tumor mass, radiating spicules. Since 80-85% of invasive carcinomas smaller than 10 mm are of histologic grade 1 or 2, fine needle aspiration biopsy may not lead to conclusive diagnosis of malignancy. Ultrasound-guided core biopsy (a single shot through the lesion) provides sufficient preoperative information for treatment planning.

Histology

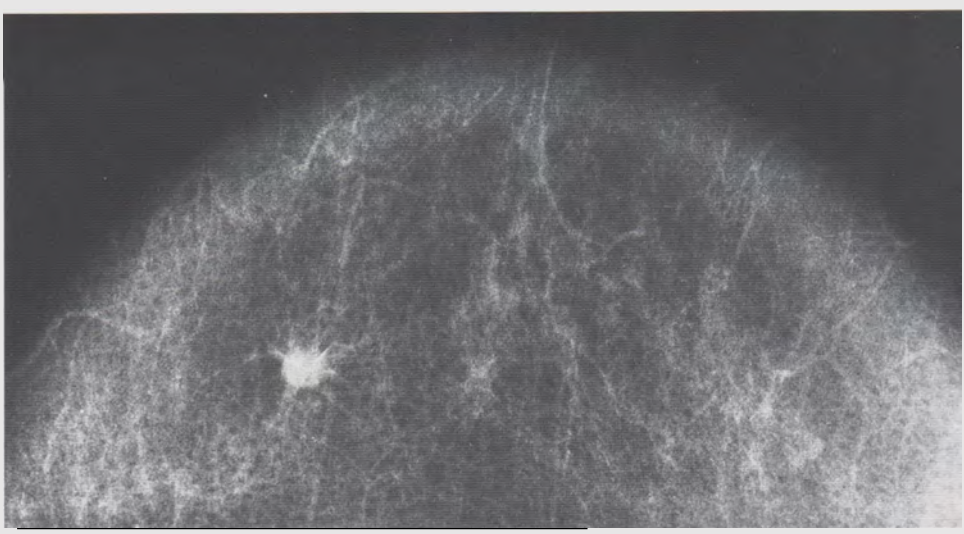
Tubular carcinoma. Size 6 mm. No axillary metastases.
Fig. 65 D: Overview of the tumor. (H & E, 12.5 x)
Fig. 65 E: Detailed view of the tubular carcinoma with a Grade 1 in situ component. (H & E, 200 x)

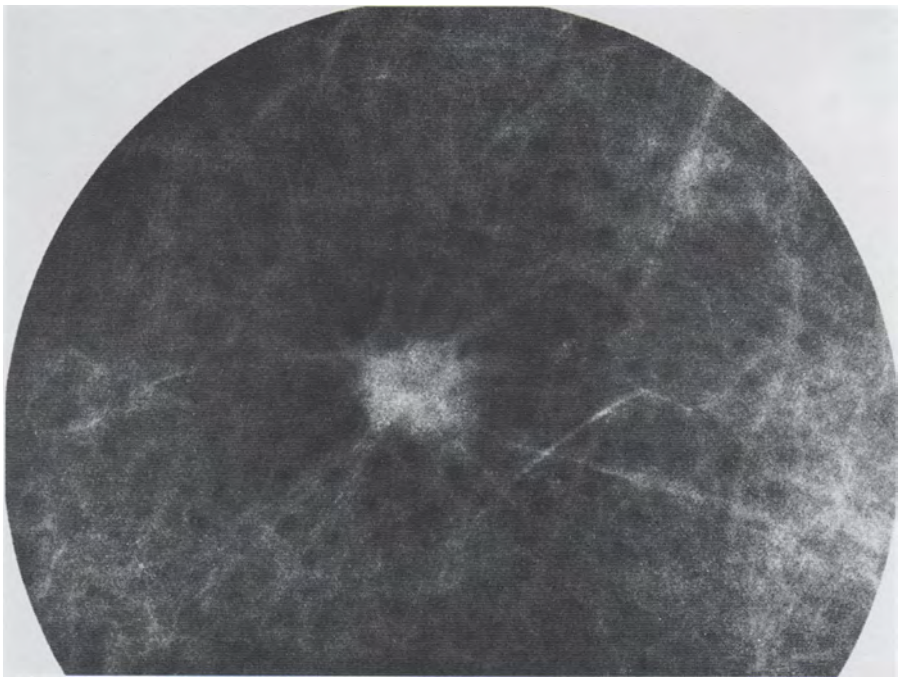
Follow-up

The woman died six years, nine months later from acute myocardial infarction. There was no evidence of breast cancer.

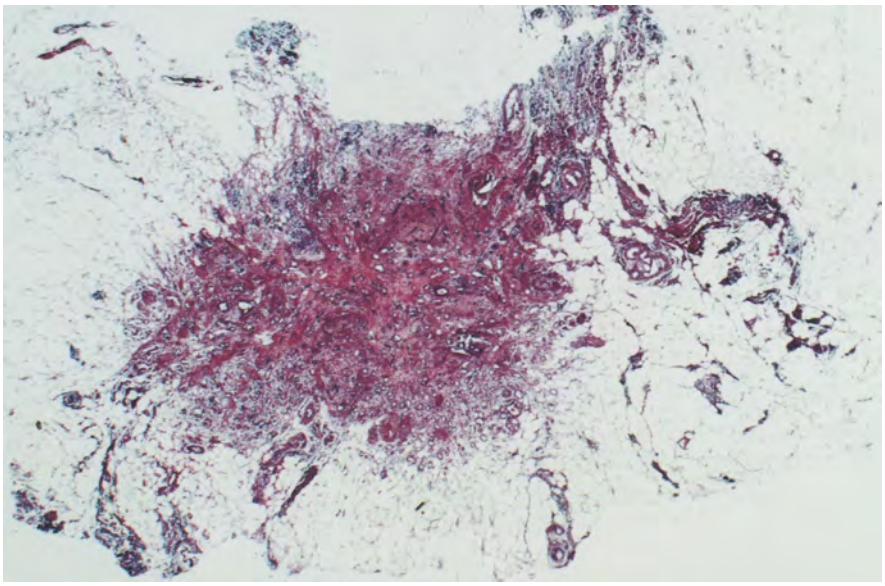


65A

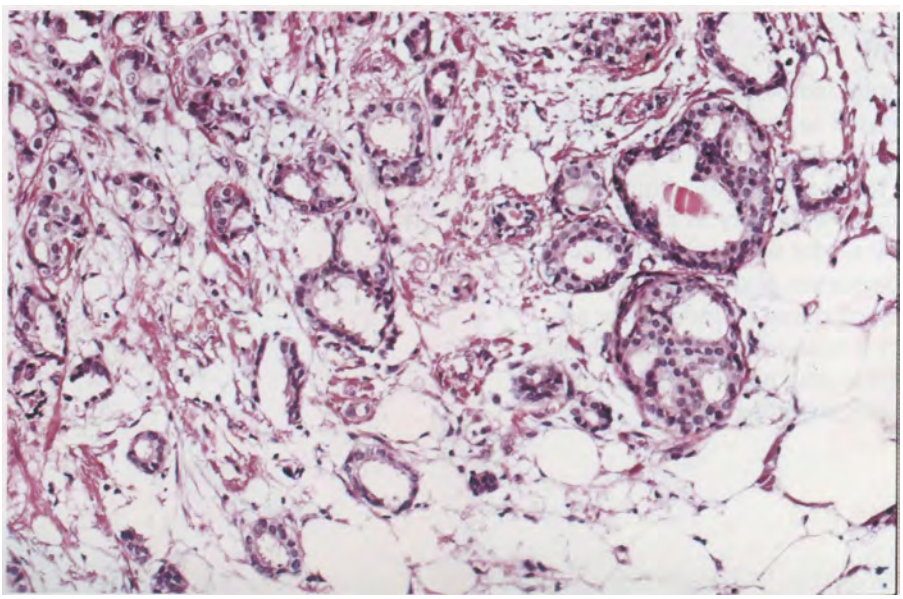




65C



65D



65E

66

Asymptomatic woman, age 66. First screening study.

Physical Examination

No history of trauma, no palpable tumor.

Mammography

Fig. 66A: Right breast, medio-lateral oblique projection: There is a radiating structure 9 cm from the nipple. In addition, calcifications are scattered throughout the breast.

Analysis of the Tumor

Form: stellate, no central tumor mass; instead, the center is radiolucent; the radiating structures are fine, long and bunched together in thick collections like sheaves of wheat
Size: large, difficult to determine, approximately 5 x 4 cm

Conclusion

The combination of the above mentioned mammographic signs is characteristic of radial scar.

Analysis of the Calcifications

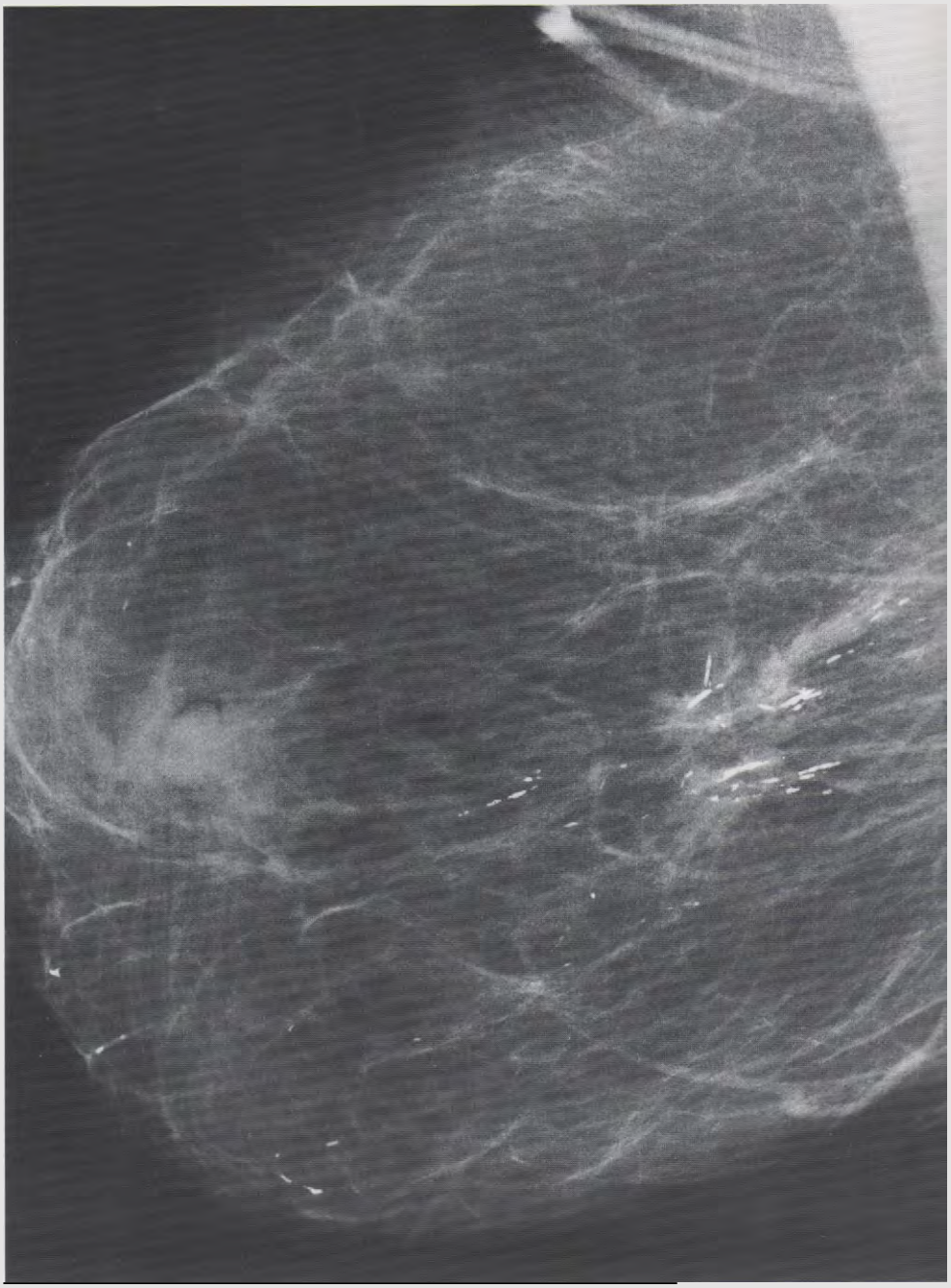
Form: elongated, smooth-bordered, some needle-like
Density: high, uniform
Size: within dilated ducts
Distribution: along the course of the ducts

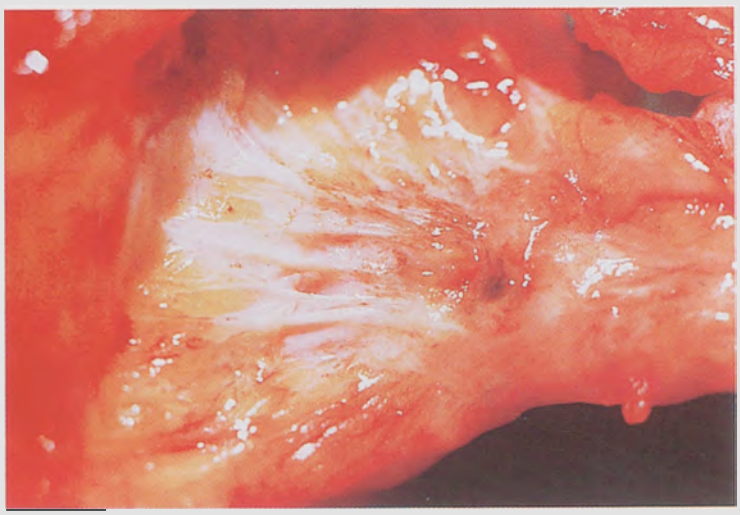
Conclusion

Typical picture of calcifications resulting from plasma cell mastitis.

Comment

Benign tumor and benign-type calcifications unrelated to each other. Although **the** mammographic picture is characteristic of radial scar, detailed histologic examination is necessary as in all stellate lesions. The tumor was excised in toto.
Fig. 66B: Specimen photograph. Note the thick radiating tissue strands. There appears: to be a hole in the center of the lesion corresponding to the radiolucent center on the mammogram.





66B

Histology

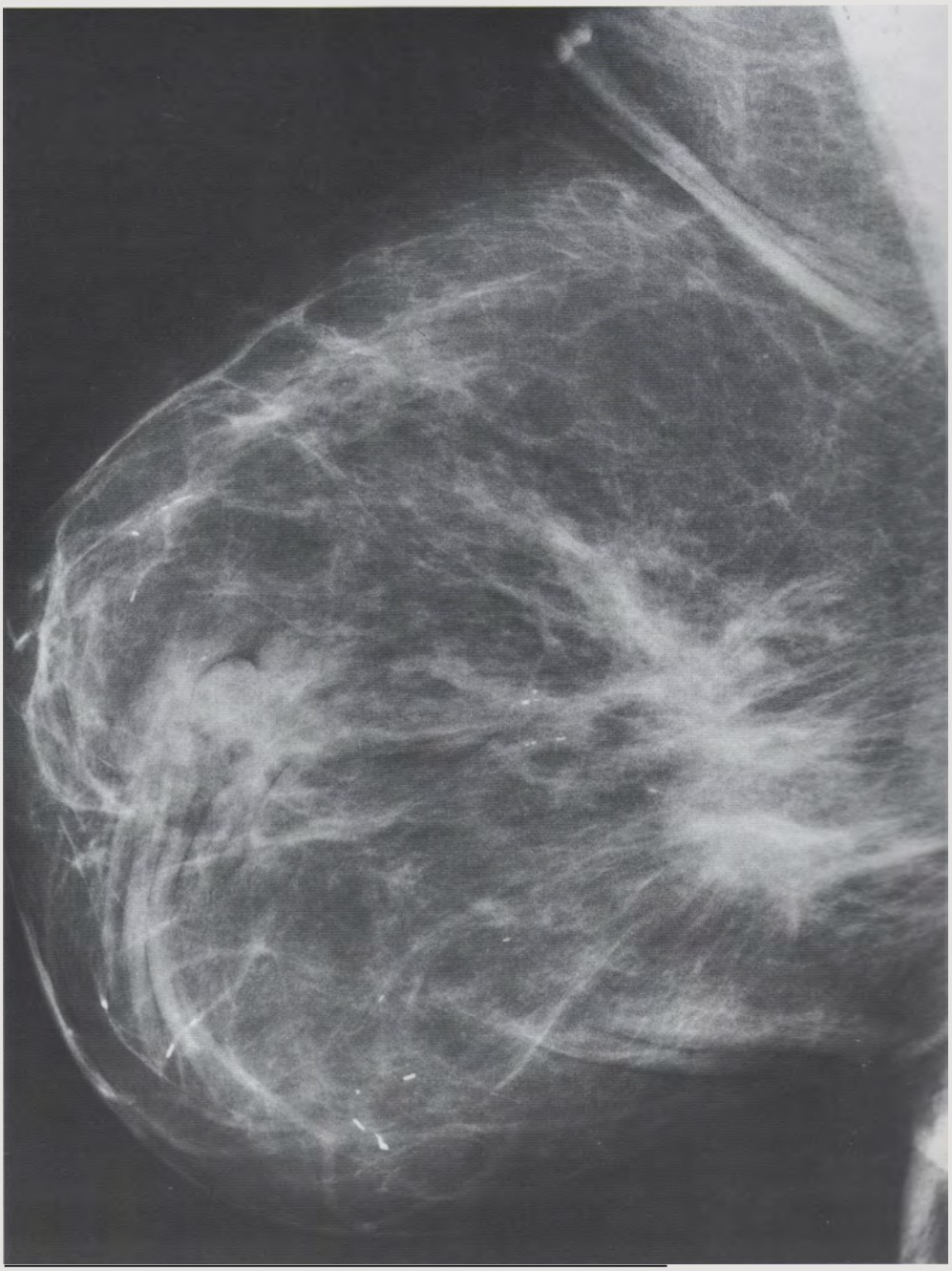
Radial scar. No evidence of malignancy. Fig. 66 C: Right breast (same case six months later). A palpable tumor has developed at the site of operation. Medio-lateral-oblique projection: the palpable tumor corresponds to the large, stellate density on the mammogram. Re-operation.

Histology

Traumatic fat necrosis. No evidence of malignancy.

Follow-up

The woman died eight years later in septicemia at age 74. There was no evidence of breast cancer.



67

Age 63.

Physical Examination

A hard, freely movable lump was palpated in the upper inner quadrant of the right breast. No history of trauma.

Mammography

Fig. 67A & B: Right breast, medio-lateral oblique and cranio-caudal projections. There is a large stellate tumor in the upper inner quadrant of the breast with associated calcifications.
Fig. 67 C: Spot magnification view, cranio-caudal projection.

Analysis

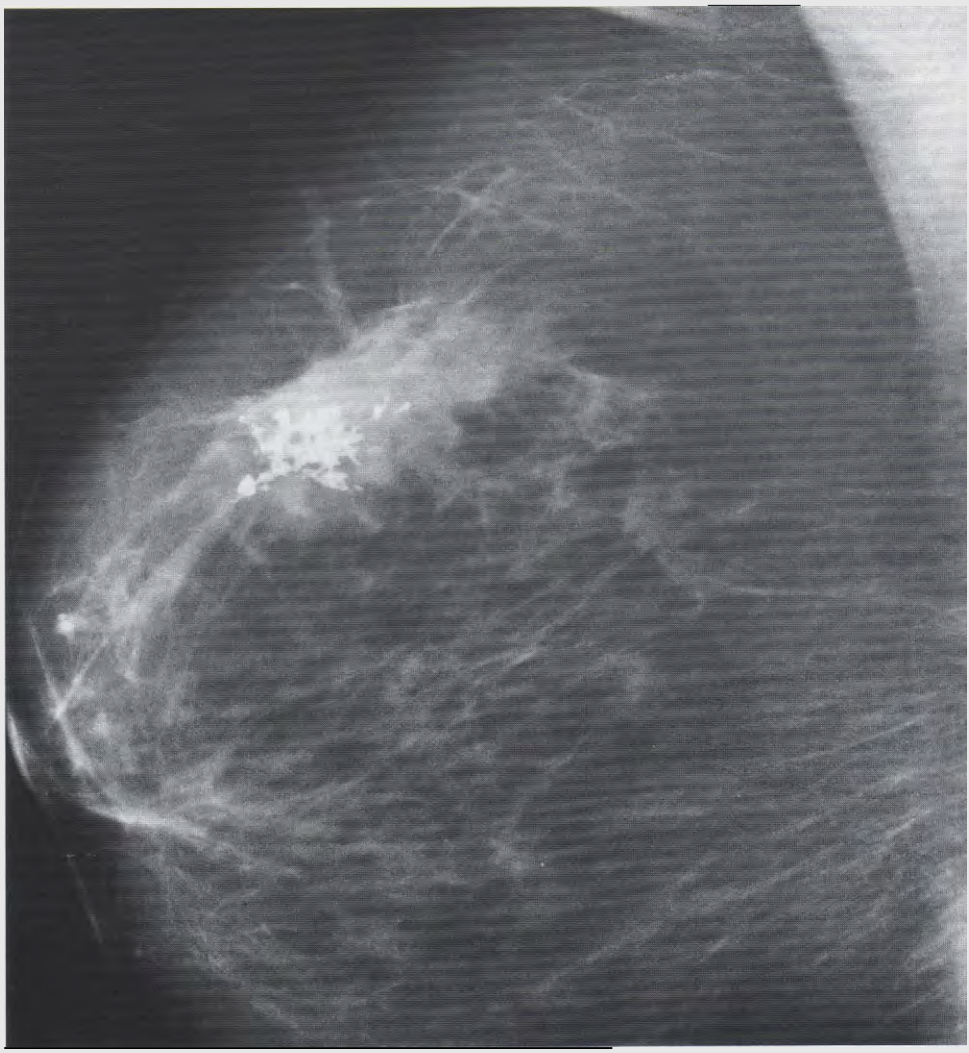
The radiating structure consists of thick collections of tissue strands. There are coarse calcifications at the center of the stellate lesion.

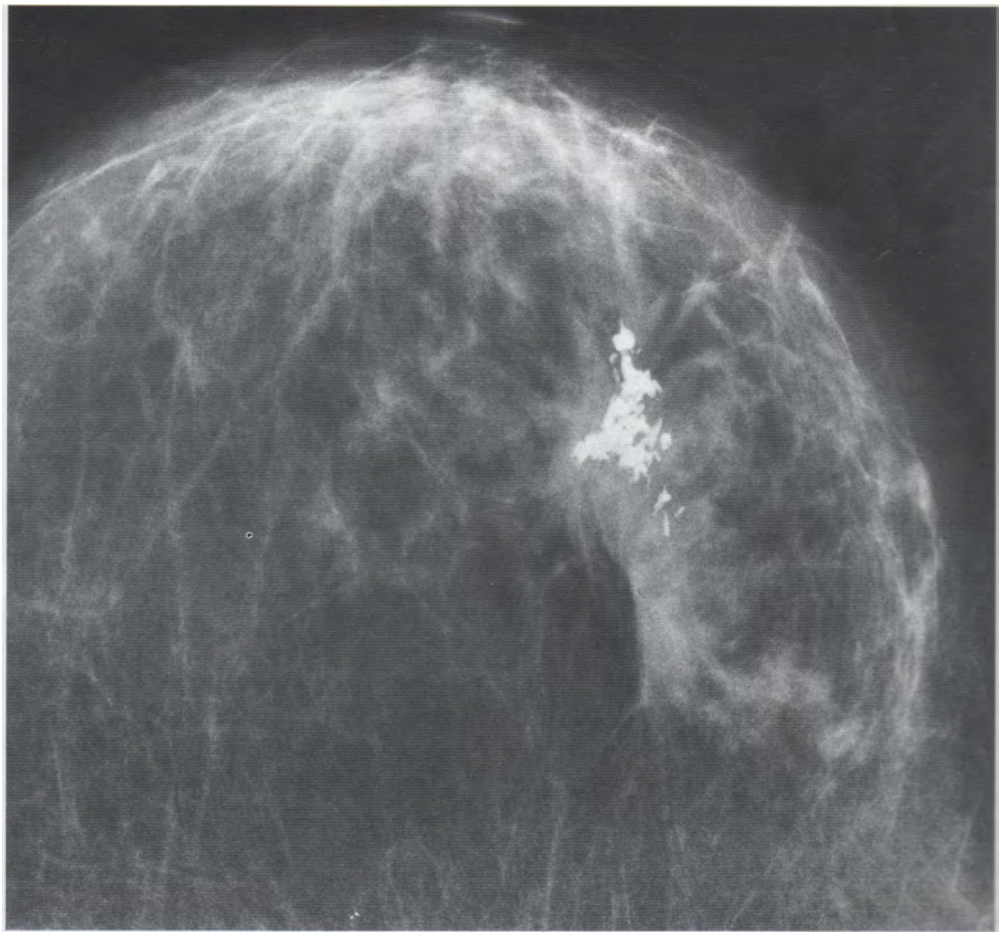
Conclusion

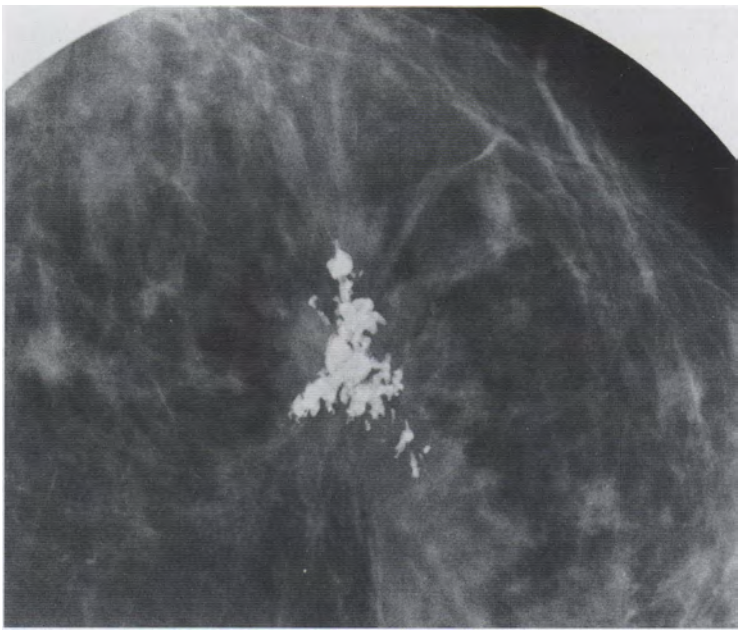
This radiating structure differs from that seen with malignant tumors. The associated calcifications are of the benign type. This large region of architectural distortion, although superficial, does not cause skin changes. The mammographic image is nonspecific and the calcifications are of a benign type. Whenever a radiating structure is palpable, the lesion must be considered suspicious for malignancy.

Histology

Radial scar (sclerosing duct hyperplasia). No evidence of malignancy.







67C

68

Age 45, history of repeated aspirations from a large cyst in the right breast.

Mammography

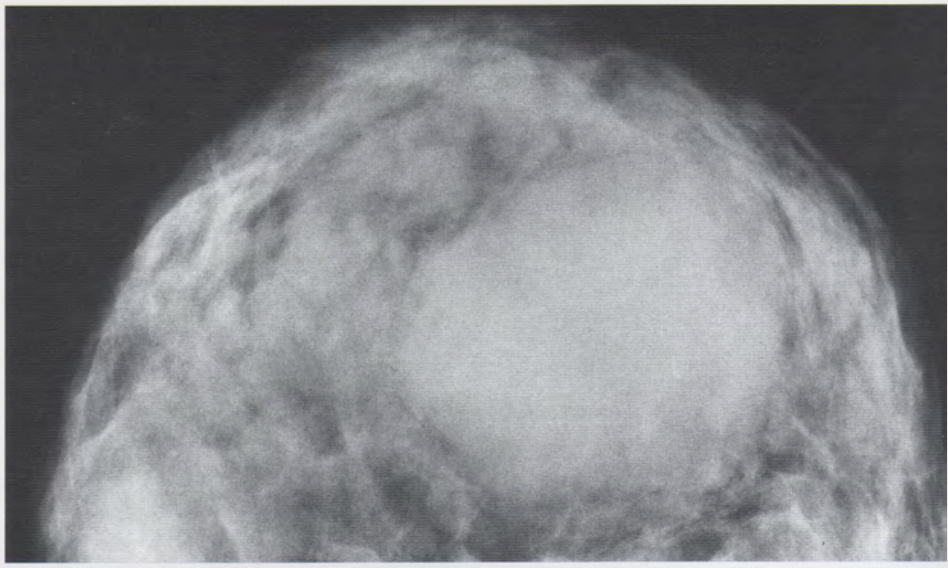
Fig. 68 A: Right breast, cranio-caudal projection. The large circular lesion in the medial half of the breast corresponds to a recurrent cyst. The patient requested surgical removal of the cyst.
Fig. 68 B: Right breast, cranio-caudal projection six months after operation. A large, stellate lesion is seen at the site of operation. No associated calcifications.
Fig. 68 C: Right breast, cranio-caudal projection two years after operation. Reduction in size of the stellate lesion.

Analysis

Center of the lesion (Fig. 68 C): This has become so indistinct that it is difficult to locate. There are circular and oval translucencies in the lesion (arrows).
Radiating structure: Much less apparent.

Comment

This case demonstrates the typical appearance and regression of traumatic (postsurgical) fat necrosis. Any palpable stellate lesion or architectural distortion should raise the suspicion of a malignant tumor. Radial scars are rarely palpable and never cause gross skin changes, and can thus be excluded in this case.
This stellate lesion has arisen at the site of the previous surgical biopsy. Traumatic fat necrosis resulting from secondary healing is the only non-malignant differential diagnostic option. Microscopic diagnosis is necessary for differentiation.



69

Age 67. First screening study. History of right breast operation for a benign lesion 25 years earlier. Retraction of skin and a focal, thick scar at the site of operation, unchanged for many years.

Mammography

Fig. 69A & B: Right breast, medio-lateral oblique and detailed view of the cranio-caudal projection. There is a stellate lesion in the lower outer quadrant with central calcifications and associated skin retraction.

Analysis

Tumor center: There is a definite tumor mass, which contains lucent areas. The appearance of the tumor changes with projection.
Radiating structure: On the cranio-caudal projection (Fig. 69 B), radiolucent linear structures from part of the stellate lesion. The overlying skin is thickened and retracted.
Calcifications: Coarse, highly dense, centrally located, mammographically of the benign type.

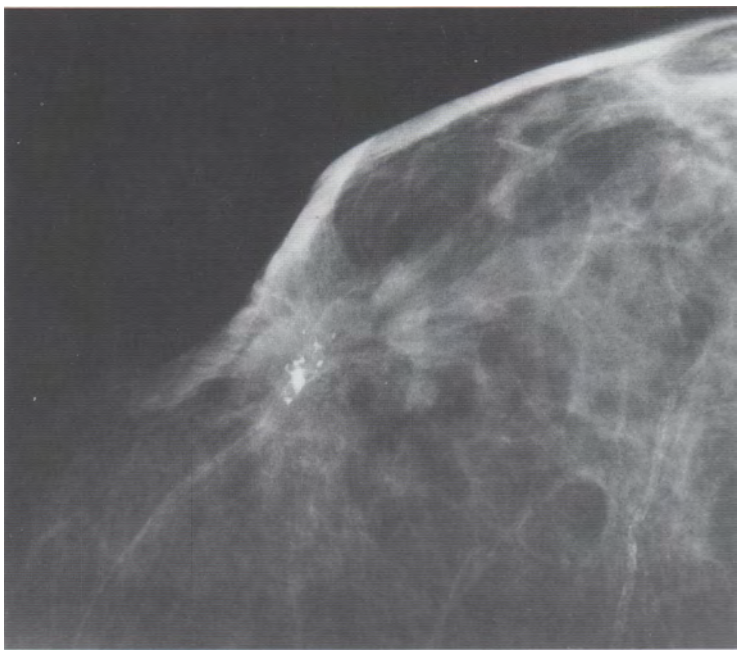
Comment

A stellate lesion on the mammogram which changes its appearance with projection and contains central translucencies (either linear, oval or circular) is characteristic of the cancer-mimicking benign stellate lesions: radial scar and the stellate form of traumatic fat necrosis. The history may help in differentiation, as in this case.

Histology

Foreign body granuloma.

69A



69B

70

Asymptomatic 70-year-old woman. First screening examination.

Physical Examination

No palpable tumor in the breasts.

Mammography

Fig. 70A — C: Voluminous right breast which required three 18 x 24 cm films for one medio-lateral oblique projection.
Fig. 70D: Right breast, cranio-caudal projection. A small tumor is seen at coordinate Al in these four mammograms.
Fig. 70E: Microfocus magnification view, cranio-caudal projection. The tumor is seen at coordinate Al.

Analysis

Central tumor mass with long radiating spicules. No associated calcifications. Mammographically malignant tumor.

Histology

Infiltrating ductal carcinoma, size 7 mm. No axillary lymph node metastases.

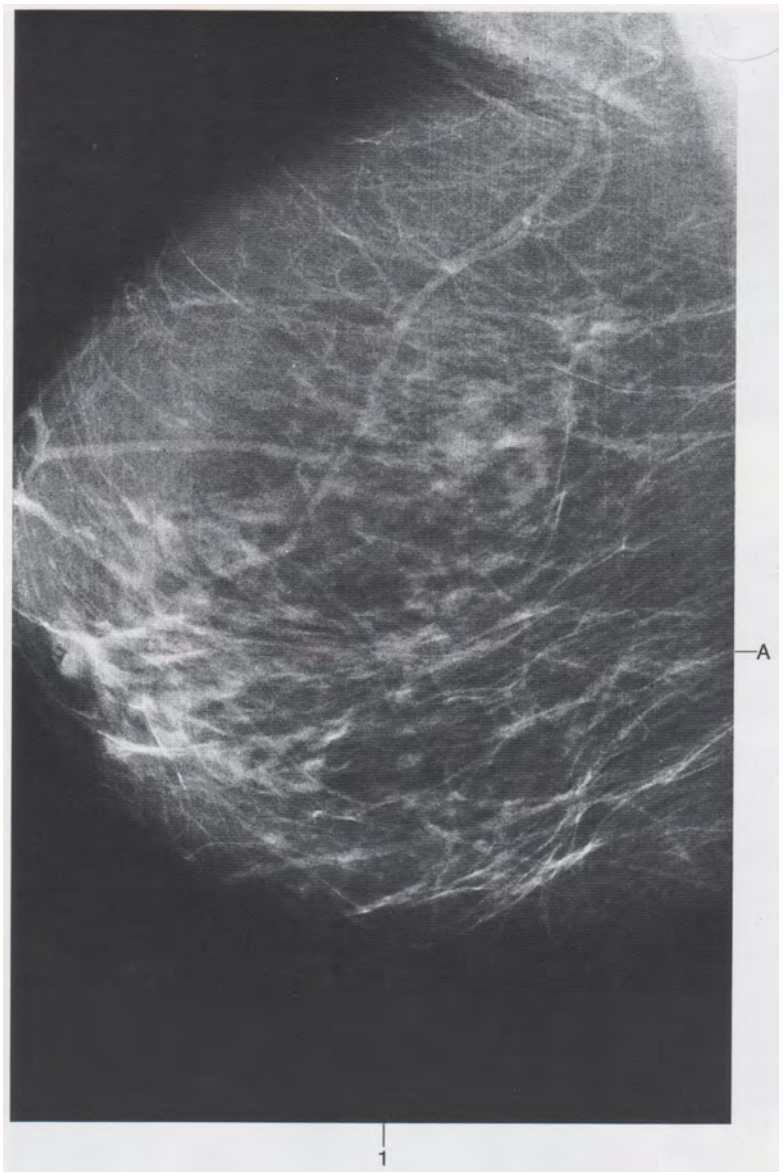
Comment

There are a number of other radiopaque, poorly-defined parenchymal structures in this breast (adenosis). Only the tumor, with its radiating spicular structure, is abnormal.

Follow-up

The woman died 13 years later from myocardial infarction at age 83. There was no evidence of breast cancer.

70A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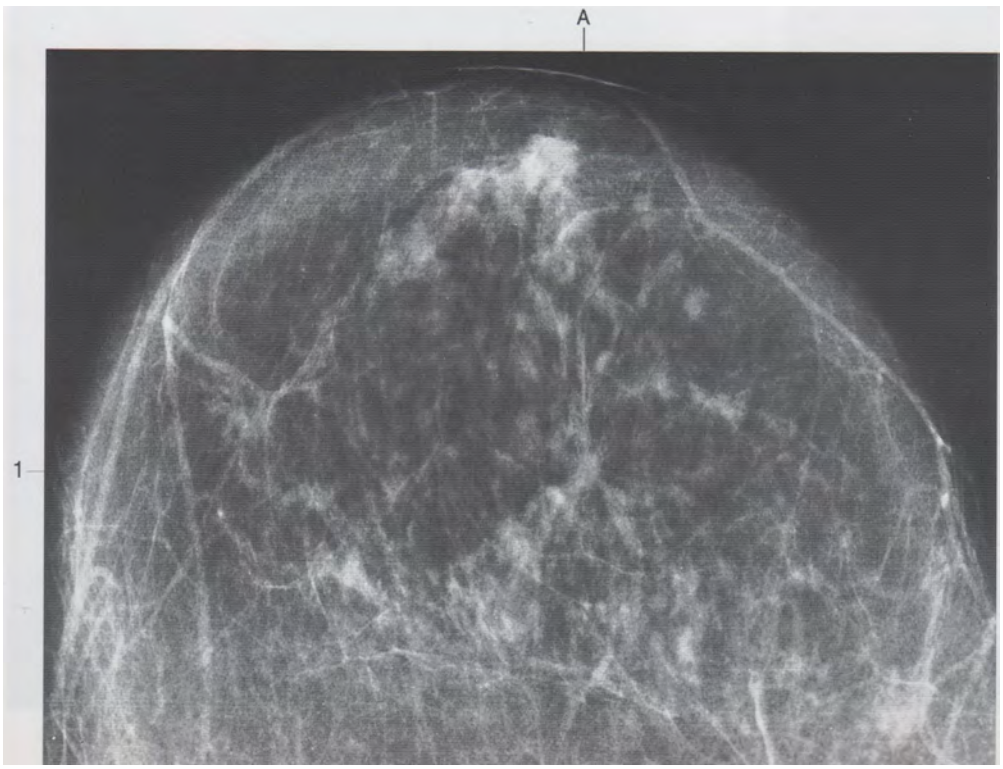
A
1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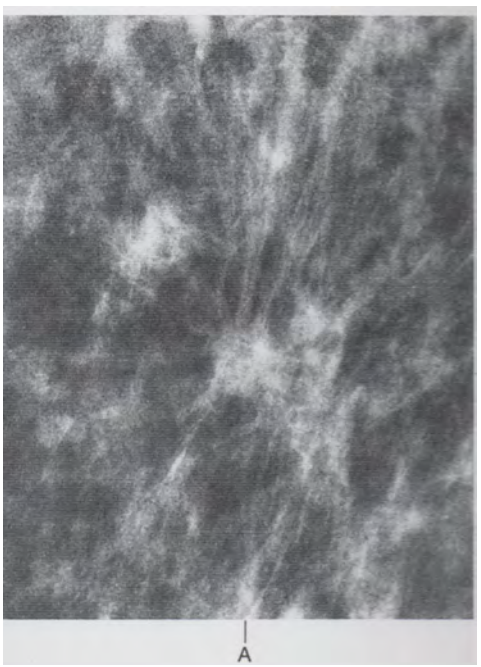

A

71

Age 60.

Physical Examination

3 cm lump detected laterally in the left breast, clinically suspicious for malignancy.

Mammography

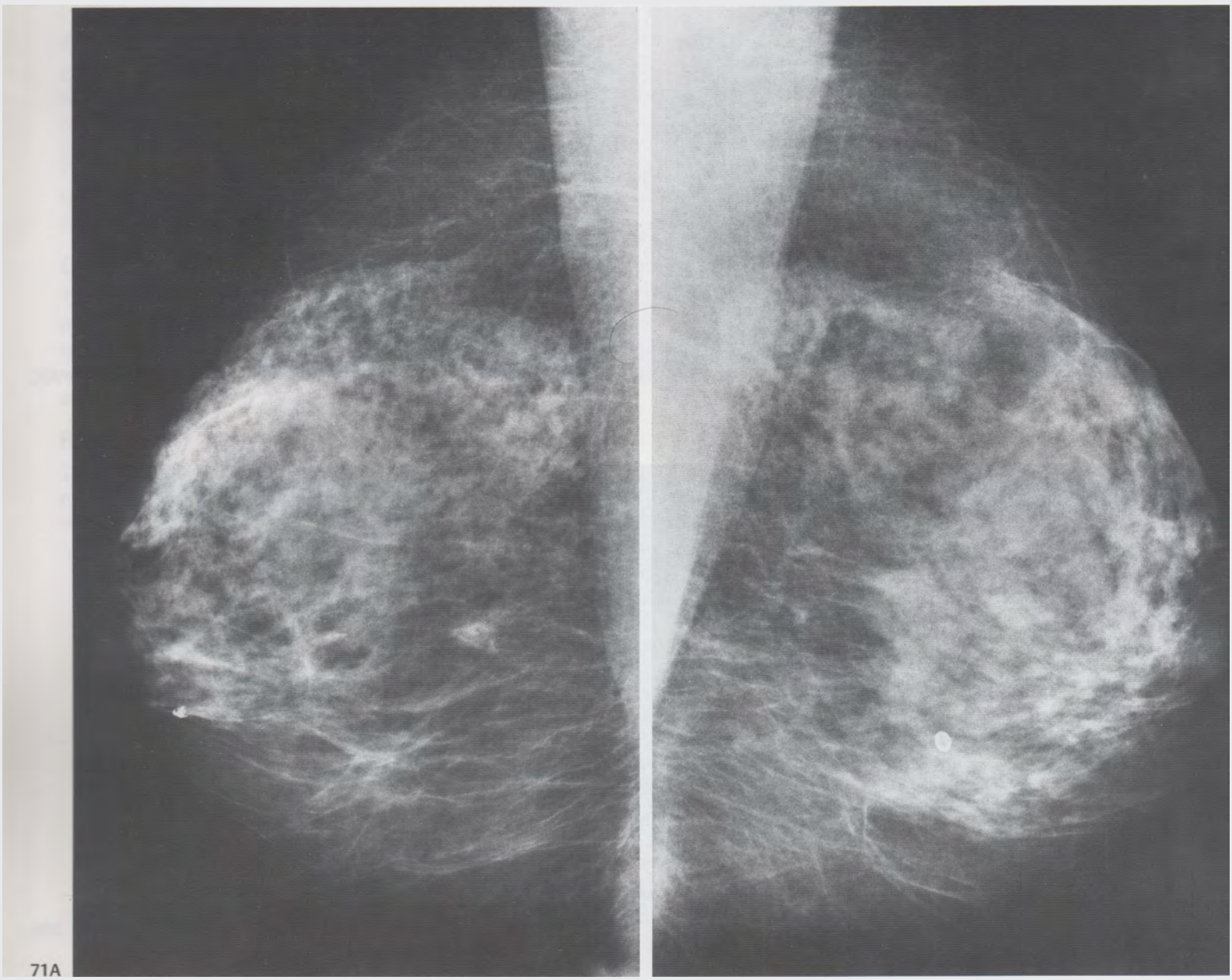
Fig. 71 A & B: Right and left breasts, medio-lateral oblique projections.
Fig. 71 C: Left breast, cranio-caudal projection.
Fig. 71 D & E: Spot compression with microfocus magnification, cranio-caudal projection. At coordinate Al in Fig. 71 B & C there is a 2-cm stellate tumor. No associated calcifications.

Analysis

(Best on the spot compression views) Stellate tumor with a central tumor mass, size 15 x 15 mm. The spicules are short. The overlying parenchyma is dens€ and obscures much of the tumor.

Conclusion

Mammographically malignant tumor.

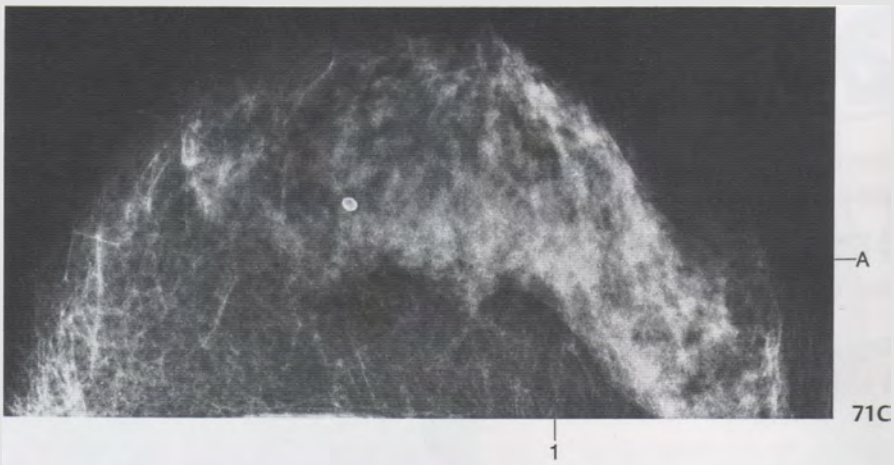


Comment

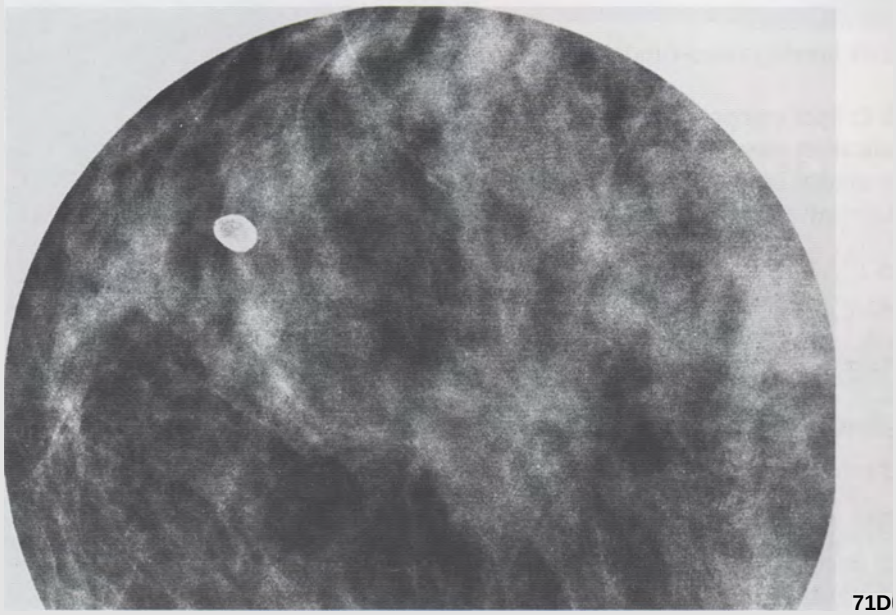
This case is a problem in perception rather than in analysis. The tumor can be detected on the medio-lateral oblique projection by oblique masking, caudal aspect (see Chapter II). Retraction of the posterior parenchymal border on the cranio-caudal projection (Fig. 71 C) produces the "tent sign" (see Chapter II).

Histology

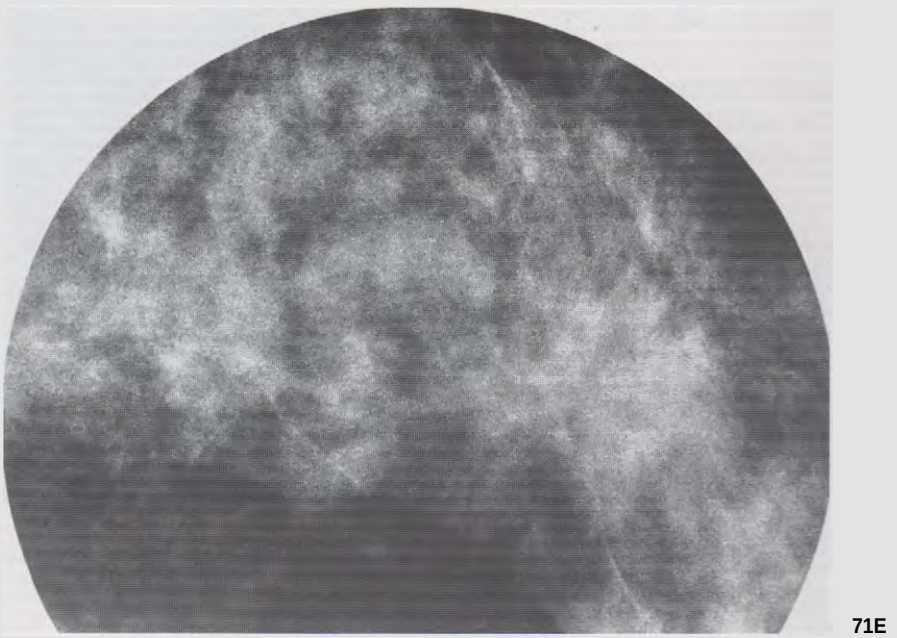
Infiltrating ductal carcinoma. No axillary lymph node metastases.



71C



71D



71E

72

Asymptomatic 71-year-old woman. First screening examination.

Physical Examination

No palpable tumor.

Mammography

Fig. 72 A & B: Right and left breasts, medio-lateral oblique projections. Normal right breast. At coordinate Al there is a small stellate tumor with no associated calcifications.
Fig. 72 C: Left breast, cranio-caudal projection.
Fig. 72 D & E: Spot compression microfocus magnification views, cranio-caudal and latero-medial projections.
Fig. 72 F: Operative specimen.

Analysis

Form: stellate; small tumor mass with surrounding spicules
Size: less than 10 mm

Conclusion

Mammographically malignant tumor.

Histology

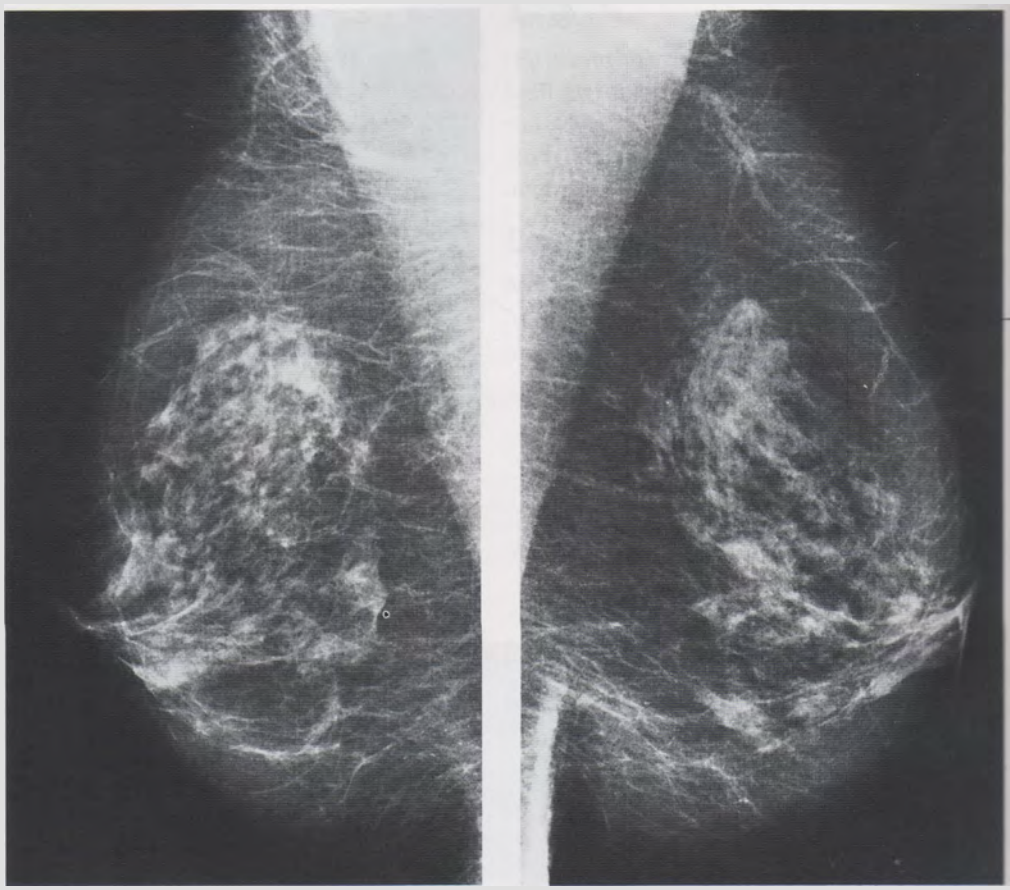
Infiltrating ductal carcinoma. No axillary lymph node metastases.
Fig. 72 G: Overview of the tumor. (H & E, 12.5x)

Comment

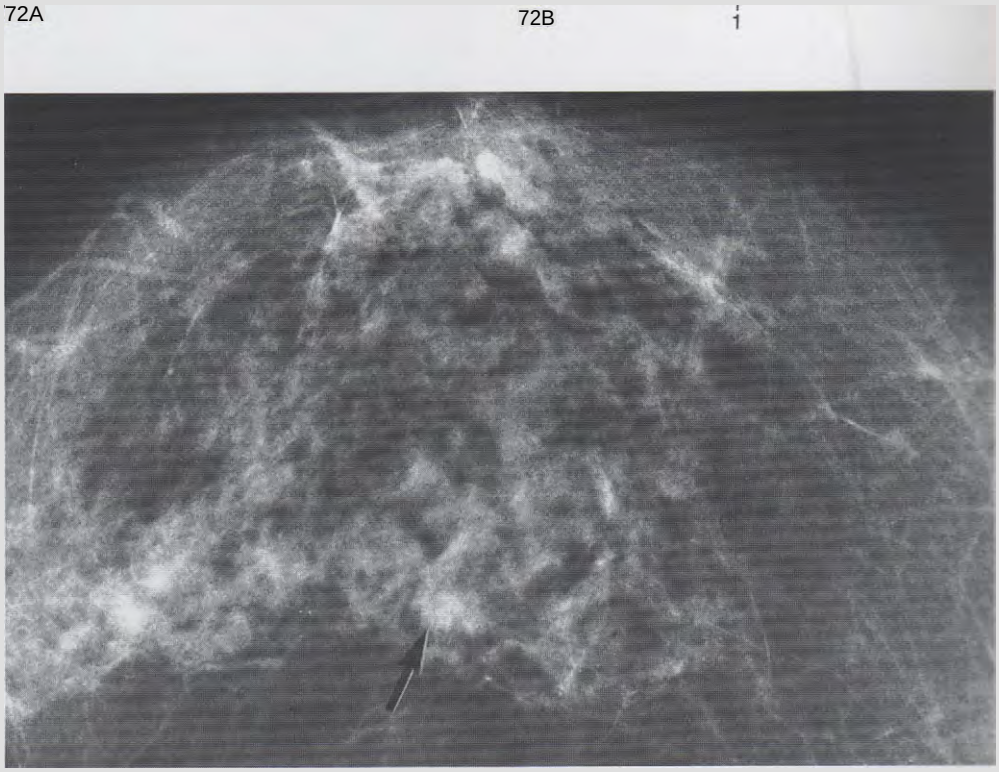
This case represents a problem in perception, which can be solved by horizontal masking, cranial aspect (see Chapter II).

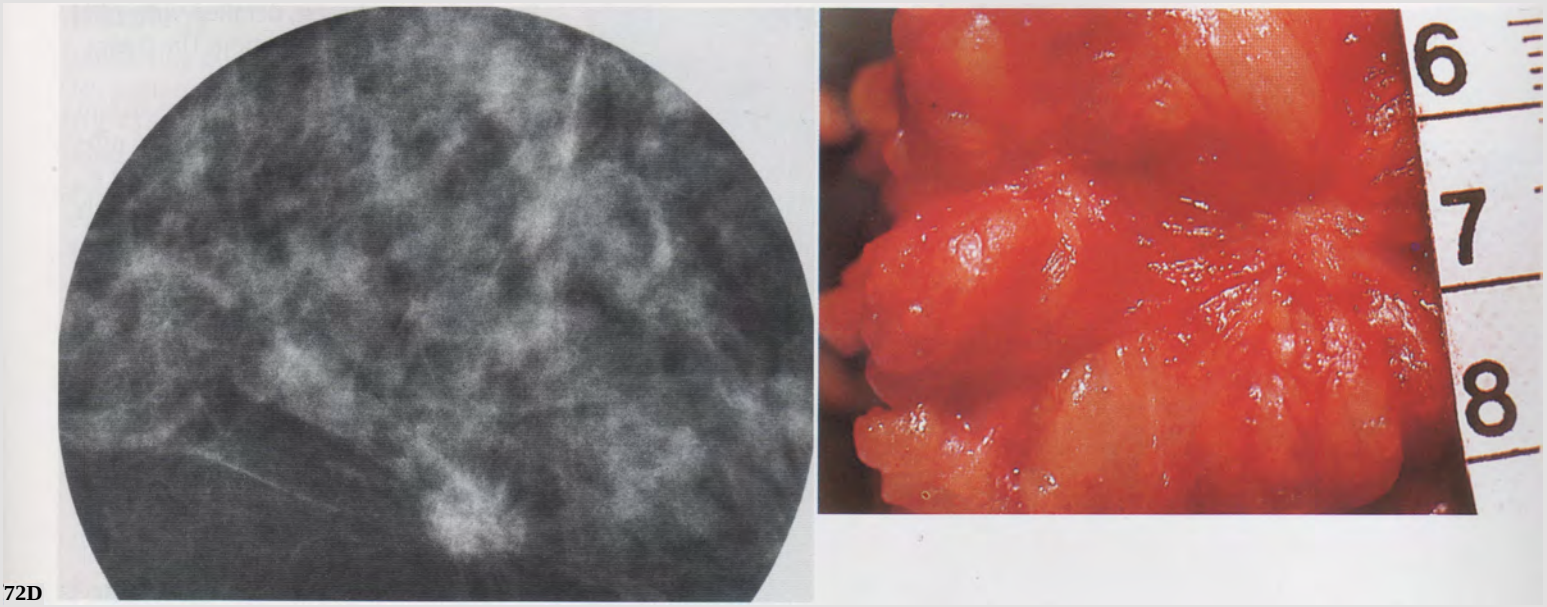
Follow-up

The woman was still alive 21 years later at age 92, with no evidence of breast cancer.

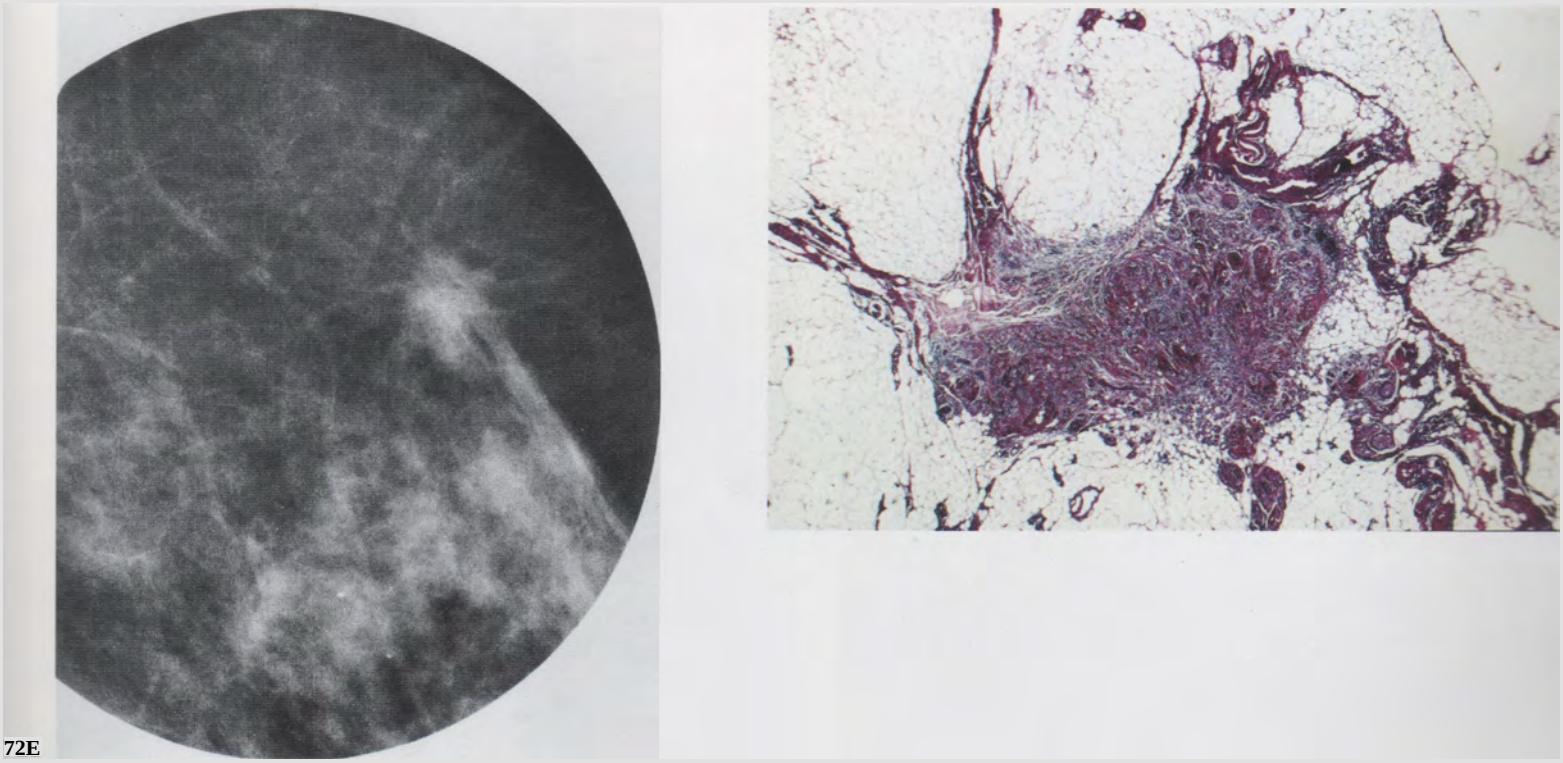


72A 72B





72D



72E

73

Asymptomatic 68-year-old woman. First screening study.

Physical Examination

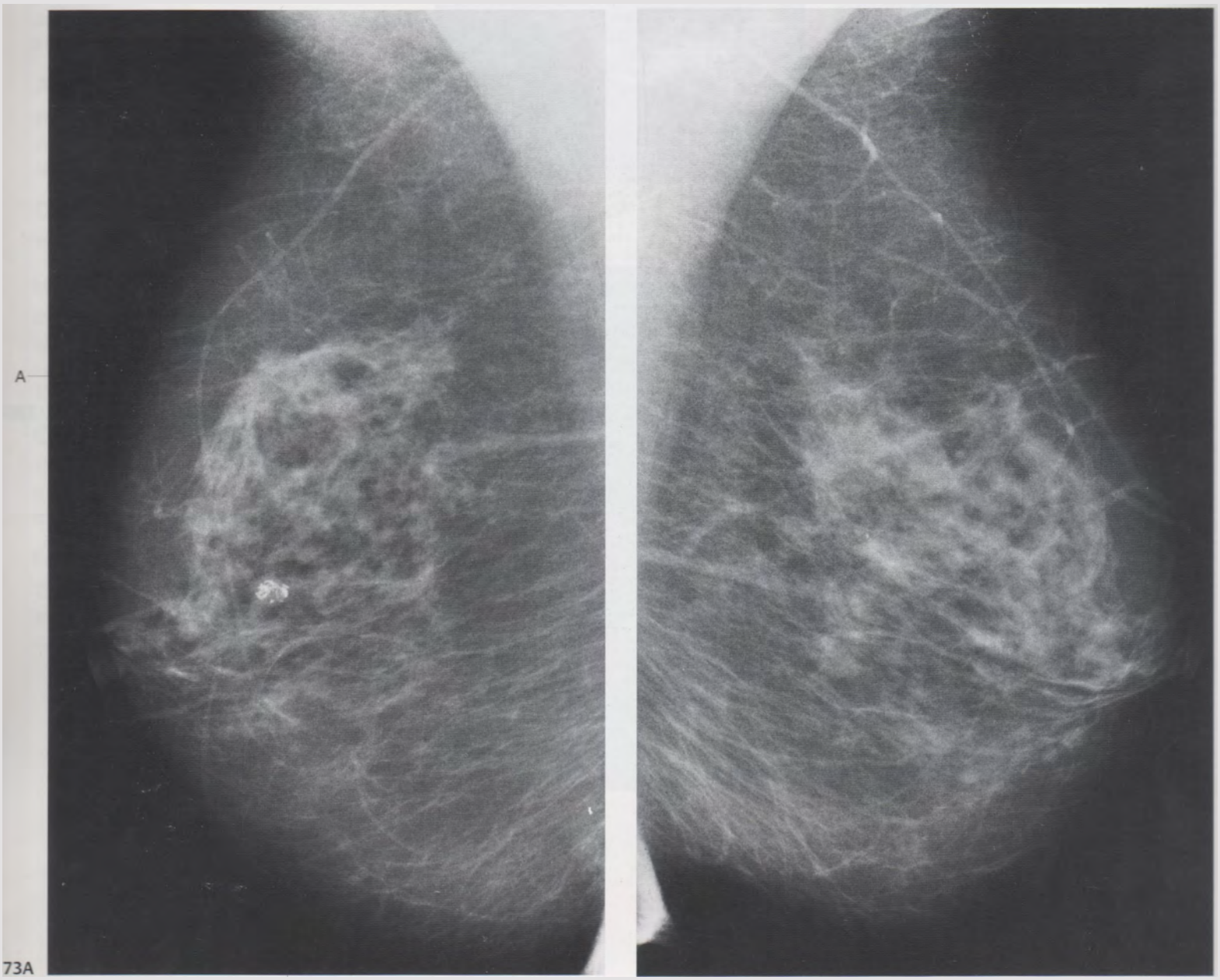
With knowledge of the mammogram a tumor could be vaguely palpated in the upper outer quadrant of the right breast.

Mammography

Fig. 73A: Right breast, medio-lateral oblique projection. A tumor is seen at coordinate Al. There are coarse calcifications not associated with the tumor 4 cm from the nipple.
Fig. 73 B: Left breast, medio-lateral oblique projection. No mammographic abnormality.
Fig. 73 C: Right breast, detailed view of the cranio-caudal projection. The tumor is located at coordinate Al.
Fig. 73 D: Right breast, microfocus magnification view, medio-lateral oblique projection. There is a stellate tumor with a distinct central mass, size approximately 10 mm, surrounded by long, sharp spicules.

Conclusion

Typical mammographic appearance of a stellate malignant tumor. The calcifications 4 cm from the nipple are coarse and of the benign type, typical of a hyalinized fibroadenoma.



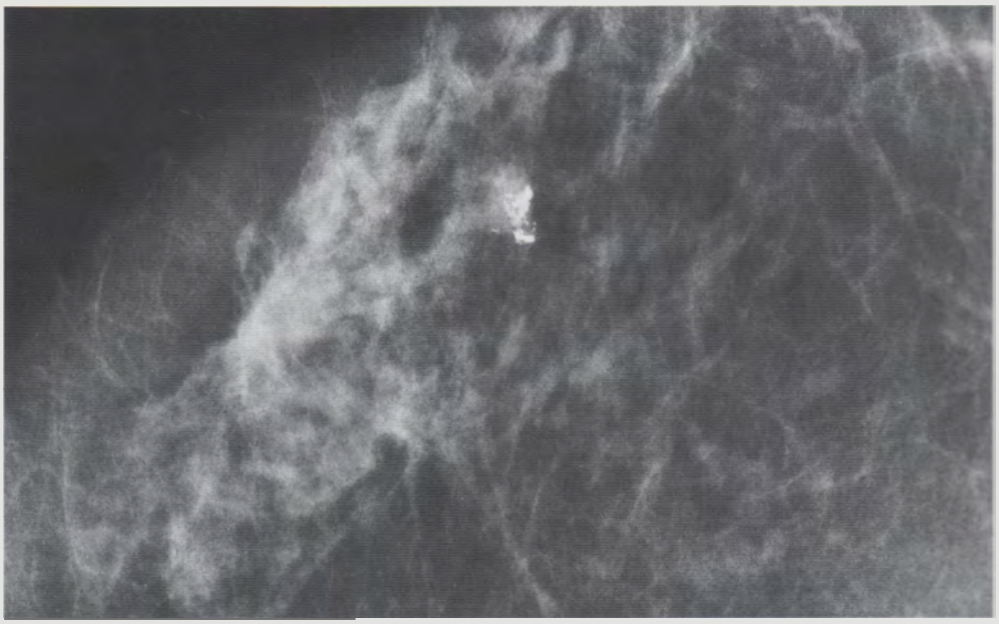
Histology

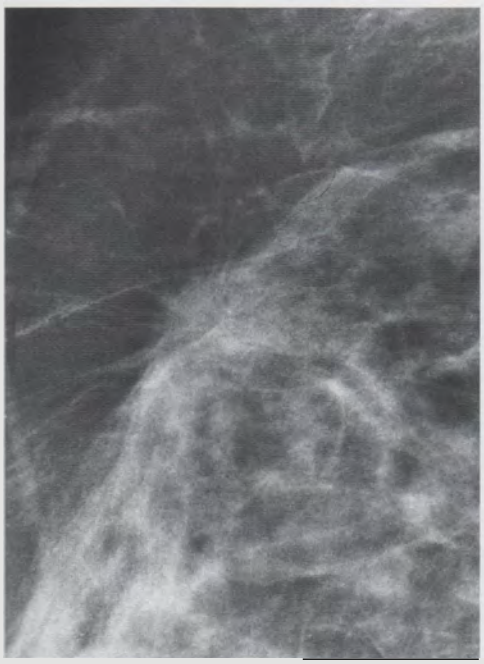
Infiltrating ductal carcinoma, size 10 mm. No axillary lymph node metastases.
Fig. 73 E: Overview of the tumor using an immunohistochemical stain for estrogen receptors. More than half of the nuclei express receptor positivity through brown staining. (12.5 x)
Fig. 73 F: Detailed view of the spiculated contour. The spicules contain Grade 1 ductal carcinoma in situ, which also stains positively for estrogen receptors. (100 x)
Fig. 73 G: Higher magnification of one spicule. (200 x)
Fig. 73 H: The invasive component of the tumor. (200 x)

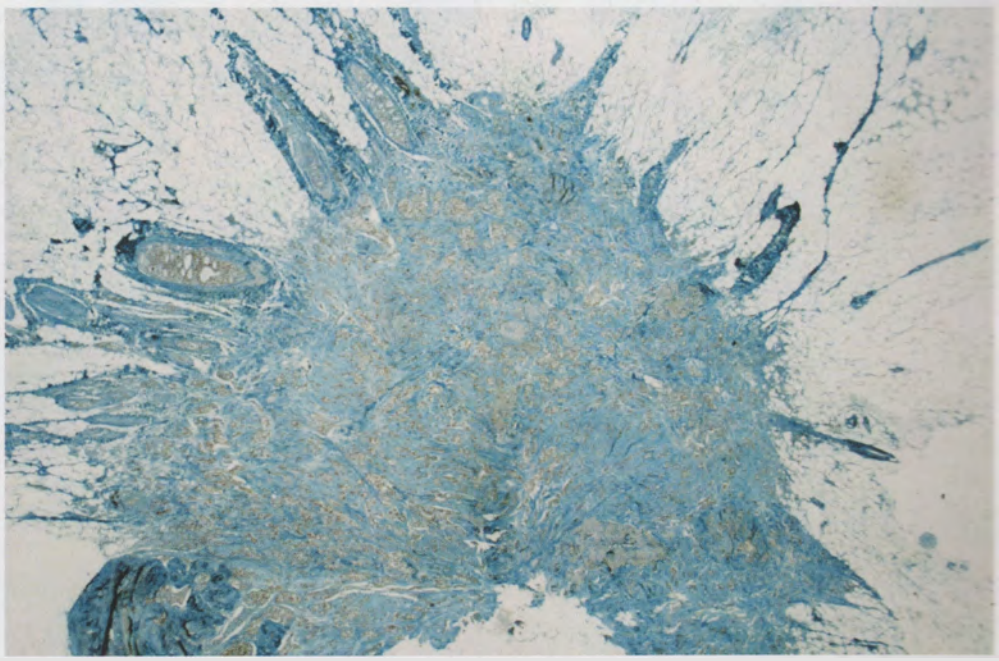
Follow-up

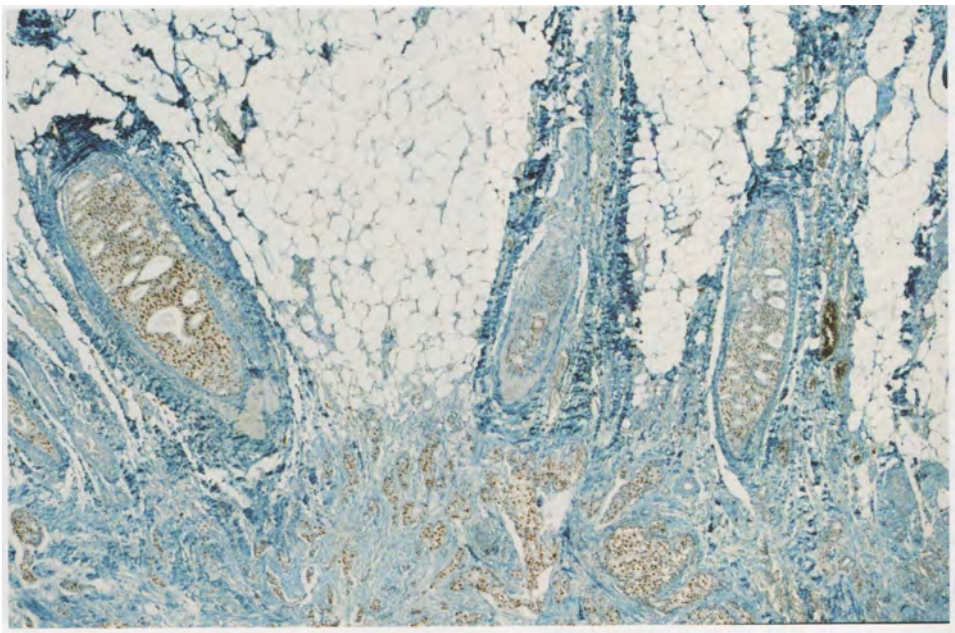
The woman was still alive 20 years later at age 88, with no evidence of breast cancer.

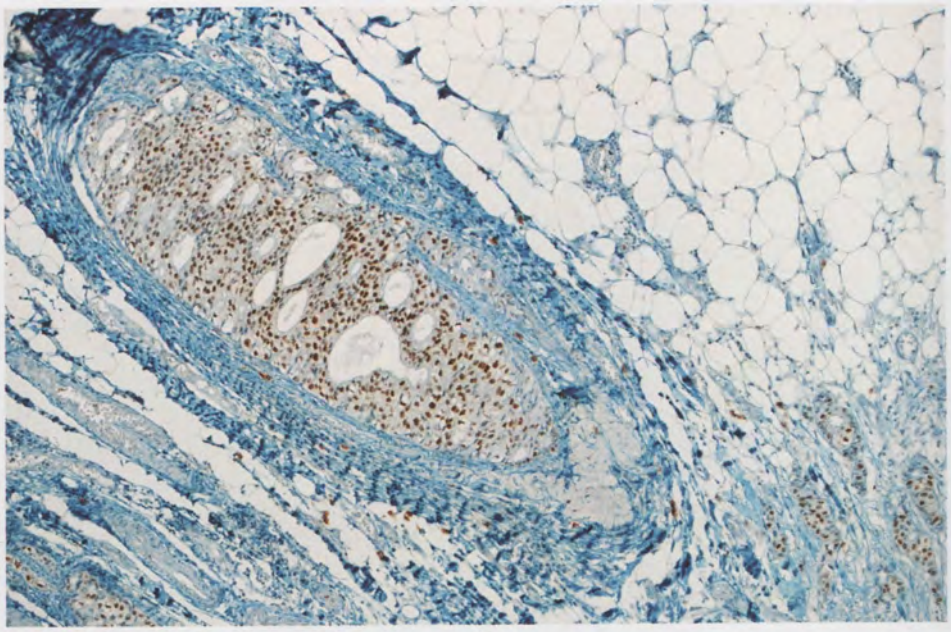
A

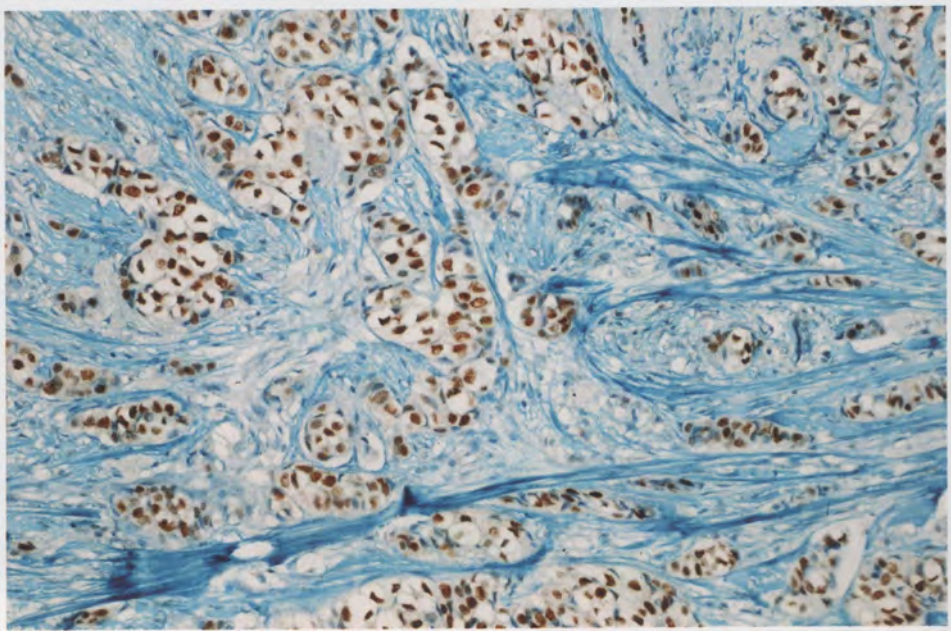












74

Asymptomatic 57-year-old woman. First screening study.

Physical Examination

No palpable tumor in the breasts.

Mammography

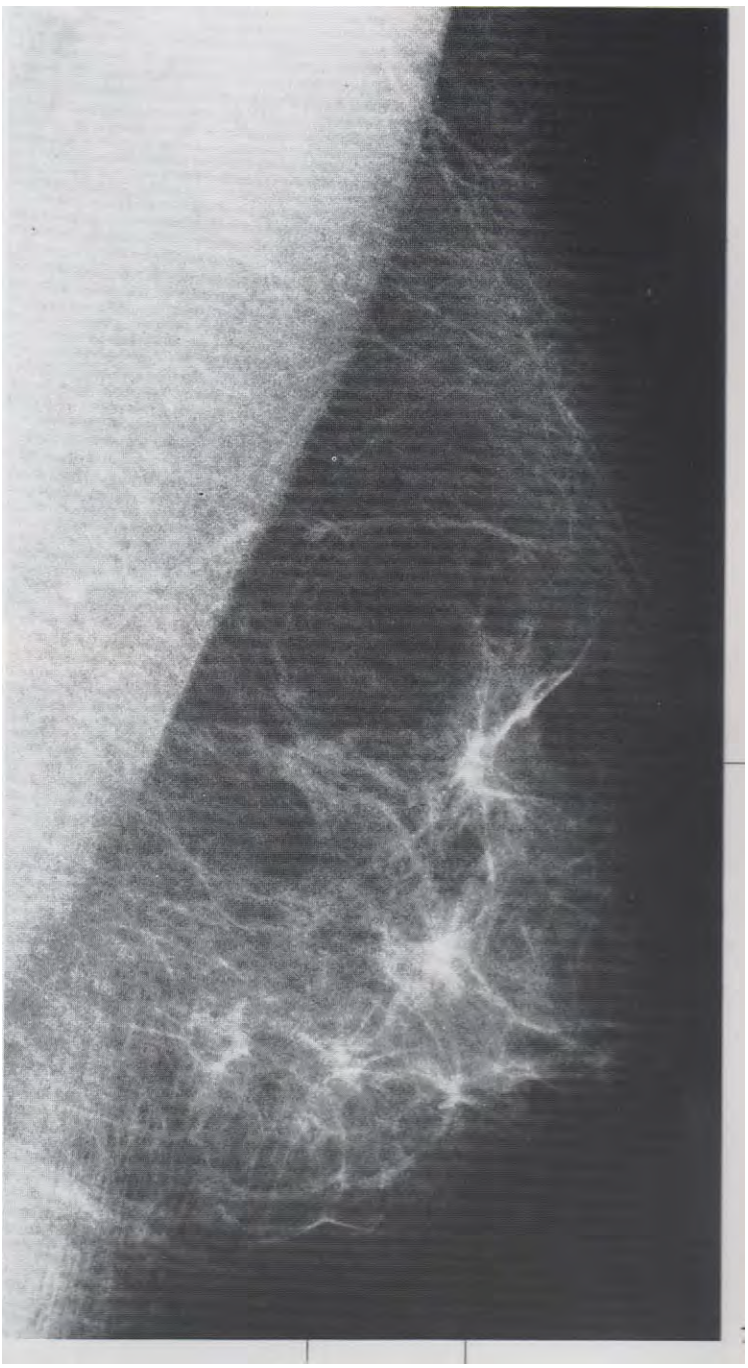
Fig. 74A & B: Right and left breast, medio-lateral oblique projections. A small tumor is seen at coordinate Al in the upper outer quadrant of the left breast.
Fig. 74C: Left breast, cranio-caudal projection.
Fig. 74D: Spot compression microfocus magnification view in the cranio-caudal projection.
Small, ill-defined circular tumor mass, mammographically malignant.

Histology

Infiltrating ductal carcinoma, size less than 10 mm. No axillary metastases.
Fig. 74E: Overview of the tiny tumor. (H & E, 12.5 x)

Comment

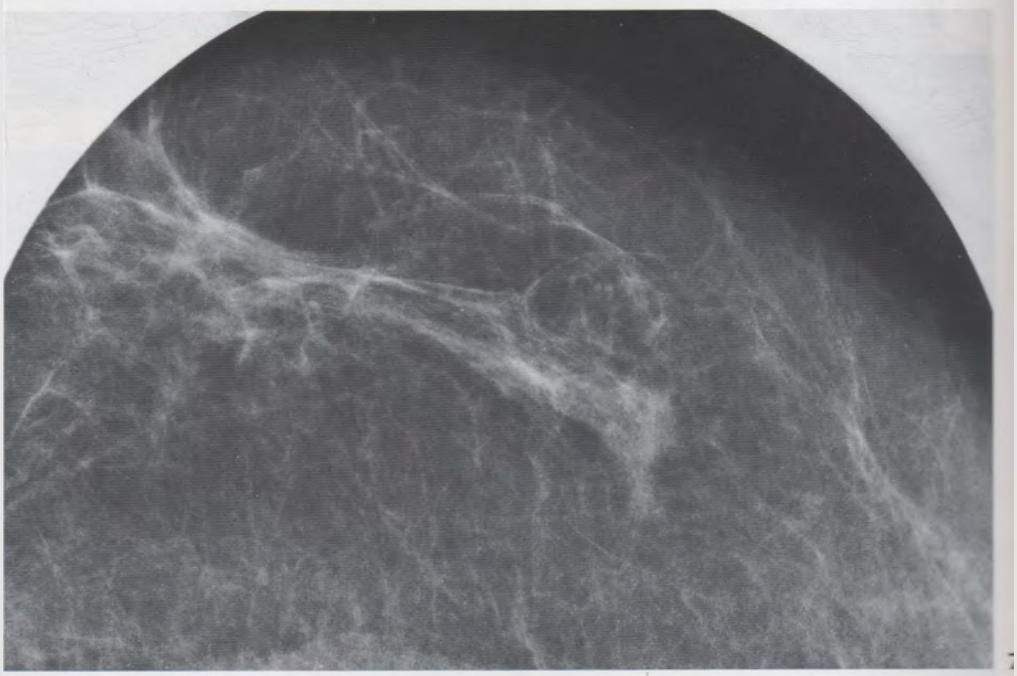
This tumor is difficult to locate on the medio-lateral oblique projection. Oblique masking, cranial aspect, helps reveal the tumor (Fig. XVI B, Chapter II). The density seen at coordinate A2 corresponds to the so-called desmoplastic reaction (connec-

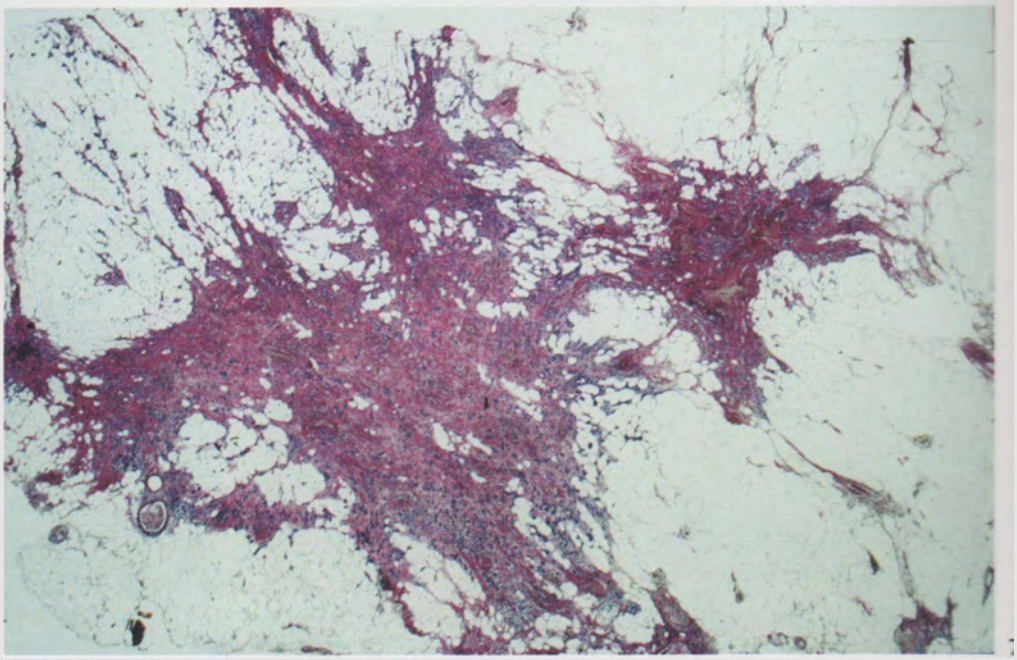


tive tissue proliferation in the vicinity of the malignant tumor).

Follow-up

The woman was still alive 19 years later with no evidence of breast cancer.





75

65-year-old asymptomatic woman. First screening study.

Physical Examination

No palpable tumor in the breasts.

Mammography

Fig. 75 A & B: Left breast, medio-lateral oblique and cranio-caudal projections. A small tumor is seen in the upper outer quadrant, 9 cm from the nipple, at coordinate Al.
Fig. 75 C & D: Microfocus magnification views, medio-lateral oblique and cranio-caudal projections.

Analysis

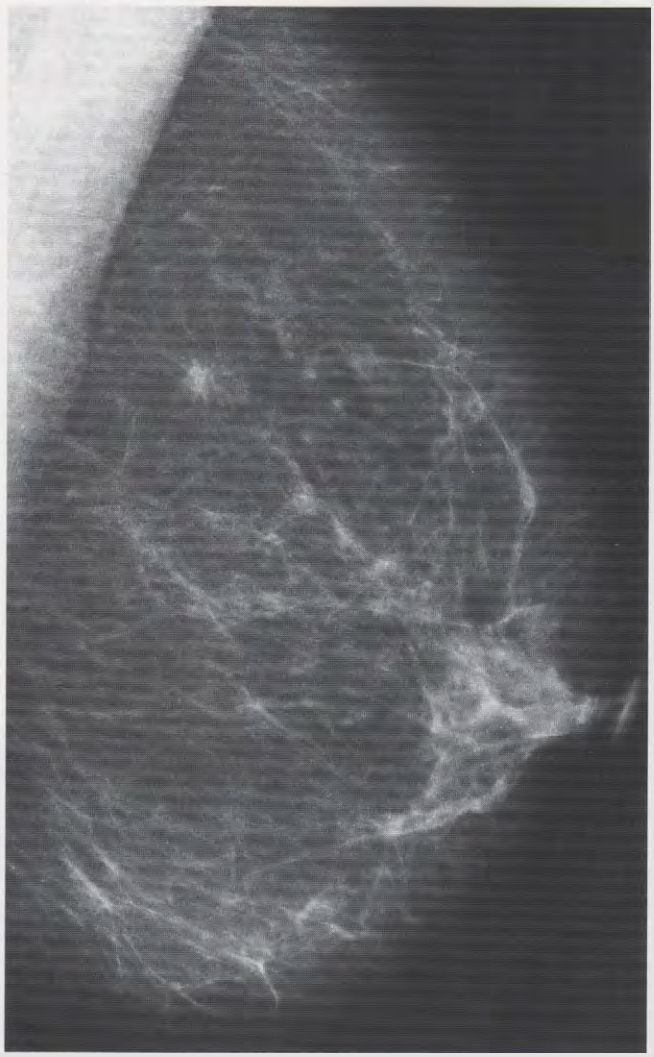
Stellate tumor, less than 10 mm in size with a radiating structure.
Mammographic diagnosis: malignant tumor.
Fig. 75 E: Operative specimen photograph.

Histology

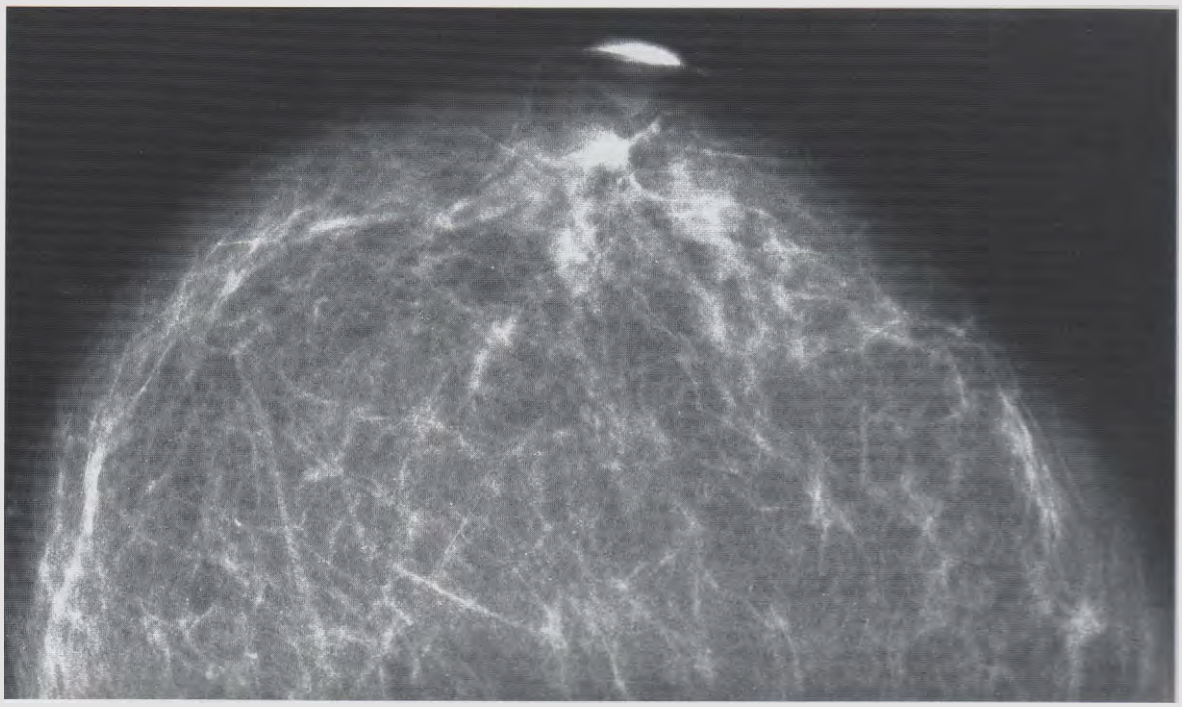
Infiltrative ductal carcinoma. Size 9 mm. No axillary lymph node metastases.

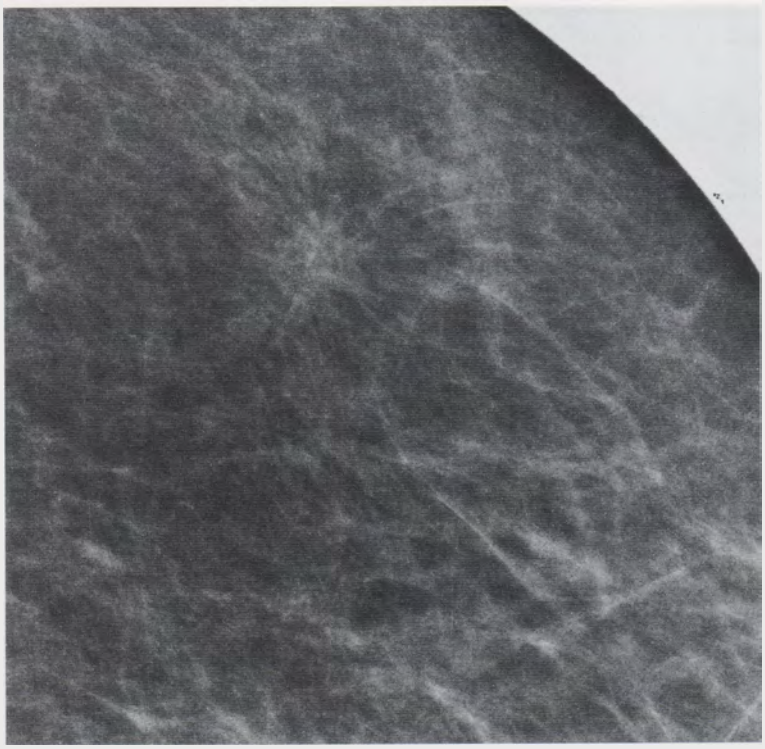
Follow-up

The patient died nine years later in renal failure at age 74. There was no evidence of breast cancer.

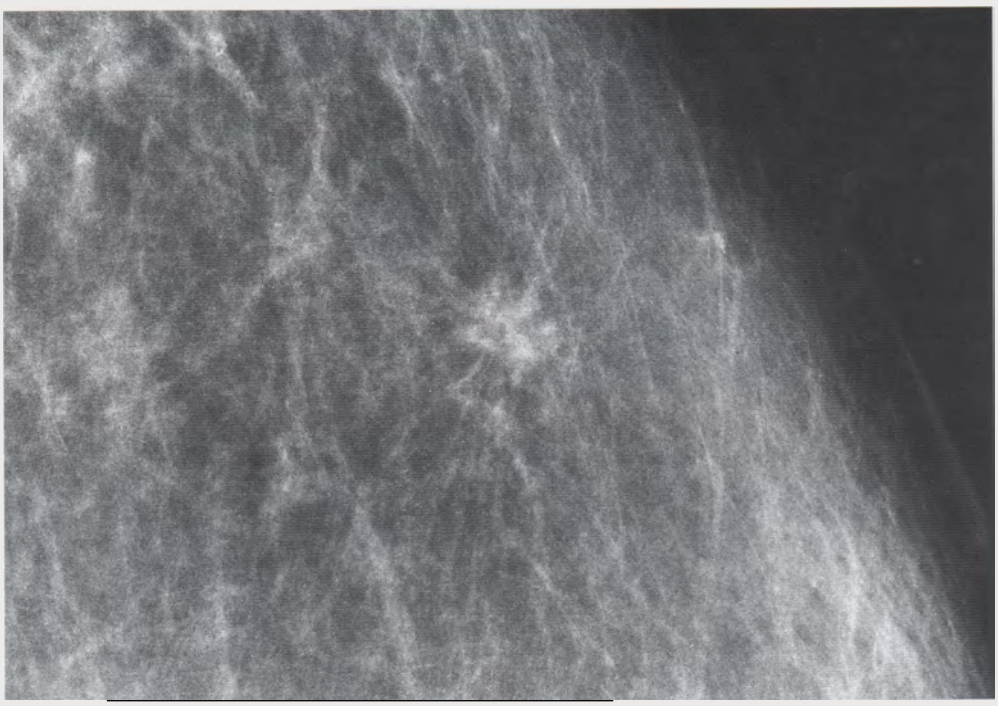


75A

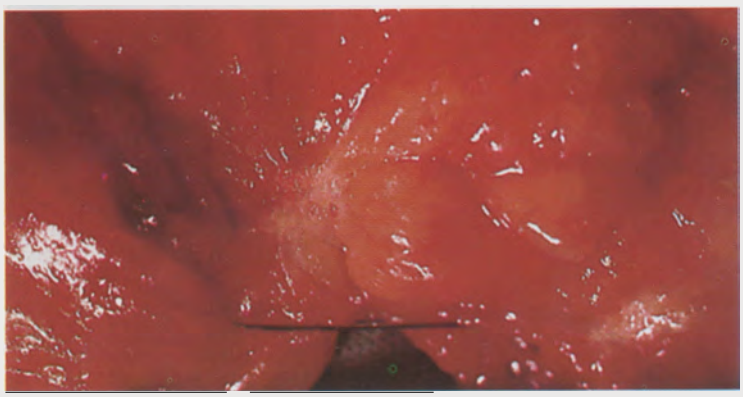




75C



75D



75E

76

73-year-old woman, asymptomatic. First screening study.

Physical Examination

No palpable tumor in the breasts.

Mammography

Fig. 76A & B: Right and left breasts, medio-lateral oblique projections. There is a stellate tumor at coordinate Al in the right breast.
Fig. 76 C: Right breast, cranio-caudal projection. The tumor is seen at coordinate Al.
Fig. 76 D: Spot compression view in the cranio-caudal projection.
Fig. 76 E: Right breast. Enlarged view in the medio-lateral projection. The tumor is located at coordinate Al.

Analysis

Form: stellate; small tumor mass with surrounding spicules; nO associated calcifications.
Size: less than 10 mm

Conclusion

Mammographically malignant tumor.

Comment

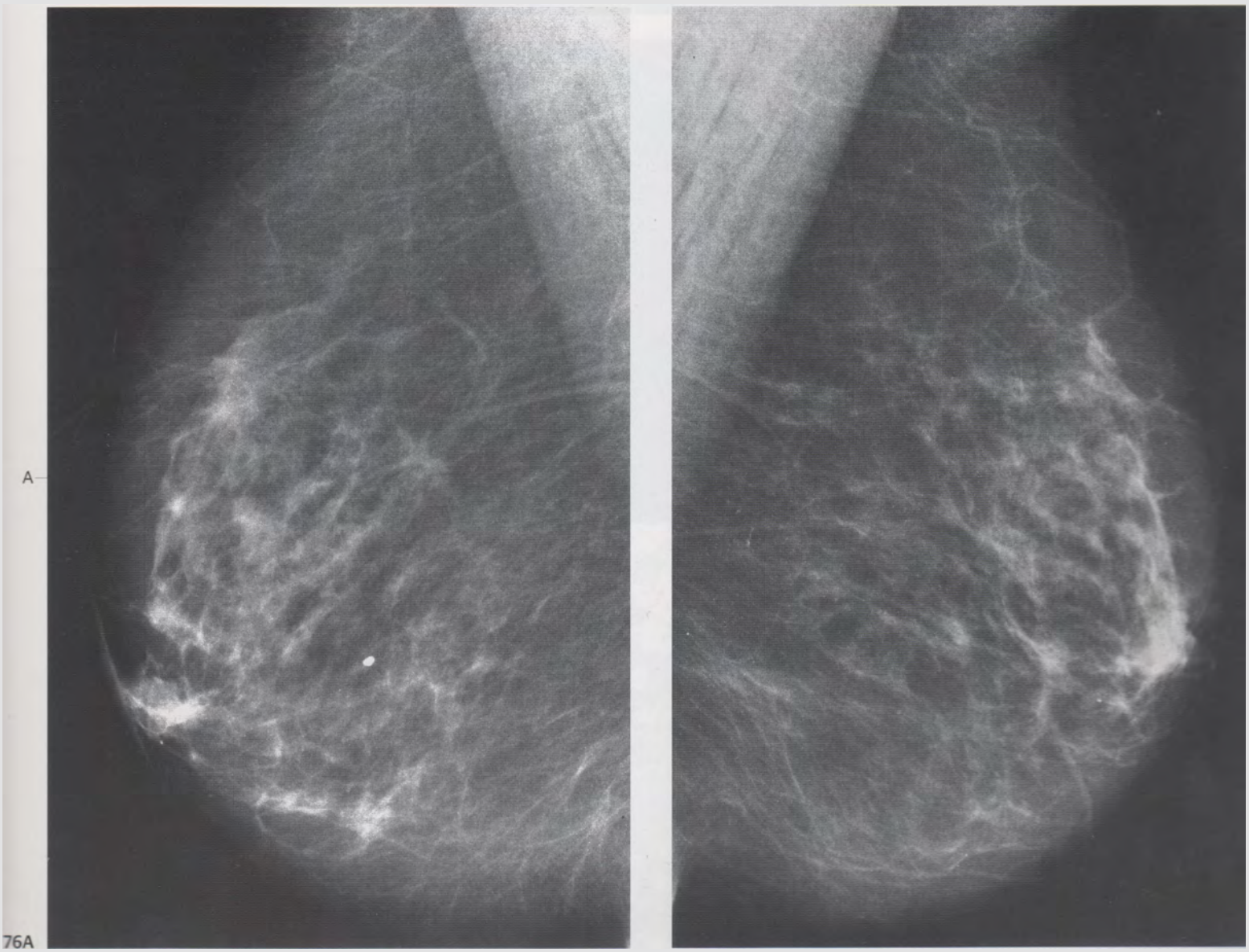
The smaller the stellate tumor, the greater the difficulty in perception. The tumor can be detected on the medio-lateral oblique projection using oblique masking, cranial aspect (see Chapter II).
Fig. 76 F: Operative specimen photograph.

Histology

Infiltrating ductal carcinoma, maximum diameter 10 mm. No axillary metastases.
Fig. 76 G: Overview of the tumor. (H & E, 12.5 x)

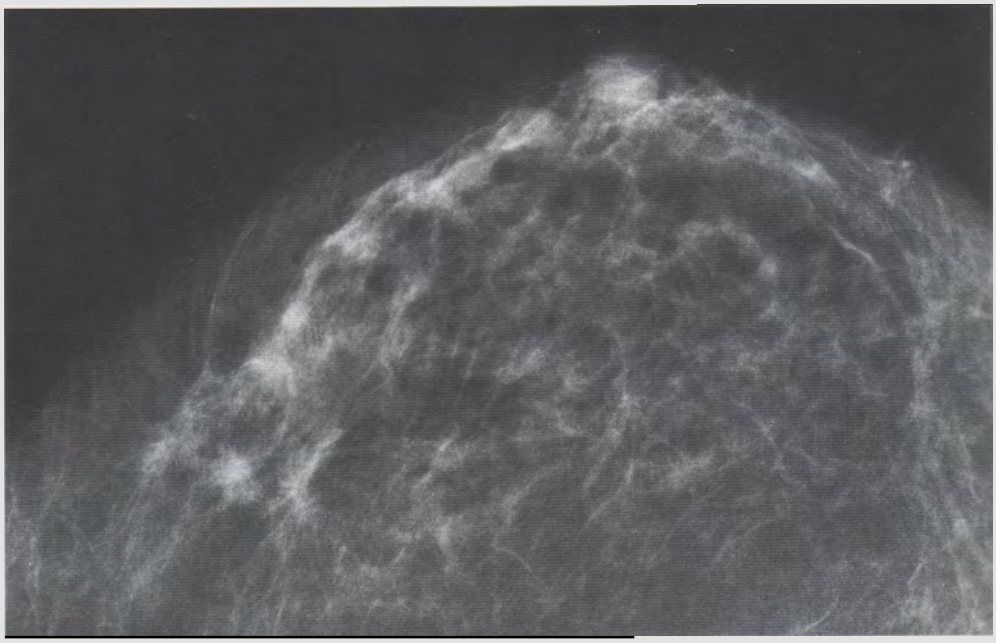
Follow-up

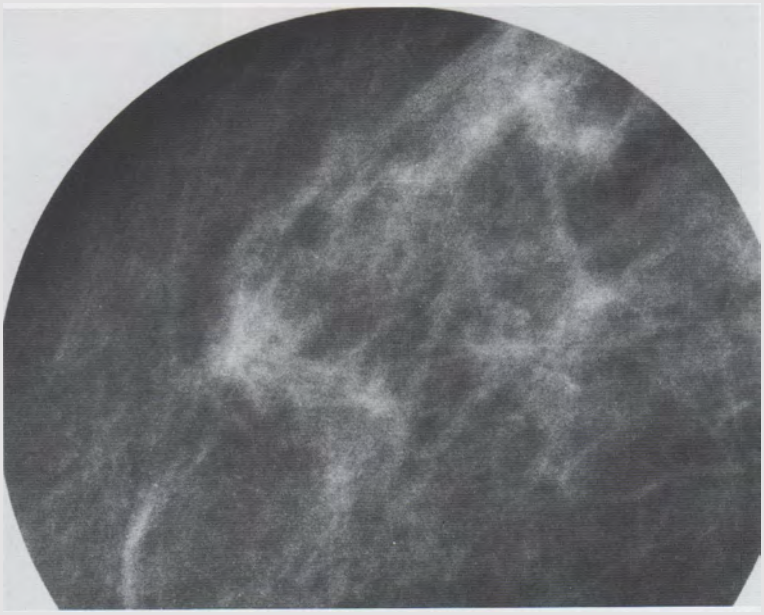
The woman died 12 years later from myocardial infarction at age 85. There was no evidence of breast cancer.



76A

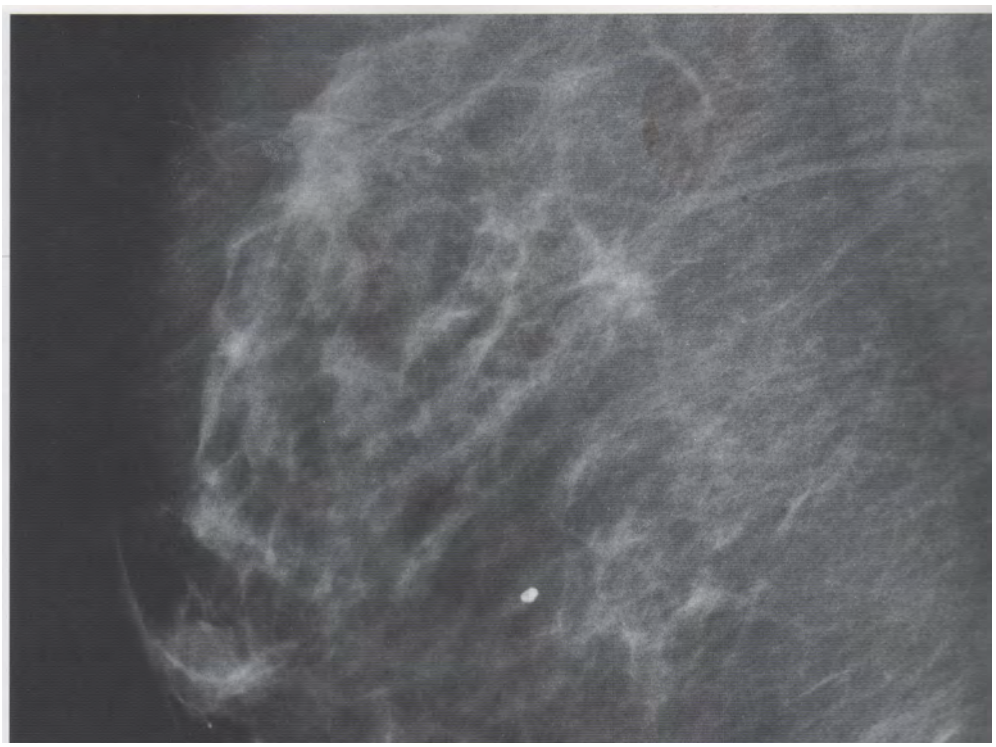
A

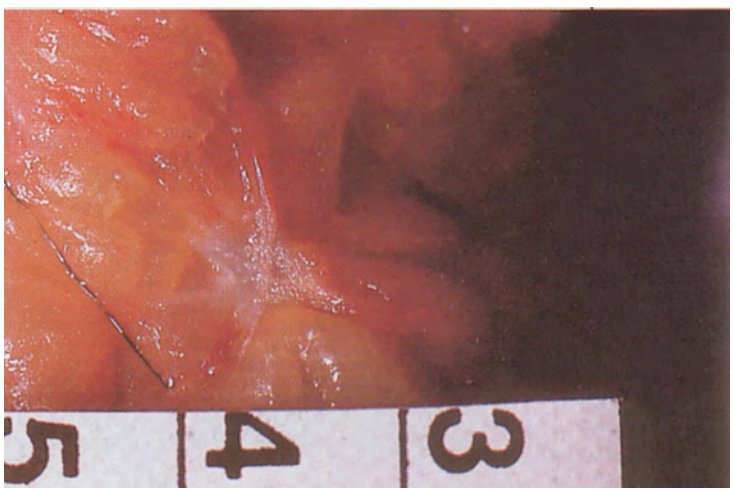




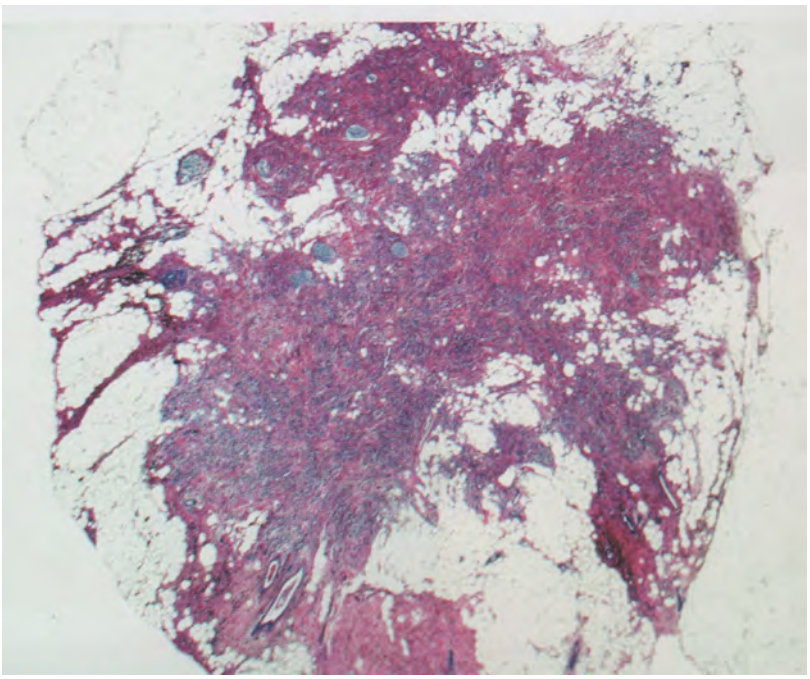
76D

A





76F



77

61-year-old woman, asymptomatic. First screening study.

Physical Examination

No palpable tumor in the breasts.

Mammography

Fig. 77 A: Left breast, medio-lateral oblique projection. At coordinate Al there is parenchymal distortion.
Fig. 77 B: Left breast, cranio-caudal projection. There is a centrally located stellate tumor 6 cm from the nipple.
Fig. 77 C: Left breast, microfocus magnification view in the cranio-caudal projection.
Fig. 77 D: Operative specimen radiograph.

Analysis

Stellate lesion. No definite central tumor mass. Long, fine spicules form the radiating structure. No associated calcifications.

Conclusion

Typical mammographic appearance of a radial scar.

Histology

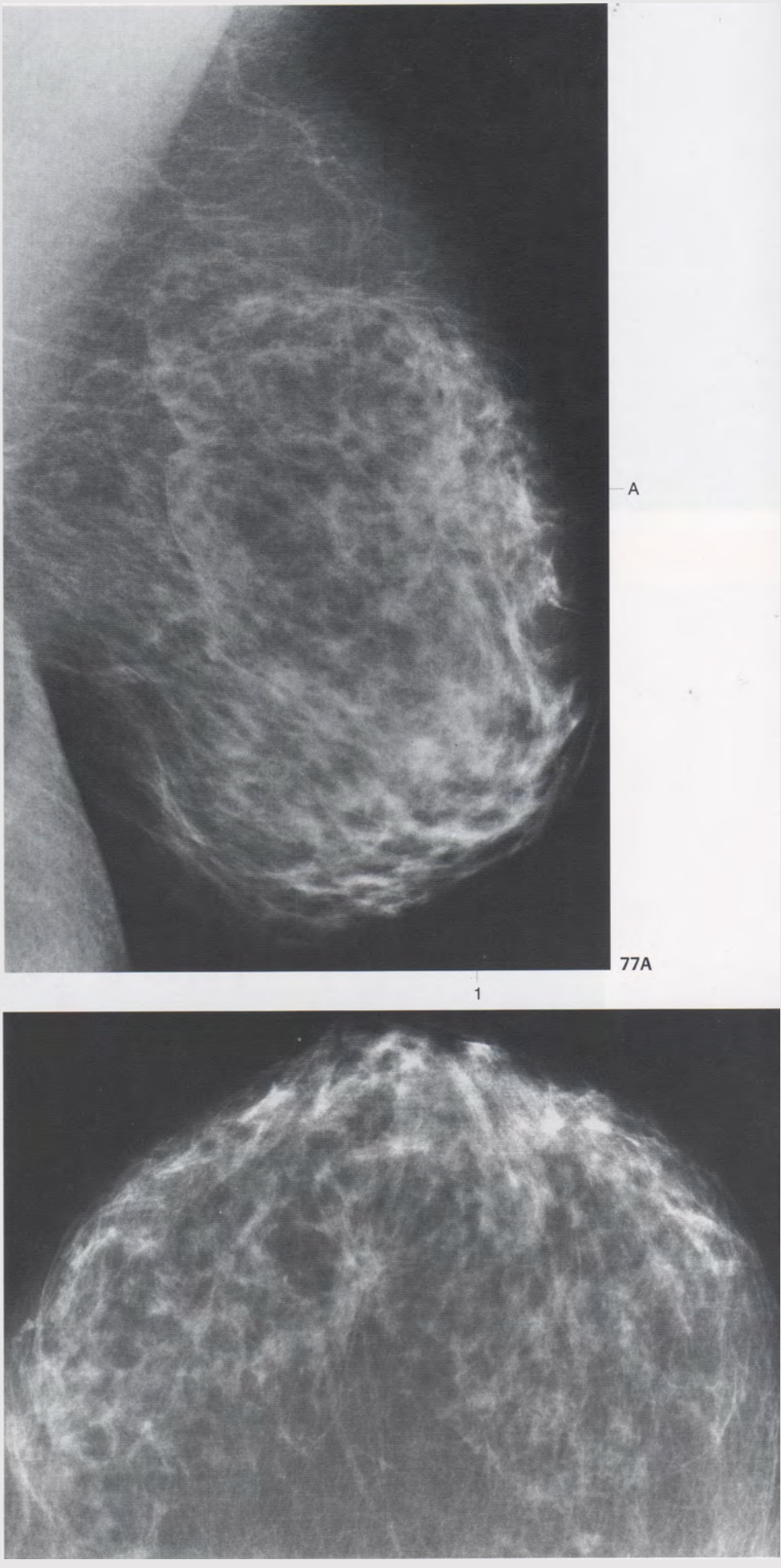
Infiltrating ductal carcinoma. No axillary metastases.

Comment

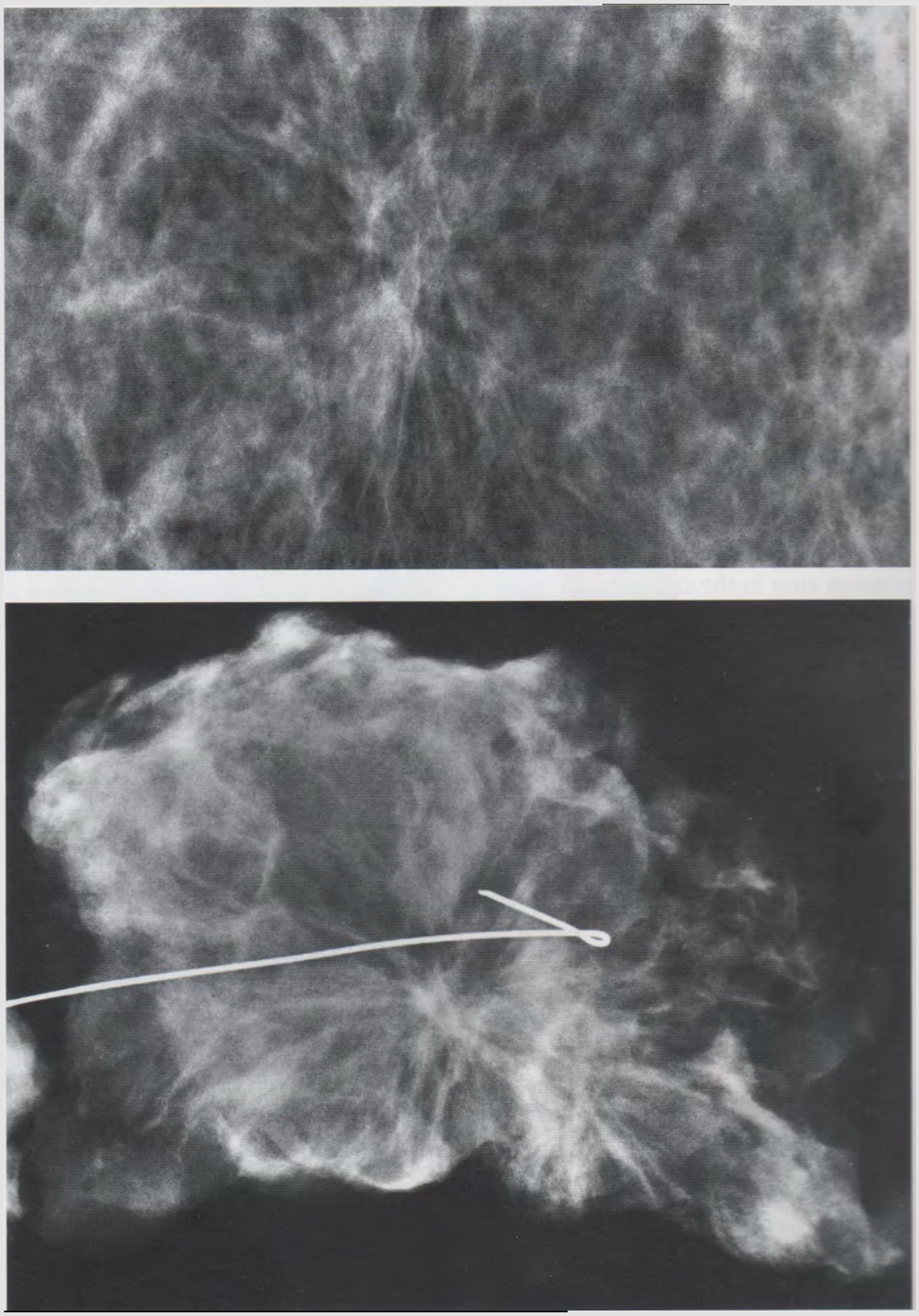
As mentioned on pages 96, the final diagnosis of stellate lesions can be made only by histology.

Follow-up

The woman was still alive 19 years later.



77A



78

64-year-old woman, asymptomatic. First screening study.

Physical Examination

No palpable tumor in the breasts.

Mammography

Fig. 78A & B: Right and left breasts, medio-lateral oblique projections. At coordinate Al in the left breast there is a small stellate tumor. Right breast normal.
Fig. 78 C: Left breast, cranio-caudal projection. The tumor is seen at coordinate **Al.**
Fig. 78 D: Left breast, coned-down compression view in the cranio-caudal projection. The tumor is seen superimposed on the calcified artery.

Analysis

Form: stellate; central tumor mass with surrounding short spicules, best seen in the spot compression view
Size: less than 10 mm

Conclusion

Mammographically malignant tumor.

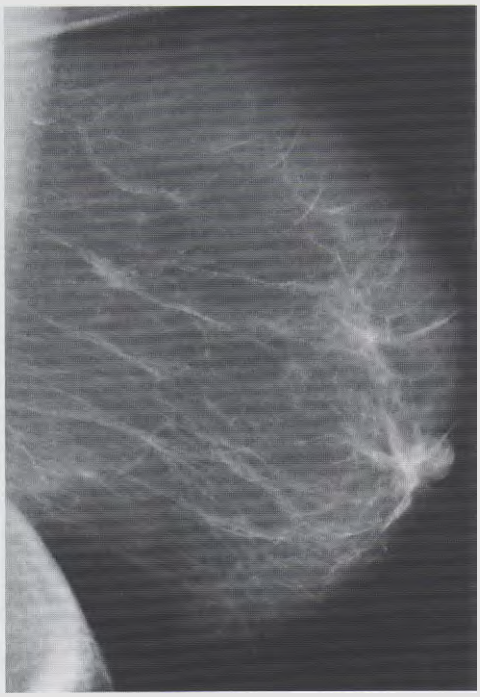
Histology

Infiltrating ductal carcinoma, maximum diameter 7 mm. No axillary lymph node metastases.

Follow-up

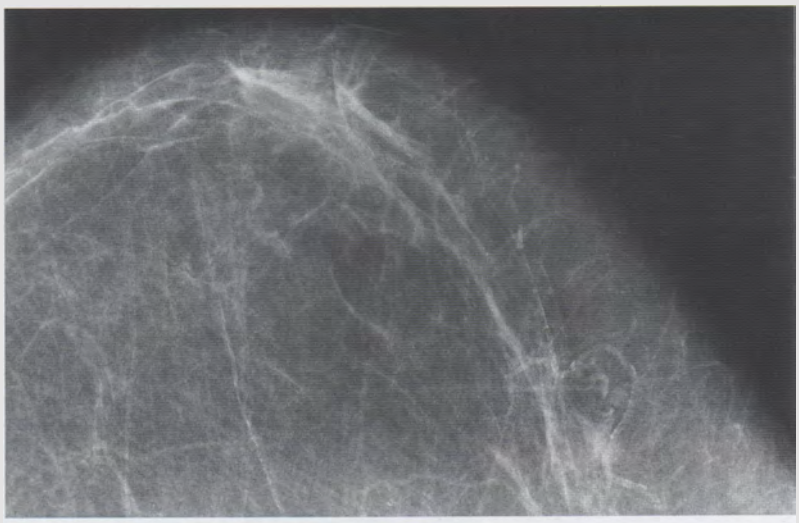
The woman died 12 years later from acute heart failure. There was no evidence of breast cancer.

78A

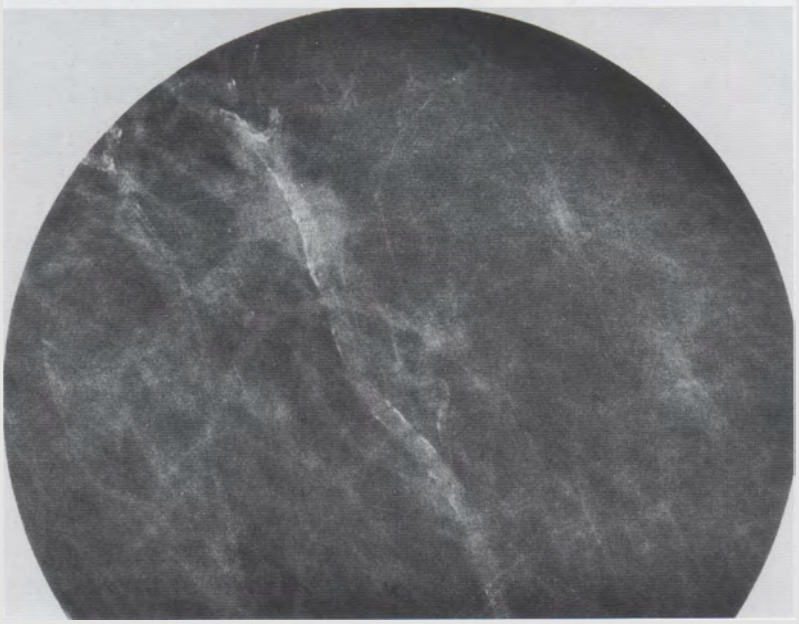


78B

A



78C



78D

79

70-year-old woman, asymptomatic. First screening examination.

Physical Examination

No palpable tumor in the breasts.

Mammography

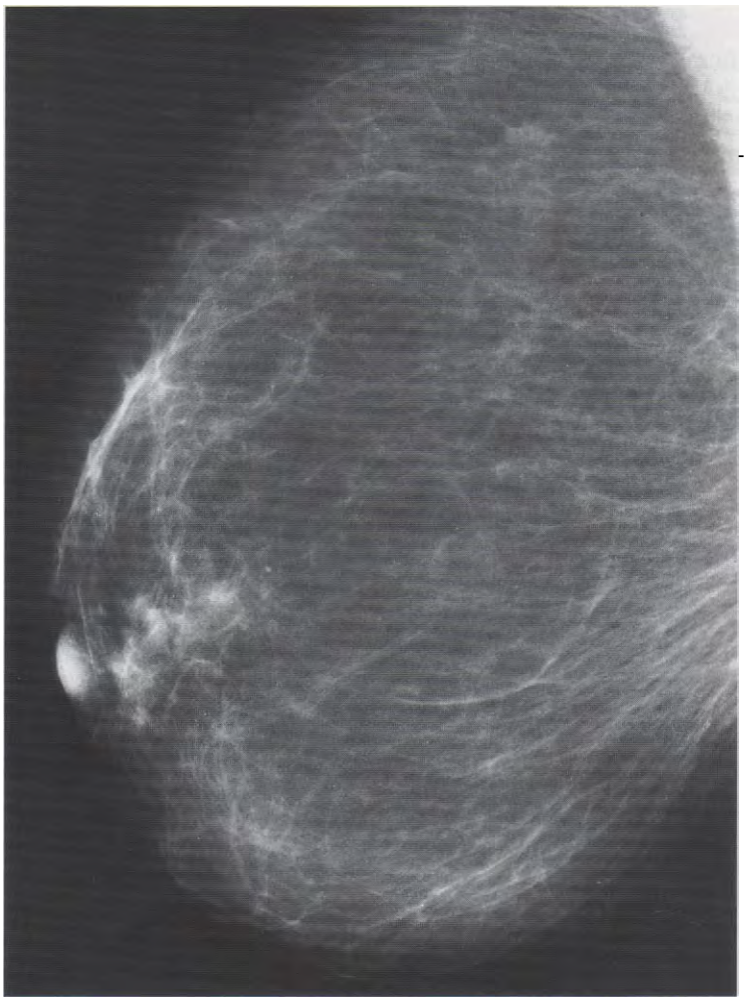
Fig. 79A: Right breast, medio-lateral oblique projection. A small stellate tumor is seen at coordinate Al.
Fig. 79B: Right breast, cranio-caudal projection. The stellate lesion is seen at coordinate Al.
Fig. 79 C: Coned-down compression view of the tumor in the medio-lateral oblique projection.

Analysis

Form: stellate lesion with a central tumor mass
Radiating structure: short spicules
Size: less than 1 cm

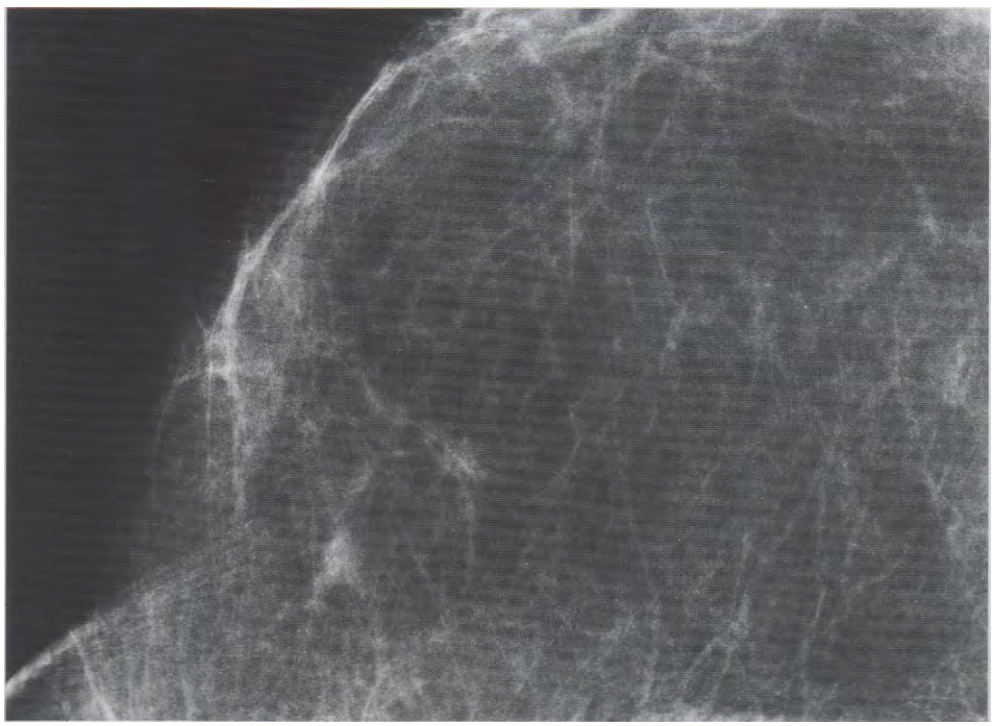
Conclusion

Mammographically highly suspicious for malignancy.



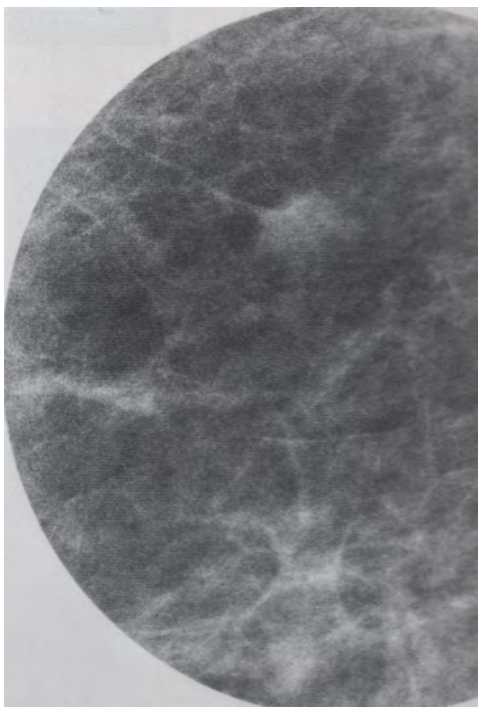
A

79A



A

79B

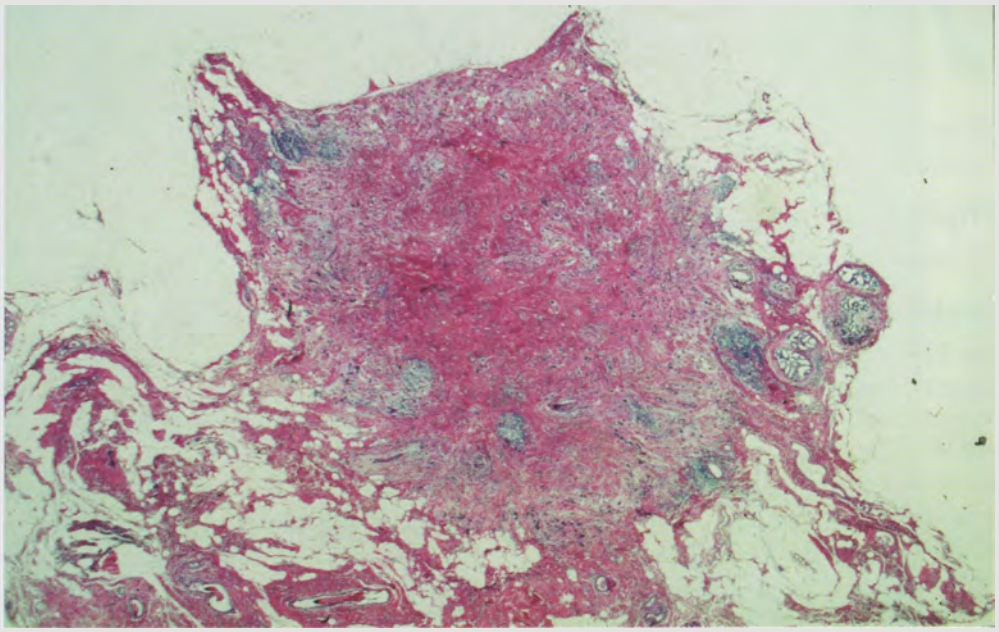


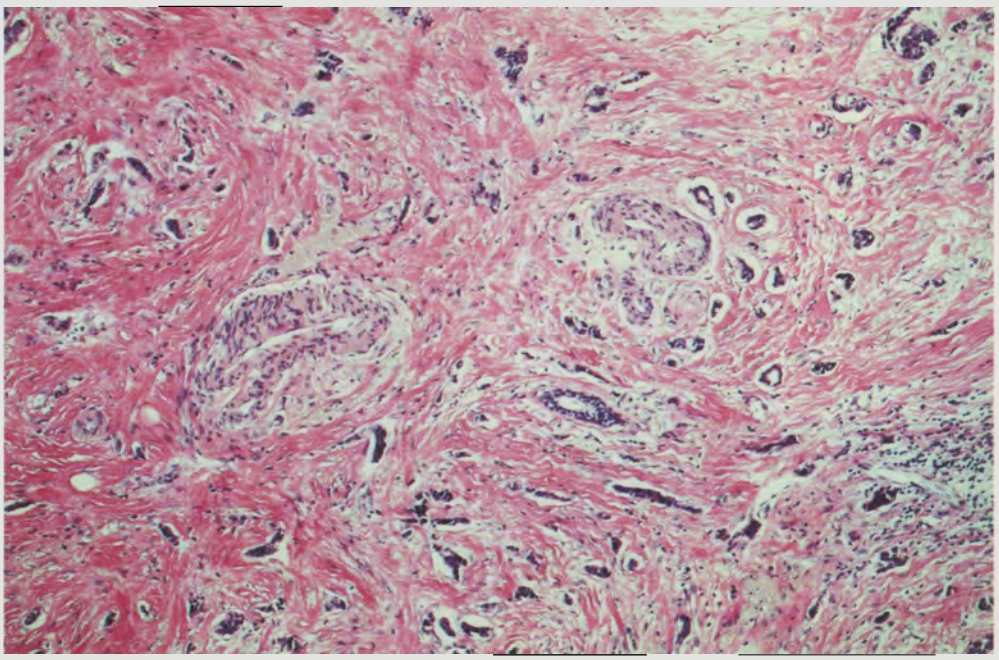
Histology

Infiltrating ductal carcinoma, size 6 x 6 mm. No axillary lymph node metastases.
Fig. 79D: Overview of the tumor. (H & E, 12.5 x)
Fig. 79 E: Detailed view of the invasive carcinoma. (H & E, 200 x)

Follow-up

The woman returned to her native country, where she died four years, 10 months later of unknown causes at age 74.





80

Age 44, referred for mammography for a palpable tumor in the upper outer quadrant of the left breast.

Physical Examination

2 x 2 cm hard lump in the upper outer quadrant of the left breast. No skin changes. Suspicious for malignancy.

Mammography

Fig. 80A: Left breast, medio-lateral oblique projection. There is parenchymal contour retraction at coordinate Al. No associated calcifications (Fig. II).
Fig. 80 B: Left breast, cranio-caudal projection. There is architectural distortion at coordinate Al. Tent sign (Fig. XIX).
Fig. 80C: Left breast, coned-down compression view, cranio-caudal projection.

Analysis

(best on the spot compression view)

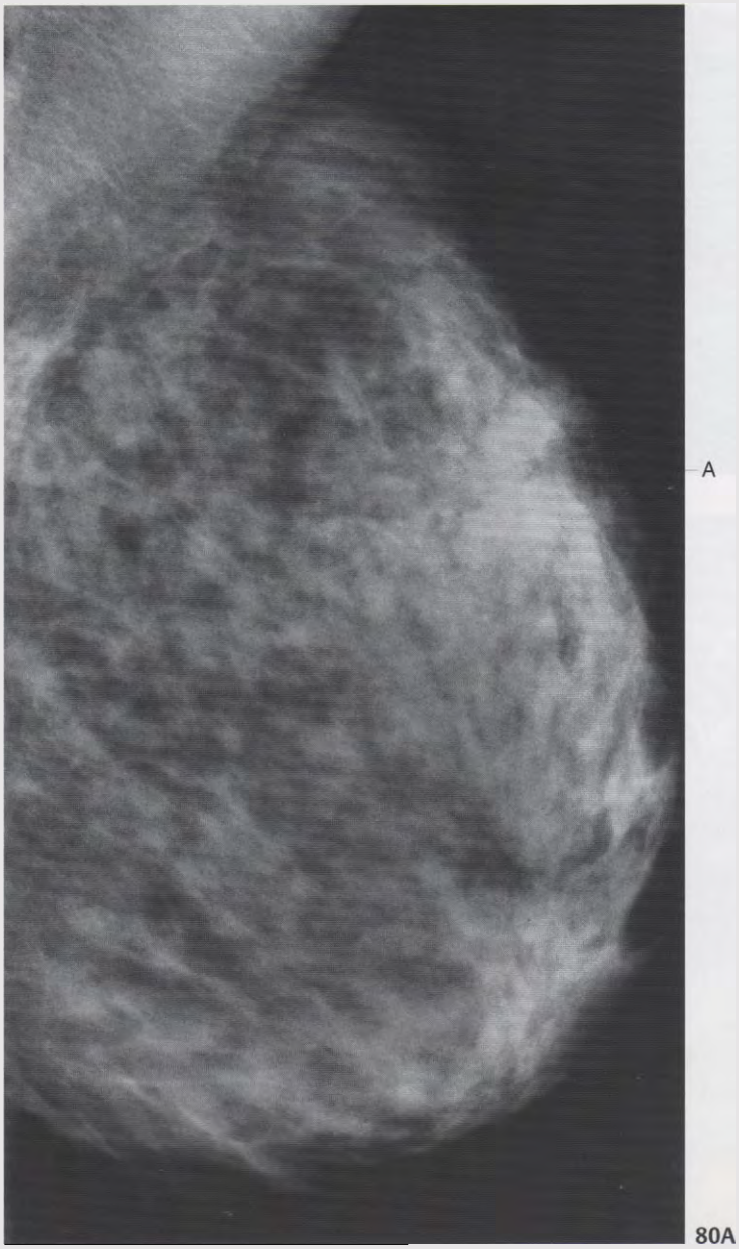
Stellate tumor with a central tumor mass surrounded by numerous spicules. Mammographically malignant tumor.

Histology

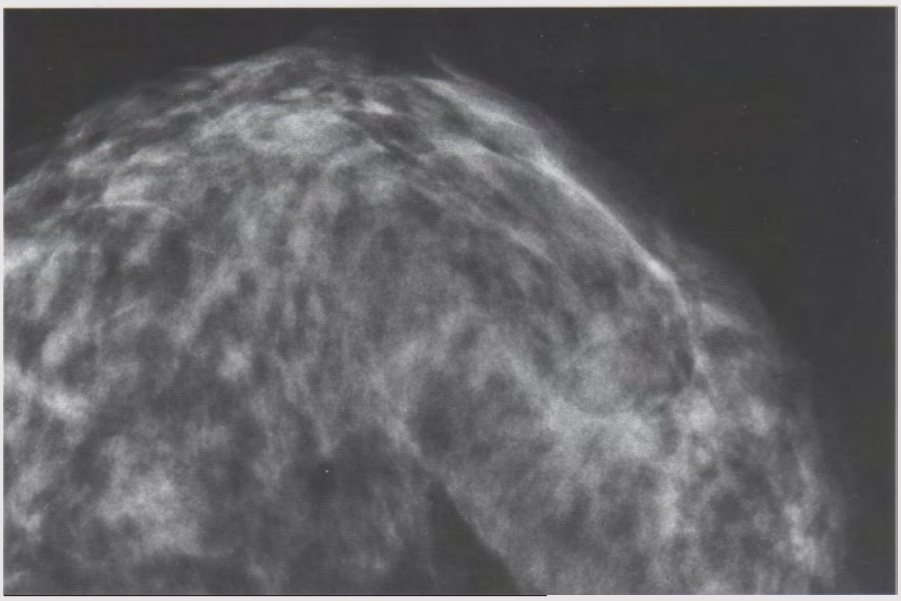
Infiltrating ductal carcinoma with axillary lymph node metastases.
Fig. 80 D: Low-power view of the invasive tumor, with a poorly differentiated in situ component containing amorphous calcifications. (I-I & E, 40 x)

Follow-up

The patient died four years later at age 48 from breast cancer with hepatic and skeletal metastases.

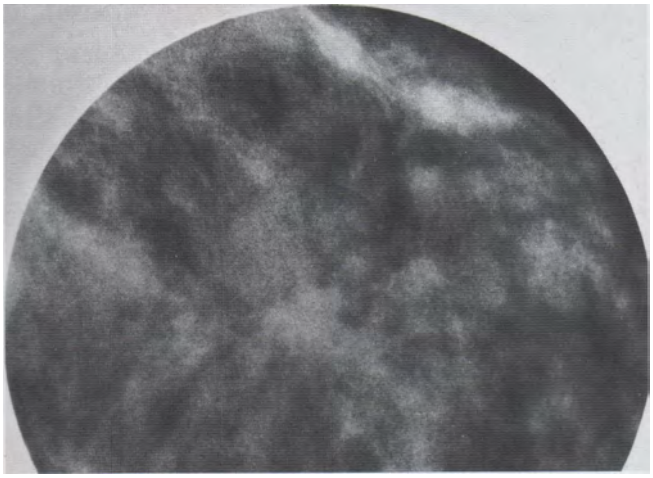


80A

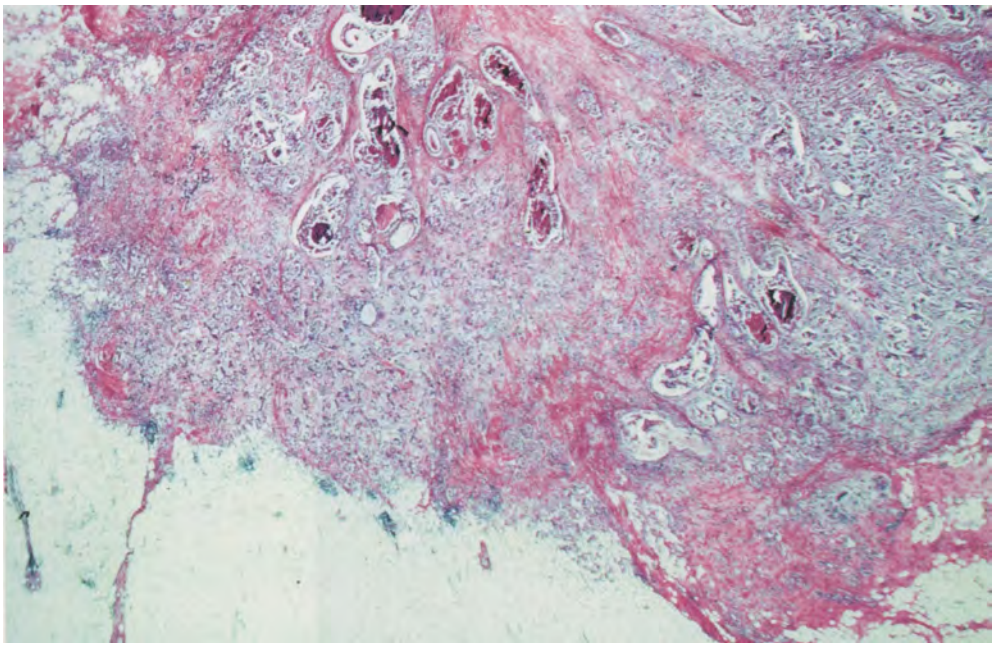


80B

Stellate/Spiculated Lesions



80C



80D

81

46-year-old asymptomatic woman. First screening study.

Physical Examination

No palpable tumor in the breasts.

Mammography

Fig. 81 A: Left breast, medio-lateral oblique projection. A stellate lesion is seen 8 cm from the nipple in the upper half of the breast.
Fig. 81 B: Left breast, microfocus magnification view of the lesion.

Analysis

Stellate tumor. An oval translucency is seen near the center of the lesion. The stellate structure is formed by radiating radiolucent linear structures. The calcifications are very faint.

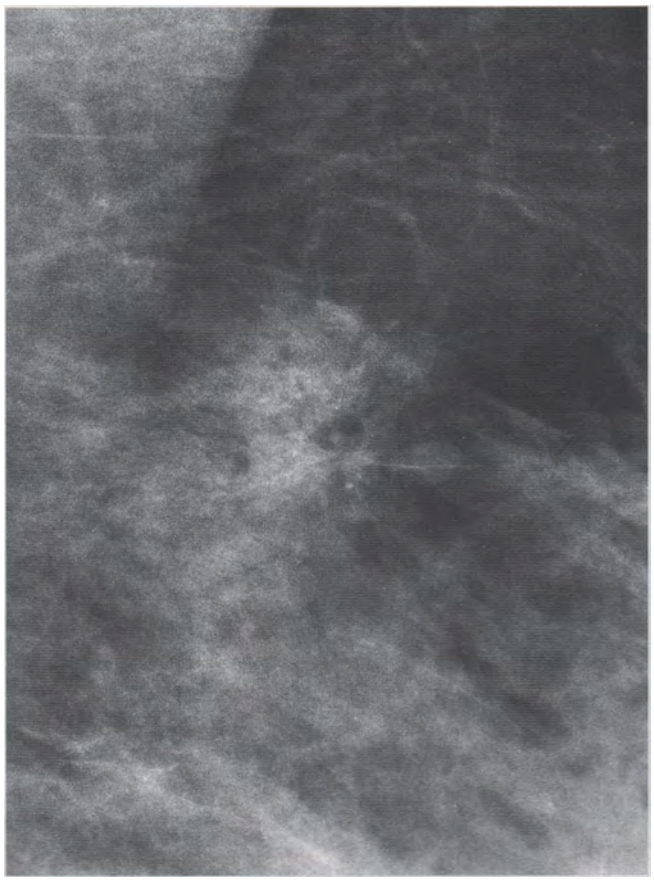
Conclusion

Typical mammographic appearance of a radial scar.

Histology

Radial scar (slerosing duct hyperplasia). No associated malignancy.

81A



81B

82

42-year-old woman, asymptomatic. First screening examination.

Physical Examination

No palpable tumor in the breasts.

Mammography

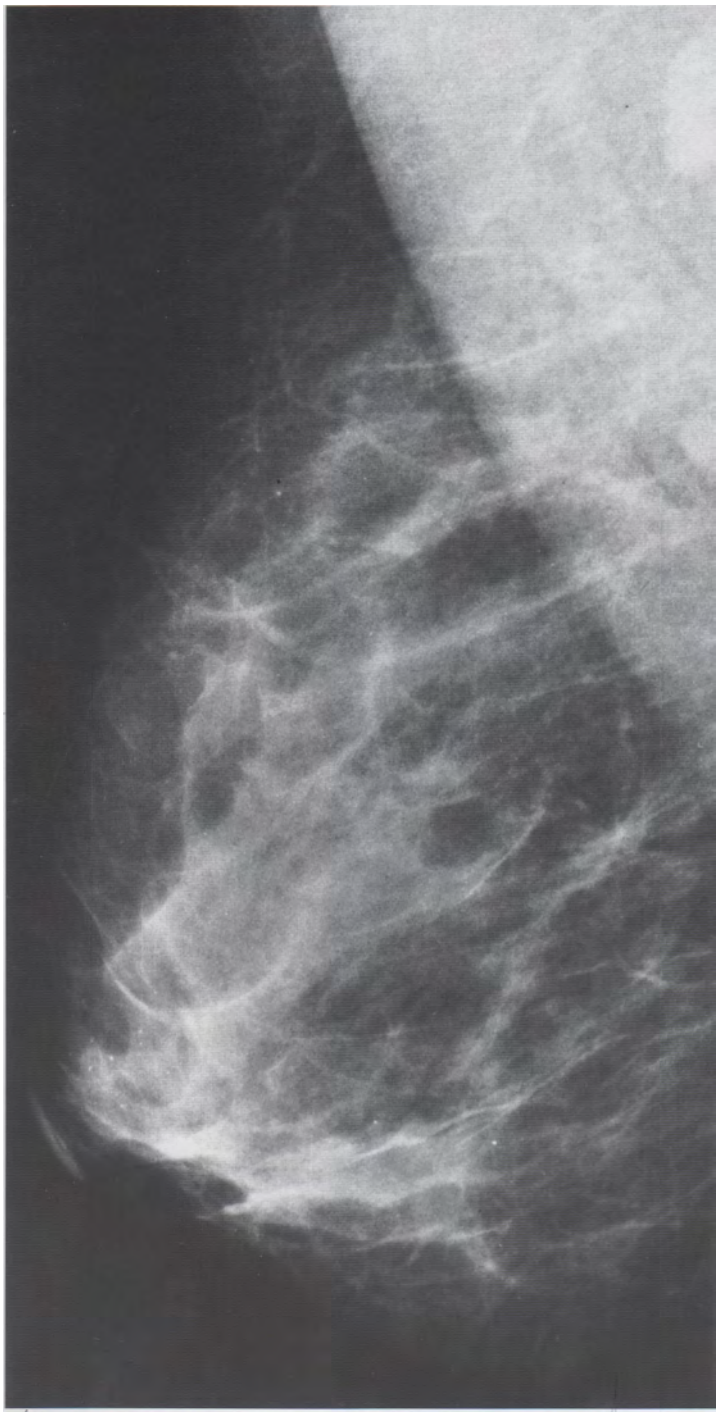
Fig. 82 A & B: Right and left breasts, medio-lateral oblique projections. At coordinate Al, in the right breast, there is a small stellate tumor.
Fig. 82 C: Right breast, cranio-caudal projection, with the tumor at coordinate Al.
Fig. 82 D: Right breast, microfocus magnification view, cranio-caudal projection.

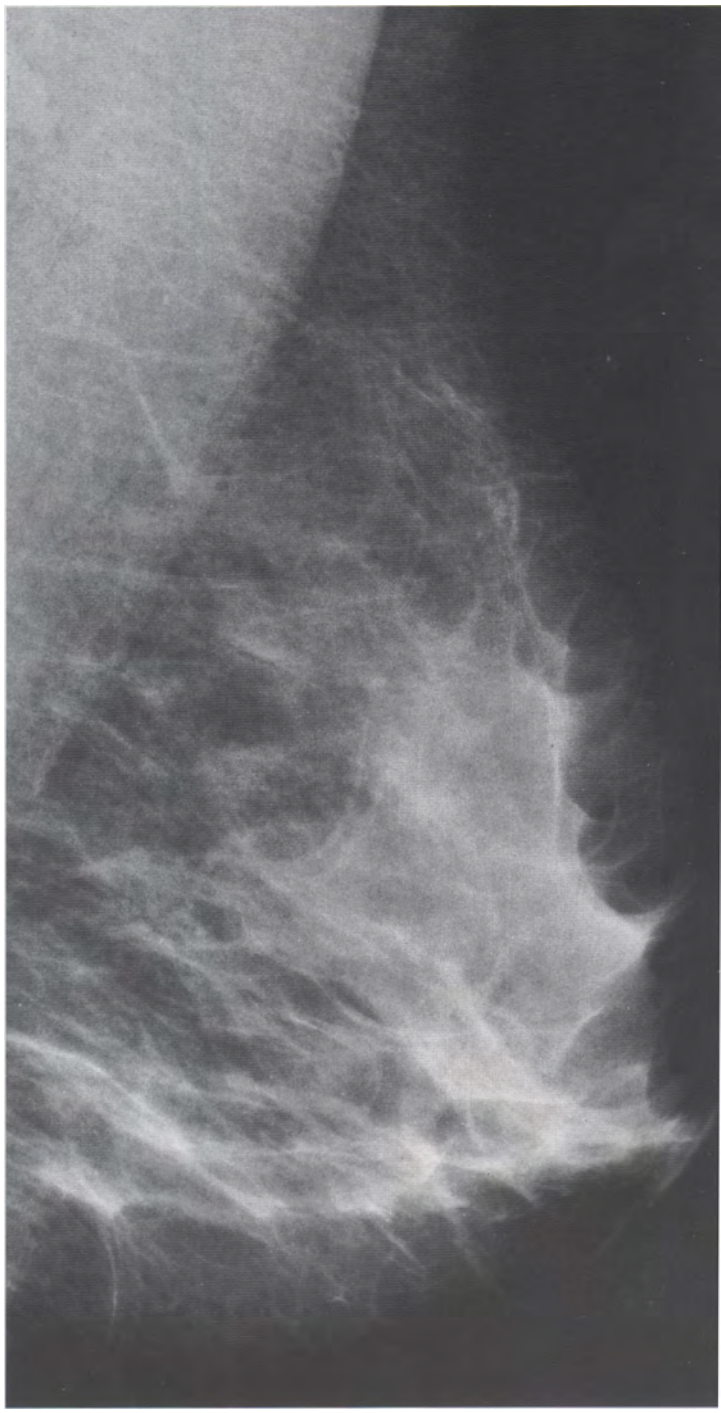
Analysis

Stellate lesion. The appearance varies with the projection. No central tumor mass. Long, fine spicules. No associated calcifications.

Conclusion

Although the central lucencies are not present in this case, the absence of a solid tumor center and the relatively long, fine spicules are the most important diagnostic factors supporting the mammographic diagnosis of a radial scat Differentiation cannot be reliably made from a small stellate malignant tumor using imaging methods.





82A

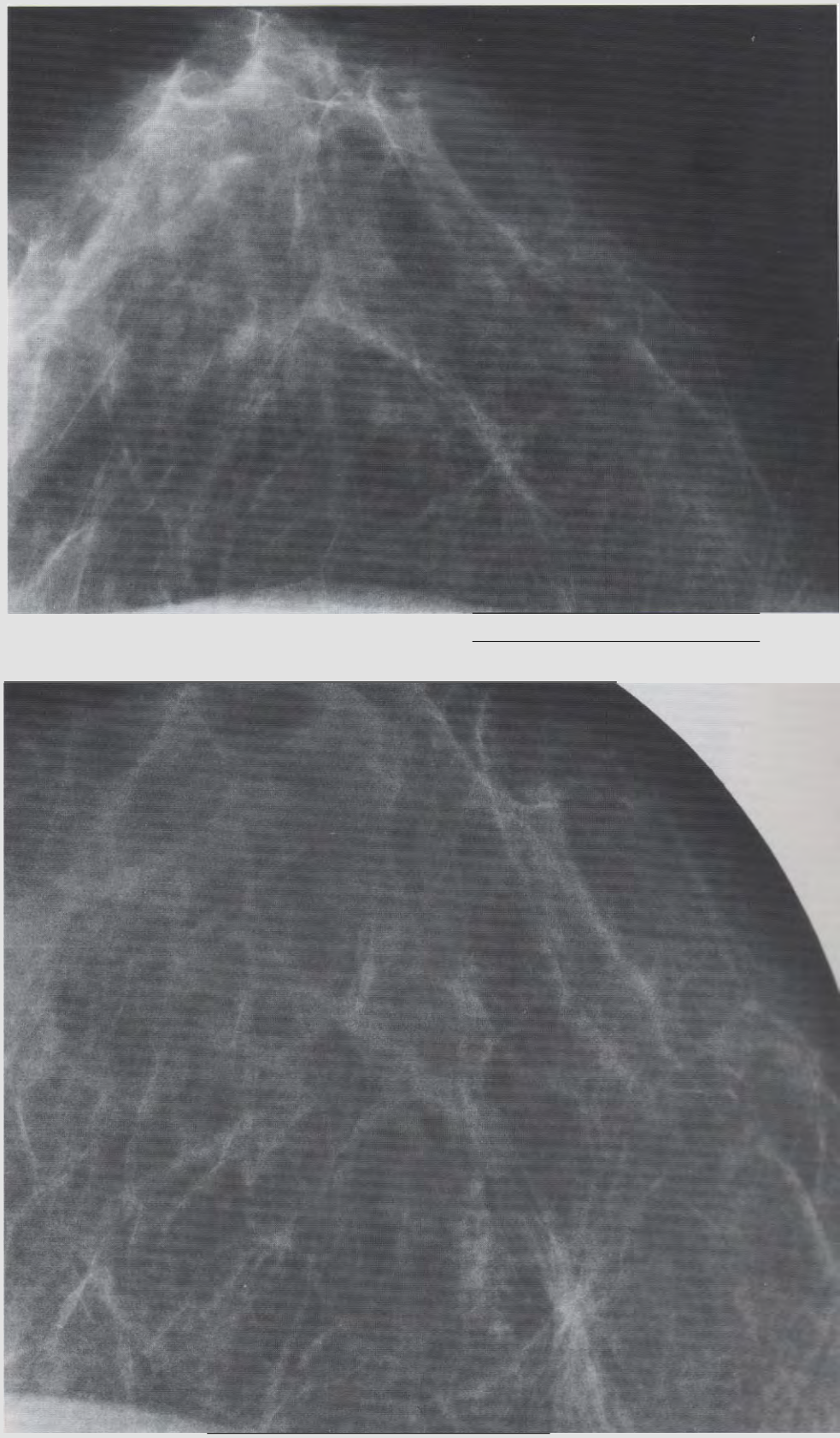
Histology

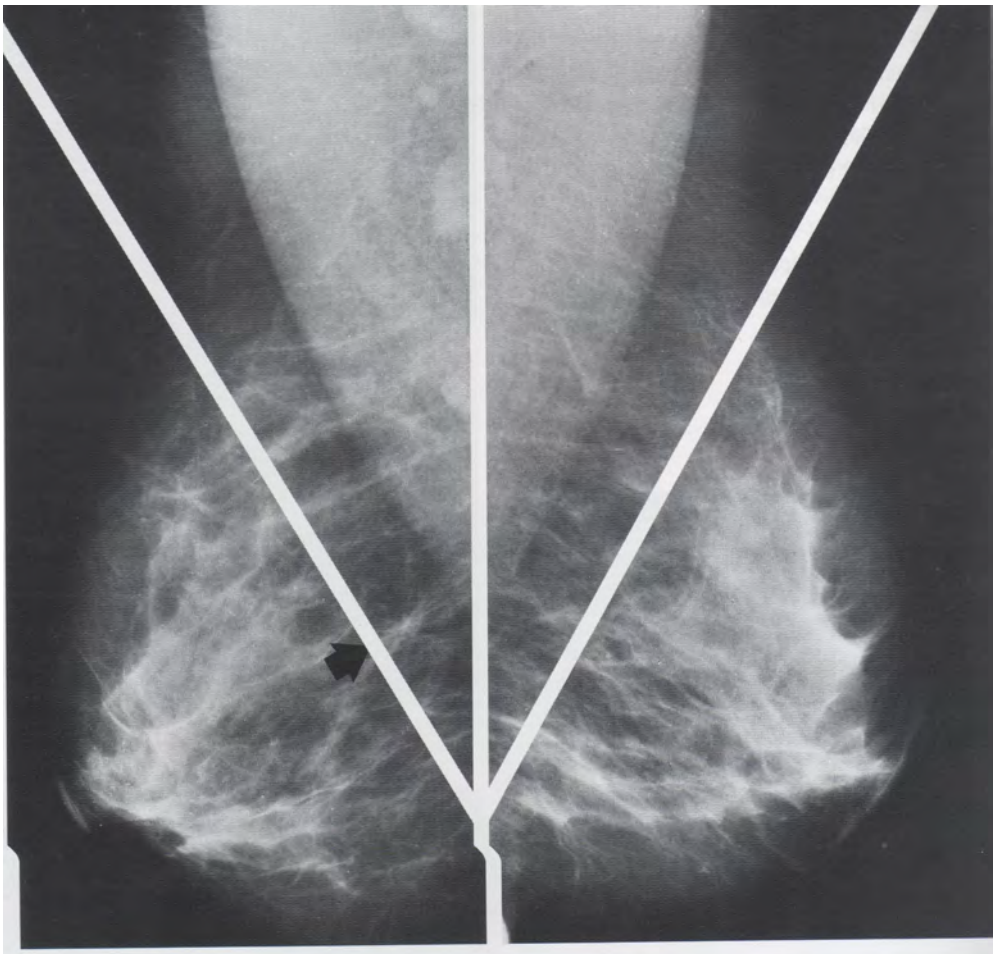
Fig. 82 F: Radial scar (sclerosing duct hyperplasia). No associated malignancy. Low-power view of the radial scar associated with a slight degree of epithelial cell proliferation. (H & E, 40 x)

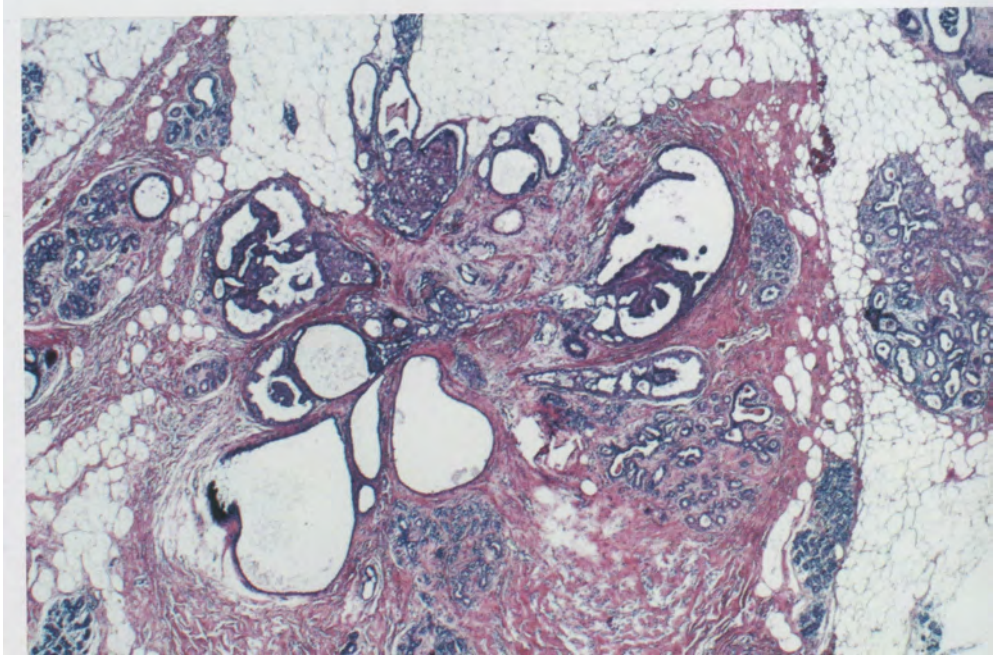
Comment

This tumor is difficult to perceive. Oblique masking, cranial aspect, helps to locate it (Fig. 82 E).

A







83

41-year-old woman, asymptomatic. First screening examination.

Physical Examination

No palpable tumor in the breasts.

Mammography

Fig. 83 A: Left breast, cranio-caudal projection. There is architectural distortion in the lateral half of the breast. No associated calcifications.
Fig. 83 B & C: Microfocus magnification views, cranio-caudal and medio-lateral oblique projections.

Analysis

A large, radiating structure, consisting of numerous long and fine spicules interspersed with linear radiolucencies (arrows). There is a remarkable difference in the appearance of Fig. 83 B and C.

Conclusion

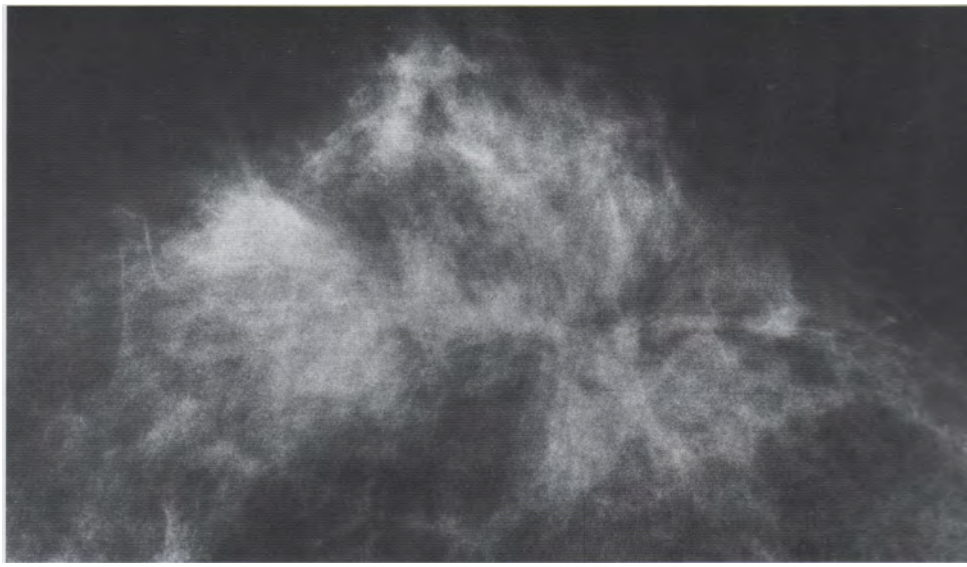
Characteristic mammographic image of a radial scar.

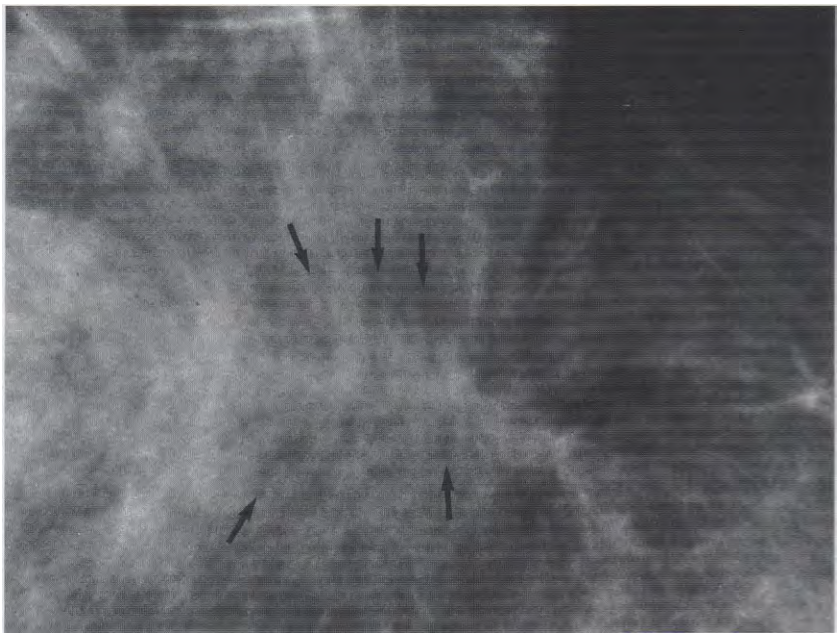
Histology

Radial scar associated with in situ ductal carcinoma and minimally invasive ductal carcinoma.

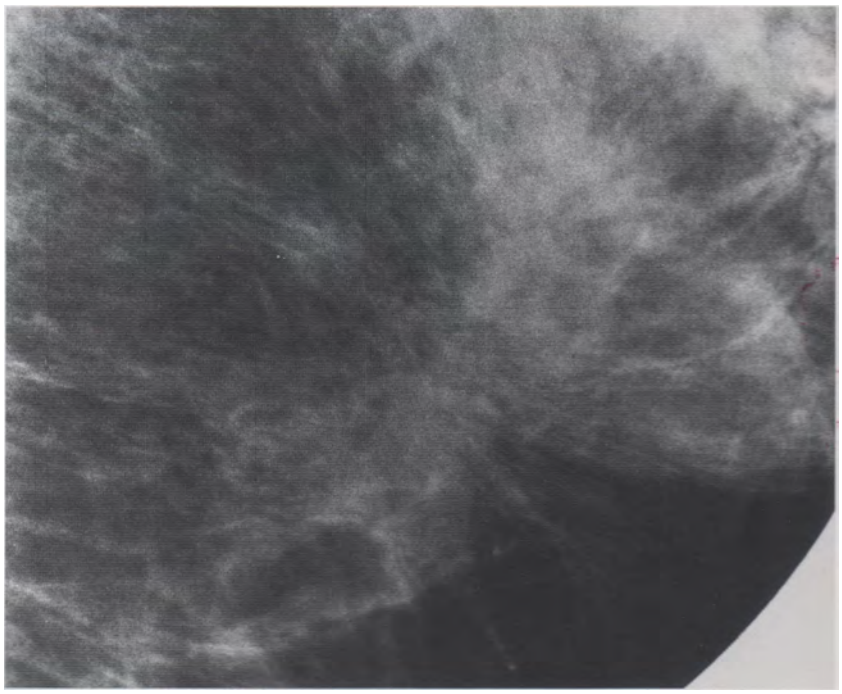
Follow-up

The patient died five years, eight months later of metastatic breast carcinoma.





83B



83C

84

Age 41, right breast operated four months earlier for a benign lesion. Screening examination.

Mammography

Fig. 84A & B: Right breast, medio-lateral oblique and cranio-caudal projections. There is a stellate lesion in the upper inner quadrant with no associated calcifications.

Analysis

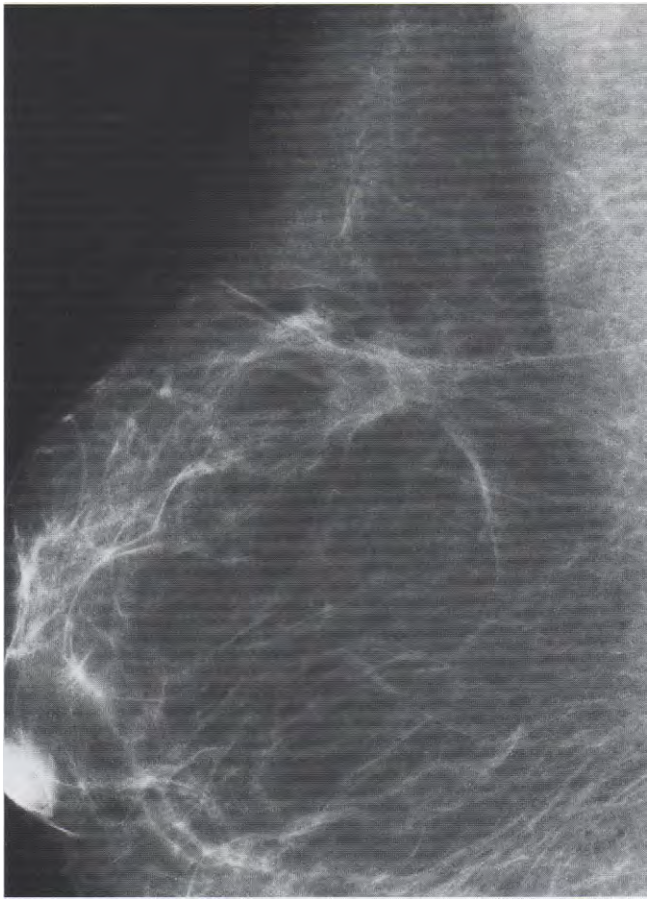
Tumor Center: There are several radiolucent areas within the indistinct tumor center.
Radiating structure: Very fine, long, low density spicules. The skin is slightly retracted at the site of operation.

Conclusion

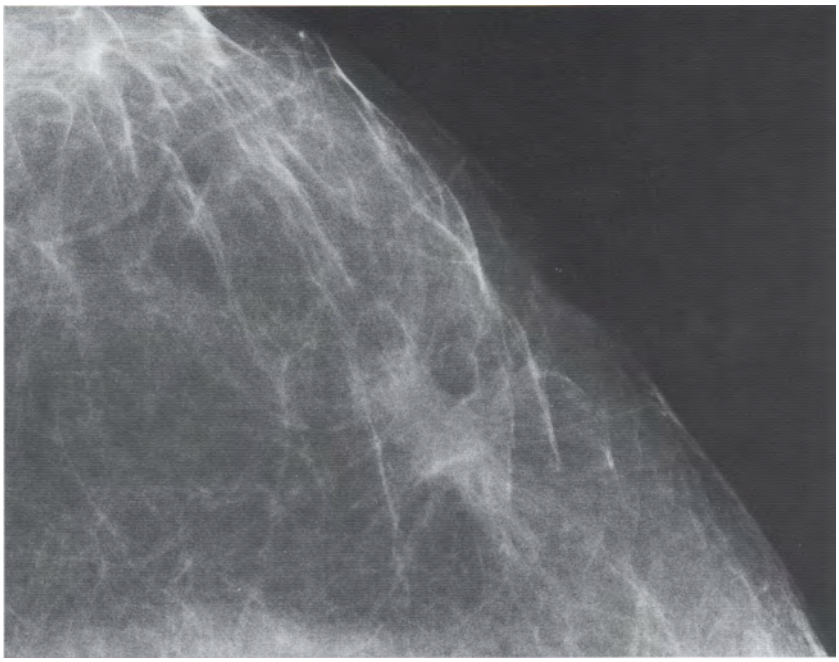
The history of recent breast surgery confirms the diagnosis of traumatic fat necrosis with considerable certainty. The mammographic description is typical of the stellate form of traumatic fat necrosis.

Repeat Mammography

Fig. 84C: Right breast, medio-lateral oblique projection, two years later.
There is nearly complete resolution of the stellate lesion with a small crater at the operative site.



84A



84B

84C

85

61-year-old asymptomatic woman. First screening study.

Physical Examination

No palpable tumor in the breasts.

Mammography

Fig. 85 A & B: Left breast, medio-lateral oblique and cranio-caudal projections. At coordinate Al a solitary, non-calcified tumor is seen.
Fig. 85 C: Microfocus magnification view.

Analysis

Form: circular, round
Contours: unsharp; a wide comet tail is directed towards the nipple

Conclusion

Mammographically malignant tumor.
Fig. 85 D: Operative specimen photograph.

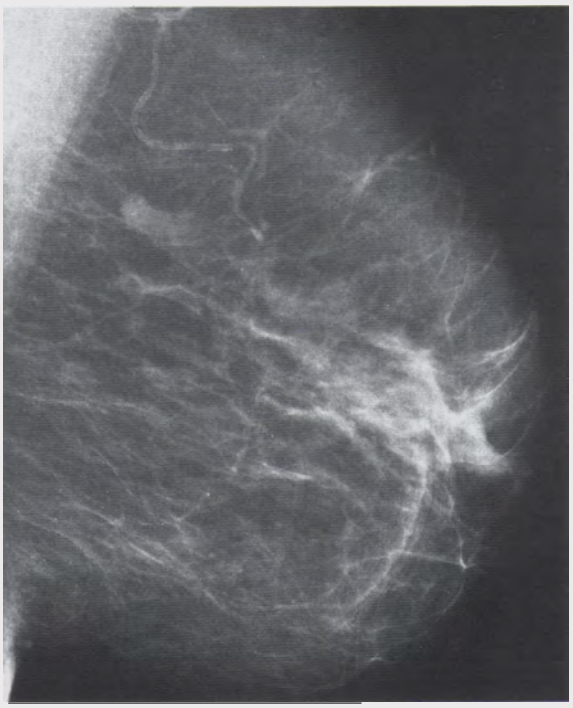
Histology

8 x 8 mm ductal carcinoma. No axillary metastases.

Follow-up

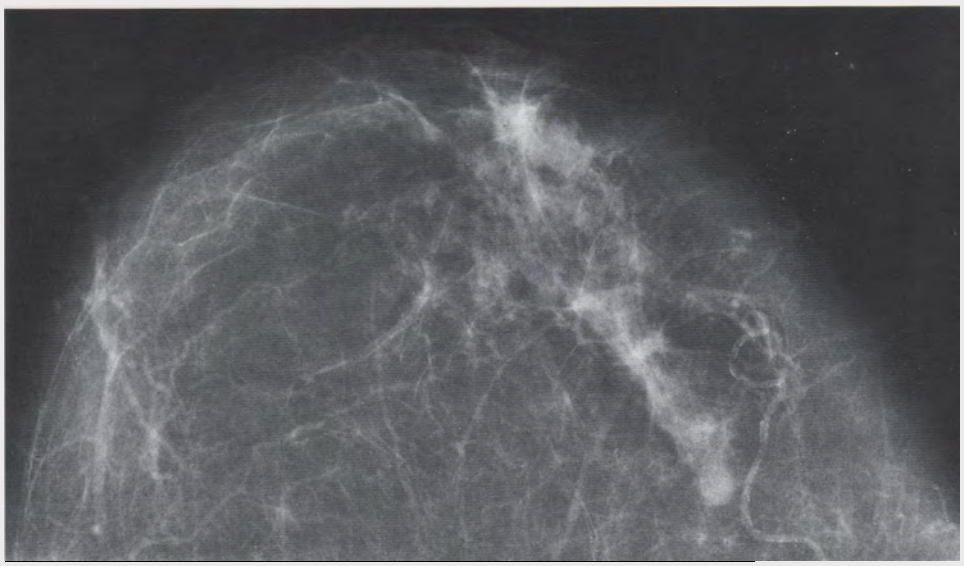
The patient died 12 years later in pulmonary edema with concurrent metastatic breast carcinoma.

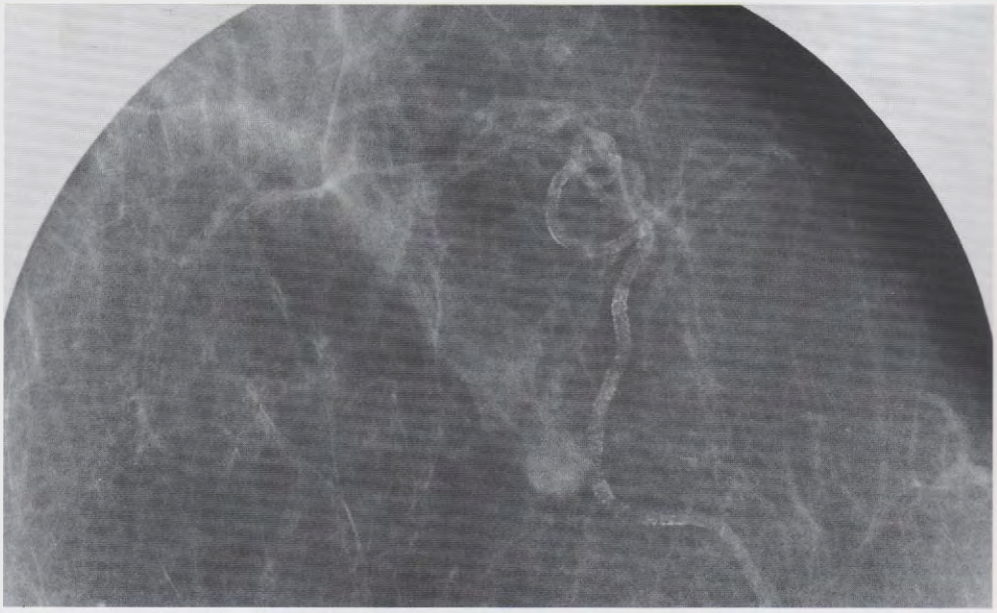
A

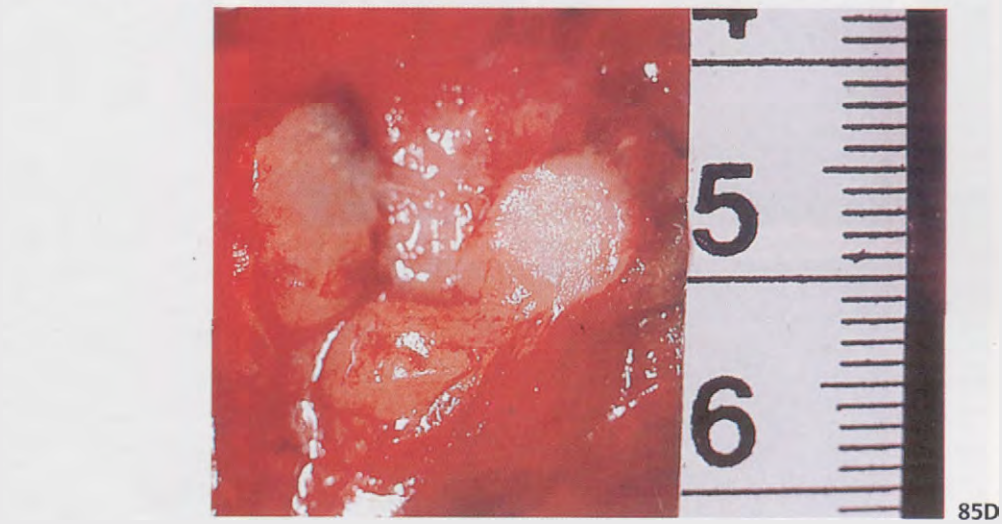


85A

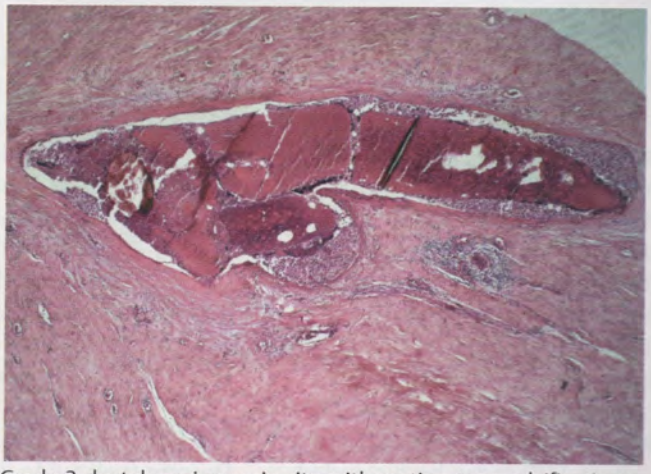
A



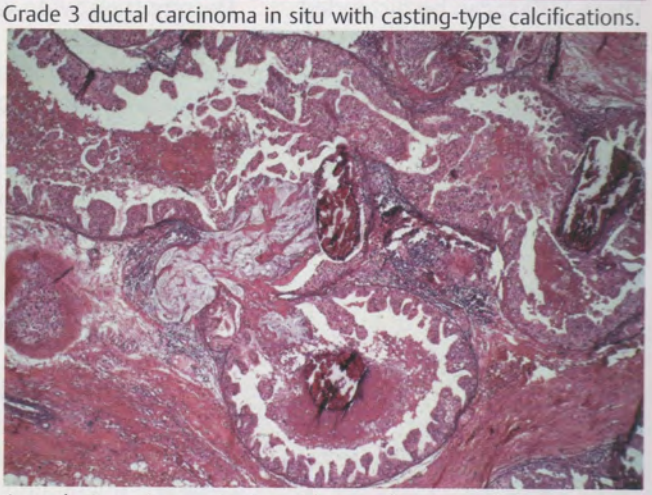



5
6
85D

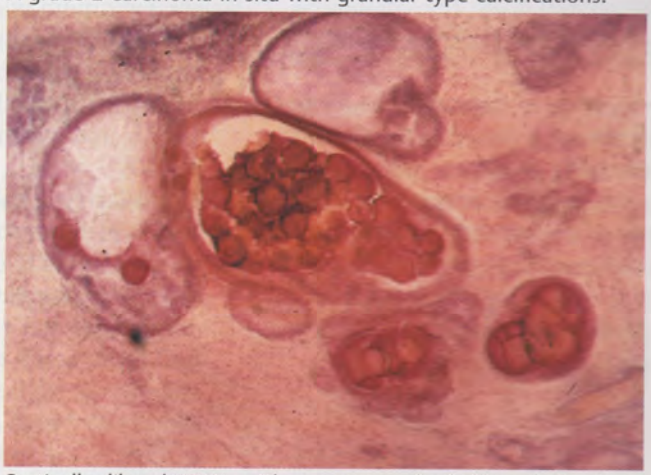
VI. Calcifications



Grade 3 ductal carcinoma in situ with casting-type calcifications.



A grade 2 carcinoma in situ with granular type calcifications.



Cystically dilated TDLUs with psammoma body like calcifications.

When analyzing calcifications in the absence of a tumor, or when disregarding the associated tumor, the most important factors are the *distribution* of the calcifications and the *form, size,and density* of the individual particles. The number of the individual calcifications is of little importance when making a diagnosis.
The goal of calcification analysis is to determine the pathological process that has produced them. The first step is to analyze their distribution and form in order to ascertain their pathoanatomical location, i. e. the cavity in which they were formed.
Linear, fragmented, branching calcifications are located within *dilated ducts.* The dilatation may be caused by fluid accumulation (plasma cell mastitis) or by proliferation of malignant cells (high-grade, poorly differentiated carcinoma in situ). Differential diagnosis of calcifications formed within the ducts is relatively easy.
Individual or multiple clusters indicate that the pathological process takes place within the terminal ductal lobular units (TDLUs). These TDLUs can be distended by the accumulation of fluid (fibrocystic change, see pages 3, 197) or by malignant cells accompanied by either necrosis (typical of Grade 2 in situ carcinoma) or by mucin (typically a product of Grade 1 in situ carcinoma cells). Differential diagnosis of calcifications formed within the lobules is often difficult.
Miscellaneous calcifications are not producted by malignant processes. They are often found within the stroma and are usually easily recognized, their differential diagnosis presenting fewer problems. Miscellaneous calcifications include calcifications surrounding the ducts and within the arterial walls, fibroadenomas, sebaceous glands, oil cysts, papillomas, etc.
Once the location of the calcifications has been determined, a closer understanding of the underlying processes producing them requires analysis of the *form, size,* and *density* of the individual calcifications. Microfocus magnification mammography is often essential for this analysis, since it provides higher-resolution images.

Malignant-Type Calcifications within Ducts and/or Lobules

Proliferation of the epithelium within the TDLU and/or the ducts may progress through several stages of atypia to carcinoma in situ. Calcifications may be a by-product of this process. The mammographic appearance of these calcifications will be largely dependent upon the malignancy grade of the surrounding cellular proliferation. The heterogeneity of in situ carcinoma explains why the malignant-type microcalcifications will be extremely variable in *form, size, density,* and *number.* Their distribution will reflect their site of origin: either ducts (linear, scattered within a lobe) or TDLUs (single or multiple clusters).
The corresponding terminology of the American College of Radiology (BI-RADS) is given below in parentheses.

Form

Despite their wide variation in appearance, the malignant-type calcifications can be classified into three basic forms:

1) **Casting-type calcifications** (BI-RADS: fine linear branching [casting]calcifications): When high-grade (poorly-differentiated) carcinoma in situ extensively fills in the ducts and their branches, the central portion of the lumens will contain necrotic cellular debris. Within this necrosis calcifications are formed, and are seen on the mammogram as linear, fragmented, occasionally branching calcifications with irregular contours (Fig. XXVI). It is the ductal lumen that determines the maximum width of the castings. Microfocus magnification views reveal that these calcifications are built of fragments that differ in density, length, and outline (cases 90, 92, 96, 99-109).
2) **Granular-type calcifications** (BI-RADS: pleomorphic, heterogeneous): The individually discernable particles resemble granulated sugar or crushed stone. They are irregular in *form, size,* and *density,* and grouped very close together in single or multiple clusters (Fig. XXII). These calcifications are typically seen in Grade 2 in situ carcinoma, when the malignant cells and the associated necrosis distend the acini. The amorphous calcifications are formed within this necrosis (cases 86, 87, 88, 94, 95, 98).
3) **Powderish calcifications** (BI-RADS: amorphous, indistinct): Psammoma-body-like calcifications may be formed within the mucin secreted by Grade 1 in situ carcinoma cells which proliferate within the TDLUs. The individual calcifications are far too small to be individually perceptible, but the summation of many of them can be seen on the mammogram as multiple clusters of powderish calcifications (lower border of Fig. 107 C).

Size

These calcifications arise within the lumens of the TDLU(s) or duct(s), and are thus initially limited in size to these dimensions. With growth and infiltration of the tumor the calcifications coalesce, becoming larger through further tissue necrosis.

Density

Density analysis should include a comparison of the various parts of the individual calcifications (intraparticulate density analysis) and also a comparison of the densities of the particles with each other (interparticulate density analysis). The granular-type and the casting-type calcifications both show great variations in density within an individual particle and among adjacent particles.

Number

Although the actual number of calcifications has been considered by some to have diagnostic significance, the form, size, and density of the calcifications are of far greater importance. Magnification mammography in particular has demonstrated that the number of calcifications detected can be highly dependent upon the mammography technique. The granular-type calcifications are often innumerable, as one can understand from the pathological background.
It is important to note that the casting-type calcifications are so characteristic of Grade 2-Grade 3, poorly differentiated carcinoma in situ that the diagnosis can be made on the basis of one or two such calcifications alone (cases 101, 105).

Calcifications localized within ducts

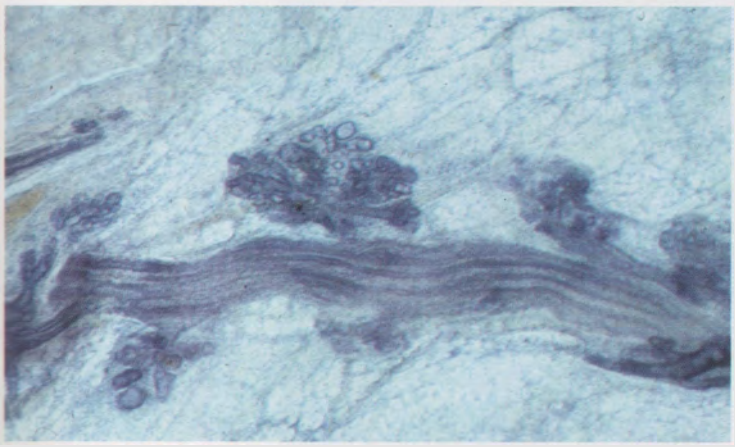


Fig. XXIV: Thick section histology image of a normal duct.

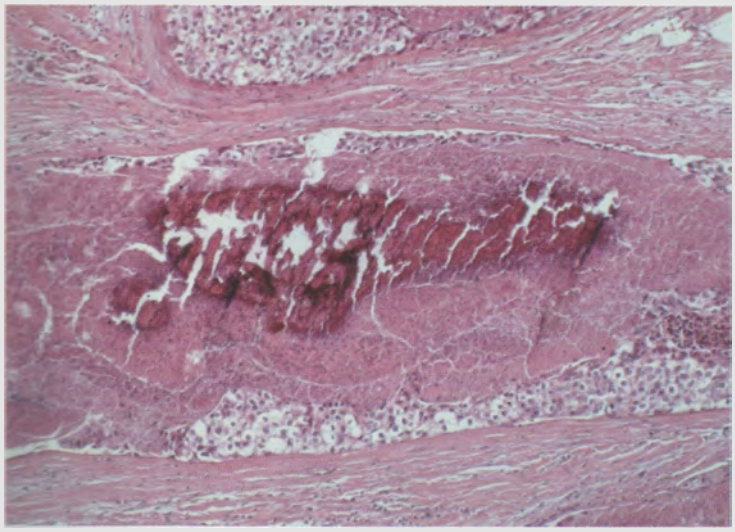


Fig. XXV: Large section histology image of a duct distended by grade 3 in situ carcinoma.

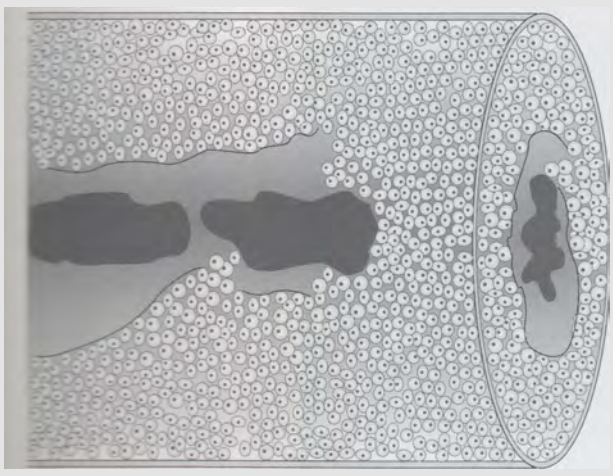


Fig. XXVI: Extremely distended duct with grade 3 arcinoma in situ, solid cell proliferation, ecrosis, and amorphous, casting-type ons.

Calcifications localized within lobules

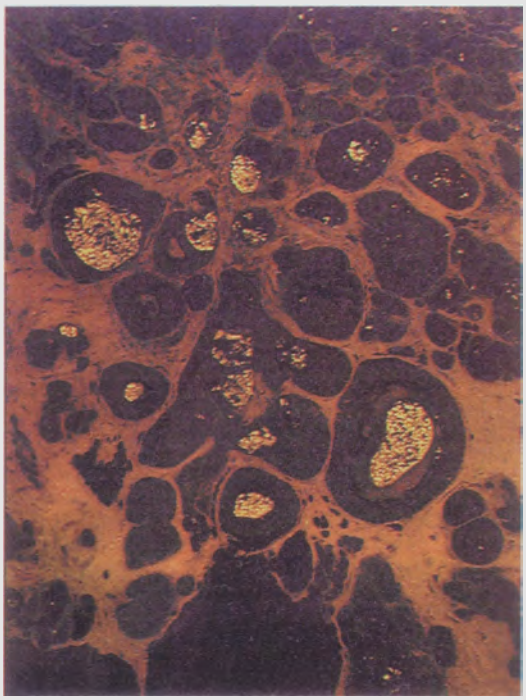


Fig. XXII: Granular type calcifications within a TDLU. The individual particles are irregular in size, shape and density and are grouped in a cluster.

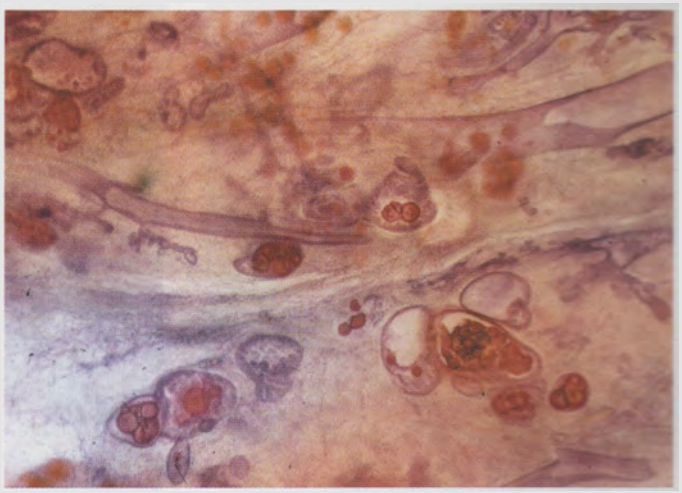


Fig. XXIII: Fibrocystic change with psammoma body like calcifications.

Practice in Calcification Analysis

(Cases 86-109)

86

48-year-old woman, asymptomatic. First screening examination.

Physical Examination

No palpable tumor in the breasts.

Mammography

Fig. 86A: Right breast, detailed view of the medio-lateral oblique projection. Normal mammogram.
Second screening examination 24 months later. No palpable tumor.
Fig. 86B: Right breast, detailed view of the medio-lateral oblique projection. A cluster of microcalcifications is now seen in the upper half of the breast (arrow). No associated tumor mass.
Fig. 86 C & D: Right breast, micro-focus magnification views, medio-lateral oblique and cranio-caudal projections.

Analysis of the Calcifications

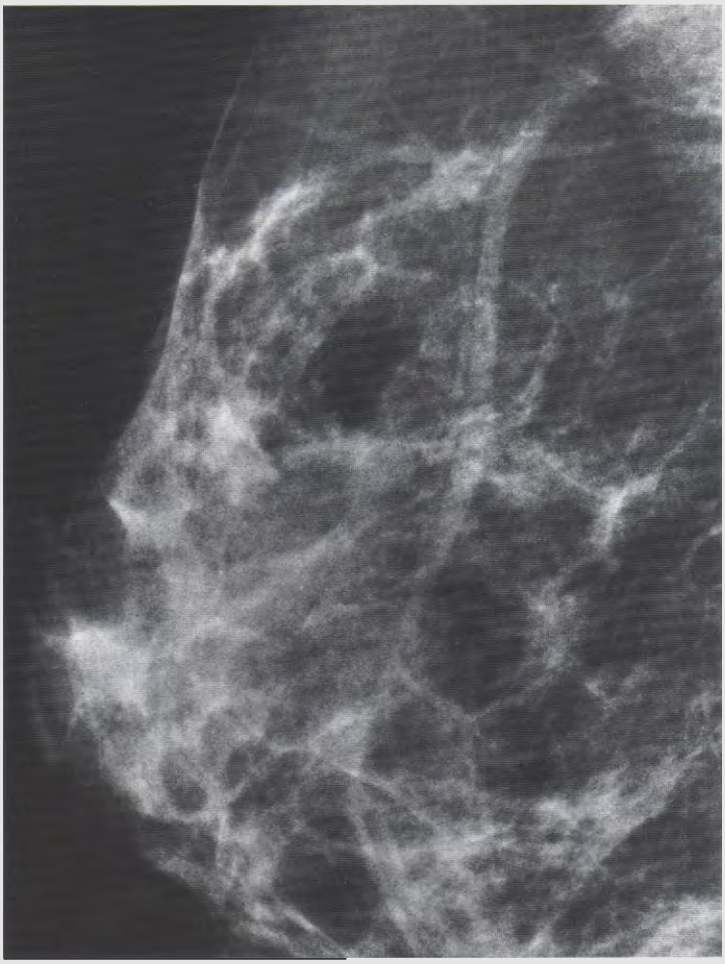
The tiny, granular, clustered calcifications are irregular in form, size and density. They have arisen since the previous examination. Mammographically malignant-type calcifications.
Fig. 86 E & F: Operative specimen radiographs, magnification view.

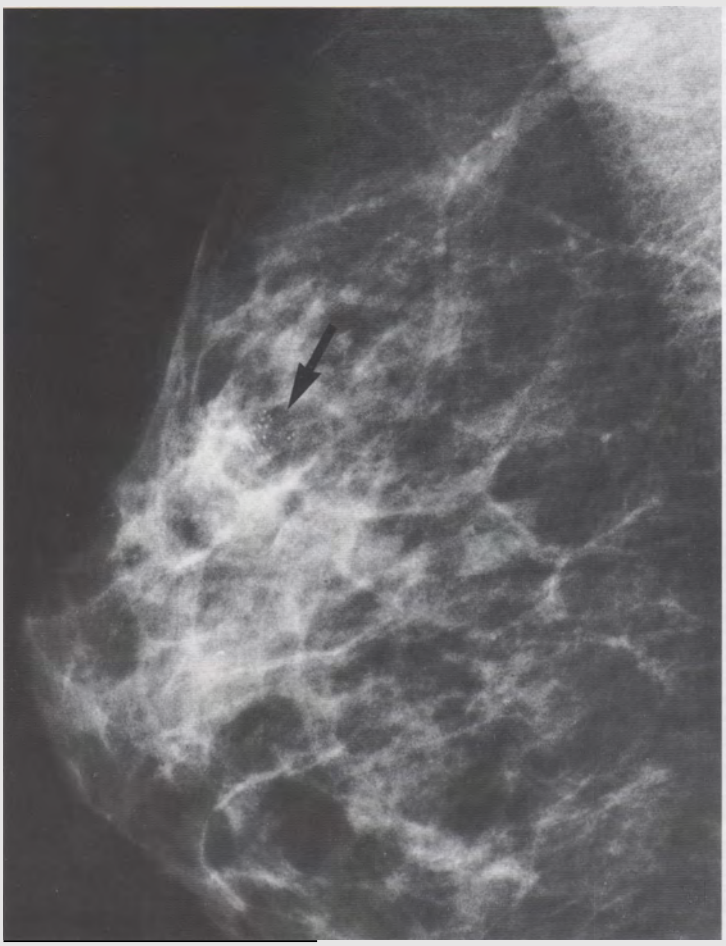
Histology

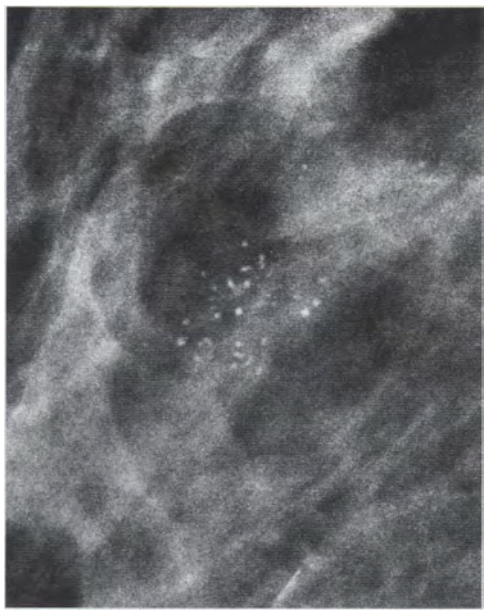
High-grade "comedo" ductal carcinoma in situ with infiltration.

Follow-up

The woman was still alive 19 years later.

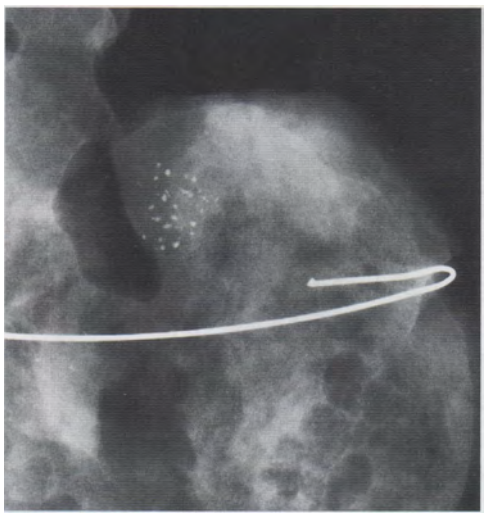




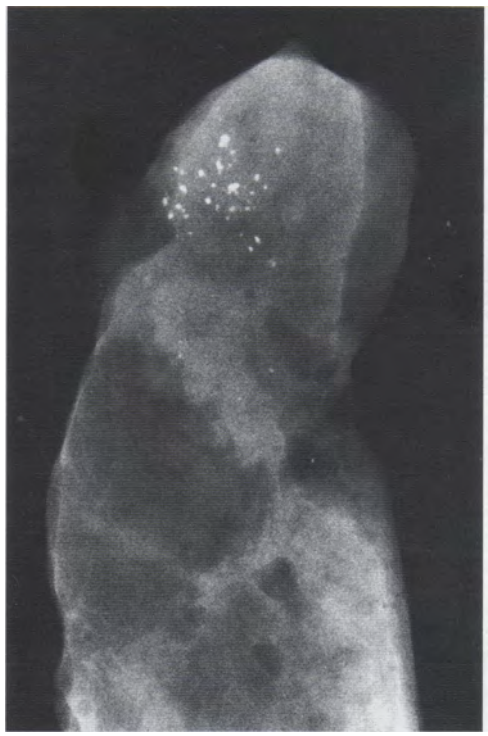


86C

86D



86E



86F

87

Asymptomatic 50-year-old woman. First screening study.

Physical Examination

No palpable tumor in the breasts.

Mammography

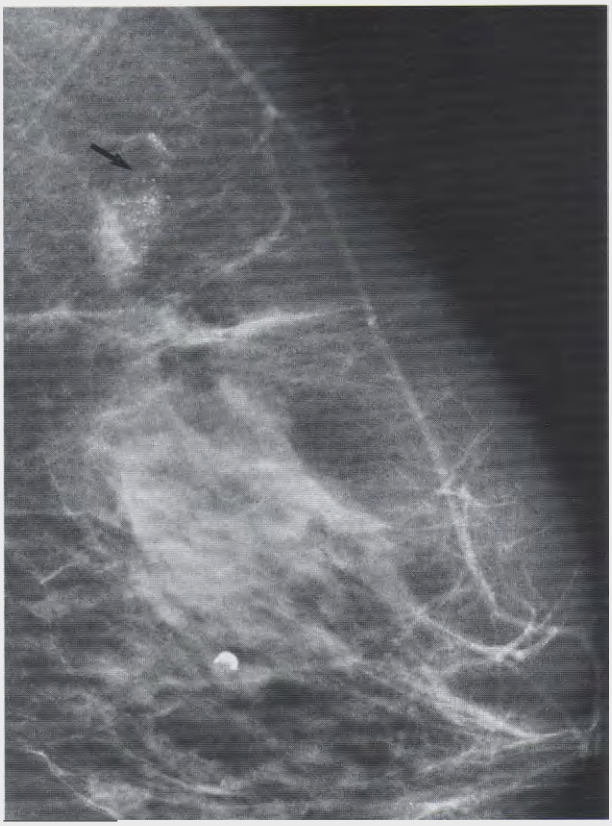
Fig. 87A: Left breast, medio-lateral oblique projection. Two clusters of microcalcifications are seen in the upper half of the breast (arrow). In addition, a solitary, 4-mm crescent-shaped calcification is seen in the central portion of the breast, mammographically benign.
Fig. 87 B & C: Magnification view, medio-lateral oblique projection and specimen radiography.

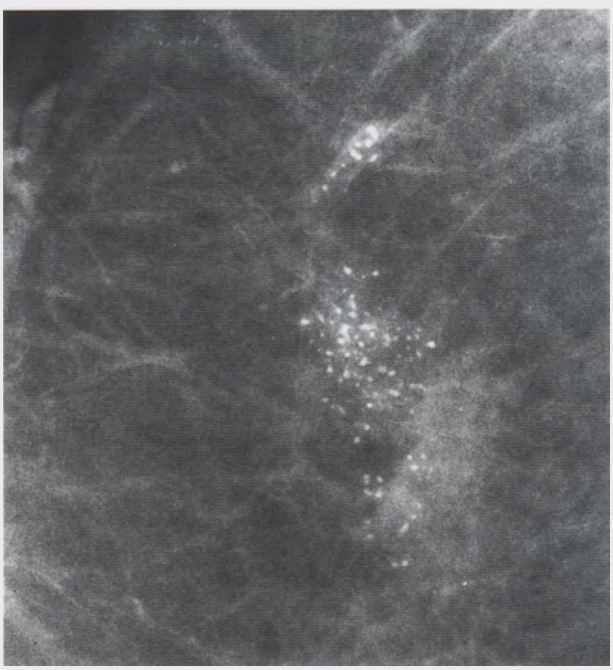
Analysis of the Clustered Calcifications

Form: granular, some elongate; highly irregular
Density: variable
Distribution: cluster, the calcifications are seen very near to each other in a small area of the breast

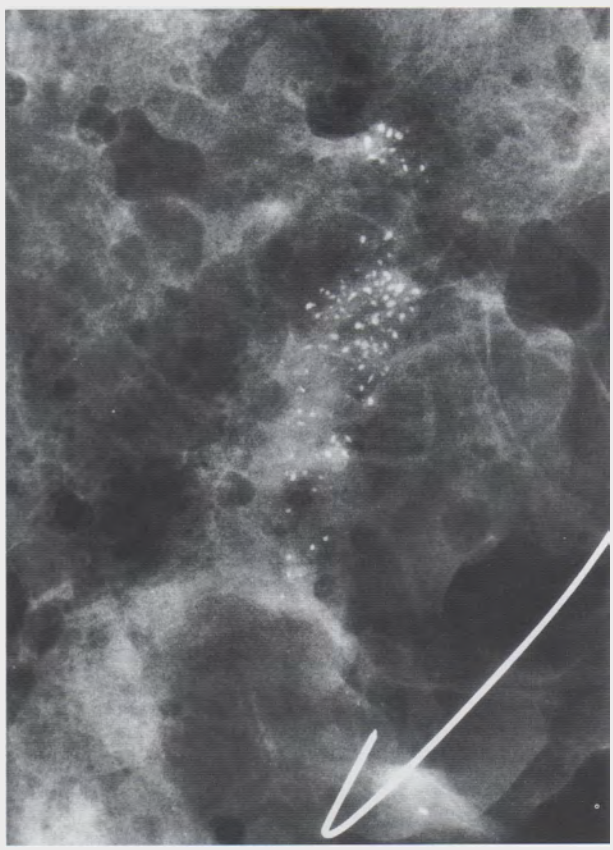
Conclusion

Mammographically malignant-type (granular) microcalcifications.





87B

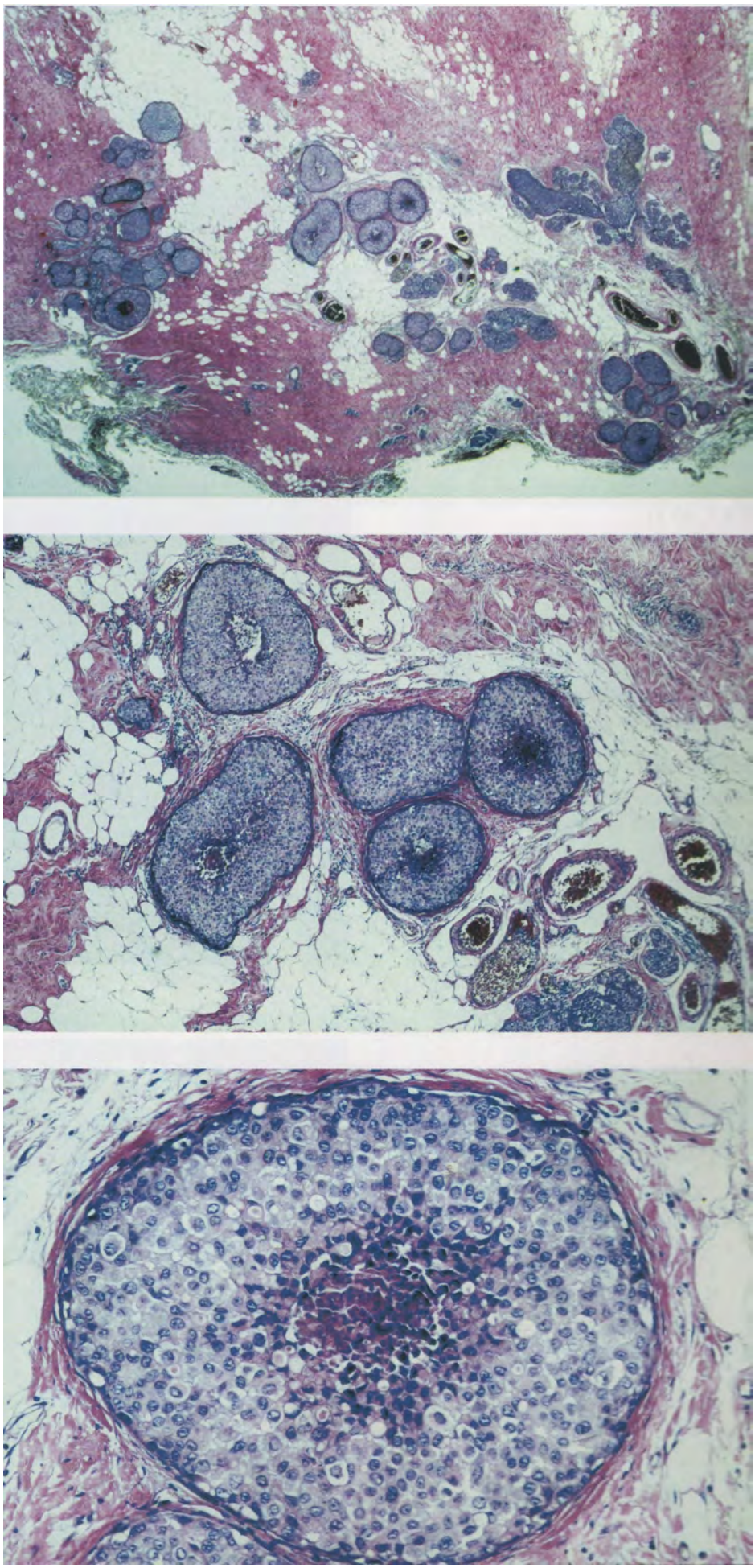


Histology

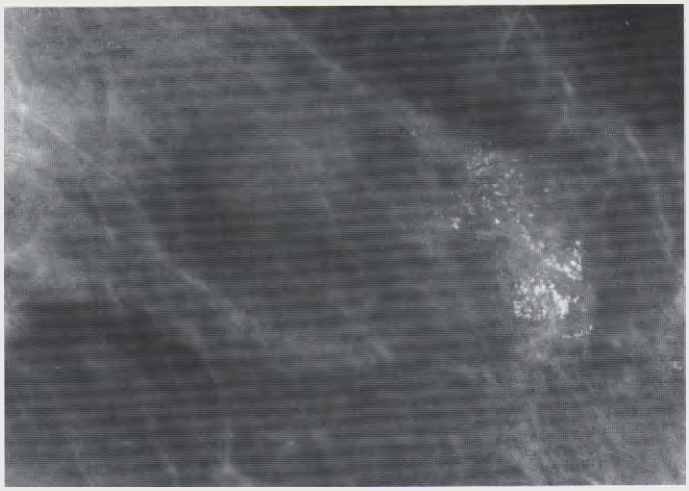
Intraductal carcinoma.
Fig. 87D: Low-power view of the Grade 2 ductal carcinoma in situ involving several TDLUs. (H & E, 40 x)
Fig. 87 E: One TDLU filled with malignant cells, corresponding to one cluster on the mammogram. (H & E, 100 x)
Fig. 87 F: Cellular details of a Grade 2 ductal carcinoma in situ. (H & E, 200 x)

Follow-up

The woman died 15 years later from myocardial infarction with no evidence of breast cancer.



88



88A

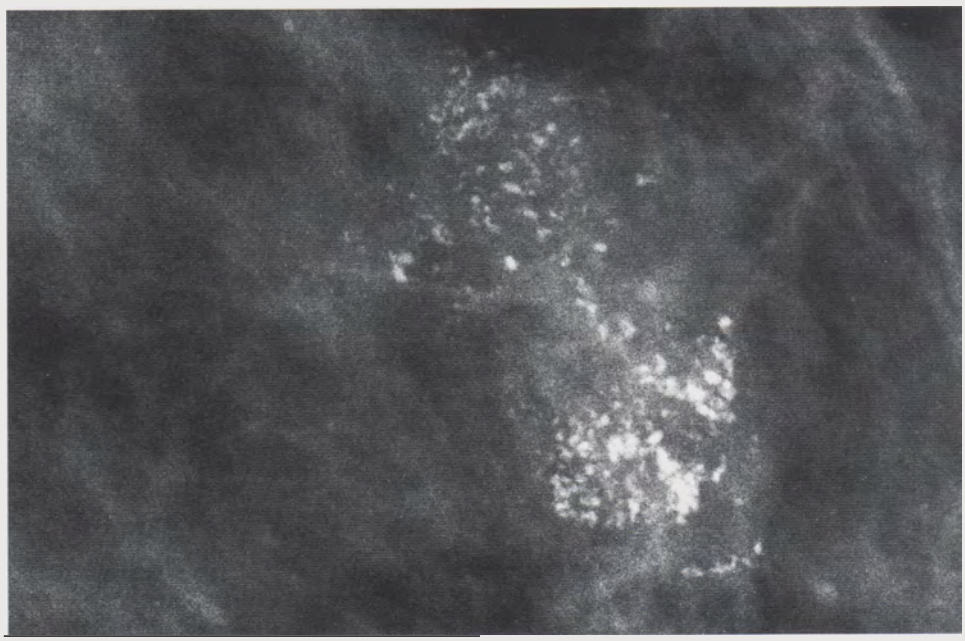
Fig. 88 A & B: Detailed view of the contact mammogram and microfocus magnification view. Innumerable granular-type calcifications of varying form, size and density. Some calcifications are of the casting type.
Typical mammographic appearance of malignant-type calcifications.

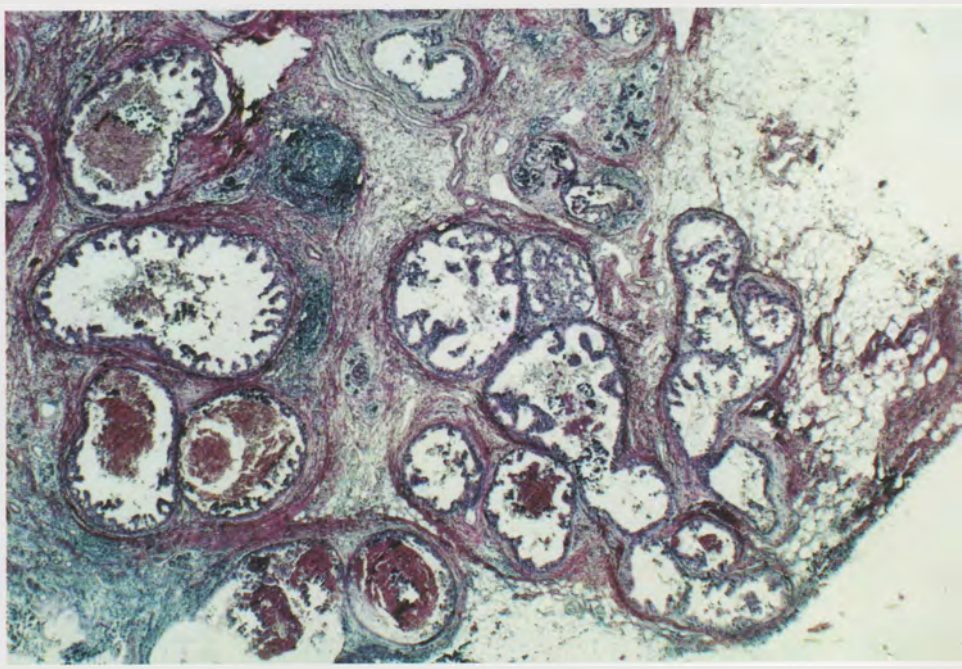
Histology

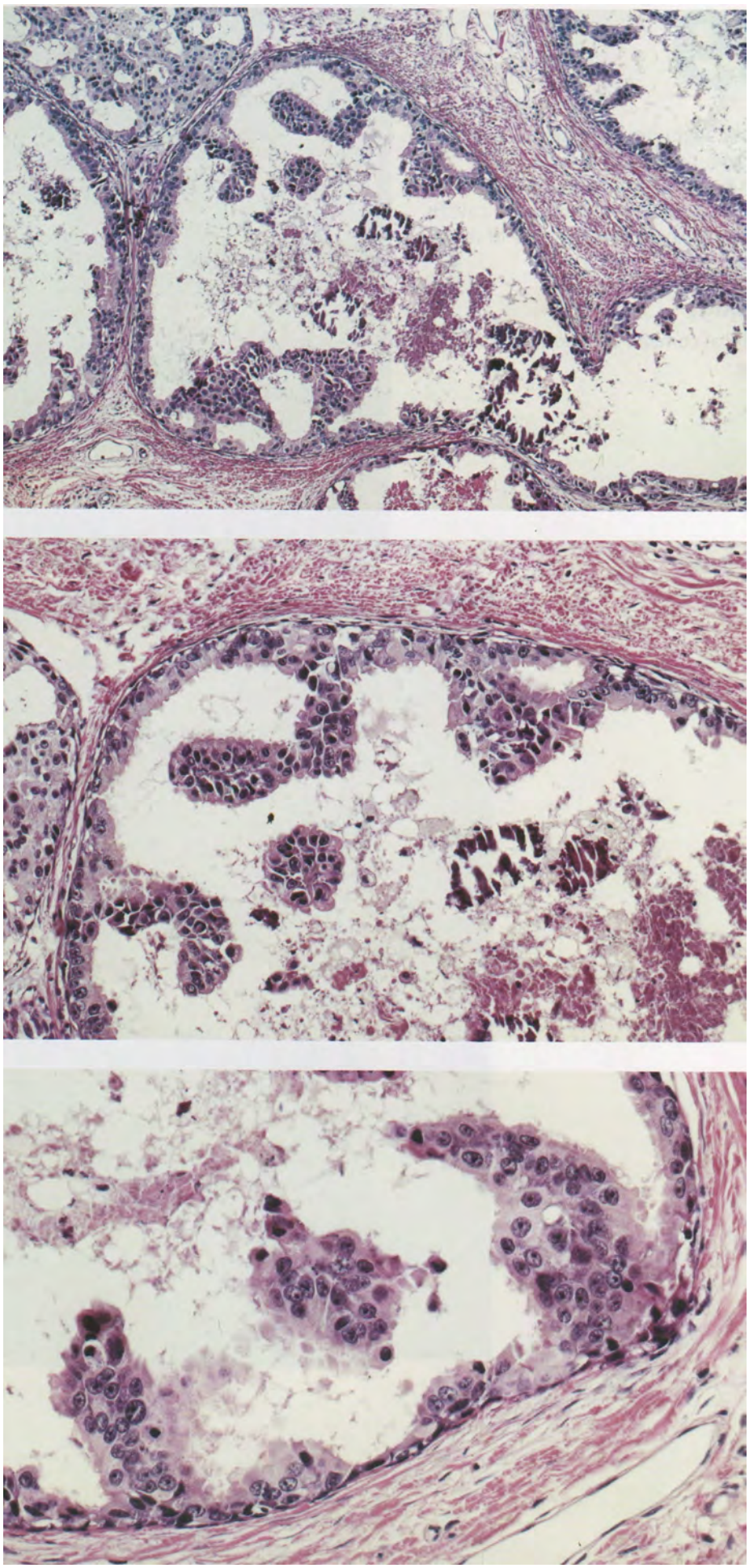
Infiltrating ductal carcinoma, associated with in situ component.
Fig. 88 C: Low-power view of the micropapillary ductal carcinoma in situ component that predominates in this tumor. (H & E, 40 x)
Fig. 88 D & E: Higher magnification of the Grade 2 carcinoma in situ with associated amorphous calcifications corresponding to the calcifications on the mammogram. (H & E, 200 x and 300 x)
Fig. 88 F: Cellular details of this Grade 2, micropapillary ductal carcinoma in situ. (H & E, 400 **x)**

Follow-up

The woman was still alive 19 years later at age 80 with no evidence of breast cancer.





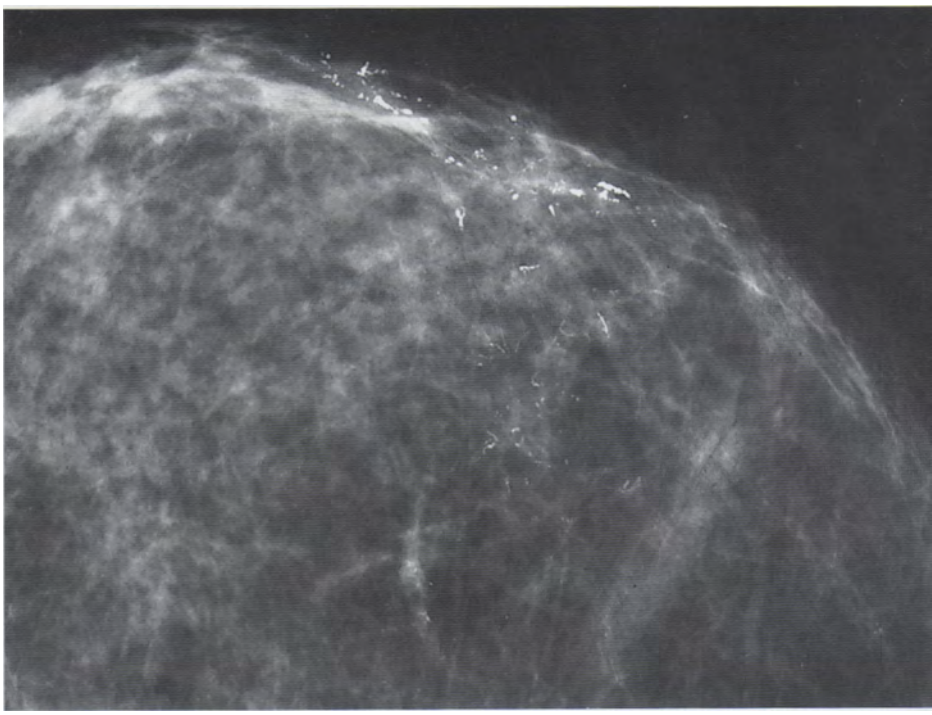


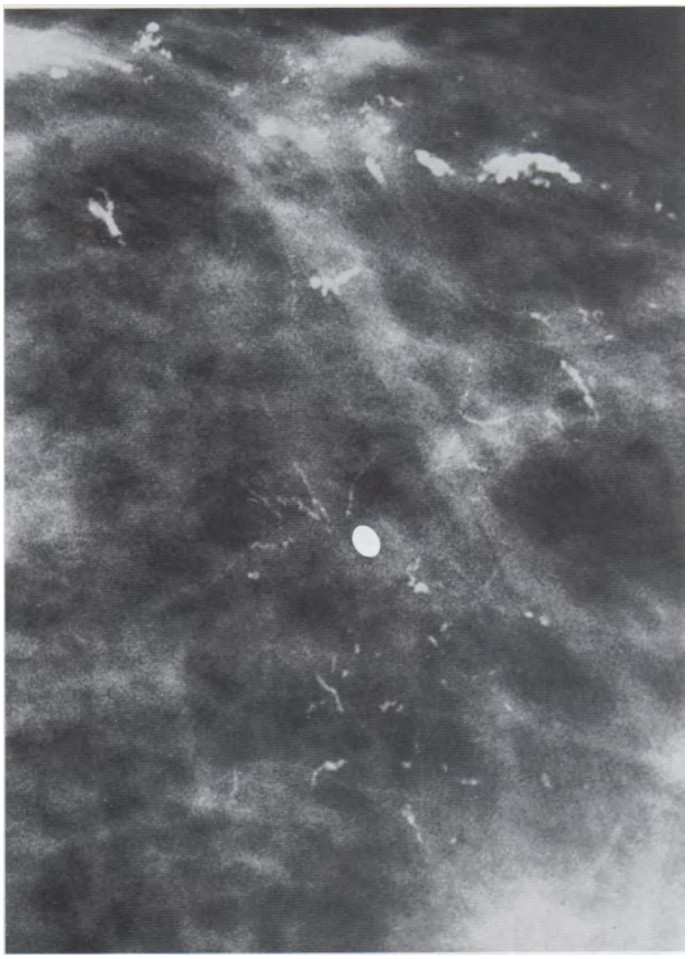
89

Fig. 89A: Right breast, detailed view of the cranio-caudal projection.
Fig. 89 B: Microfocus magnification view. There are numerous casting-type calcifications indicating the presence of malignancy.

Histology

Multifocal comedo carcinoma, non-infiltrating.





89B

90

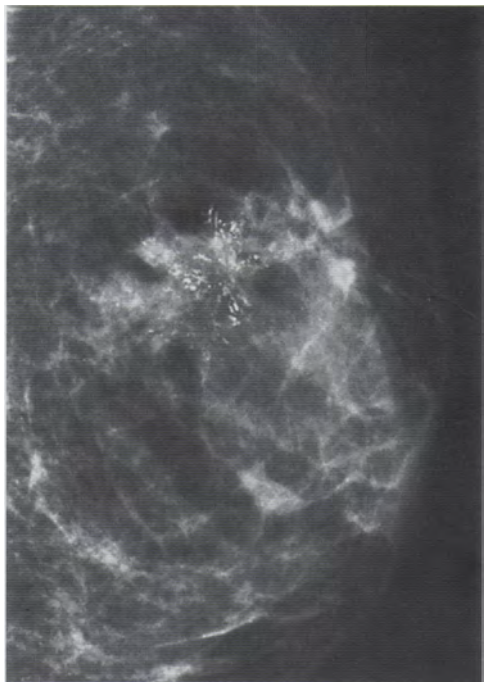
Fig. 90A: Detailed view of the mediolateral oblique projection, left breast. Age 27.
Fig. 90B: Enlarged view of the calcifications.
There is a cluster of numerous casting-type, branching calcifications, characteristic of carcinoma.

Histology

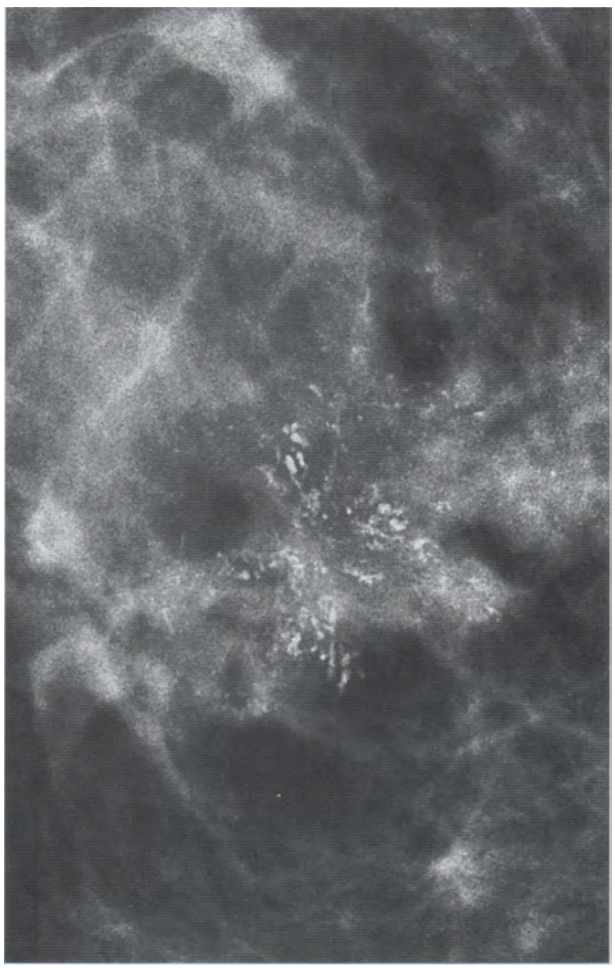
Infiltrating carcinoma with lymph node metastases.
Fig. 90C: Low-power view of the invasive ductal carcinoma including an in situ component. (H & E, 40 x)
Fig. 90D: Poorly differentiated invasive ductal carcinoma. (H & E, 200 x)
Fig. 90E: Axillary lymph node containing metastes. (H & E, 200 x)

Follow-up

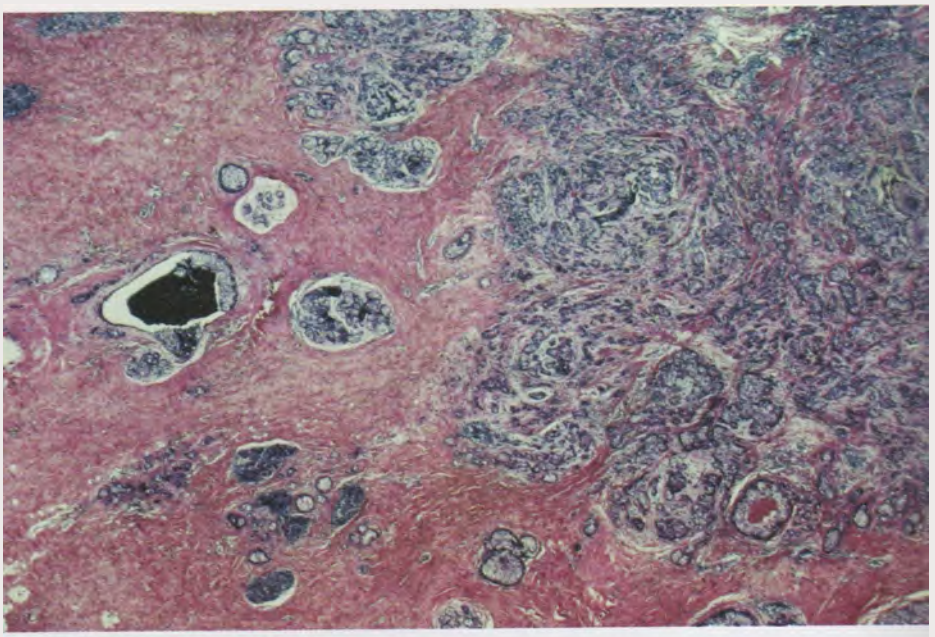
The patient died tow years later of metastatic breast carcinoma at age 29.

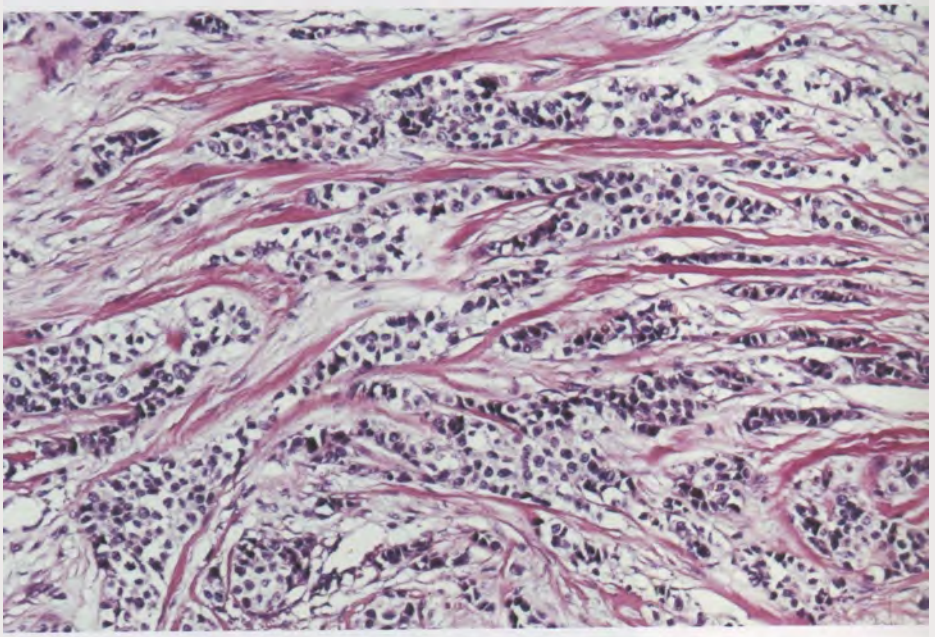


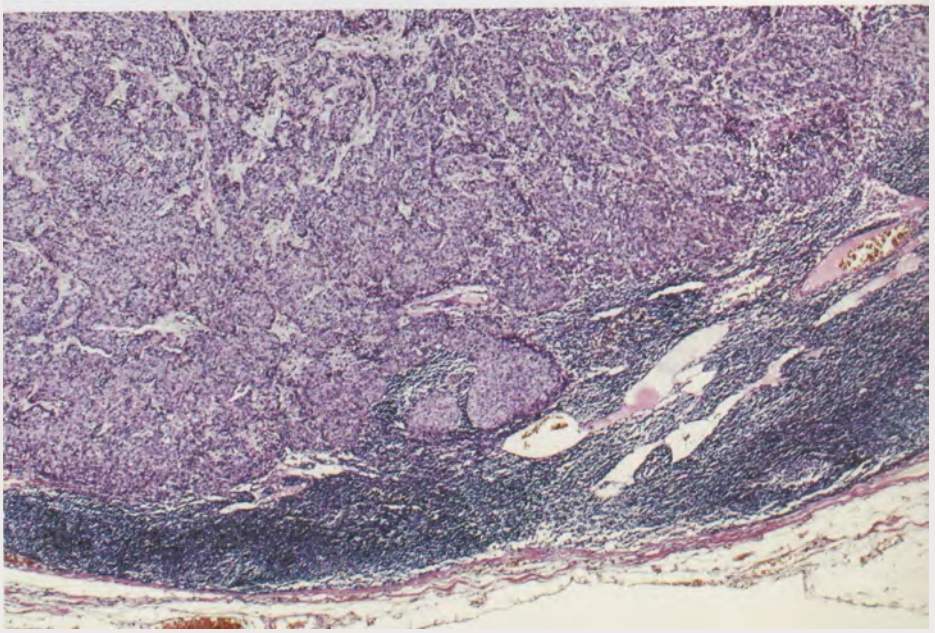
90A



90B







91

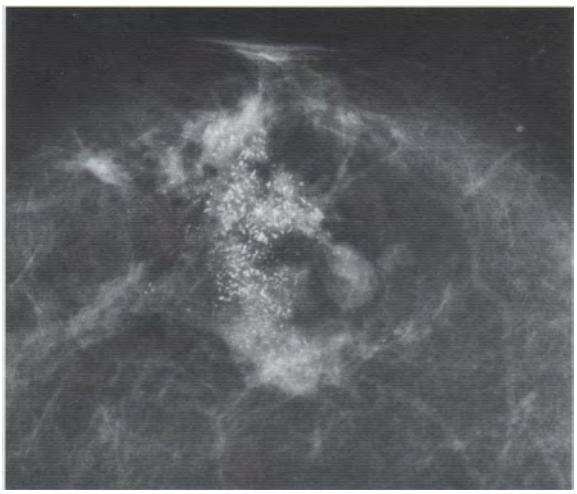
Fig. 91 A: Right breast, detailed view of the cranio-caudal projection. There are innumerable, highly irregular, mostly branching, casting-type calcifications of varying size and density. An ill-defined density surrounds the calcifications. This may correspond to either infiltration or desmoplastic reaction.
Fig. 91 B: Microfocus magnification view.

Histology

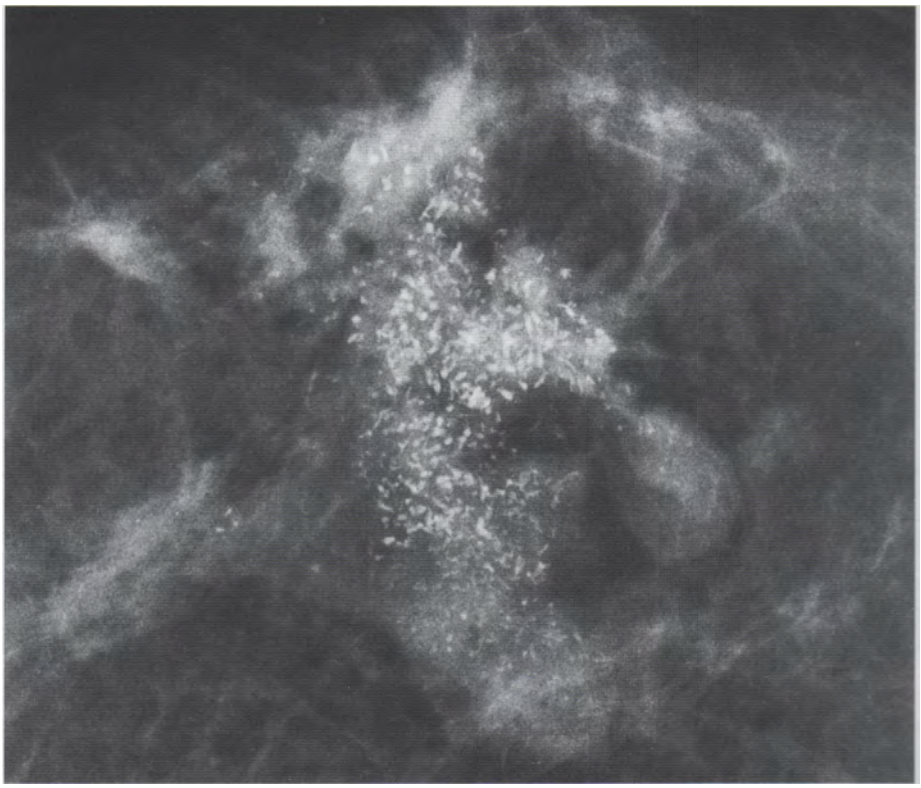
High-grade ductal carcinoma in situ with central necrosis and invasion.
Fig. 91 C: Low-power view showing a large number of amorphous intraductal calcifications corresponding to the coarse calcifications on the mammogram. (H & E, 40 x)

Follow-up

The woman died 13 years later from myocardial infarction at age 74. There was no evidence of breast cancer.



91A



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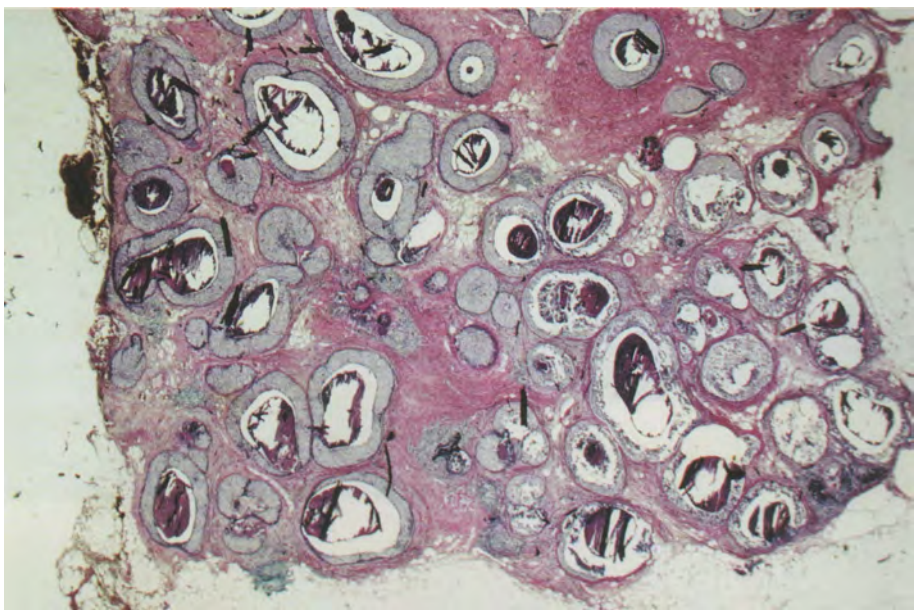
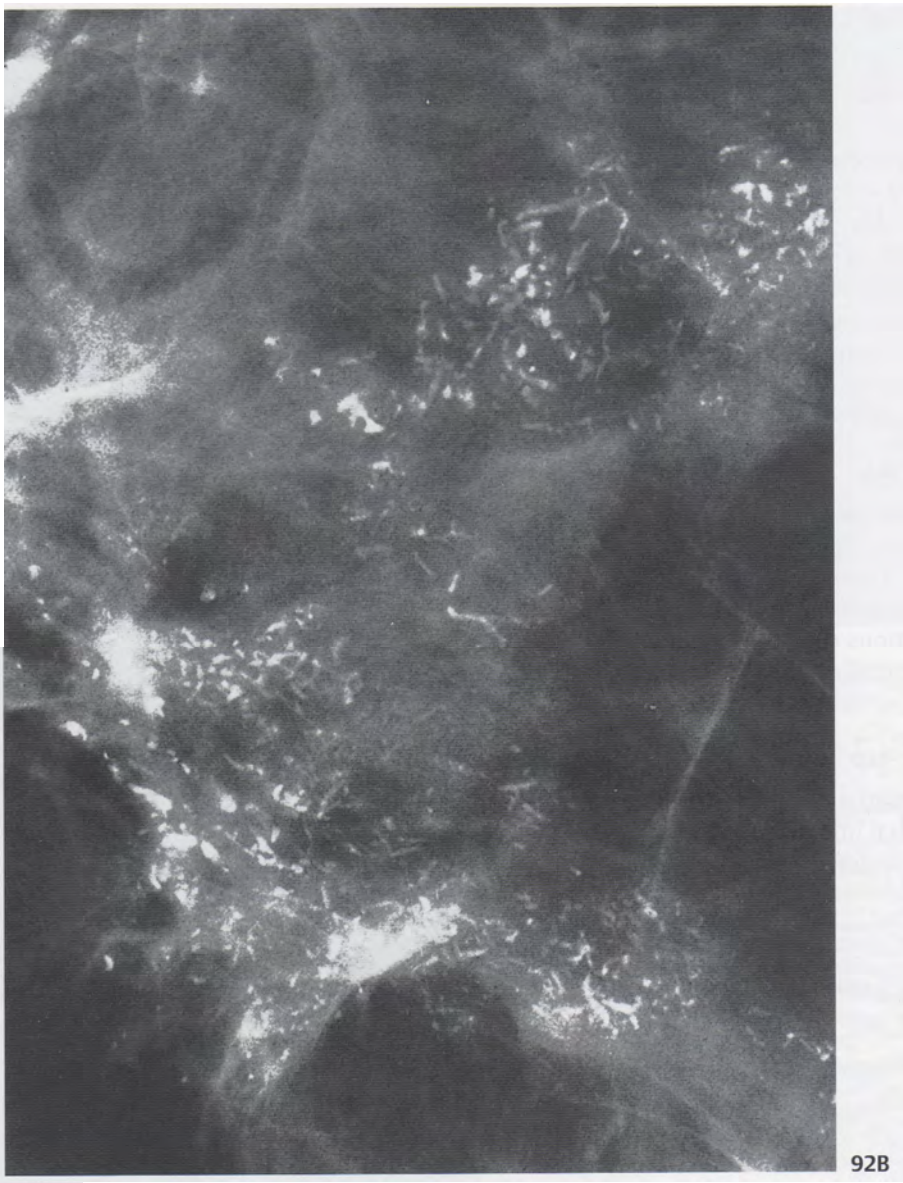
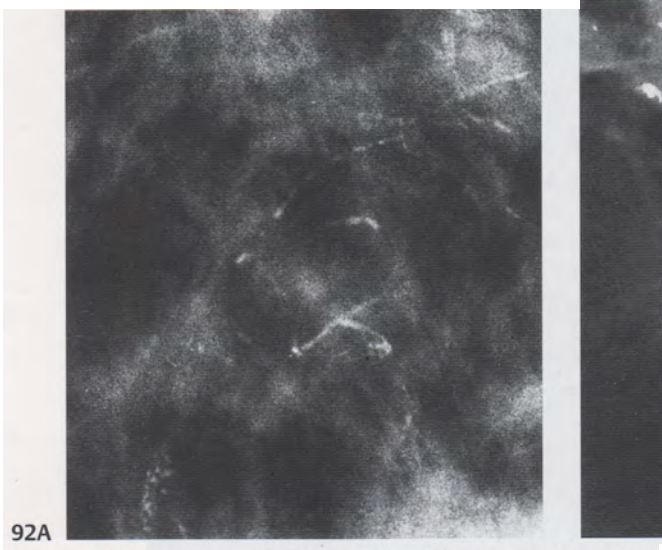


91C

92

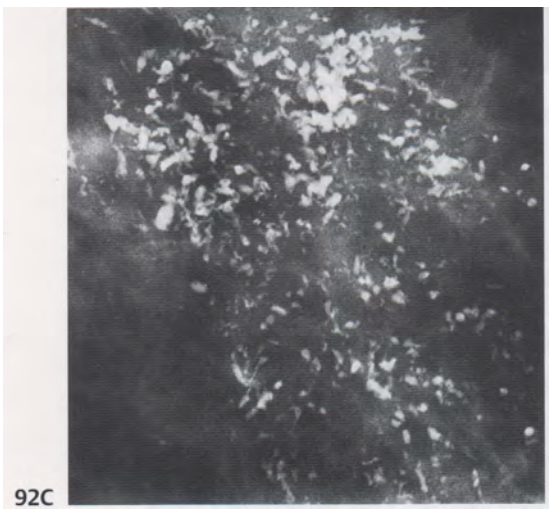
Fig. 92 A—D: Four examples of malignant type calcifications, mostly casting type. Magnification reveals that the castings are constructed of fragments that differ in density, width, and length and are irregular in outline.



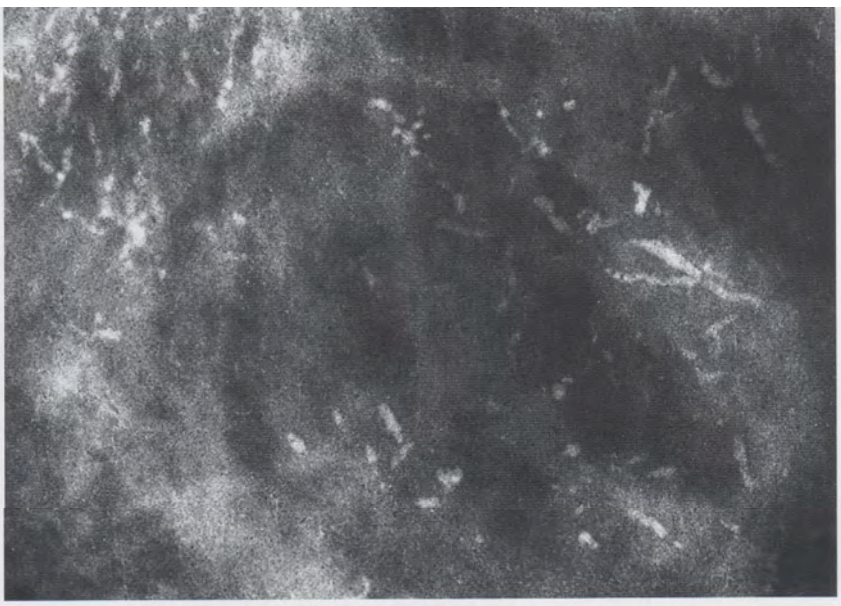


92A

92B



92C



92D

93

Age 40. Asymptomatic. First screening examination.

Physical Examination

No palpable tumor in the breasts.

Mammography

Fig. 93 A & B: Left breast, detailed views of the medio-lateral oblique and cranio-caudal projections. There is a small group of calcifications in the lower outer quadrant.
Fig. 93 C: Microfocus magnification view of the medio-lateral oblique projection.

Analysis

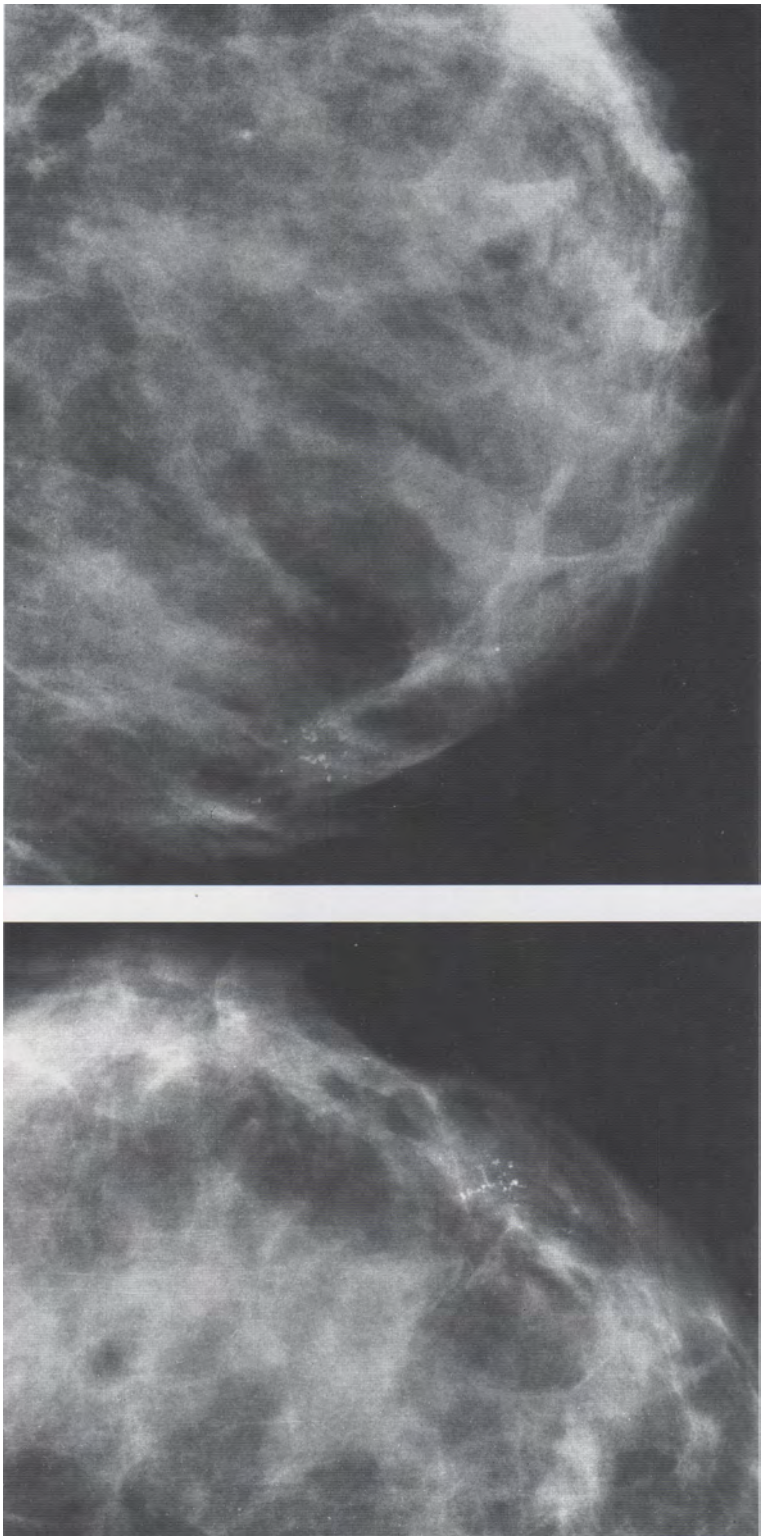
This is an example of casting-type calcifications. These are formed within segments of a duct and its branches. The ductal lumen contains the irregular epithelial proliferation which gradually undergoes necrosis and becomes partially calcified. There is also an irregular, active production of calcifications, and together these two processes result in the highly variable outline typical of casting-type calcifications. The magnification view reveals that the cast is built of fragments that differ in density, length, and outline.
Fig. 93 D: Operative specimen radiograph, magnification.

Histology

Invasive and in situ ductal carcinoma. No lymph node metastases.
Fig. 93 E: Overview of the 3-mm invasive component associated with an in situ focus. (H & E, 40 x)
Fig. 93 F: Higher magnification of the invasive tumor. (H & E, 220 x)
Fig. 93G & H: Cellular details of the extensive Grade 3 ductal carcinoma in situ. (H & E, 600 x)
Fig. 931: Overview of the retromamillary area with extension of the high-grade ductal carcinoma in situ. (H & E, 12.5 x)
Fig. 93J: High-power view of the retromamillary ductal carcinoma in situ. (H & E, 600 x)

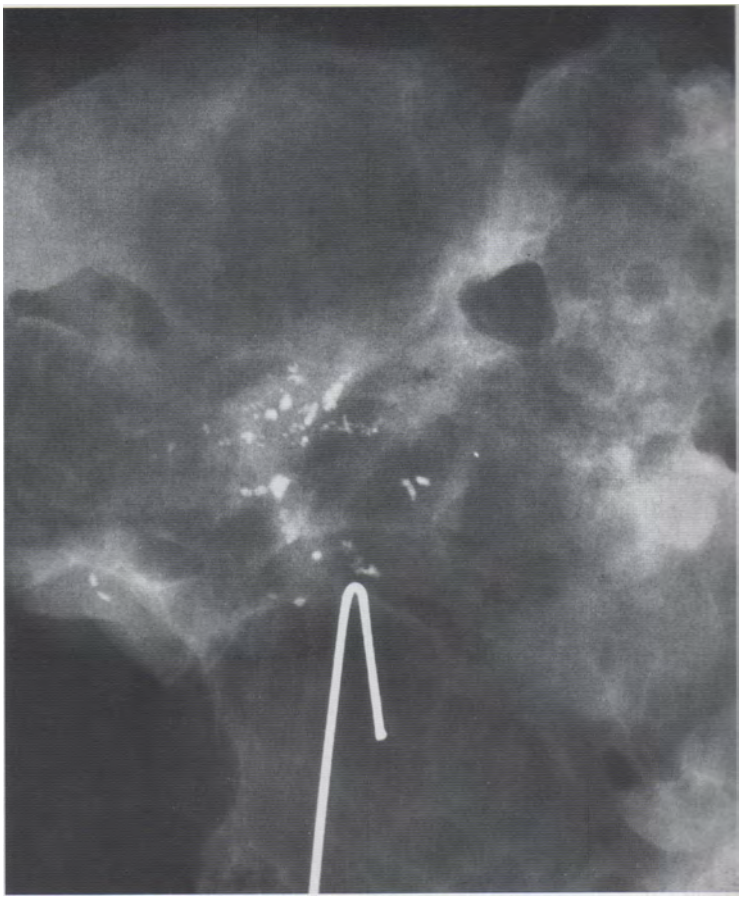
Follow-up

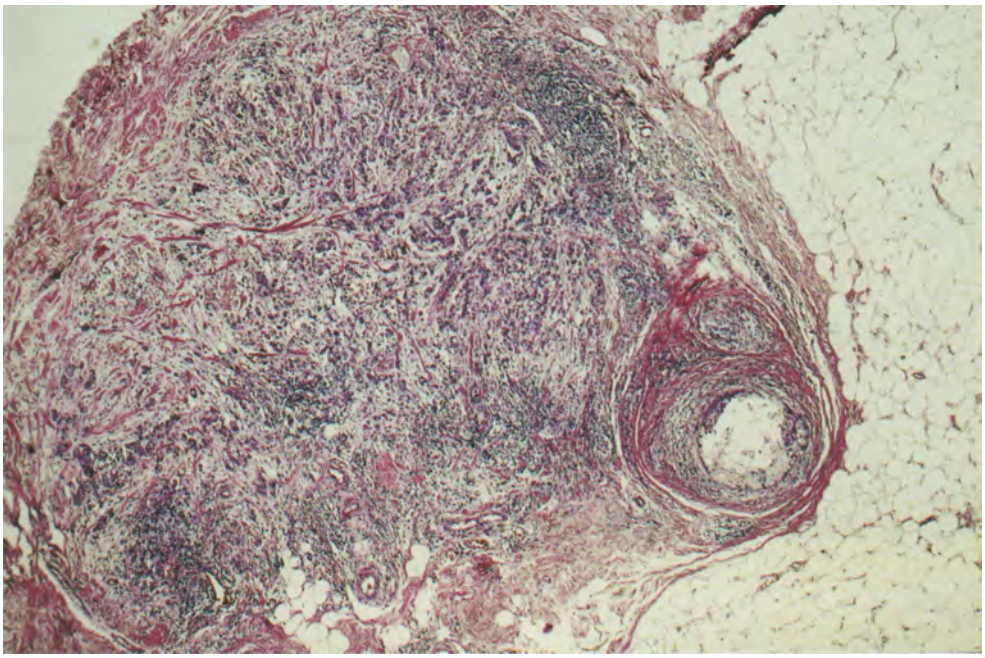
The woman was still alive 20 years later at age 60.



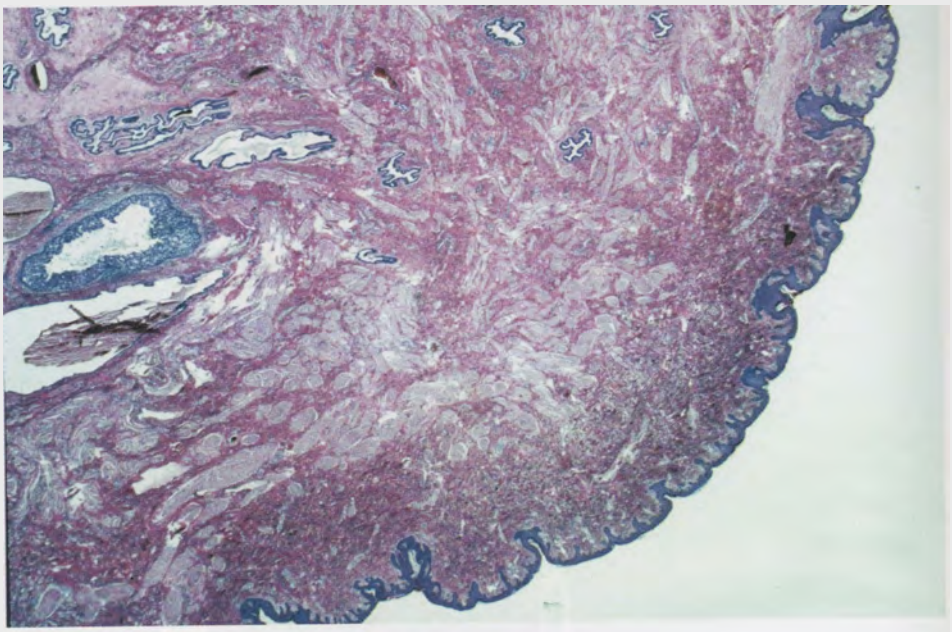
Calcifications

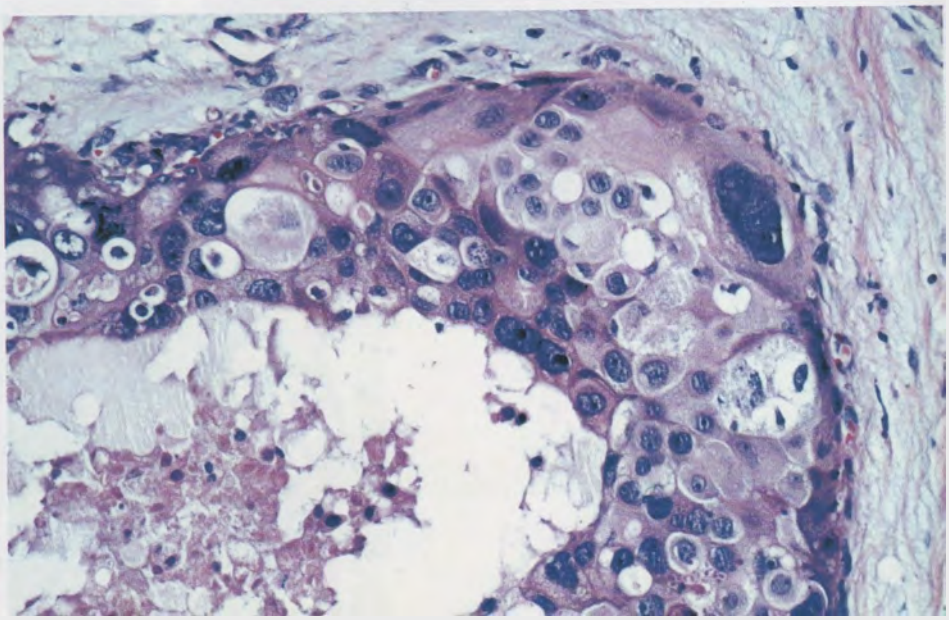
93C

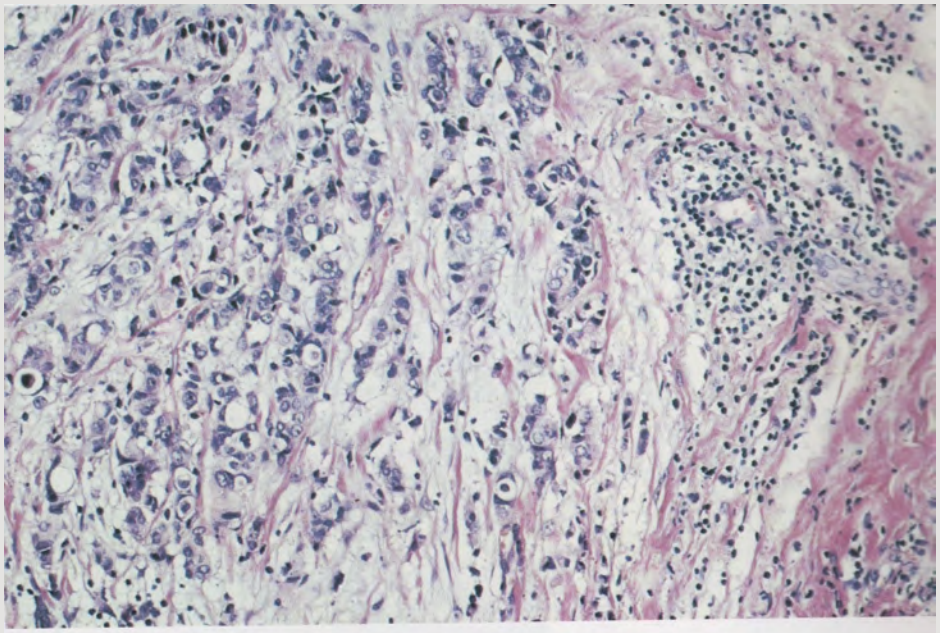


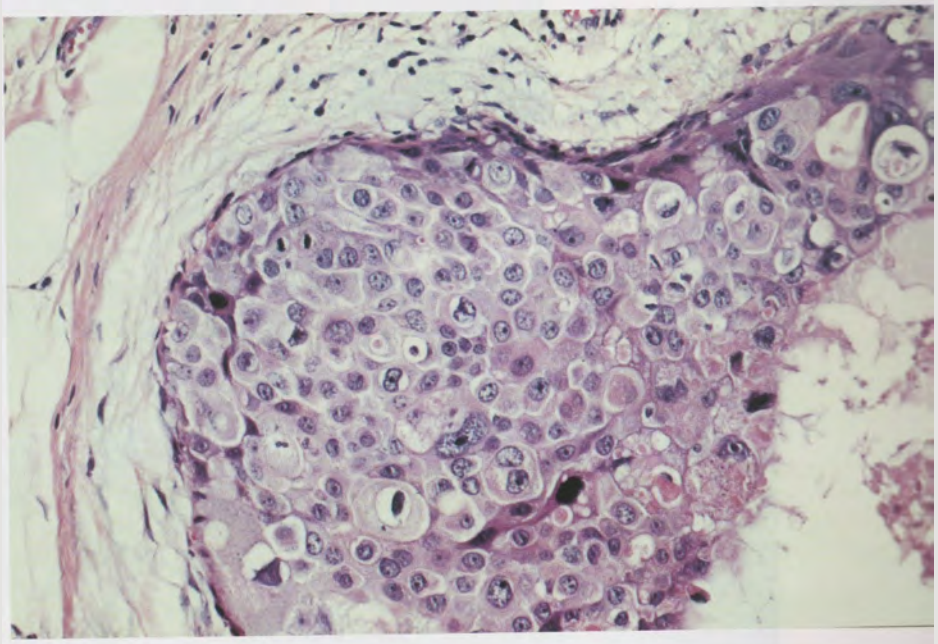


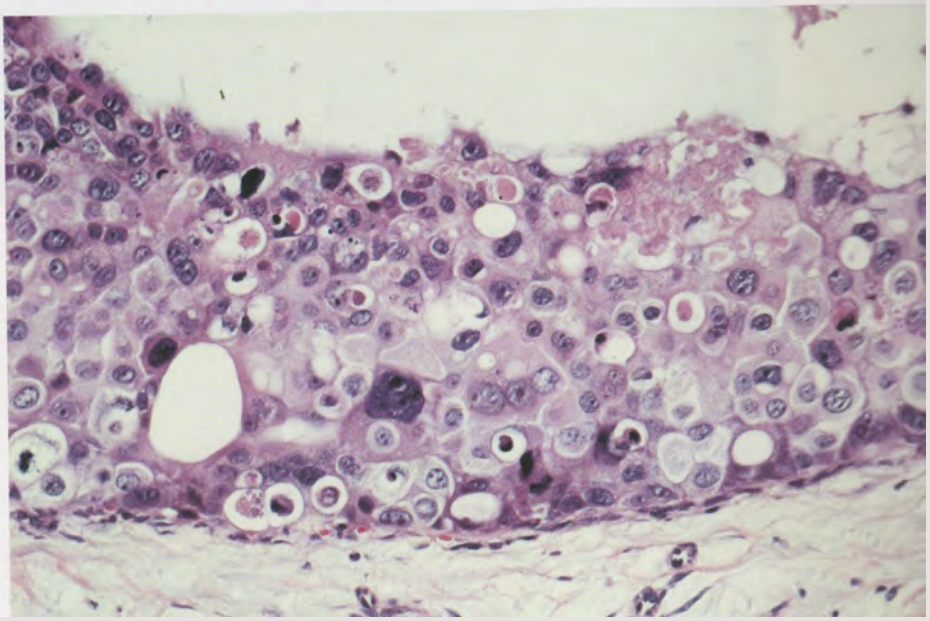
93E











94

75-year-old woman, asymptomatic. First screening study.

Physical Examination

No palpable tumor in the breasts.

Mammography

Fig. 94A & B: Left breast, detailed views of the medio-lateral oblique and cranio-caudal projections. In the upper outer quadrant there are two clusters of calcifications surrounded by an ill-defined density.
Fig. 94C & D: Microfocus magnification views, medio-lateral oblique and cranio-caudal projections.

Analysis of the Calcifications

Form: highly variable
Density: highly variable, some fade into the background
Distribution: cluster

Conclusion

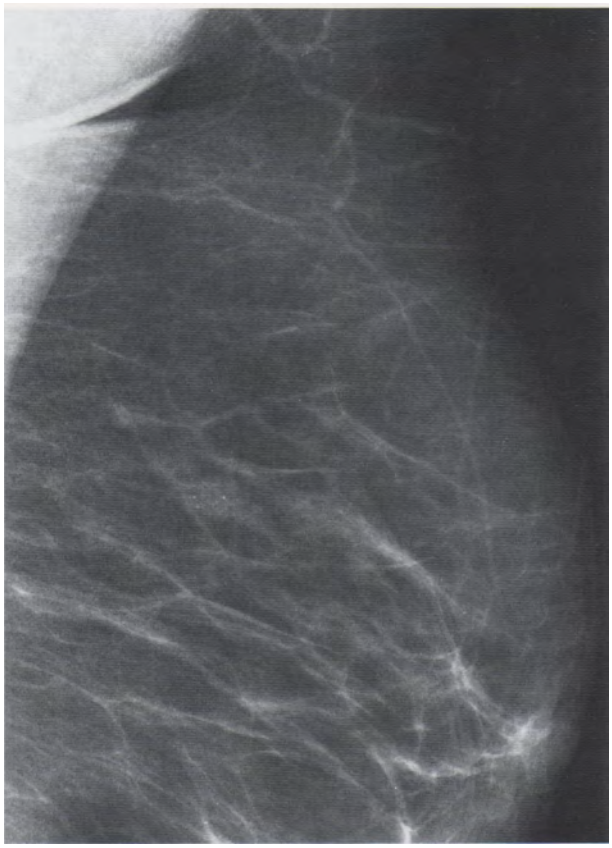
Mammographically malignant-type calcifications (granular type), within an ill-defined density.

Histology

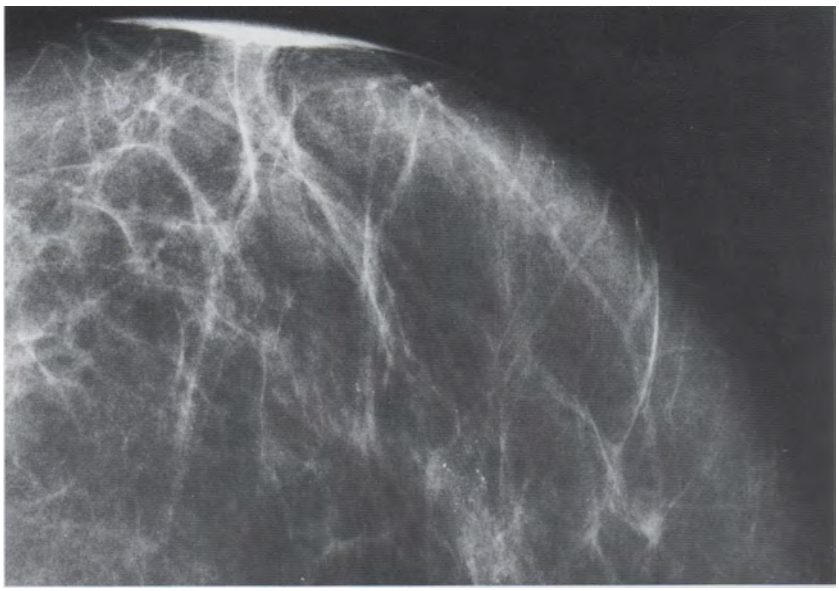
Intraductal carcinoma with minimal invasion.
Fig. 94 E: Grade 2 ductal carcinoma in situ, low-power magnification. (H & E, 20 x)
Fig. 94F: Cellular details with amorphous calcifications corresponding to the micro-calcifundcations seen on the mammogram. (**H &** E, 200 **x)**

Follow-up

The woman died 12 years later from pneumonia at age 87 with no evidence of breast cancer.



94A



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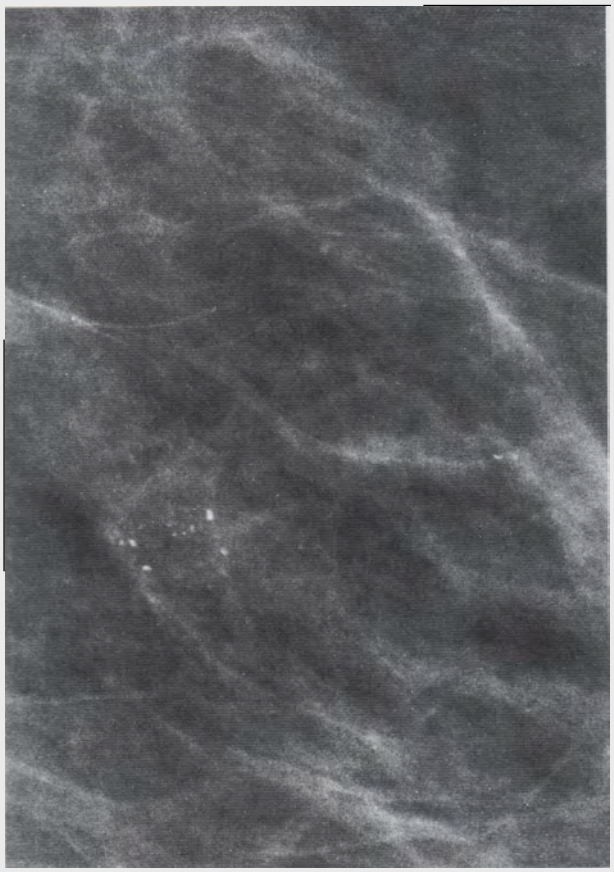
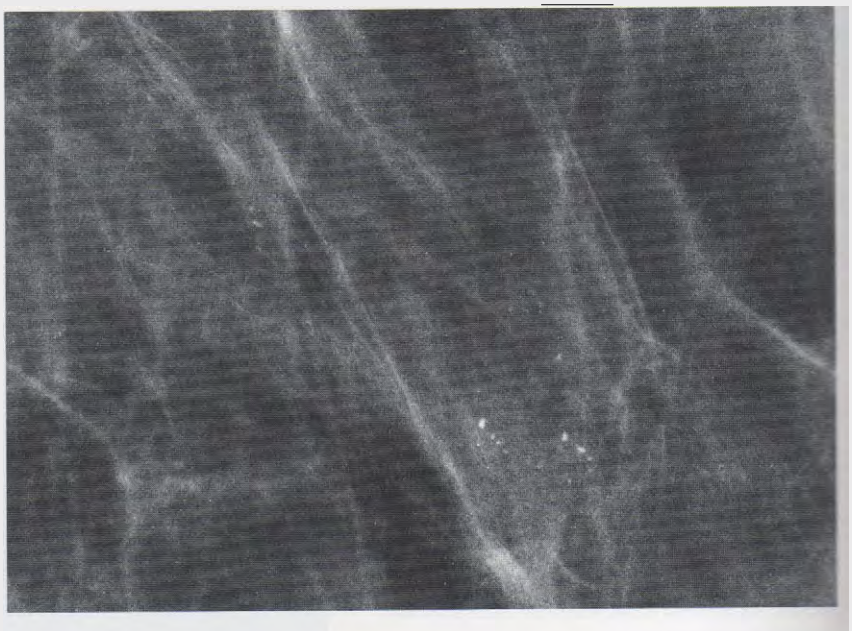
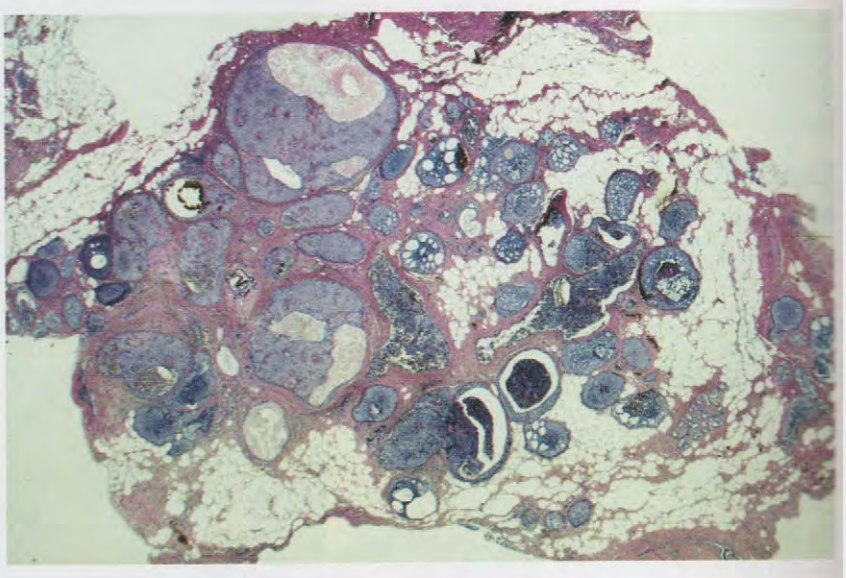
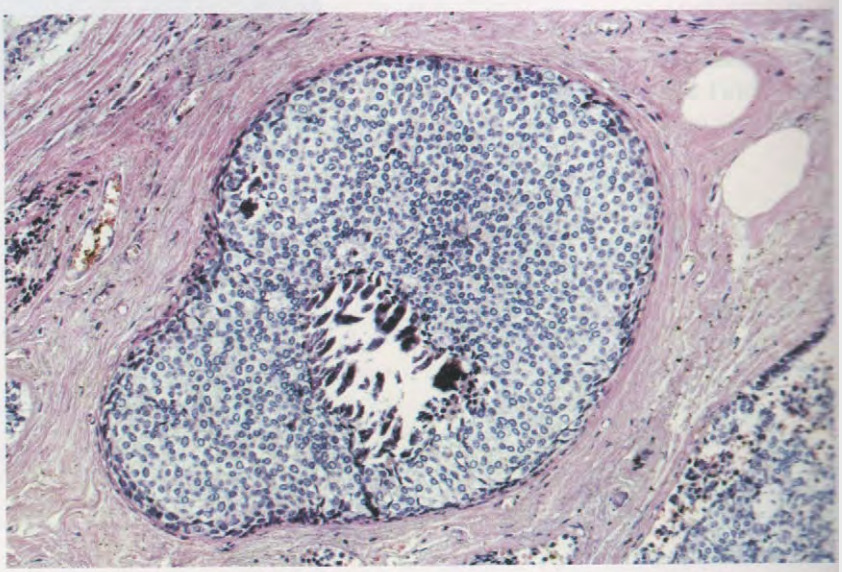


94C







95

Age 62, referred for a tumor in the left breast first detected two weeks earlier.

Physical Examination

The palpable tumor is clinically malignant.

Mammography

Fig. 95A: Left breast, cranio-caudal projection. A cluster of calcifications without an associated tumor shadow is seen in the lateral half of the breast. A single, oval, smooth-bordered calcification is seen centrally (mammographically benign calcified hematoma).
Fig. 95 B: Left breast, microfocus magnification view, cranio-caudal projection.

Analysis of the Clustered Calcifications

Form: highly variable, amorphous, fragmented
Density: variable
Size: highly variable
Distribution: clustered

Conclusion

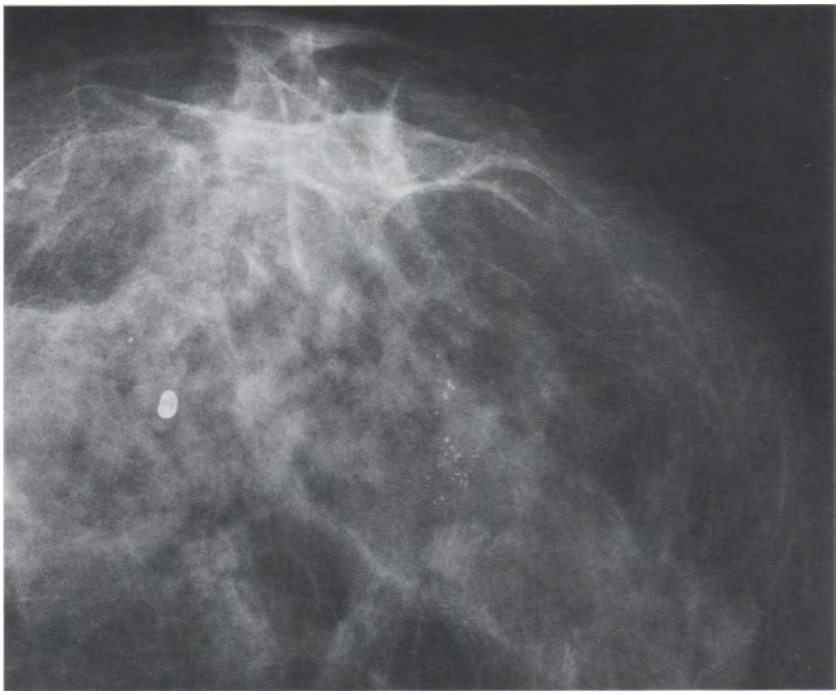
Typical mammographic appearance of malignant-type calcifications.

Histology

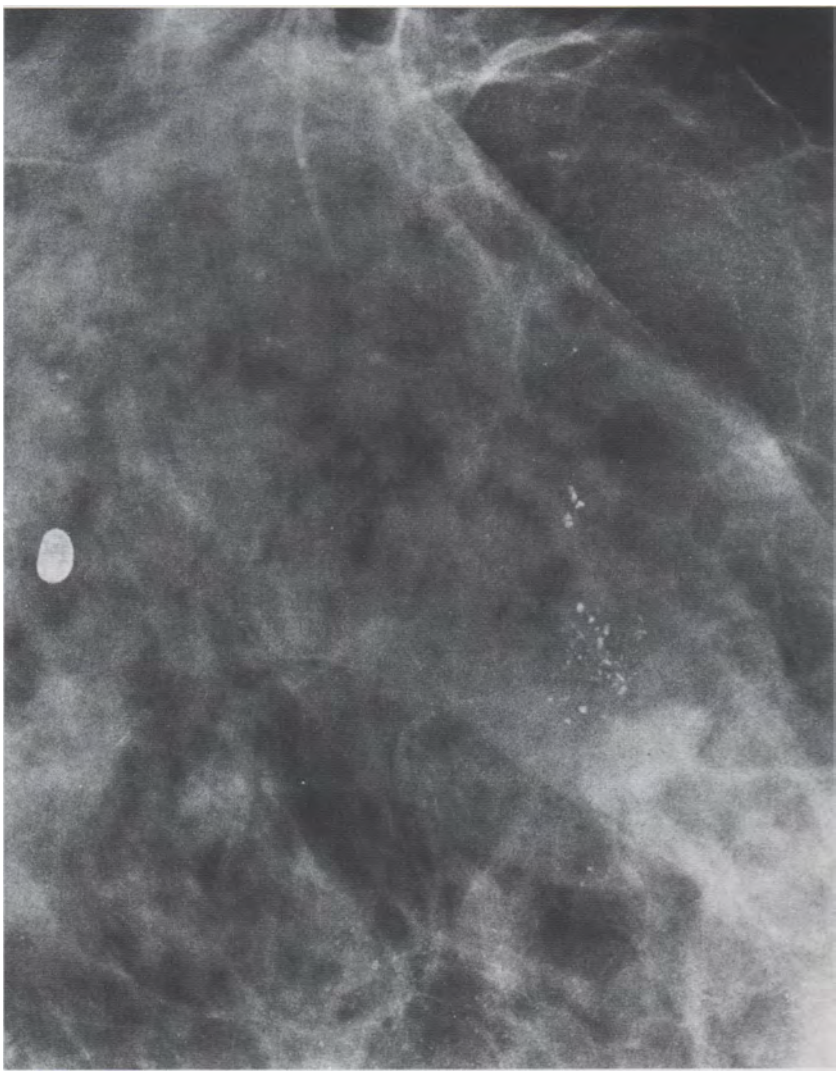
Ductal carcinoma in situ with minimal infiltration.
Fig. 95 C: Overview of one TDLU distended by cancer cells. (H & E, 12.5 x)
Fig. 95D: High-power view of the ductal carcinoma in situ showing the amorphous calcifications also seen on the mammogram. (H & E, 220 x)
Fig. 95E: The 5-mm invasive component of the tumor adjacent to the in situ carcinoma. (H & E, 100 **x)**

Follow-up

The patient died three years, seven months later of metastatic breast carcinoma at age 65.



95A



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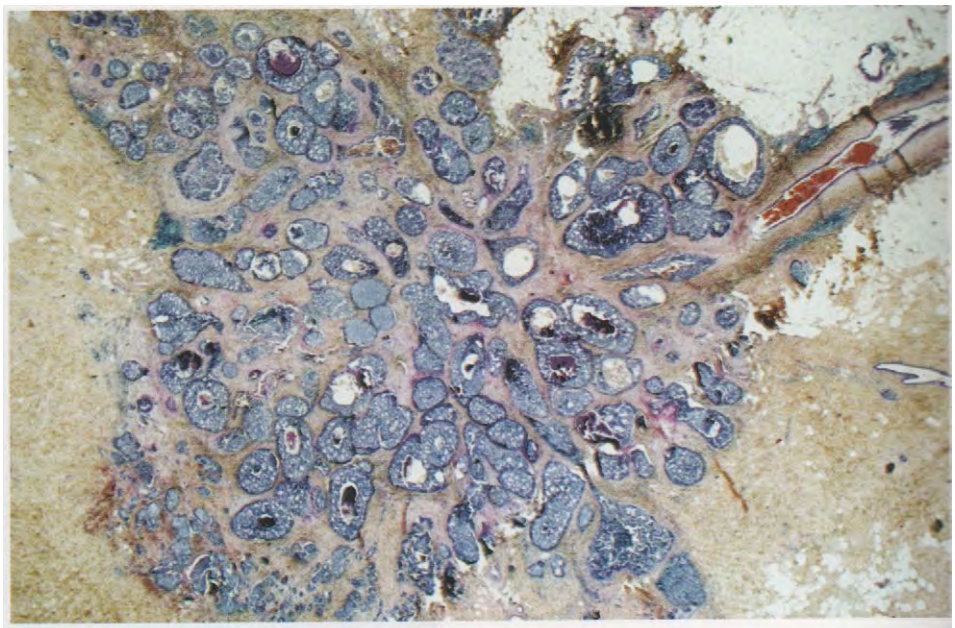
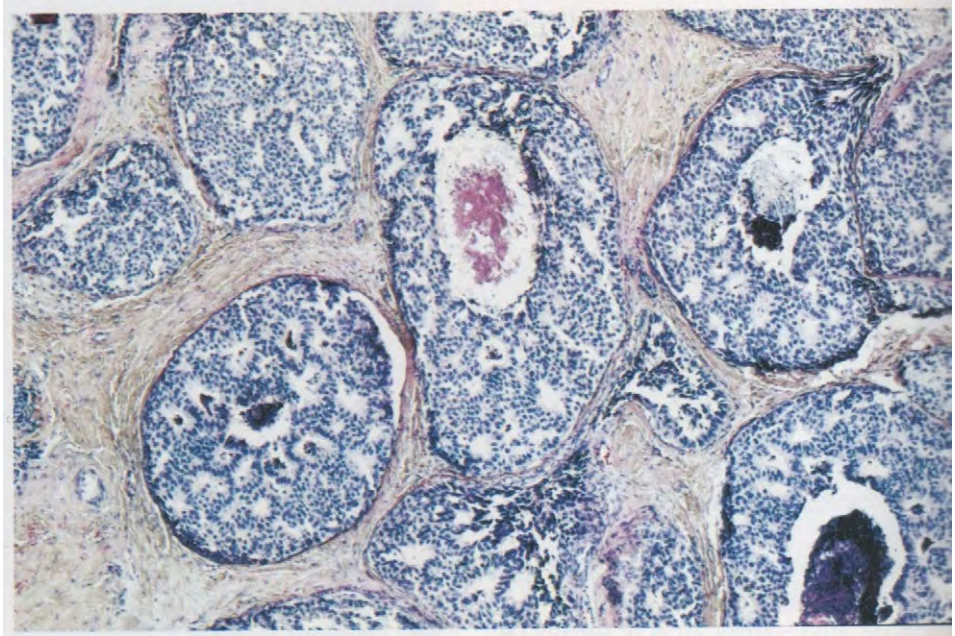
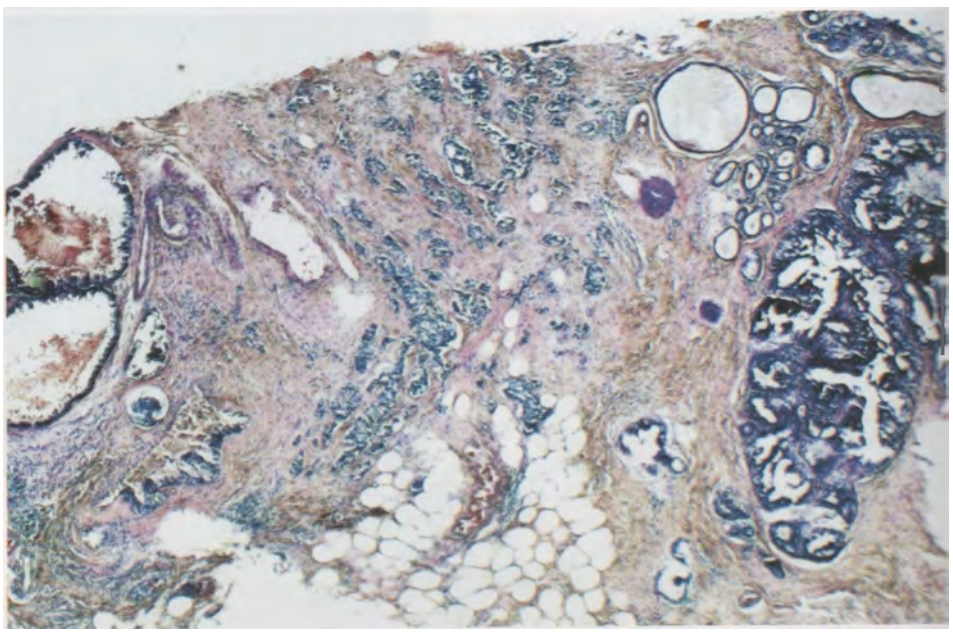






96

Age 61, asymptomatic. First screening study.

Physical Examination

No palpable tumor in the breasts.

Mammography

Fig. 96A: Right breast, medio-lateral oblique projection. A cluster of calcifications is seen in the axillary portion of the breast (arrow). No associated tumor.
Fig. 96 B: Right breast, microfocus magnification view, medio-lateral oblique projection.

Analysis

Form: granular and casting type
Density: highly variable
Size: small, although considerable variation
Distribution: cluster

Conclusion

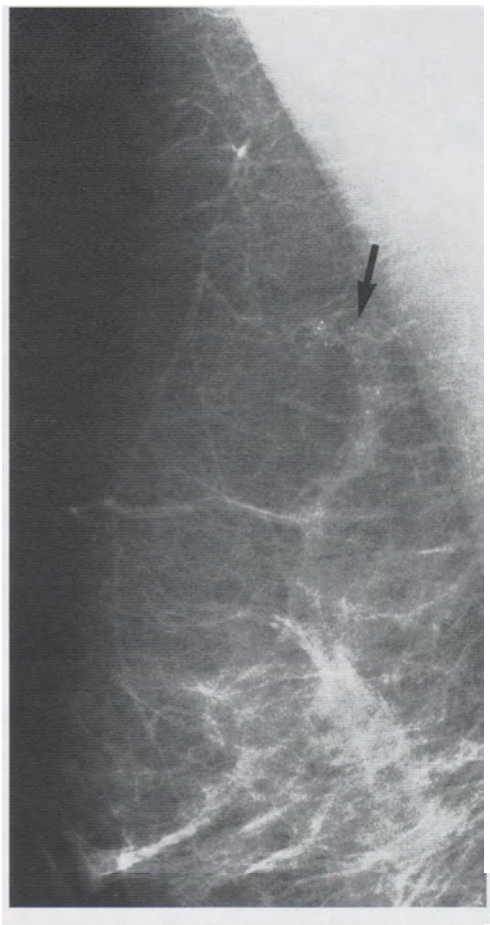
Mammographically malignant-type calcifications.

Histology

Ductal carcinoma in situ.
Fig. 96C: Grade 3 ductal carcinoma in situ with central necrosis and amorphous calcifications. (H & E, 20 x)
Fig. 96D: Detailed view of the in situ carcinoma. (H & E, 300 x)

Follow-up

The woman was still alive 20 years later with no evidence of breast cancer.



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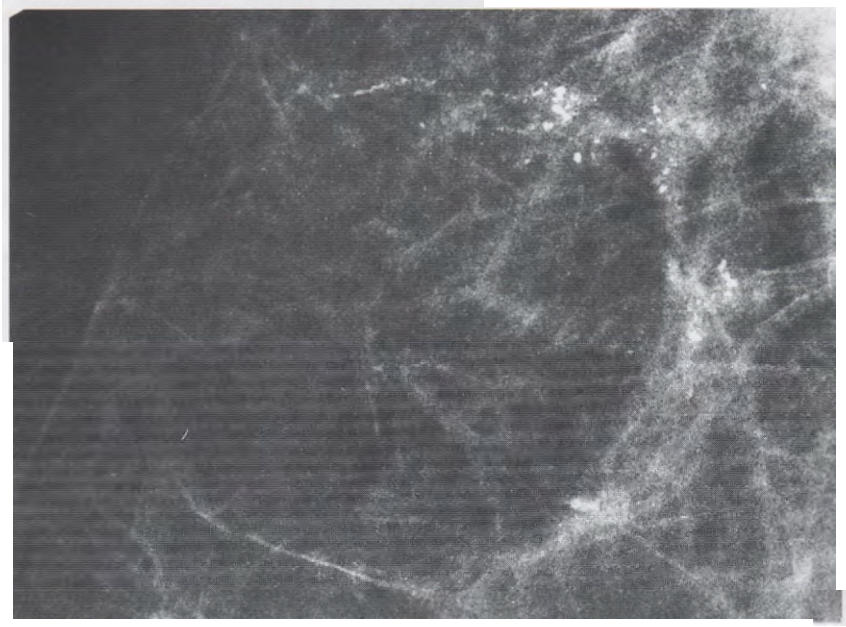

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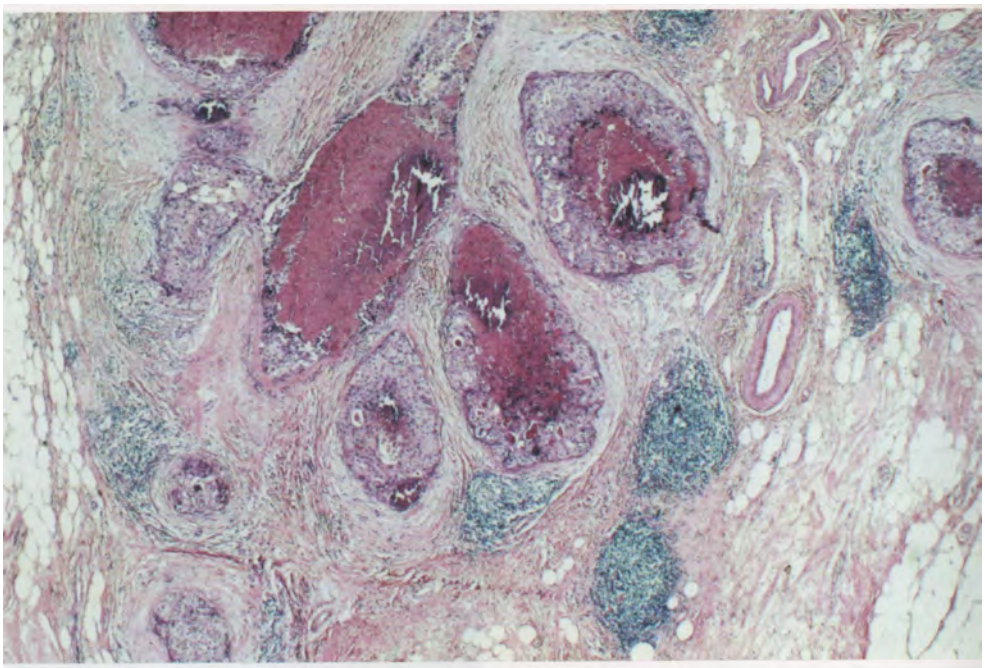
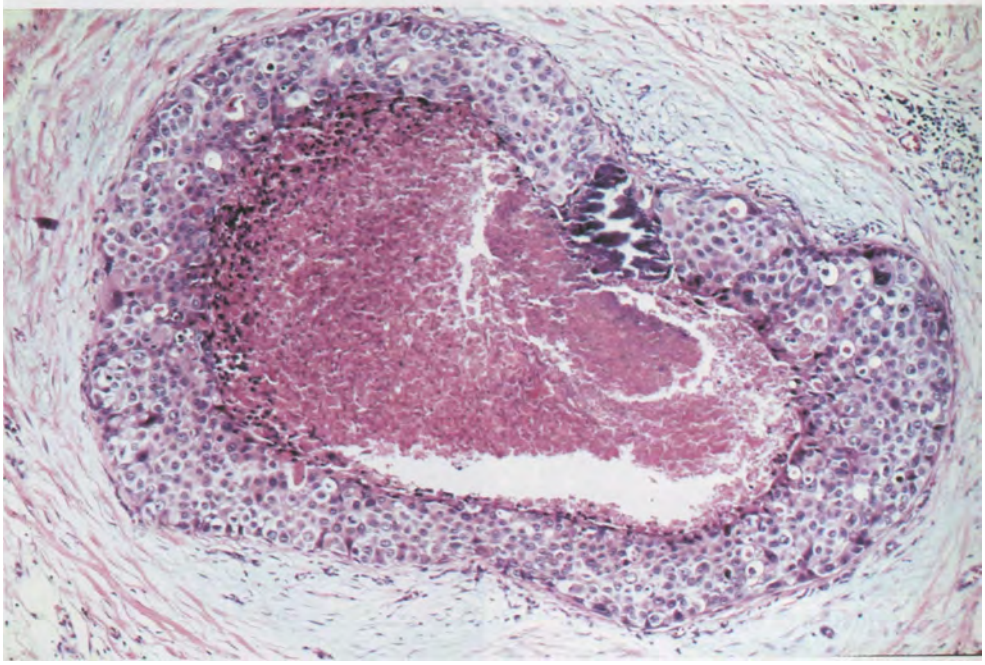




97

48-year-old woman, referred for an abscess in the right breast. No palpable tumor in the left breast.

Mammography

Fig. 97A: *Left* breast, detailed view of the cranio-caudal projection. Mammographically benign tumor (open arrows) in the lateral portion of the breast. Immediately superficial to the tumor a cluster of calcifications is seen (solid arrow).
Fig. 97 B: *Left* breast, microfocus magnification view, cranio-caudal projection. The cluster of calcifications (solid arrow) is more clearly seen. In addition, numerous scattered calcifications are revealed.
Fig. 97 C: *Left* breast, operative specimen radiograph, magnification view.

Analysis of the Calcifications in the Left Breast

The clustered calcifications are irregular in form, density and size. They are a mixture of granular and casting types, mammographically highly suspicious for malignancy. Many of the scattered calcifications are of the benign type, localized in cystically dilated lobules.
Fig. 97 D: *Right* breast, detailed view in the medio-lateral oblique projection, lower portion of the breast.
Fig. 97 E: Operative specimen radiograph with microfocus magnification.

Analysis of the Calcifications in the Right Breast

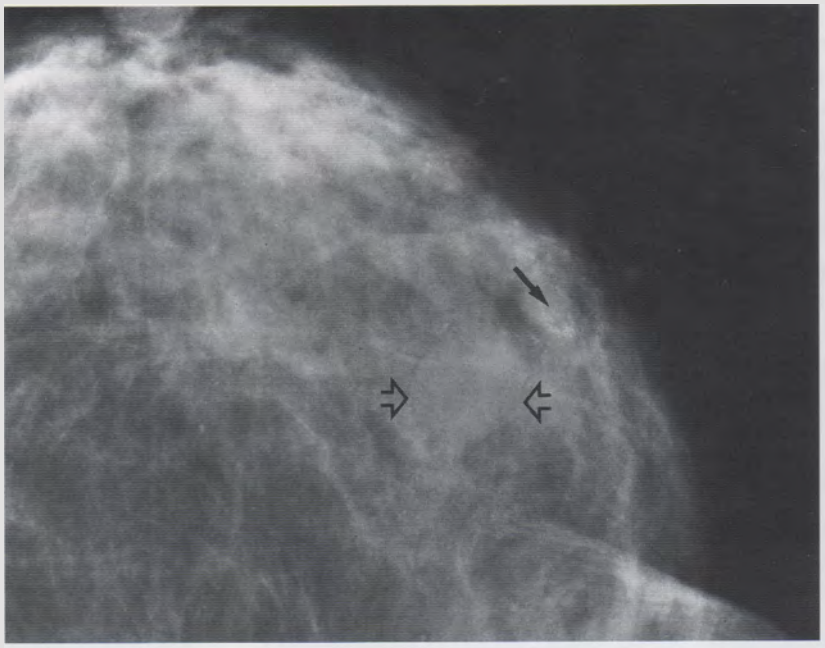
Form: round, sharply outlined
Density: fairly uniform
Distribution: scattered

Conclusion, Right Breast

Mammographically benign-type calcifications.

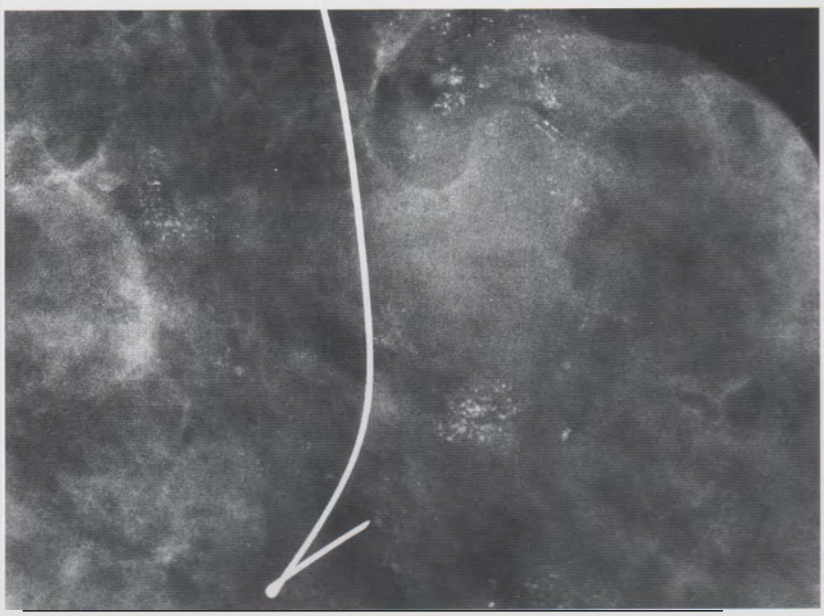
Histology

Left breast: Carcinoma in situ. Slerosing adenosis, atypical lobular hyperplasia.
Right breast: Sclerosing adenosis, blunt duct adenosis. No epithelial cell proliferation or atypia.
Fig. 97 F: Left breast, low-power view of a focus with atypical hyperplasia in a TDLU with psammoma body like calcifications. (H & E, 100 x)



97A

97B

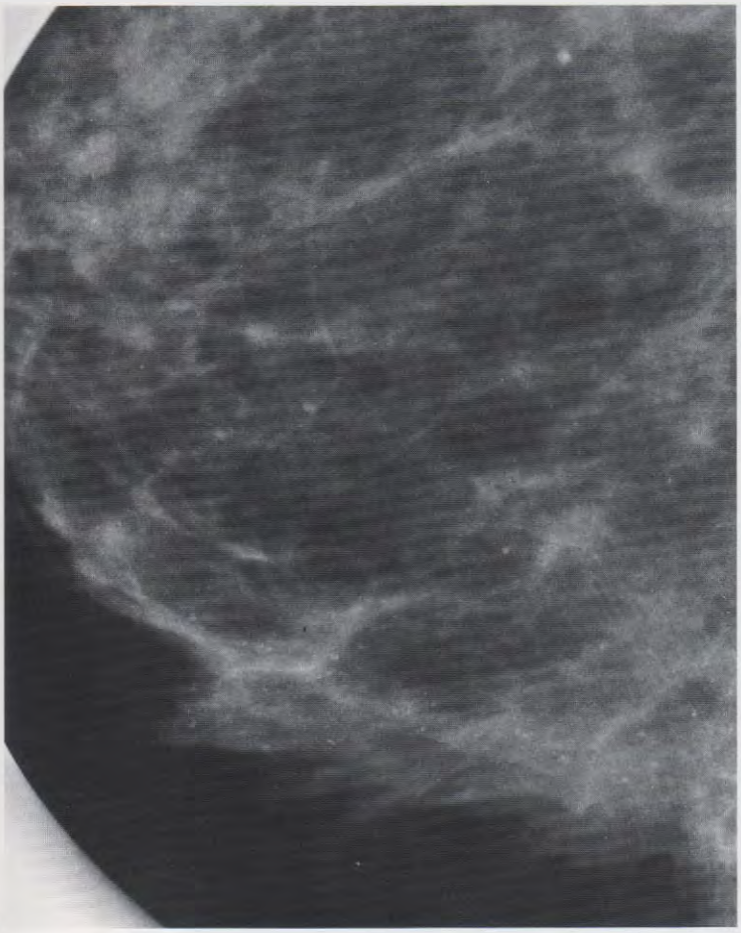


97C

Fig. 97 G: Right breast, fibrocystic change with psammoma body like calcifications corresponding to the calcifications seen on the mammogram. (H & E, 20 x)
Fig. 97 H & I: High-power views of Fig. 97 G. (H & E, 200 x)

Follow-up

The woman was still alive 18 years later with no evidence of breast cancer.



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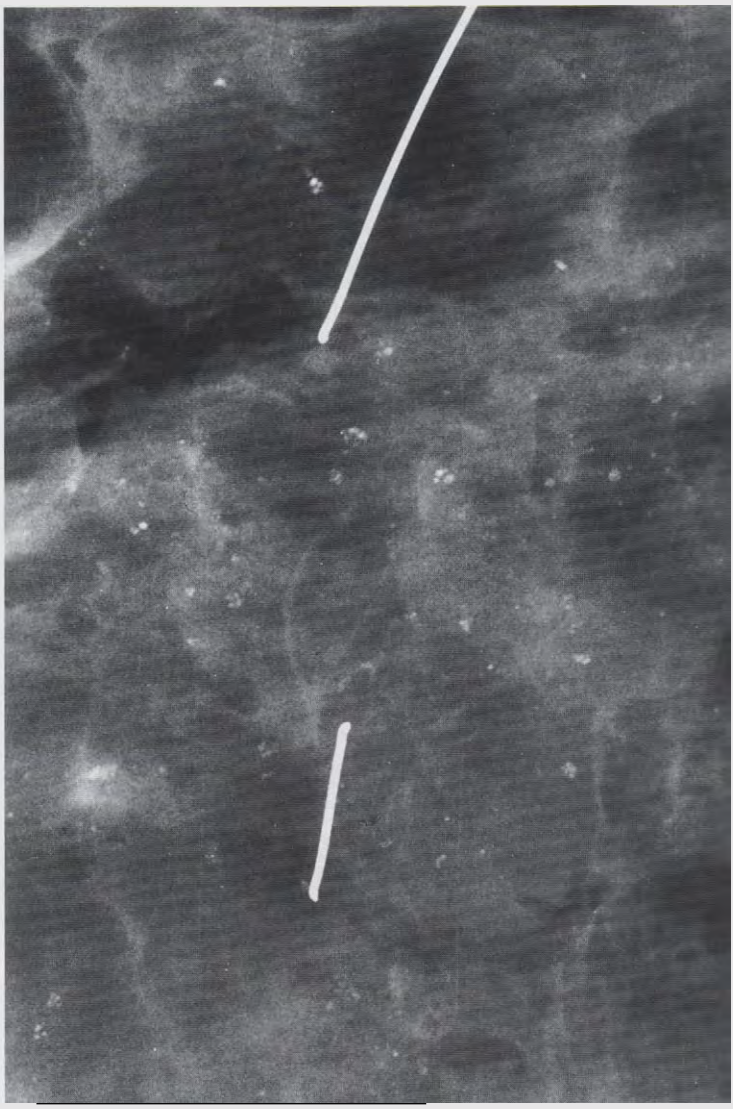

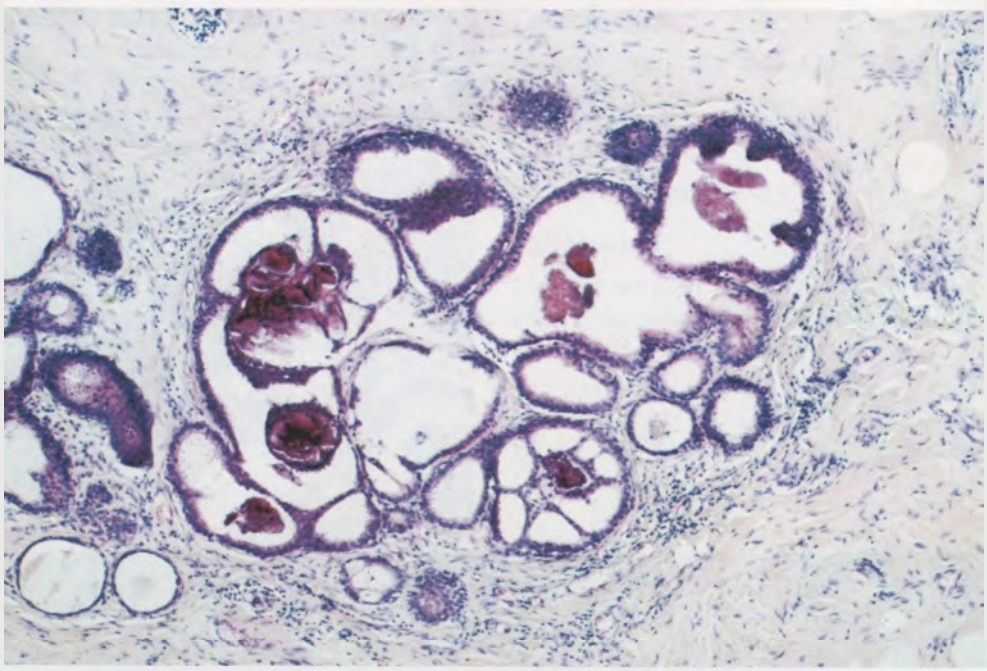

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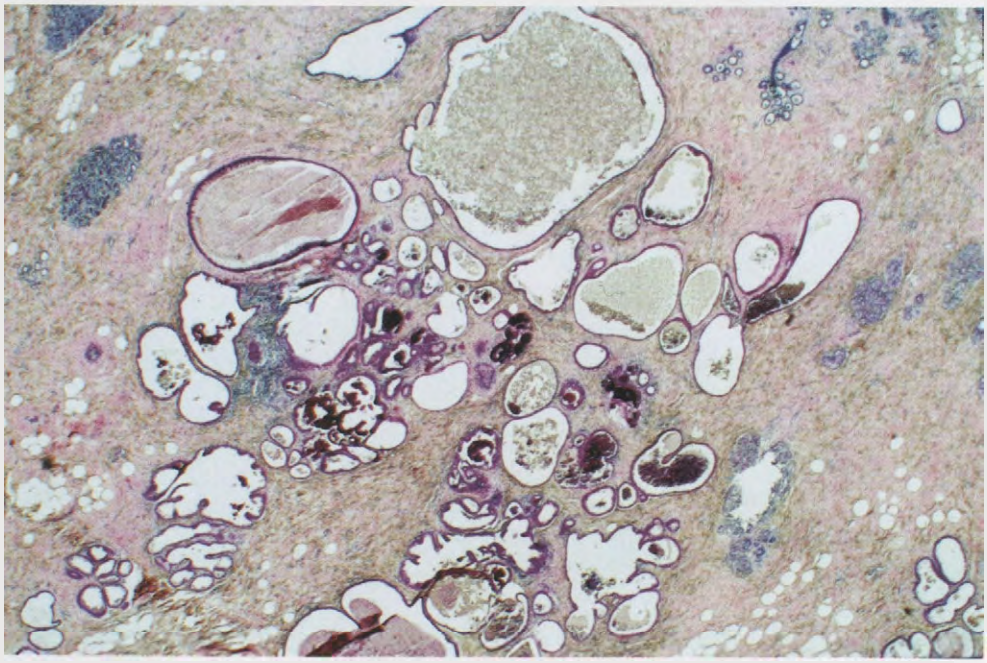
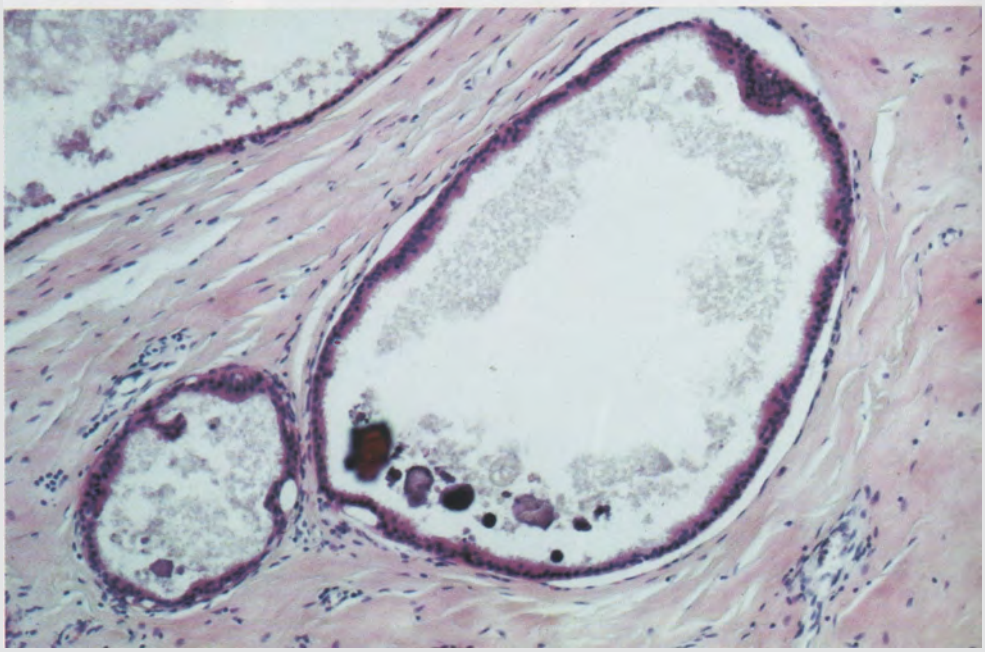


97G



98

67-year-old woman, asymptomatic. First screening study.

Physical Examination

No palpable tumor in the breasts.

Mammography

Fig. 98A: Left breast, detailed view of the cranio-caudal projection. A few small calcifications are demonstrated (arrows).

Fig. 98 B: Enlarged coned-down compression view, cranio-caudal projection.
Fig. 98 C: Microfocus magnification view, cranio-caudal projection. The cluster of calcifications is seen adjacent to a partially calcified artery.

Analysis

The clustered calcifications are of the granular type, some elongated. They vary considerably in shape and density and are of different sizes.

Conclusion

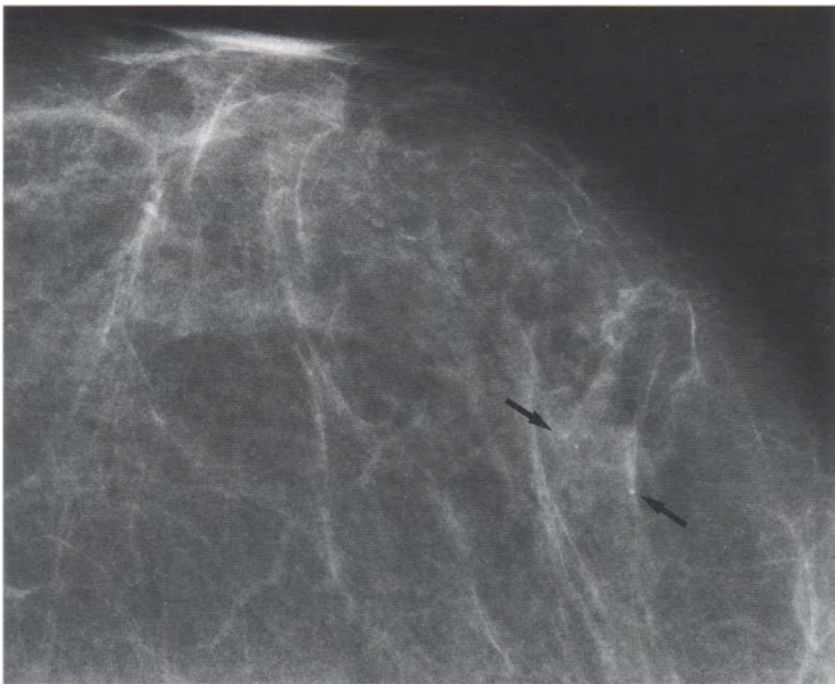
Mammographically malignant-type calcifications.

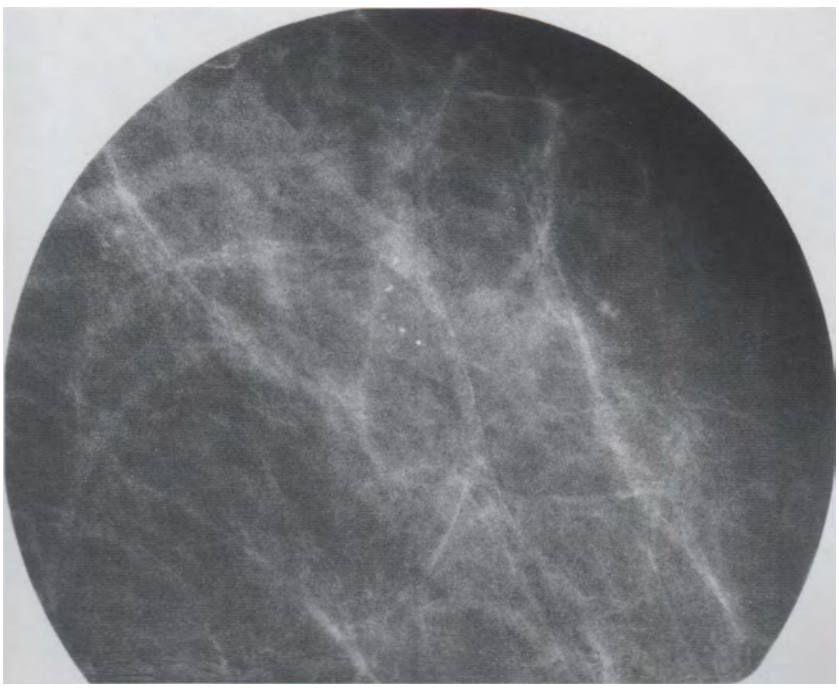
Histology

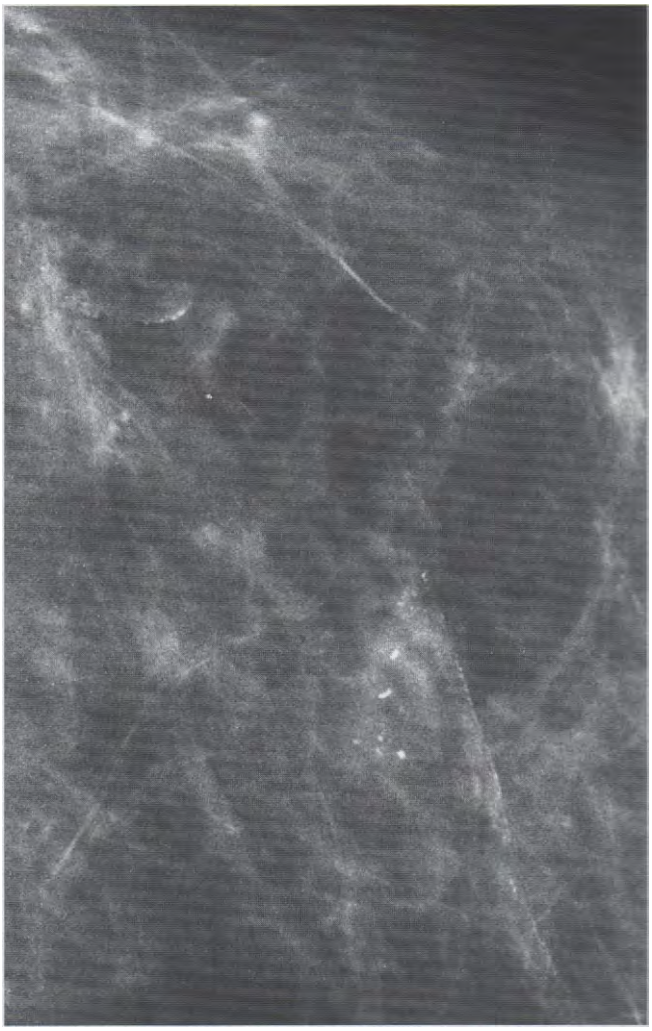
Ductal carcinoma in situ.

Follow-up

The woman died 17 years later from myocardial infarction at age 84. There was no evidence of breast cancer.







MB

99

74-year-old woman, not a awar of any breast abnormality. First screening examination.

Mammography

Fig. 99A: Left breast, detailed view of the medio-lateral oblique projection. In the upper outer quadrant there is a 5 x 5 cm area containing numerous calcifications associated with an ill-defined density.

Fig. 99 B & C: Microfocus magnification medio-lateral oblique and cranio-caudal projections. Most of the calcifications are of the casting type, mammographically malignant.

Analysis

This case gives an excellent opportunity to demonstrate the casting-type calcifications. The shape of the cast is determined by the uneven production of calcification and the irregular necrosis of the cellular debris. The contours of the cast are always irregular and the cast is always fragmented. Density analysis reveals that within one cast the several fragments may differ in density. A calcification may be branching when it extends into adjacent branches of a duct.

Histology

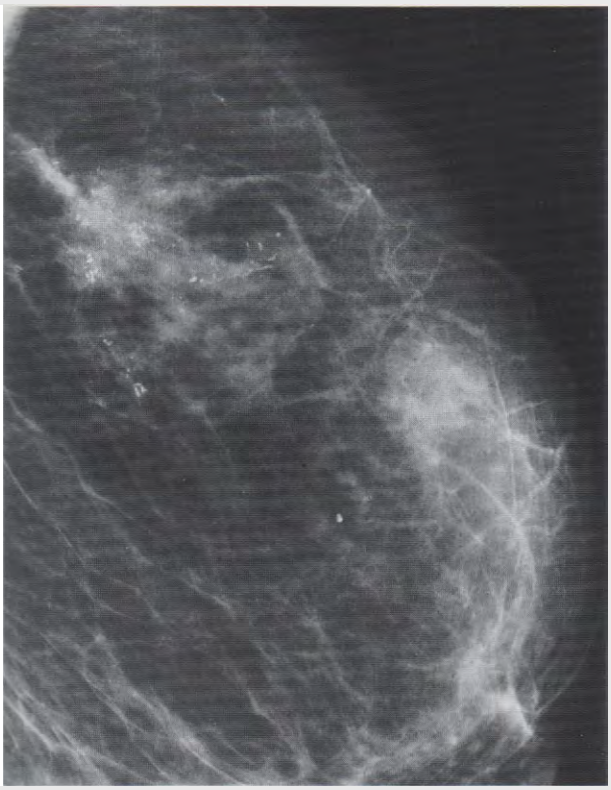
Poorly differentiated invasive ductal carcinoma associated with a Grade 3 ductal carcinoma in situ. No lymph node metastases.

Note:

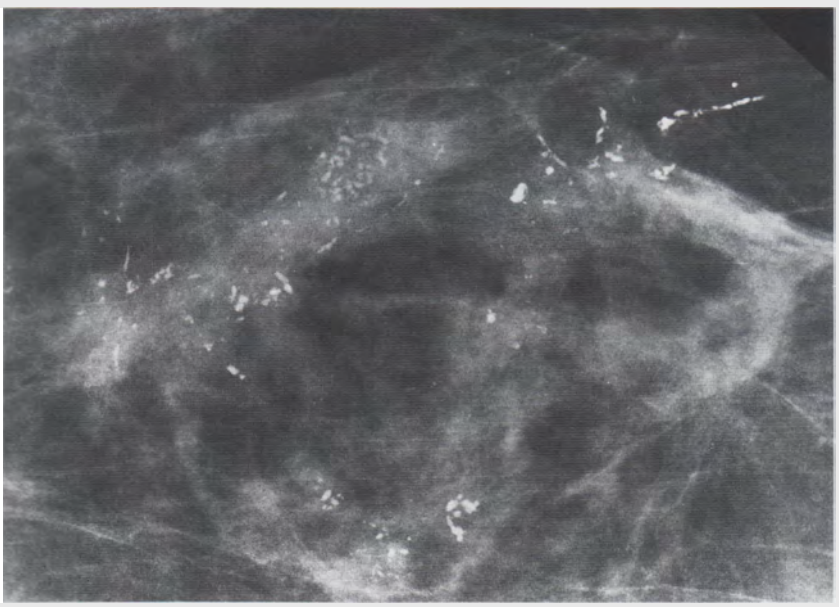
The infiltration probably accounts for some of the density surrounding the calcifications.

Follow-up

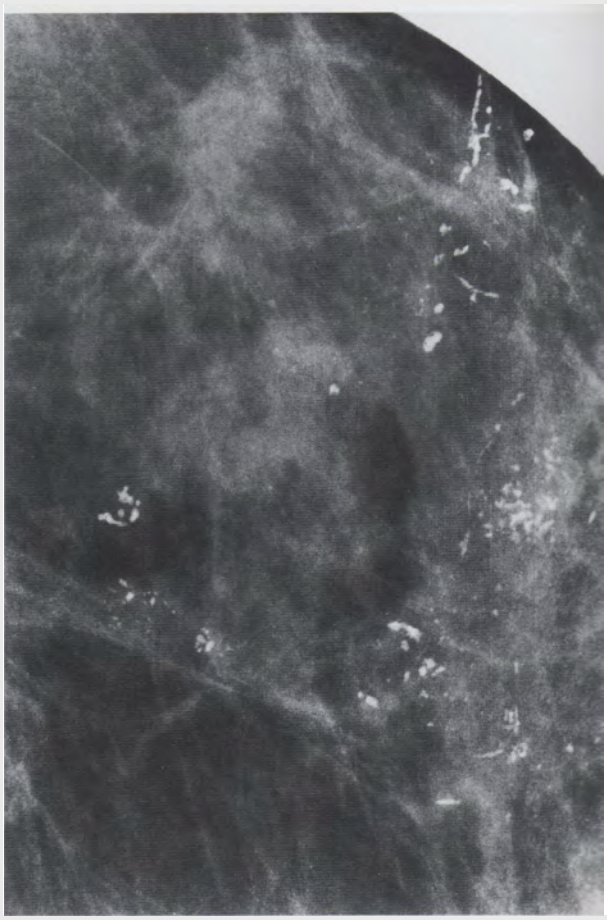
The patient died two years, five months later of metastatic breast carcinoma at age 76.



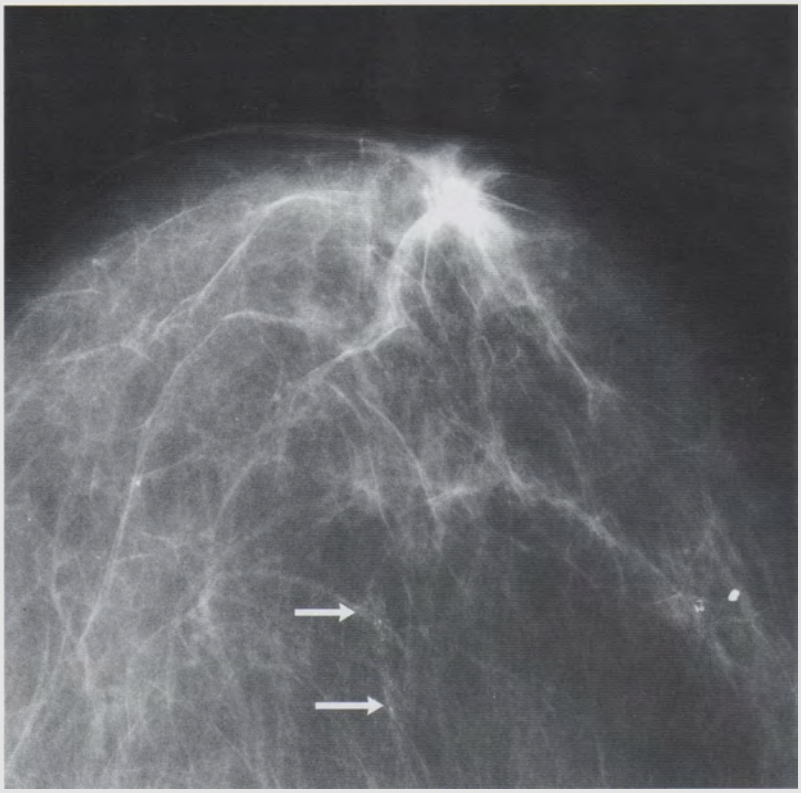
99A



99B



100



100A

Fig. 100A: Left breast, cranio-caudal projection. There is a cluster of calcifications, centrally located (arrows).
Fig. 100B: Microfocus magnification view of the microcalcifications, cranio-caudal projection.

Analysis

Typical intraductal, casting-type calcifications. They are irregular in shape, size and density, and follow the course of a duct and its branches.

Conclusion

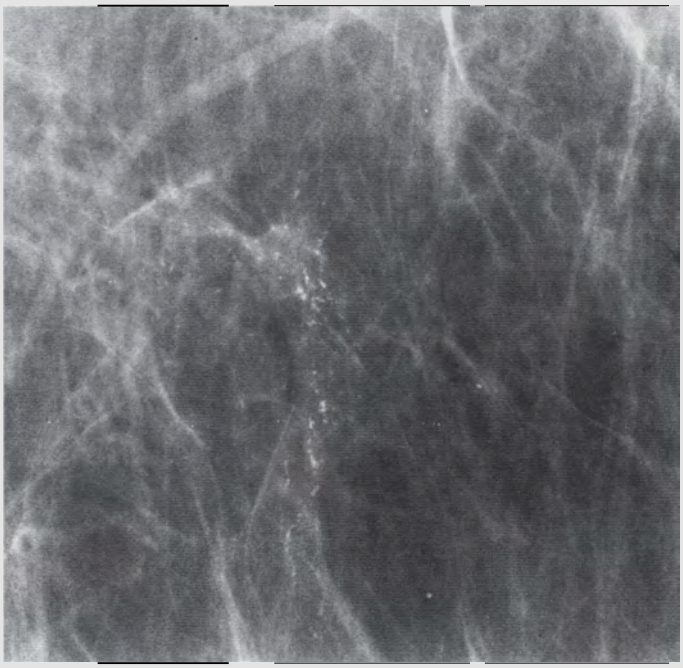
Mammographically malignant-type calcifications.

Histology

Ductal carcinoma in situ.
Fig. 100 C: Grade 3 ductal carcinoma in situ with central necrosis and amorphous calcifications. (H & E, 40 x)
Fig. 100 D: Detailed view of the poorly differentiated ductal carcinoma in situ. (H & E, 100 x)

Follow-up

The woman died eight months later from myocardial infarction at age 74. There was no evidence of breast cancer.



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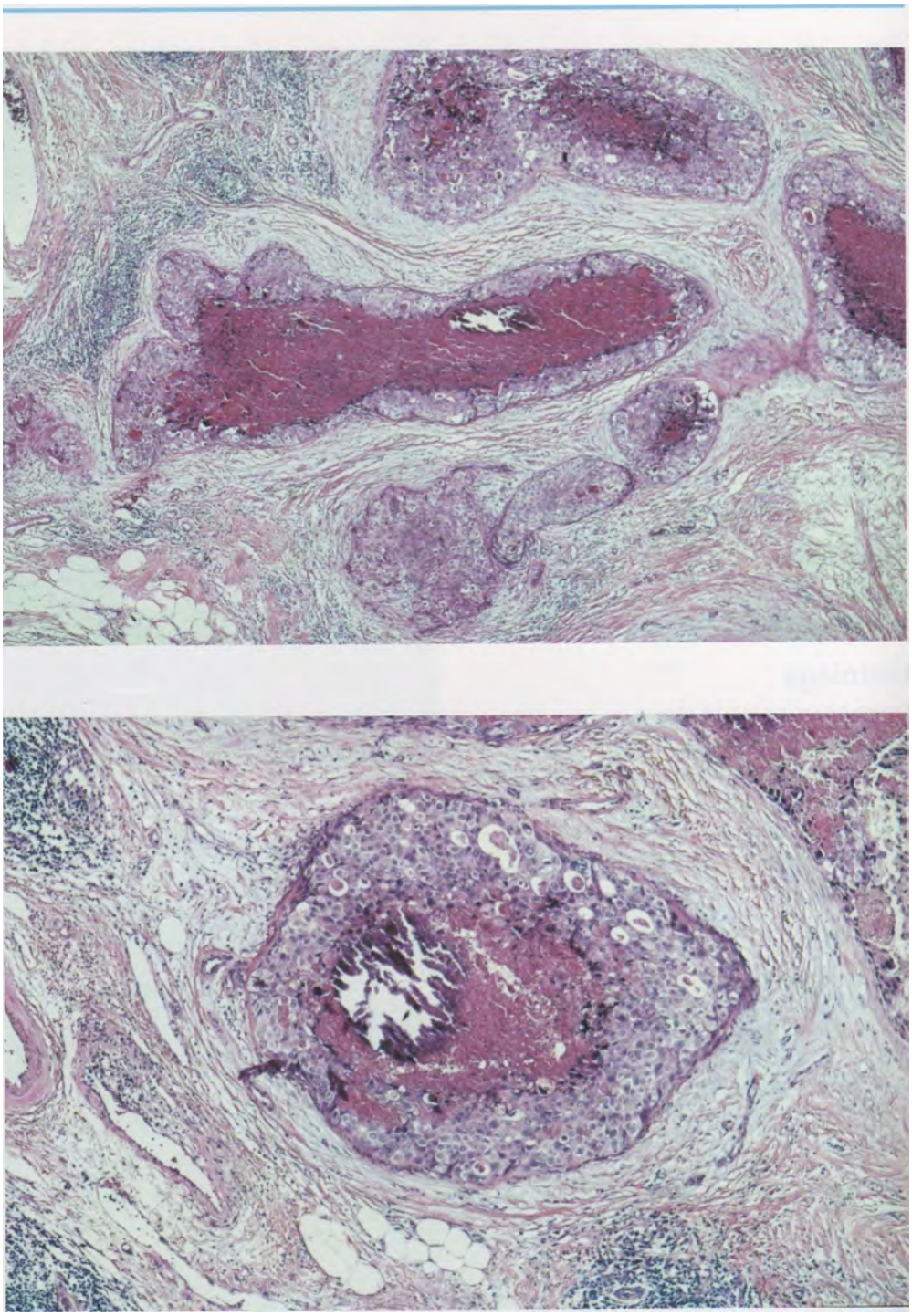

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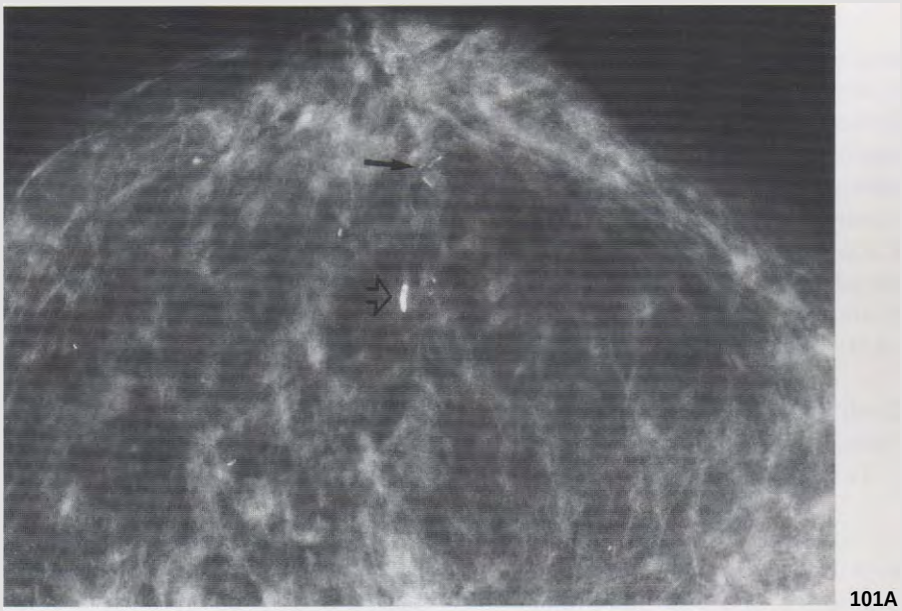
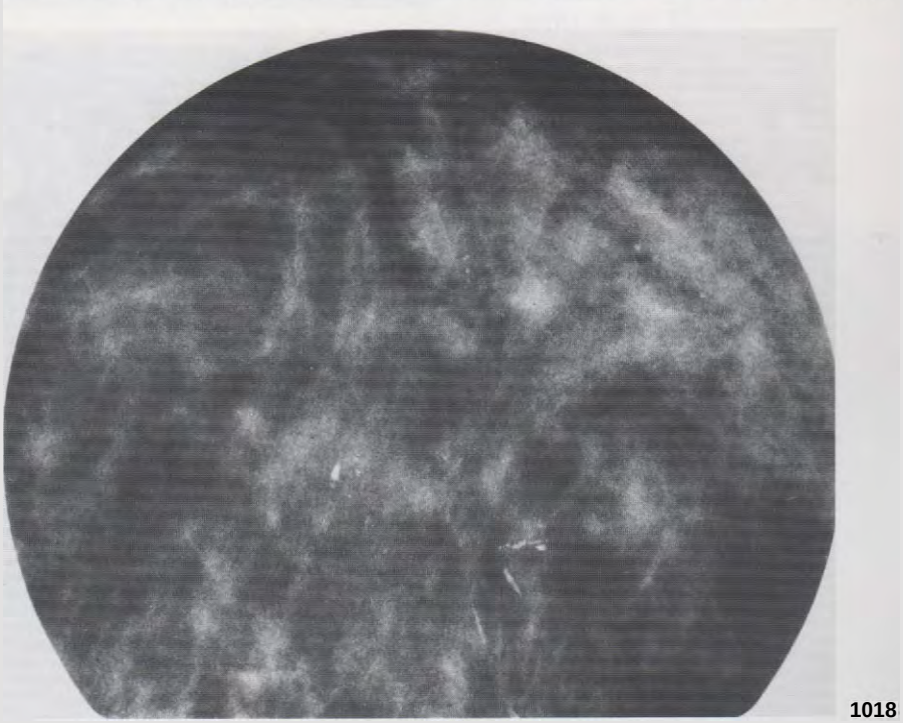


101A



1018

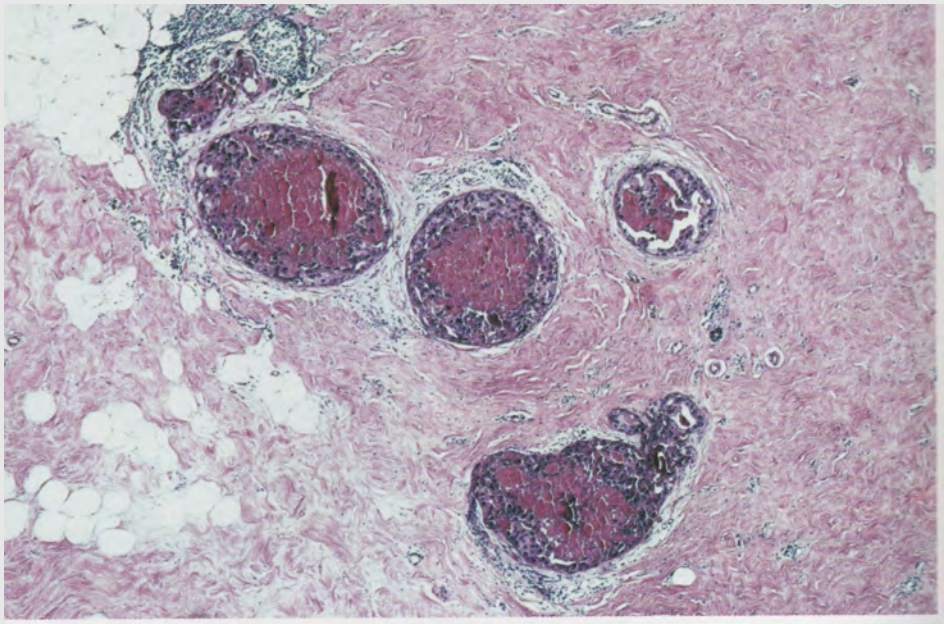
Fig. 101 A: Right breast, cranio-caudal projection. Typical casting-type calcifications.
Fig. 101 B: Coned-down compression view, cranio-caudal projection. The typical casting-type calcifications, one of them branching, are a reliable mammographic sign of carcinoma.

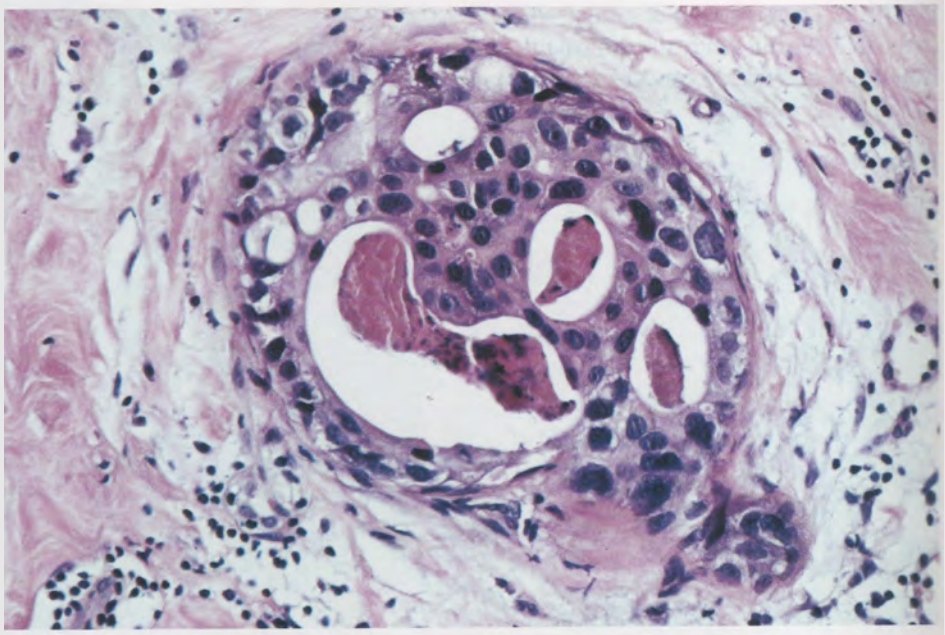
Histology

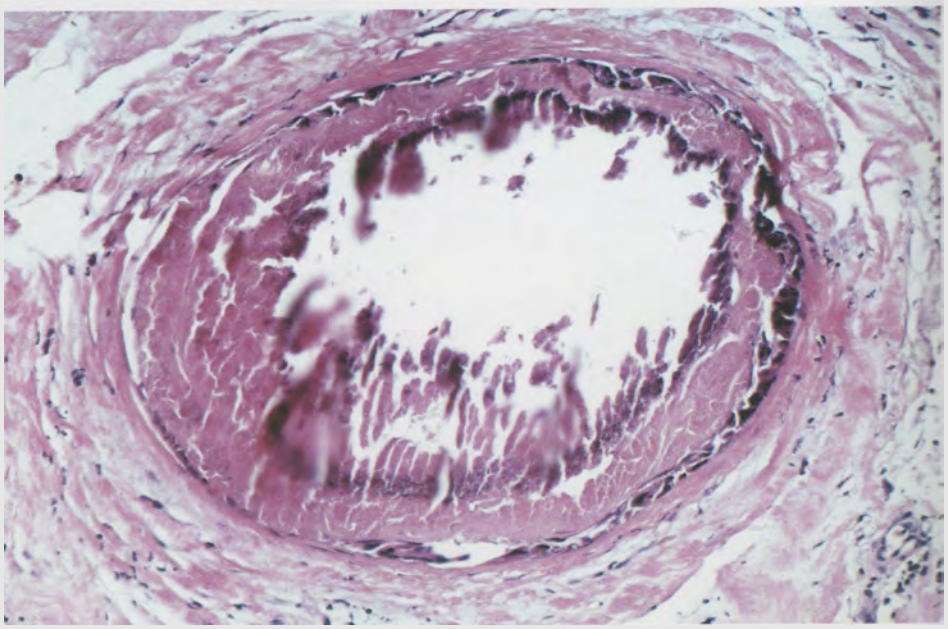
Ductal carcinoma in situ, Grade 3.
Fig. 101 C: Low-power view of the ductal carcinoma in situ. (H & E, 20 x)
Fig. 101 D: Cellular details demonstrating marked atypia and central necrosis. (H & E, 200 x)
Fig. 101 E: Cross section of a duct with extensive central necrosis and calcification. Only few viable cancer cells are visible. (H & E, 200 x)

Follow-up

The woman was still alive 18 years later at age 82.







102

28-year-old woman, felt a lump in the upper outer quadrant of the right breast.

Physical Examination

No distinct tumor mass but the entire upper outer quadrant of the right breast was hard and there was a large axillary lymph node.

Mammography

Fig. 102 A—C: Right breast, detailed views of the medio-lateral oblique projection with contact (A) and microfocus magnification mammography (B & C). The entire upper half of the breast is filled with innumerable calcifications. Most striking, one duct and its main branches are completely filled with calcifications all the way to the nipple. No associated tumor.
Fig. 102 D: Operative specimen magnification radiograph.

Analysis

An unusual picture of innumerable casting-type calcifications spread over a large area of the breast, filling in one large lobe.

Conclusion

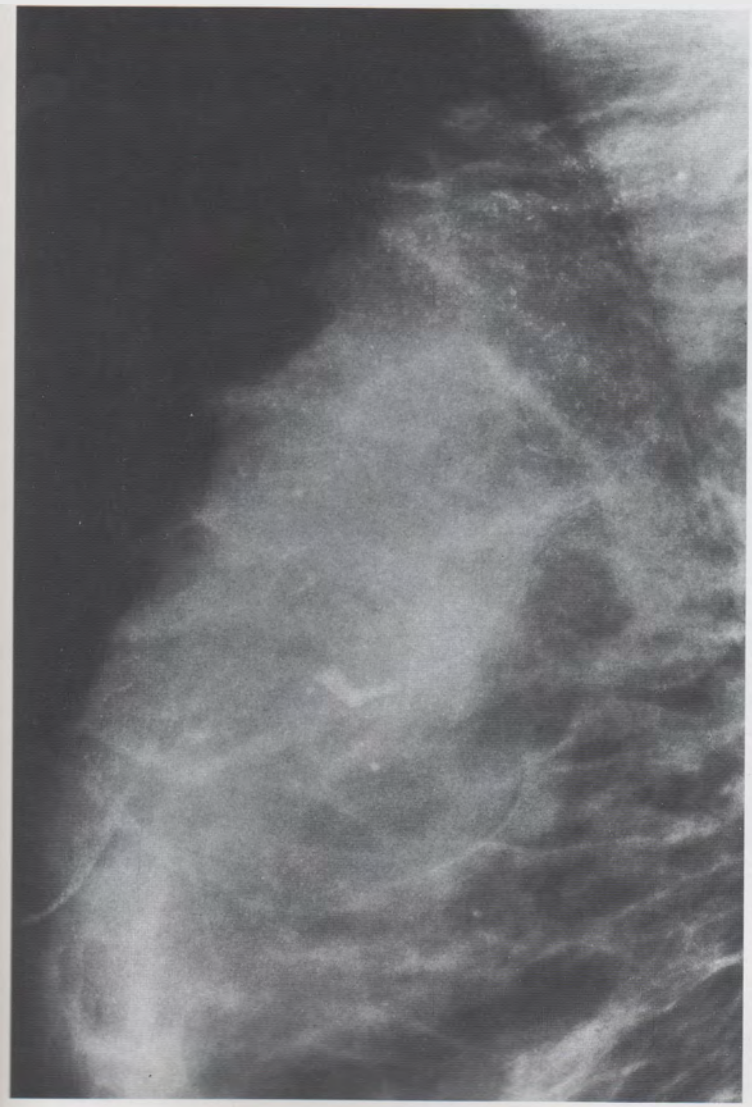
Typical appearance of malignant-type calcifications.

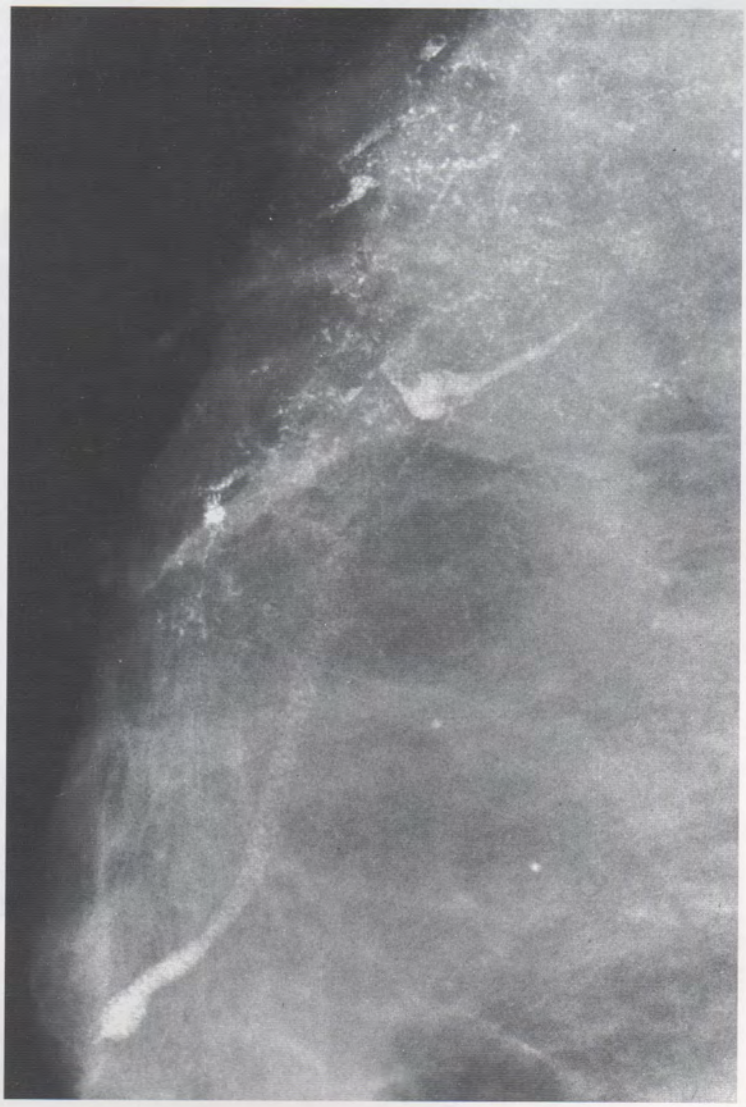
Histology

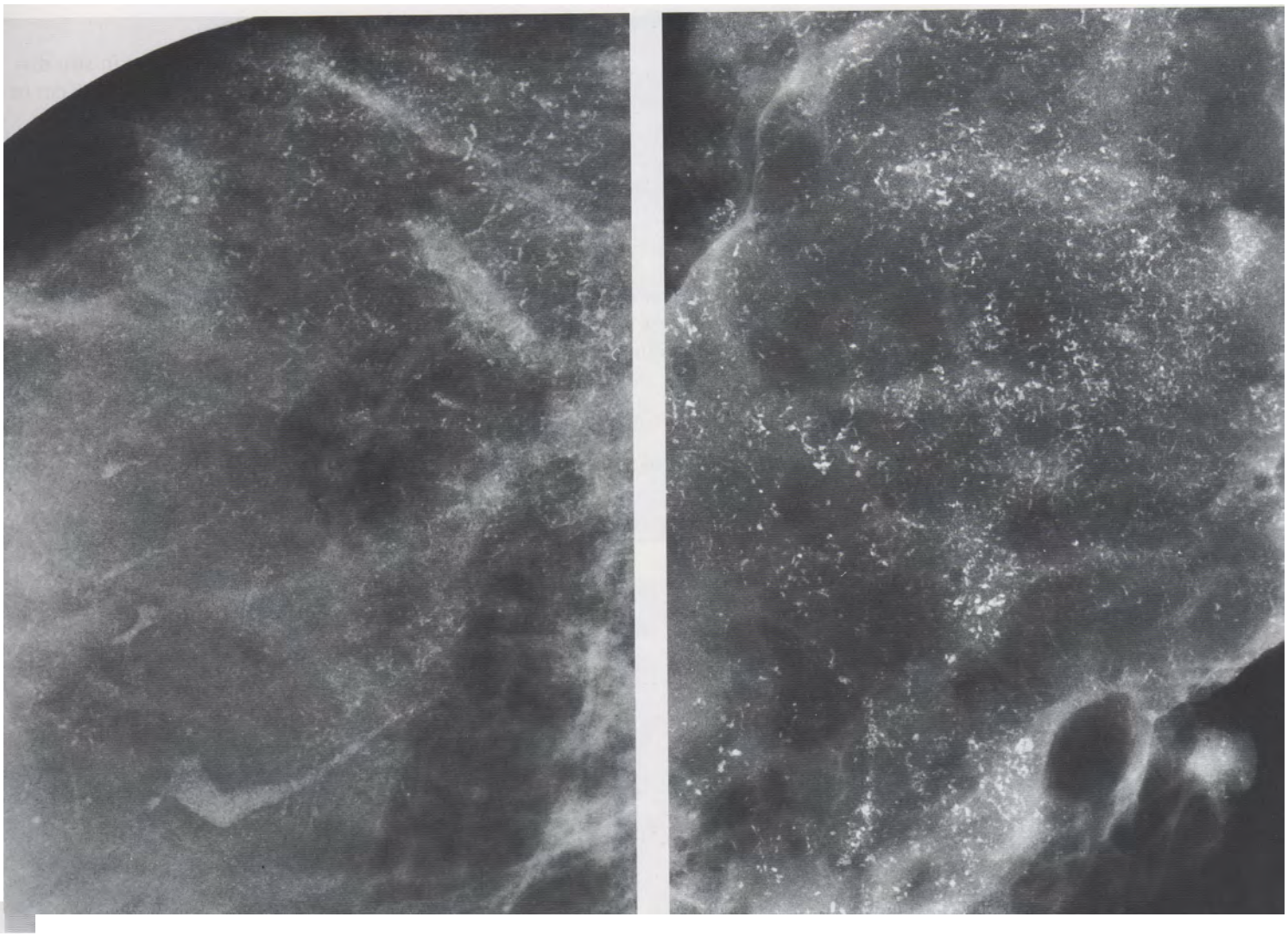
High-grade ductal carcinoma in situ distributed over an area of at least 15 cm in diameter, associated with small foci of invasive, poorly differentiated ductal carcinoma. Axillary lymph node metastases.
Fig. 102 E: Overview of both invasive and in situ ductal carcinoma. (H & E, 12.5 x)
Fig. 102 F: Detailed view of the micropapillary and cribriform in situ component with cellular atypia. (H & E, 200 x)
Fig. 102 G: Further details of the Grade 3 micropapillary carcinoma in situ showing central necrosis. (H & E, 200 x)

Follow-up

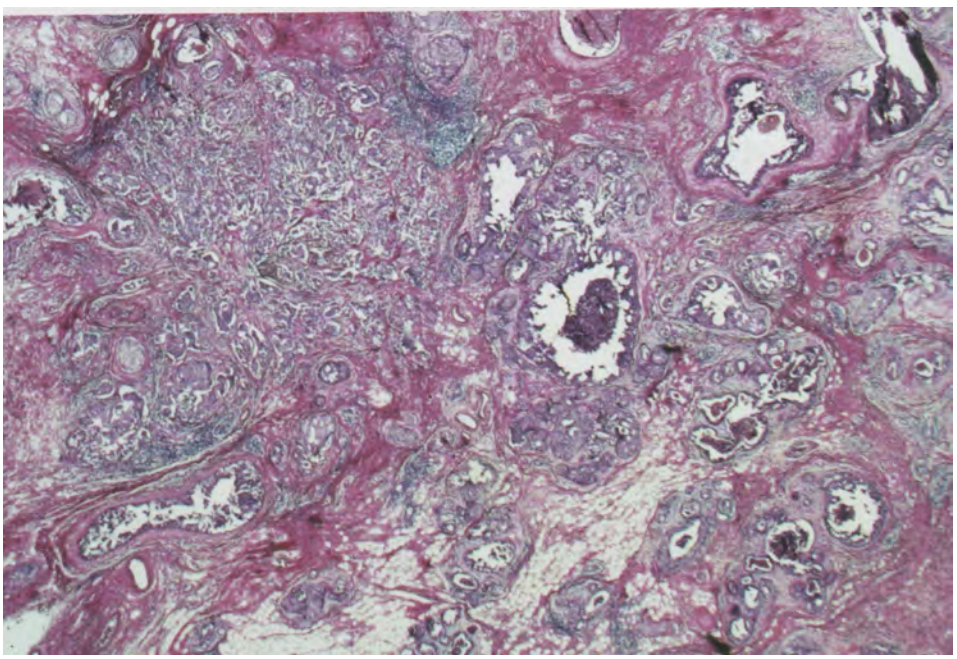
The patient died three years, seven months later of metastatic breast carcinoma at age 31.

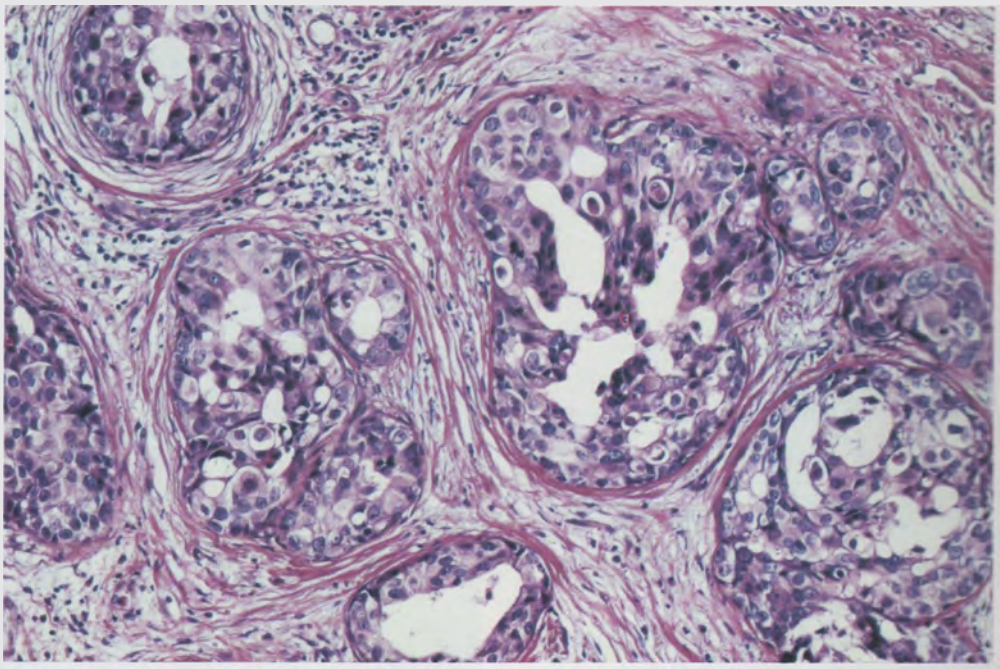


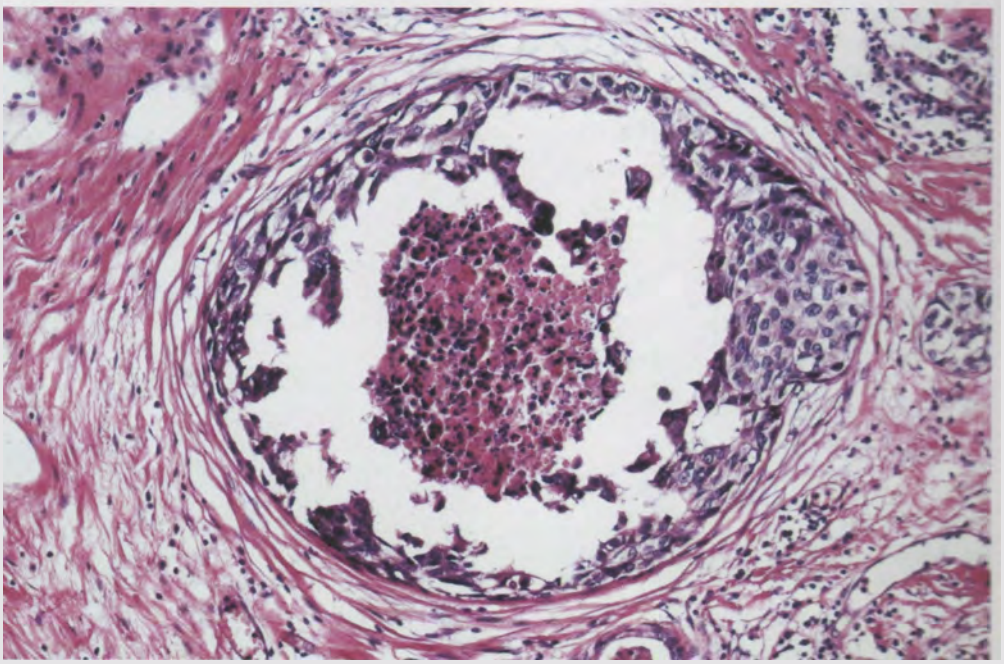




02C







103

62-year-old woman, asymptomatic. First screening study.

Physical Examination

No palpable tumor in the breasts.

Mammography

Fig. 103 A—C: Left breast, cranio-caudal projection and detailed views in the cranio-caudal and medio-lateral projections. An oval tumor with associated calcifications is seen 5 cm from the nipple.

Analysis of the Tumor

Form: oval, lobulated
Contour: partly sharply outlined (arows), partly ill defined. Parenchymal structures obscure part of the tumor border.
Density: low density radiopaque
Size: 15 x 10 mm

Analysis of the Calcifications

Form: irregular, some of them casting type
Density: highly variable
Distribution: within the tumor

Conclusion

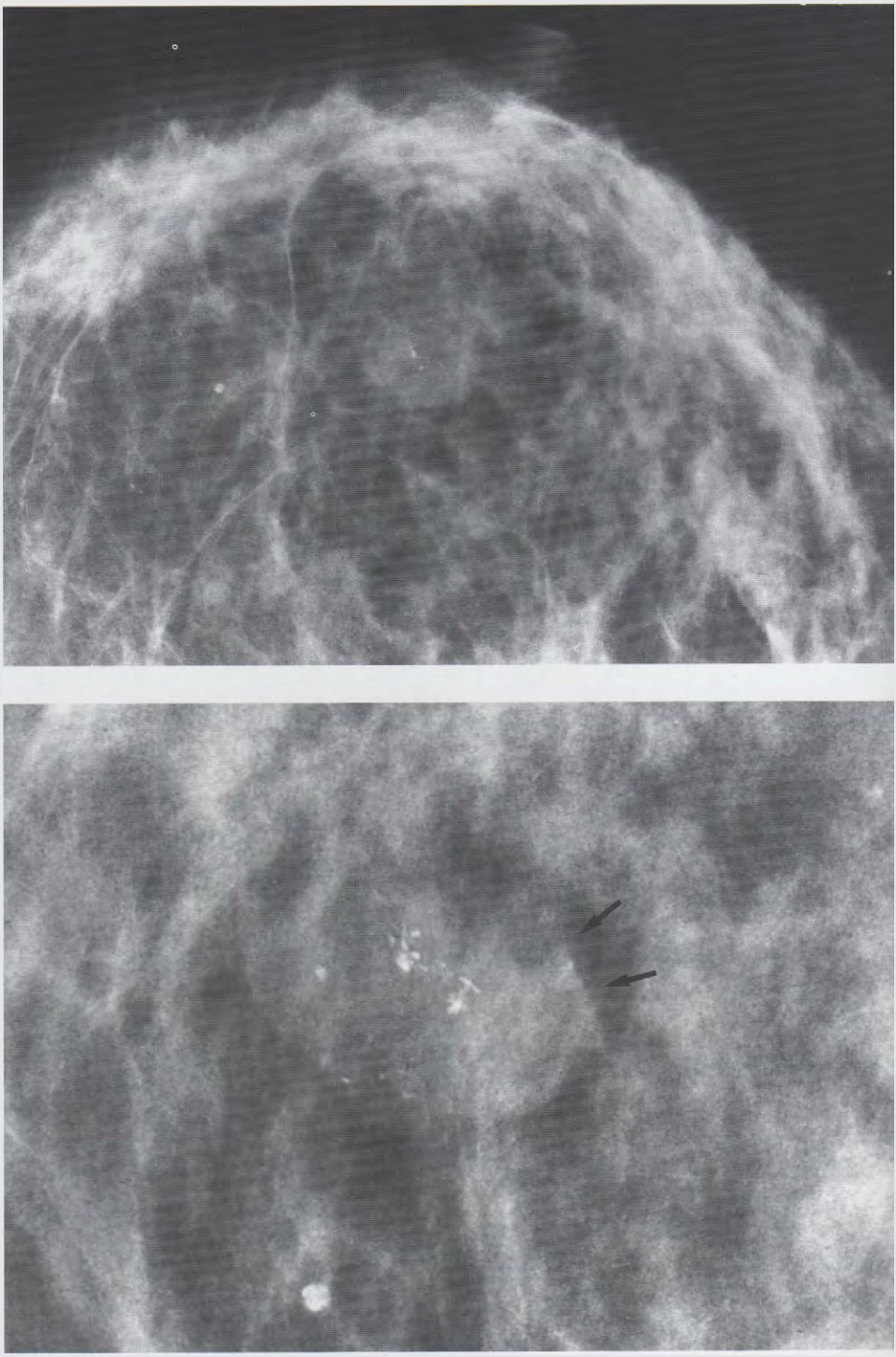
Mammographically malignant type calcifications.

Histology

Ductal carcinoma in situ within a fibroadenoma.
Fig. 103 D: Overview of the fibroadenoma. (H & E, 12.5 x)
Fig. 103 E: Higher magnification reveals an in situ carcinoma with pleomorphic nuclei and amorphous calcifications within the fibroadenoma. (H & E, 200 x)
Fig. 103 F: Further details of the in situ carcinoma. (H & E, 400 x)

Follow-up

The woman died 13 years later from acute myocardial infarction at age 75. There was no evidence of breast cancer.



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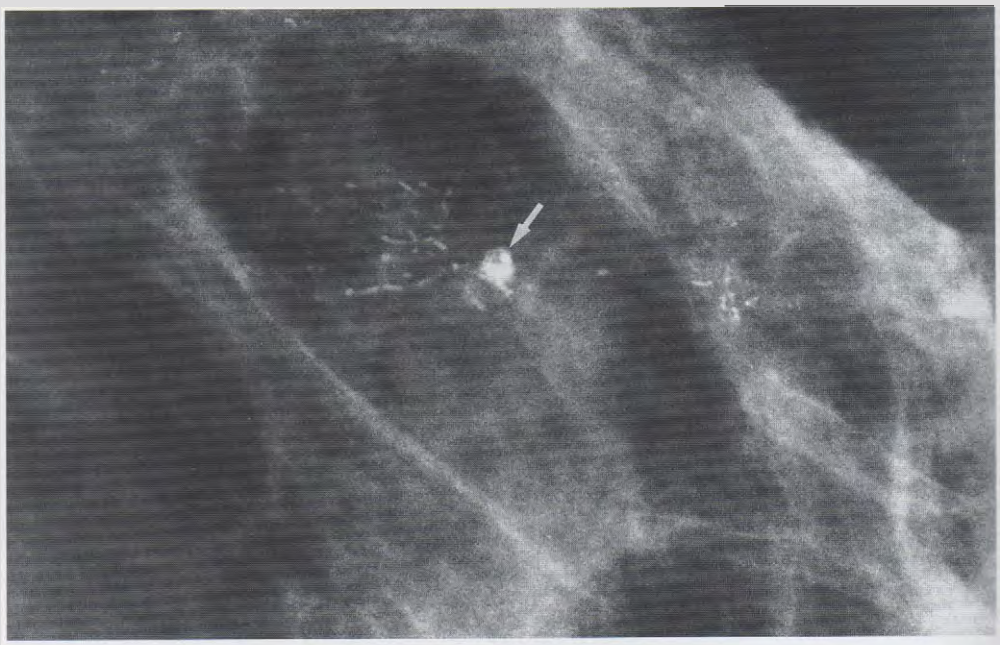


Fig. 104A: Left breast, microfocus magnification view in the medio-lateral oblique projection. Numerous calcifications are seen, with no associated tumor.

Analysis

Typical casting-type calcifications. These are mammographically characteristic of malignancy. A single, dense, benign-type periductal calcification (arrow) is superimposed.

Histology

Ductal carcinoma in situ with minimal invasion. No axillary lymph node metastases.

Fig. 104B: Central necrosis and periductal fibrosis in the ductal carcinoma in situ. (H & E, 100 x)

Fig. 104 C: Grade 3 ductal carcinoma in situ with central necrosis and amorphous microcalcifications. (H & E, 300 x)

Fig. 104D: Grade 3 ductal carcinoma in situ with central necrosis showing high nuclear grade and high mitotic activity. (H & E, 300 x)

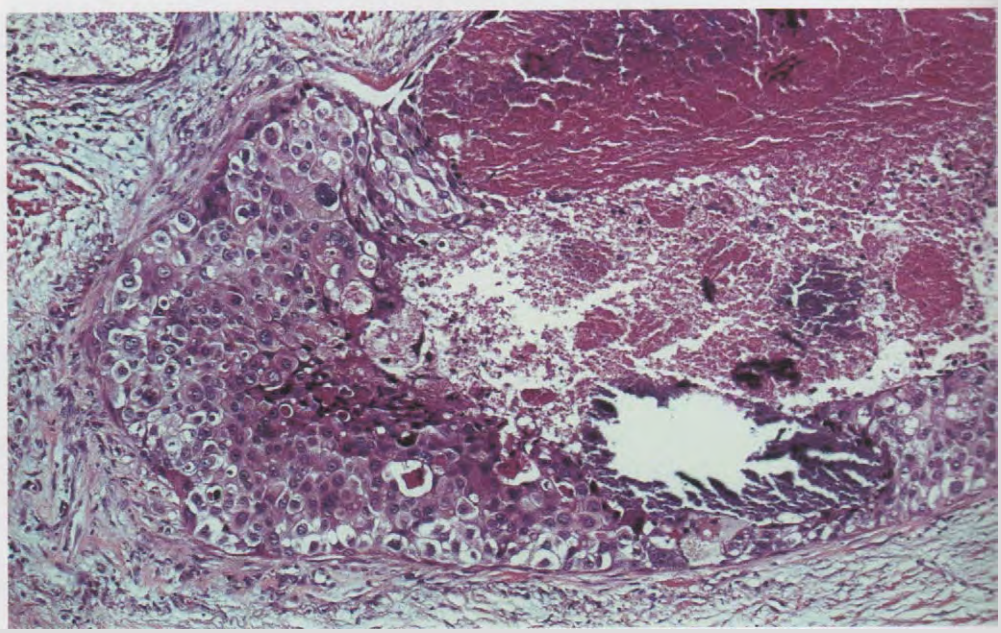
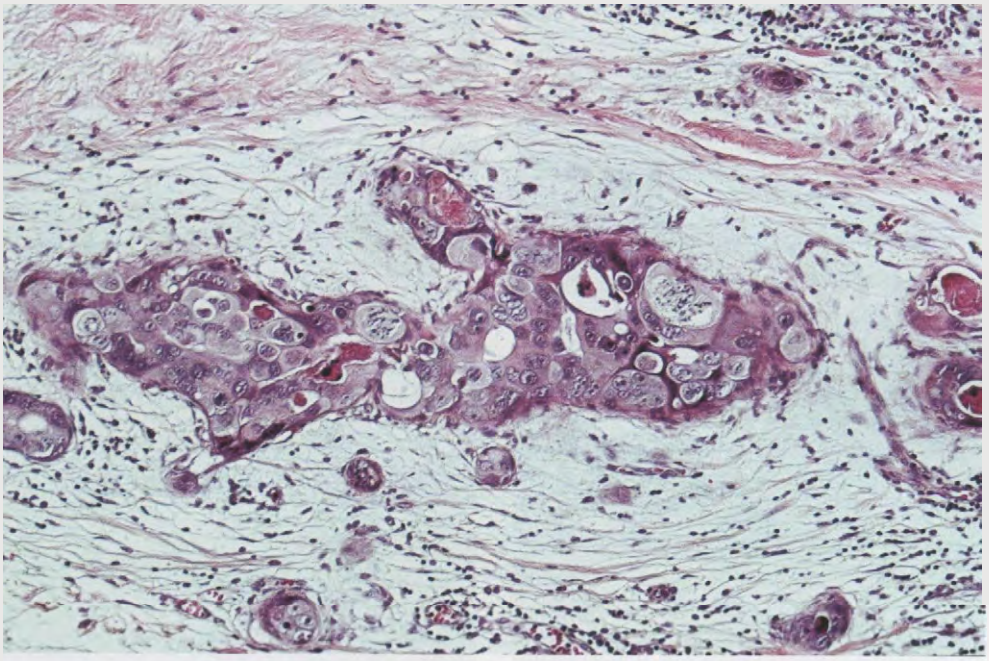


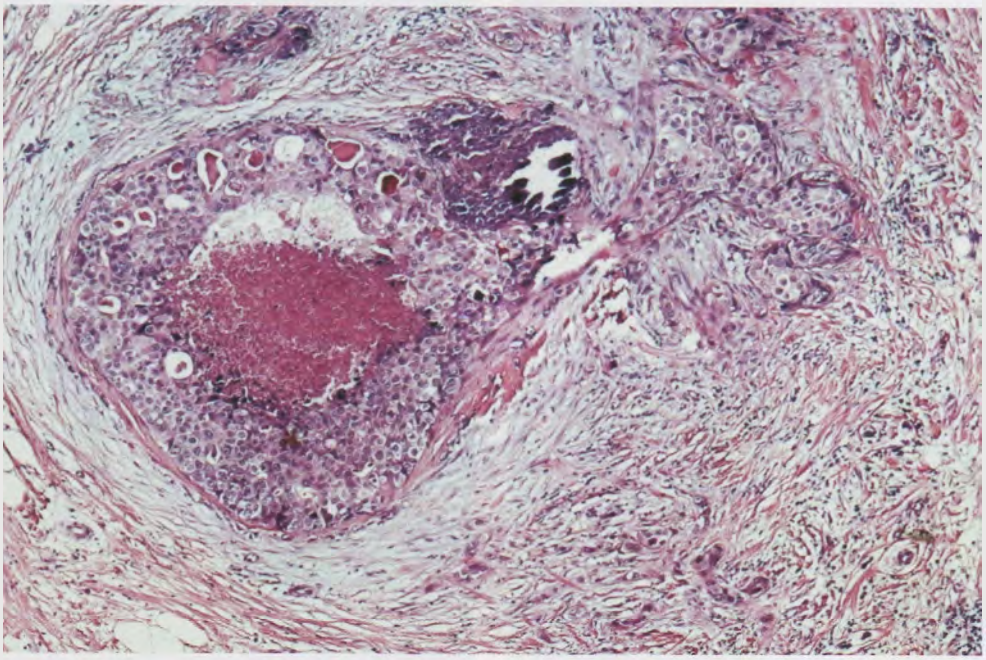
Fig. 104 E: Foci of microinvasion surrounding the in situ tumor. (H & E, 200 x)

Follow-up

The woman was still alive 18 years later at age 64.



104D



104E

105

Age 80, two month history of eczematous change of the nipple.

Physical Examination

Fig. 105 A: The appearance of the nipple resembles Paget's disease. No palpable breast tumor.

Mammography

Fig. 105 B: Left breast, microfocus magnification view, medio-lateral oblique projection. A single casting type calcification (solid arrow) and a group of granular type calcifications (open arrow) are seen with no associated tumor. An additional solitary, benign type, smooth bordered calcification is readily apparent. (typical of a calcified hematoma).

Analysis

Both the granular and casting-type calcifications indicate the presence of a malignant lesion.

Conclusion

One has to search for the carcinoma focus in a patient with Paget's disease. The described malignant-type calcifications indicate the site of an intraductal carcinoma.

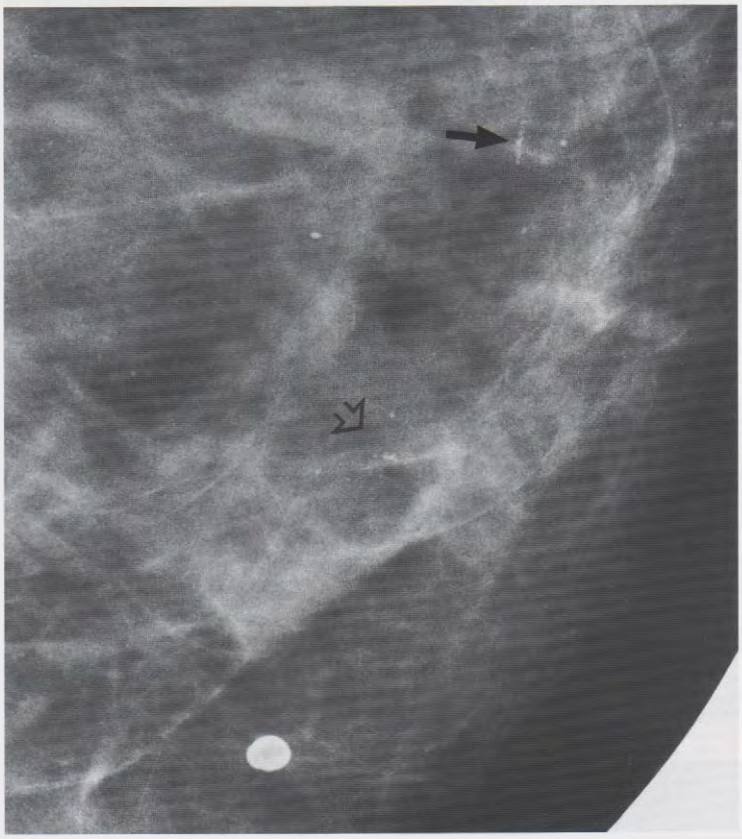
Histology

Ductal carcinoma in situ. Paget's disease of the breast.

Comment

Paget's disease of the breast, first described by J. Paget in 1874, is a special form of ductal carcinoma associated with eczematous changes of the nipple. The clinical picture is dominated by the malignant nipple lesion, and the ductal carcinoma is usually occult to palpation. Mammography can demonstrate the underlying ductal carcinoma in most cases. Occasionally the carcinoma in the breast may be occult to imaging methods.

105A



1058

106

47-year-old woman, asymptomatic. First screening study.

Mammography

Fig. 106 A: Right breast, medio-lateral oblique projection. There are several coarse, benign-type calcifications in the lower half of the breast.
Second screening study two years later. The patient is asymptomatic, with no palpable tumor in the breasts at physical examination.
Fig. 106 B: Right breast, medio-lateral oblique projection. There is a small, de novo cluster of calcifications 4 cm from the nipple. No associated tumor.
Fig. 106 C & D: Right breast, microfocus magnification view of the calcifications.

Analysis

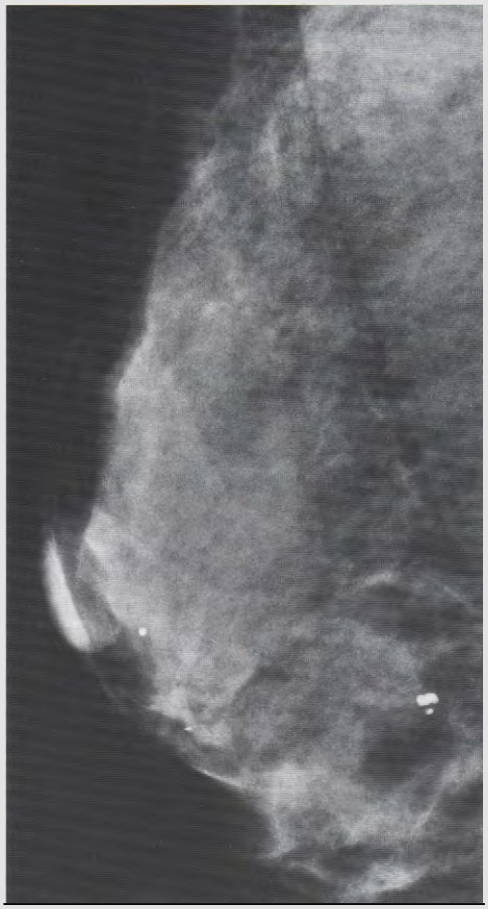
Form: irregular, some casting-type calcifications, some amorphous and fragmented
Density: variable
Distribution: cluster

Conclusion

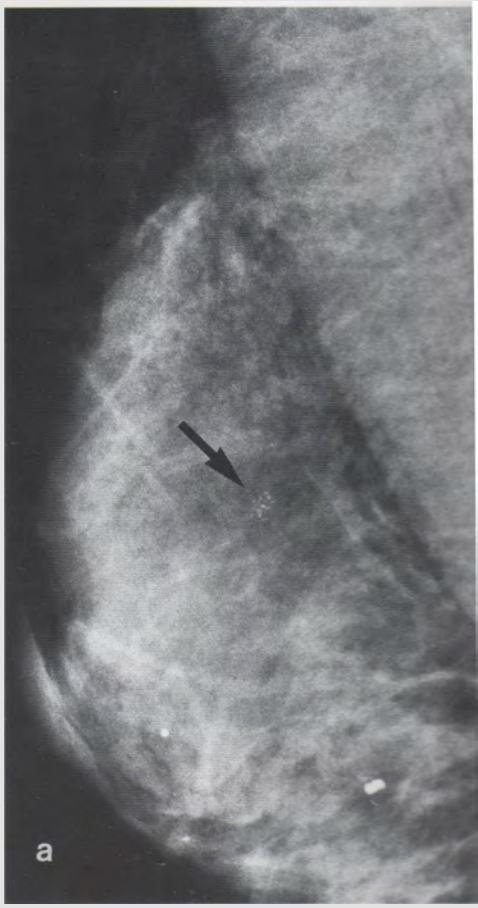
Newly arising, mammographically malignant-type calcifications.

Histology

High-grade ductal carcinoma in situ ("comedo") with minimal infiltration.



106A



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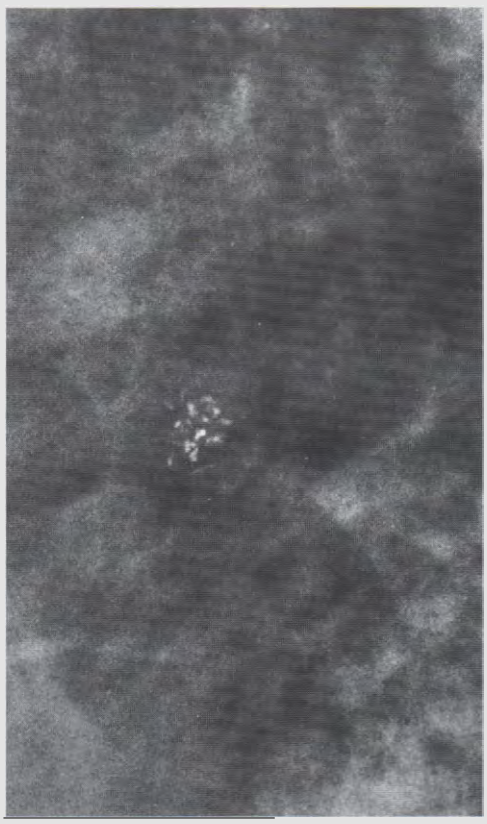


106C

107

47-year-old woman with a self-detected tumor in the upper outer quadrant of the right breast.

Physical Examination

The tumor appears malignant and there are enlarged axillary lymph nodes.

Mammography

Fig. 107 A: Right breast, medio-lateral oblique projection. Dense breast with scattered and multiple cluster calcifications throughout the breast. No associated tumor shadow.
Fig. 107 B & C: Right breast, medio-lateral oblique projection, microfocus magnification views of the upper (B) and lower (C) halves of the breast.

Analysis (best on the magnification views)

Form: highly irregular, partly granular and elongated, some branching in the lower half of the breast
Density: highly variable
Distribution: many clusters distributed throughout the breast.

Conclusion

The granular and casting-type calcifications are of the mammographically malignant type, spread throughout the parenchyma, suggesting a multicentric carcinoma.

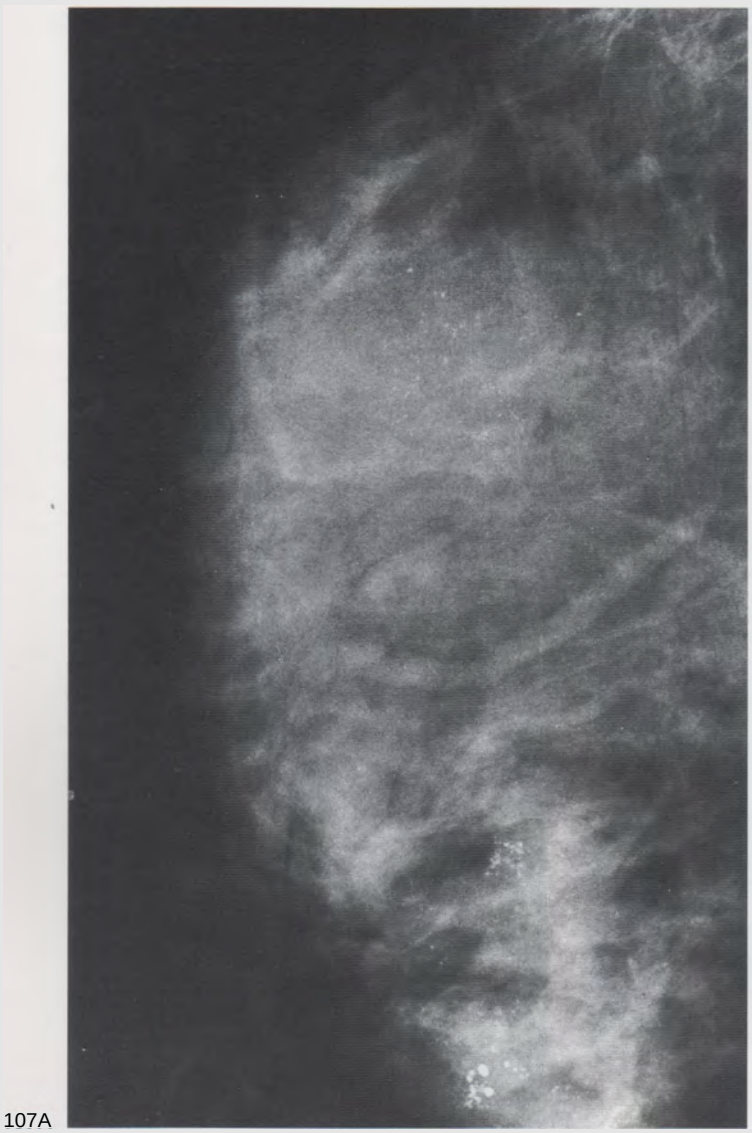
Histology

Poorly differentiated, multicentric, invasive ductal carcinoma associated with multiple foci of in situ carcinoma (corresponding to the calcifications). Axillary metastases with periglandular growth.

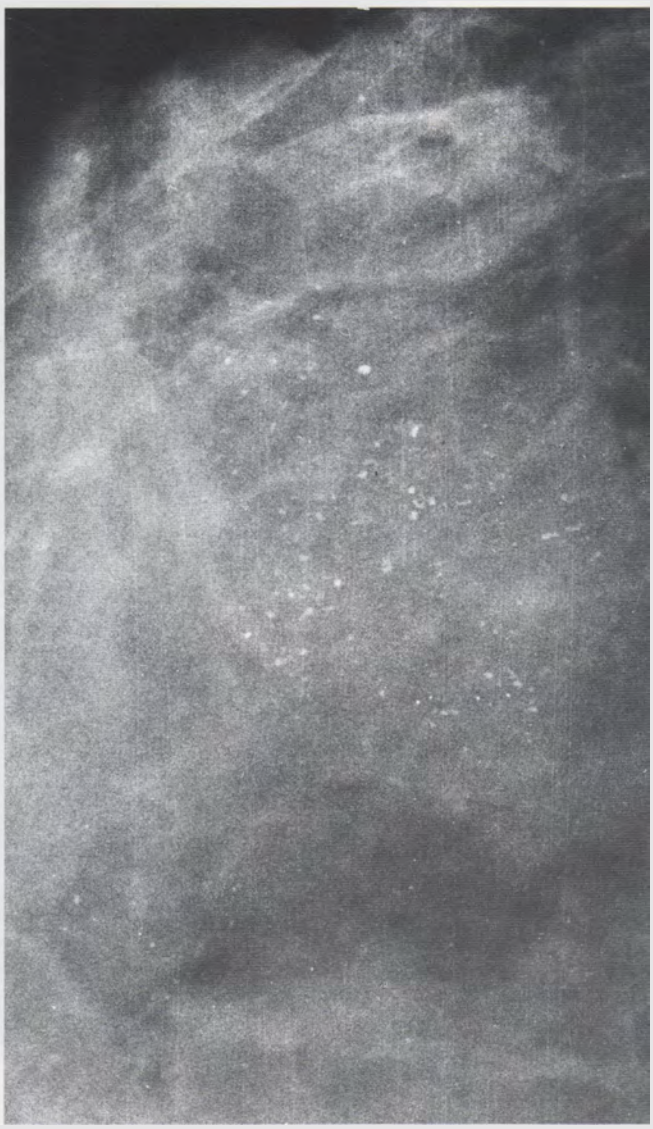
Fig. 107 D: Part of one invasive focus, which covers most of the field, and associated in situ components (H & E, 20 x).
Fig. 107 E: Detail of Fig. 107D showing a cross section of one duct with in situ Grade 2 carcinoma (H & E, 200 x)
Fig. 107 F: Lymph vessel invasion surrounded by fibrous stroma, (H & E. 300 x)
Fig. 107G: Metastases from the primary tumor within an axillary lymph node. (H & E, 12.5 x)

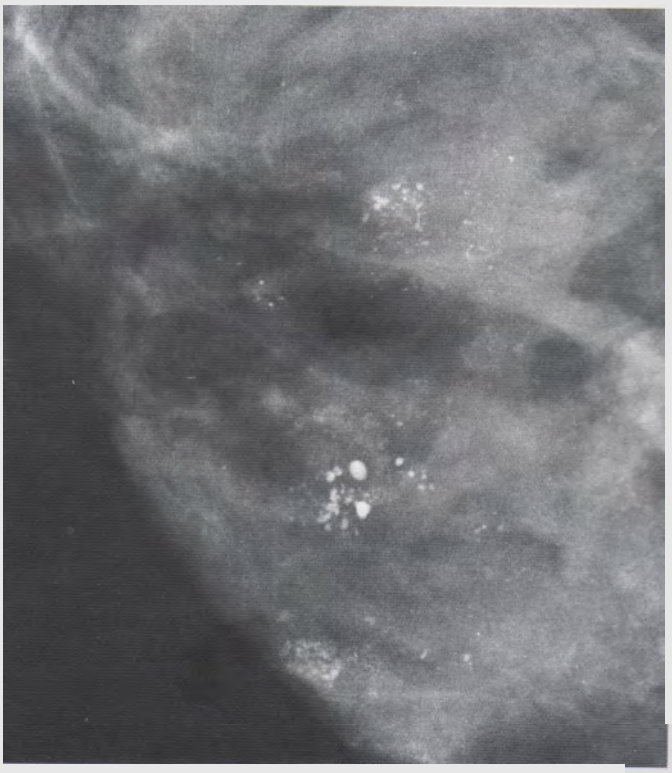
Follow-up

The patient died four years later of metastatic breast carcinoma at age 51.



107A





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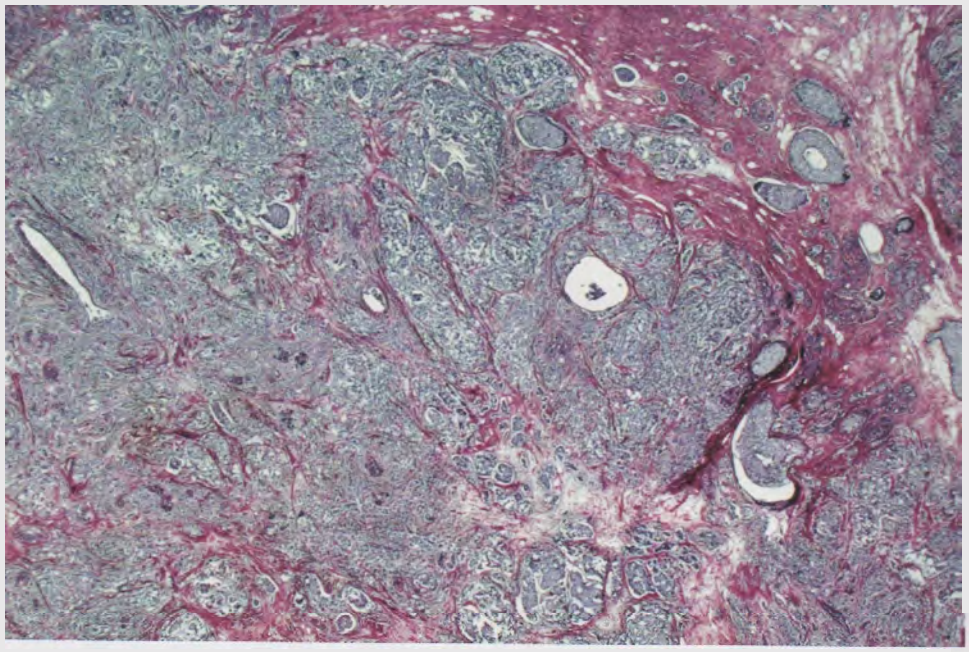

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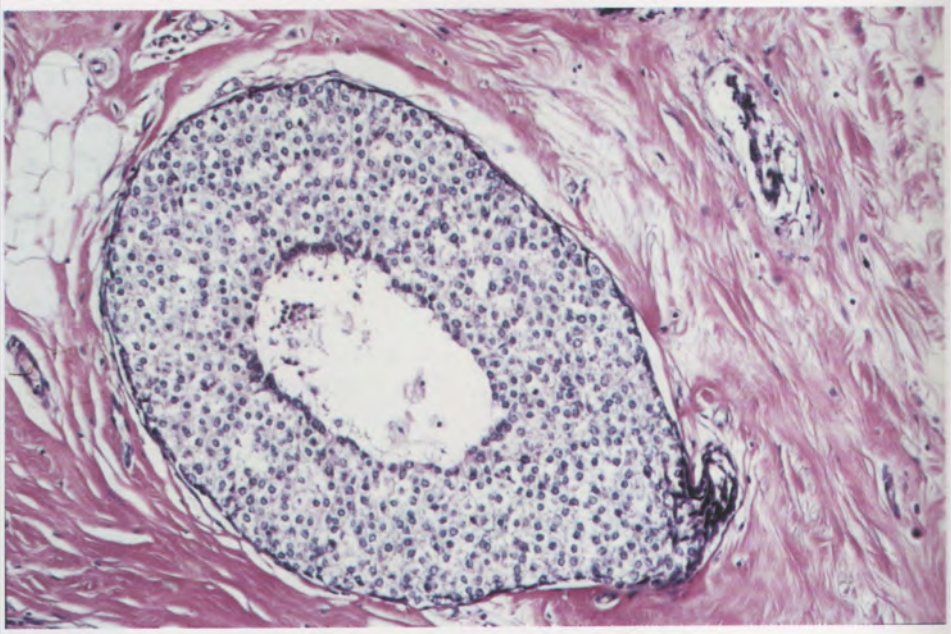
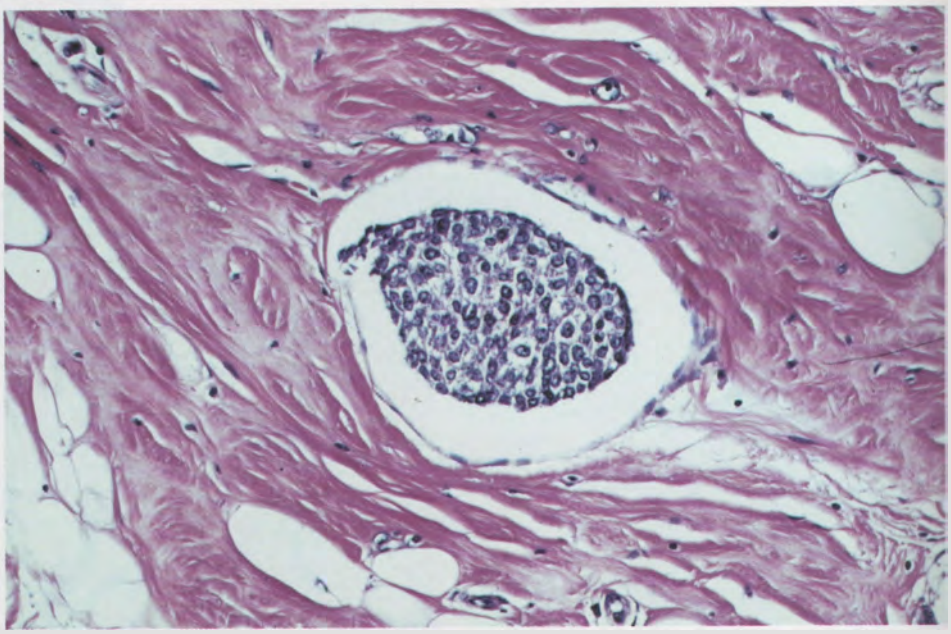
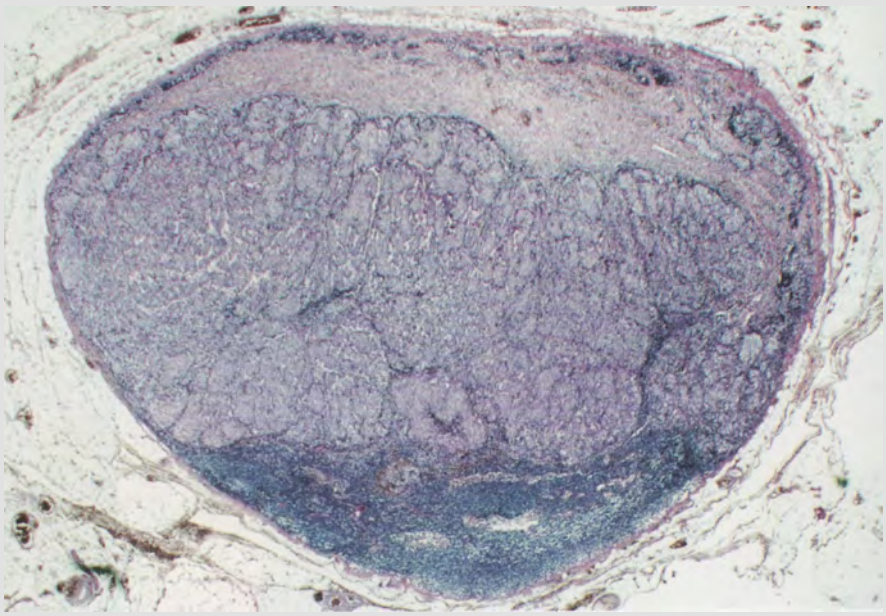






108

43-year-old woman referred for a recently detected lump in the upper outer quadrant of the right breast. The tumor was clinically suspicious for malignancy.

Mammography

Fig. 108A & B: Right breast, medio-lateral oblique projection, contact and microfocus magnification. A cluster of calcifications is seen associated with a tumor mass.

Analysis of the Calcifications

Form: irregular, a mixture of granular- and casting-type calcifications
Size: highly variable
Density: highly variable
Distribution: cluster

Conclusion

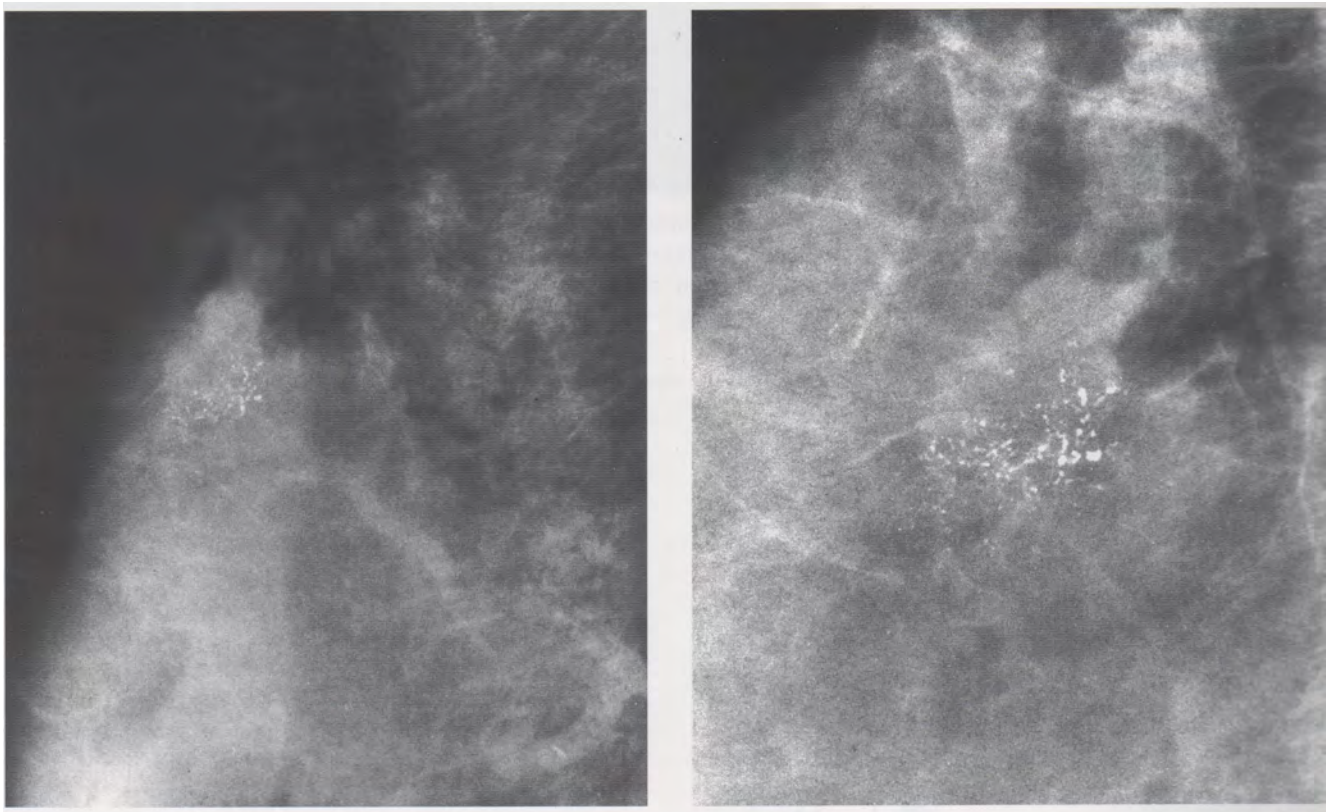
Mammographically typical picture of malignant-type (granular and casting) calcifications, associated with an ill-defined tumor mass.

Histology

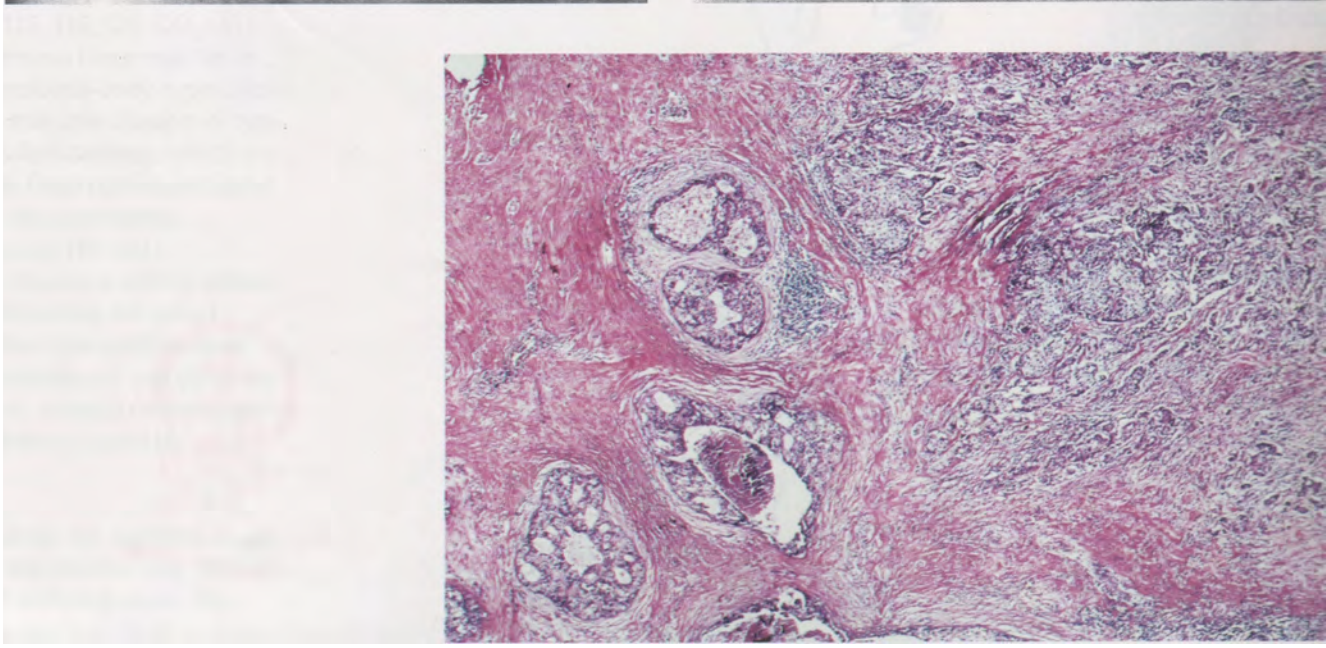
Poorly differentiated, invasive and in situ ductal carcinoma with axillary lymph node metastases.
Fig. 108 C: Low-power view showing part of the invasive tumor to the right and in situ components to the left. (H & E, 40 x)

Follow-up

The patient died seven years later of metastatic breast carcinoma at age 50.



108A



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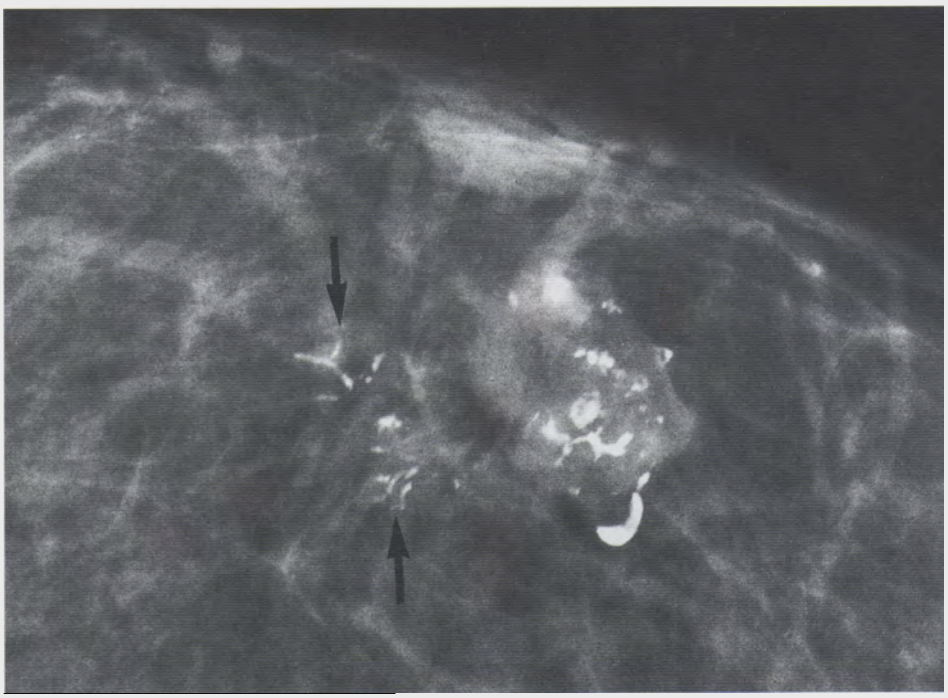


77-year-old asymptomatic woman. First screening study.

Mammography

Fig. 109: Detail of the cranio-caudal projection. Microfocus magnification of the retroareolar region. There is a retroareolar tumor with coarse associated calcifications.
One cm medial to the tumor there is a small cluster of calcifications without a tumor mass (arrows).

Analysis of the Tumor

Form: oval, lobulated
Contour: unsharp
Density: low density radiopaque

Analysis of the Intratumoral Calcifications

Form: irregular, coarse
Size: variable
Density: high
Distribution: within and immediately adjacent to the tumor mass

Conclusion

Mammographically benign-type calcifications within a tumor mass of low density. Most probably a calcified fibroadenoma.

Analysis of the Calcifications Adjacent to the Tumor

Form: irregular, branched, elongated, fragmented, casting-type
Density: variable within the same elongated calcification

Conclusion

Casting-type calcifications, typical for ductal carcinoma.

Histology

The tumor mass with calcifications corresponds to a partially calcified fibroadenoma. The casting-type calcifications were localized within a high-grade DCIS associated with a small invasive ductal carcinoma.

Benign-Type Calcifications within Ducts or Lobules

Normal lobules are demonstrated by galactography and labeled "A" in Fig. 110. Cystically dilated TDLUs are demonstrated by galactography in Fig. **111,** illustrating the sites where benign-type lobular calcifications may arise. The cluster/multiple cluster *distribution* of the calcifications indicates that they are localized with the lobules. Differentiation among the benign pathological entities leading to calcification within the lobules (fibrocystic change, sclerosing adenosis, blunt duct adenosis) is the task of the pathologist.

Form

The most frequent cause of benign-type calcifications arising within lobules is fibrocystic change, in which fluid distends the TDLU. Calcifications in this fluid form sediments, which assume the shape of the mould within which they are formed. When the freely mobile particles within the "milk of calcium" settle to the dependent portion of the cavities, they are seen on the lateral view as crescent-shaped or elongate calcifications, which may resemble a **teacup** seen from the side (Fig. XXVIII E & F) (25). On the cranio-caudal view these calcifications are circular, faint, opaque smudges, resembling a teacup seen from above (53).
The entire contents of the cavity may also solidify, producing **punctate calcifications** (BIRADS: punctate) which are *tiny, homogenous, evenly scattered, individually discernable, sharply outlined, spherical, pear-like densities* (Fig. XXVIII B & C) (cases 112, 113, 115, 116, 121, 122, 141).
In sclerosing adenosis there may be innumerable psammoma-body-type calcifications forming multiple clusters of typical **powderish calcifications,** which are indistinguishable from those associated with Grade 1 in situ carcinoma (Fig. XXVIII D) (cases 119, 121).
Benign type calcifications arising within ducts and their branches are called *plasma cell mastitis type calcifications.* They are linear intraductal calcifications with regular form, smooth contour, and a high, uniform desntiy (case 118).

Size

In fibrocystic change the variable saccular dilatation of the lobules (Fig. 111) produces moulds of differing sizes. The larger the cavity, the less likely it is to become completely calcified (cases 113, 114, 120). In sclerosing adenosis, the individual particles are too small to be discernable. The involutional-type, punctate calcifications, although very small, can still be resolved on the mammogram (cases 122, 141).
The width of the of plasma cell, mastitis-type calcifications will be determined by the extent to which the fluid distends the duct.

Density

Calcifications in larger, saccular cavities differ somewhat in density according to their size. The density of these sediments is faint on the cranio-caudal projection and is denser on the latero-medial, horizontal projection. The extremely small calcifications typical of sclerosing adenosis are very faint, even when many are superimposed. Small pearl-like calcifications are uniform and dense, an example being involutional type calcifications. The large, elongate calcifications of plasma cell mastitis type have a very high, homogenous density.

Number and Distribution

The benign calcifications within lobules may be numerous and scattered throughout much of the parenchyma. The distribution of plasma cell mastitis is generally bilateral and evenly scattered,with the calcifications following the course of the ducts.

Comment

Fibrocystic change may rarely be associated with lobular carcinoma in situ. However, most cases have been incidental findings at serial histological sectioning, located at some distance from the calcifications. Diagnosis of lobular carcinoma in situ cannot be reliably made by mammography.

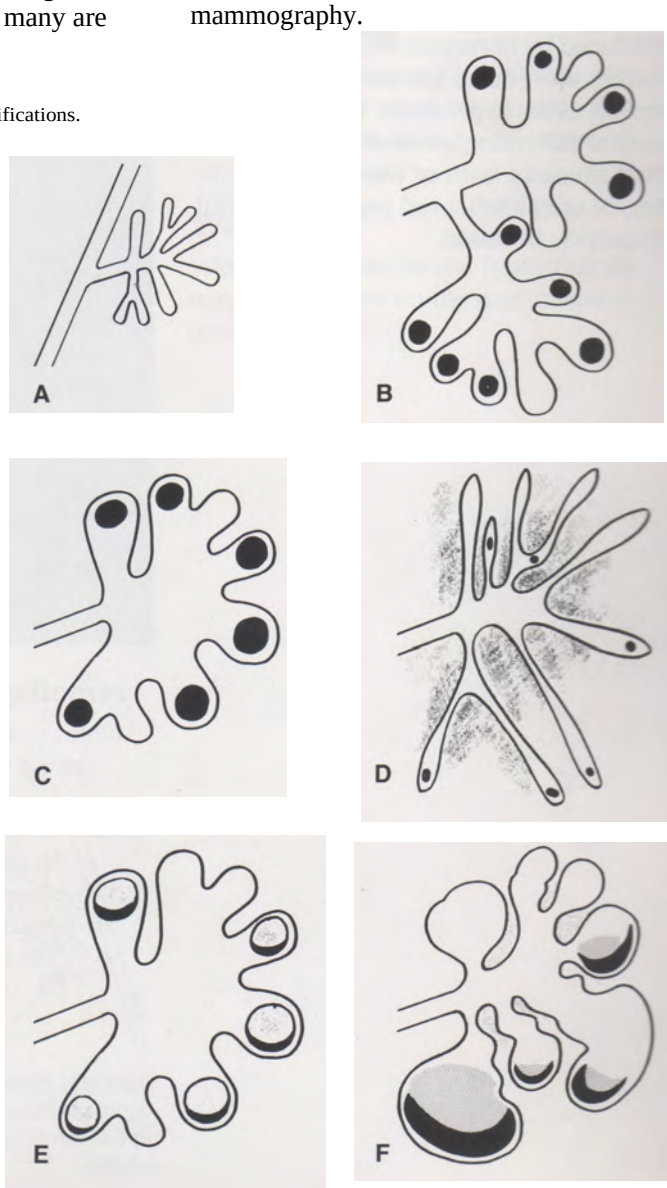


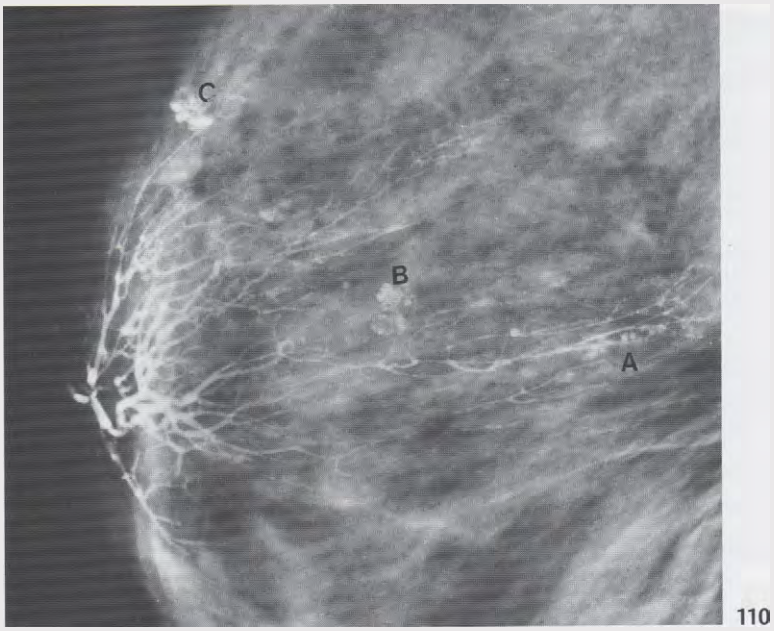
Fig. XXVIII A—F: Lobular-type calcifications.
A: normal lobule,
B & C: adenosis,
D: sclerosing adenosis,
E & F: fibrocystic change

110
111

Galactograms outline the main duct and its branches and some of the TDLUs in a single lobe in these two cases.
Normal lobules: Fig. 110, marked "A." Cystically dilated, saccular, spherical lobules: Fig. 110, marked "B" and "C," as well as those in Fig. 111.
The cyst-like dilatations contain stagnating fluid that may eventually calcify.

Conclusion

When the mammogram shows considerable fibrosis and scattered calcifications that are spherical, oval, or teacup-shaped with little variation in form, size, and density, such calcifications have been produced by fibrocystic change. No further procedures are indicated. If biopsied, other hyperplastic breast changes, such as sclerosing adenosis and blunt duct adenosis, with or without some degree of epithelial cell proliferation, will frequently be found.



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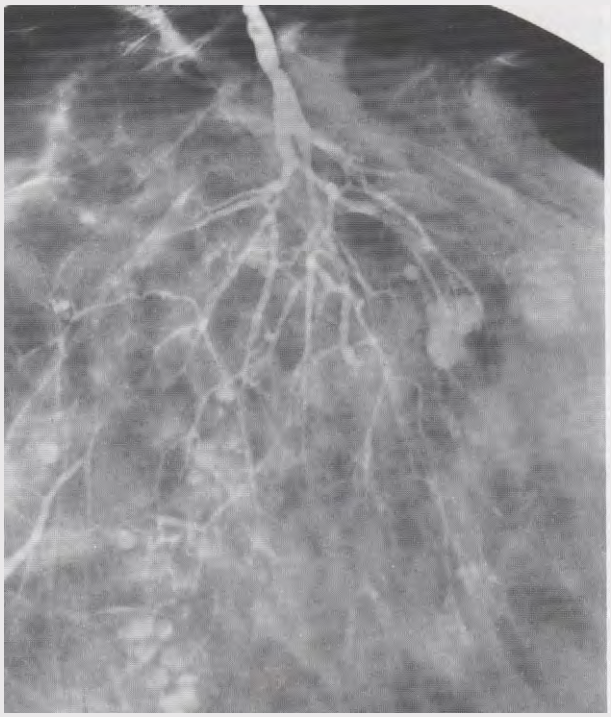
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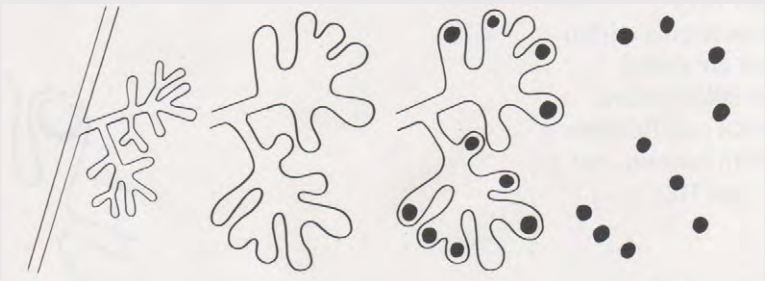


Fig. XXIX: Involutional-type calcifications. These may result from a mild degree of fibrocystic disease that calcifies during involution. The glandular tissue atrophies, leaving behind the calcifications within one or more lobules.

Miscellaneous Calcifications

Arterial Calcifications

Arterial calcifications are usually easy to recognize because the calcified arterial walls have a typical radiologic appearance. When calcification is sparse it may be difficult to recognize the arterial origin of these intermittent calcifications.

Periductal Mastitis

(Ductal ectasia, plasma cell mastitis)

Periductal mastitis produces a typical mammographic appearance. This condition results from extravasation of intraductal secretions causing a periductal chemical mastitis. This sterile, inflammatory reaction is characterized by the presence of plasma cells surrounding the dilated duct. Periductal fibrosis and intraductal and/or periductal calcifications are the final result.

The calcifications can be located
around the dilated ducts (most frequently),
inside the lumen (see pages 138-139), or
in the duct wall.

Form

— A calcified ring lies within the fibrous tissue that surrounds the dilated duct. The lumen of the duct is well seen inside the calcified ring (cases 117, 125).
— When the calcification extends around and along the duct, it appears oval or elongated. Fibrosis accompanies these hollow calcifications.

Density

Both ring and elongate forms have a center of varying lucency, corresponding to the lumen of the duct. The periphery of the calcifications is very dense.

Number and Distribution

Multiple, often bilateral, scattered, oriented towards the nipple, following the course of the ducts.

Sebaceous Gland Calcifications

These are easily recognized and should not lead to confusion (case 124). There are two characteristic mammographic appearances, depending upon whether calcification arises within the sebaceous gland wall (ring-like, hollow) or within the cavity (punctate).

Number and Distribution

Often very numerous. Occur only within the skin.

Eggshell-Like Calcifications

a) Oil cysts (cases 4, 134-136)
Following trauma to the breast, blood may collect within a smaller or larger spherical or ovoid cavity. Enzymes from the blood decompose adipose tissue to oil (glycerin) and fatty acids. A fibrotic capsule will surround the oil-filled cavity. The fatty acids eventually precipitate as calcium soaps at this capsular surface, forming a thin layer of calcification surrounding the oil cyst. This gives an eggshell-like appearance on the mammogram.
Form: Spherical or oval.
Size: Variable, up to several cm.
Density: The lesion is surrounded by an eggshell-like calcification, but the oily contents are radiolucent. This characteristic appearance makes the mammographic picture unmistakable.

b) A larger cyst with eggshell-like calcification is a rare finding (cases 136, 137). Although eggshell-like calcifications are almost invariably benign, the rare exception is a smaller retroareolar eggshell-like calcification. This may represent an intraductal, intracystic papilloma or intracystic carcinoma (case 137).

c) Fibroadenoma with eggshell-like calcification is rare. This also has a radiopaque center but the calcifications are coarse and dense. The mammographic image is highly characteristic and no intervention is necessary (case 200)

Papilloma, Multiple Papillomas

These occasionally calcify. The mammographic appearance is usually typical: circular/oval with small lobulations (resembling a raspberry). The calcified areas are dense, may be uniform, but often contain small, lucent areas. Papillomas may be solitary, central or retroareolar; or may be multiple, scattered within a lobe (cases 127, 128, 130-132).

Fibroadenomas

Fibroadenomas may present with three different types of calcification:

1) Coarse, irregular but sharply outlined very dense calcification. This popcorn like appearance is diagnostic of an olc fibroadenoma, which has undergone myxoid degeneration. The calcification may involve part or all of the fibroadenoma (cases 142-144).
2) Peripheral calcifications in a fibroadenoma are of high and fairly uniform density. They may take the appearance of an eggshell (case 138) or **may** be flecked (cases 145-149).
3) Small, discernable, irregular crushed-stone-like calcifications may cause a considerable differential diagnostic problem. The appearance mimics that of Grade 2 in situ carcinoma. Core needle biopsy can resolve this dilemma.
4) Carcinoma within a fibroadenoma. If benign tumor contains malignant-type calcifications, of either the granular of casting type, malignancy should be suspected (case 103).

Hemangiomas

Hemangiomas (cases 23, 151) may present with either small calcificatins that vary in form and size or with larger, bizarre calcifications.

Warts

Warts may rarely calcify. Those that do may be deceptive on the mammogram (case 152).

Practice in Calcification Analysis

(Cases 112-152)

112

43-year-old woman with pain in the breasts and grayish secretion from several ducts of the right breast.

Mammography

Fig. 112: Right breast, detailed view of the cranio-caudal projection (micro-focus magnification view).
Numerous calcifications of varying size are scattered within the fibrous tissue.

Note

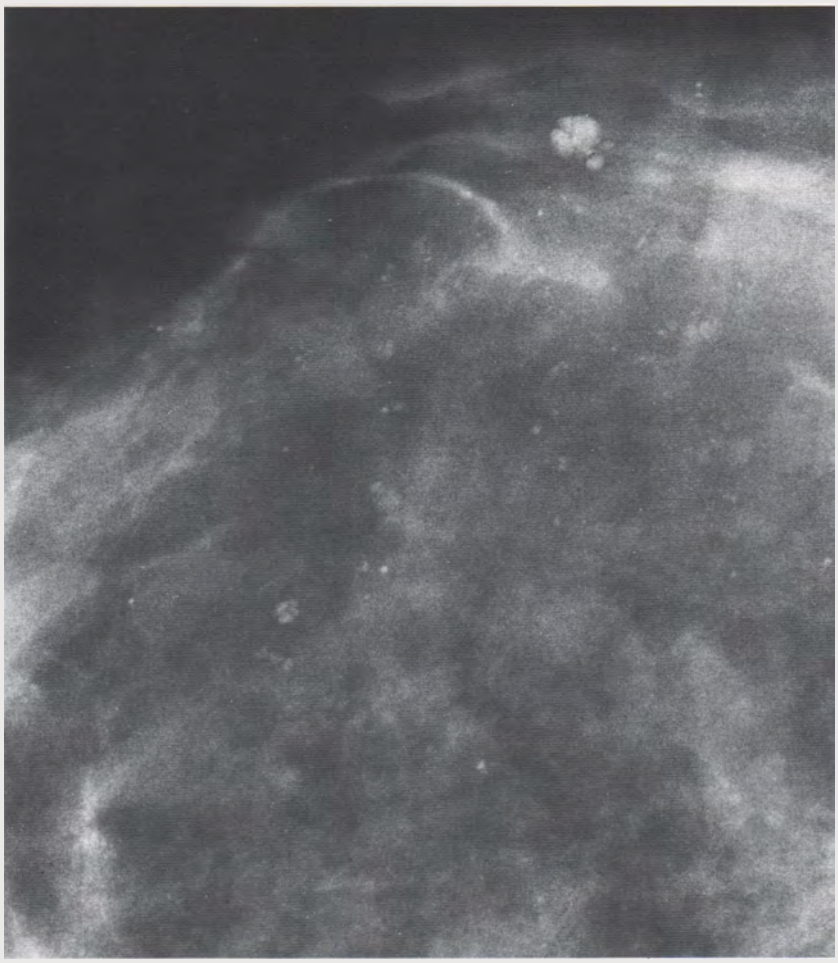
Compare with cases 110 and 111 where the dilated lobules are demonstrated on galactograms.

Analysis of the Calcifications

Form: spherical, some lobulated; the largest calcifications have a septated structure; these calcifications are situated in cystically dilated ductules. Tho cyst-like dilatations that are only partially calcified present as faint smudges because they are imaged *en face* with a vertical beam. The same calcifications a pear crescentic (teacup-shaped) when imaged with a horizontal beam.
Size: variable
Density: faint, uniform
Distribution: scattered

Conclusion

Extensive fibrosis with scattered calcifications in cystically dilated lobules is a typical mammographic image of fibrocy tic change.



113

52-year-old woman, first screening study. Previous biopsy of the right breast. No palpable tumor.

Mammography

Fig. 113 A: Right breast, medio-lateral oblique projection. There is an extensive fibrosis over much of the breast, with numerous calcifications. No tumor is seen.

Fig. 113 B: Microfocus magnification view, medio-lateral oblique projection. There are three different kinds of calcifications.

Analysis best on the magnification view (Fig. 113 B)

1) The linear calcifications (solid arrows) correspond to the site of operation. They are smooth-bordered and highly dense and appear to be benign, possibly the consequence of post-operative traumatic fat necrosis.
2) The punctate calcifications (open arrow) are small, round and sharply outlined, with uniform density. These are localized within spherical, dilated lobules, mammographically benign.
3) There are several larger, spherical and oval, partially calcified, cyst-like lesions (dilated lobules). The calcifications themselves are crescent like, teacup-shaped and situated in the dependent, caudal portions of the dilated lobules.

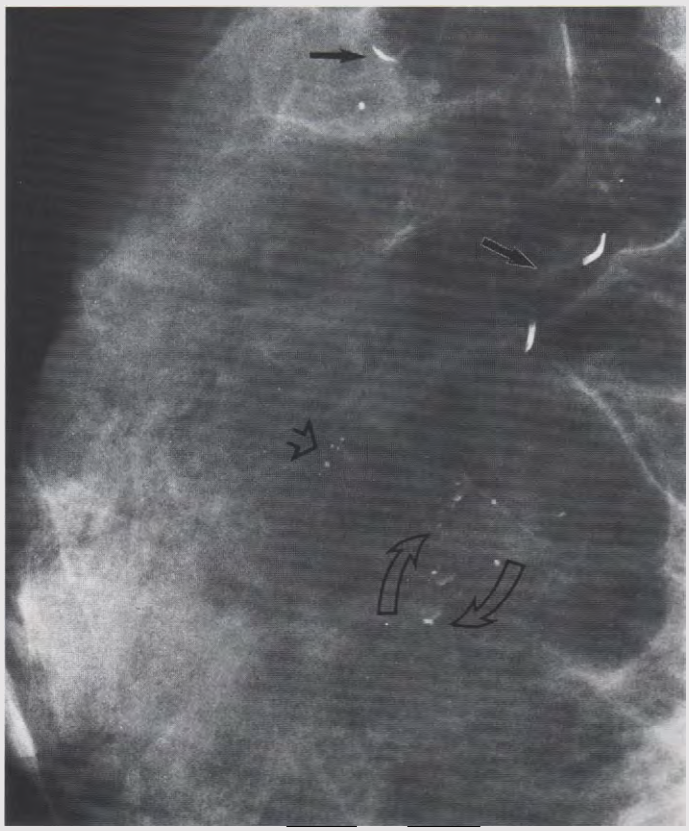
Conclusion

The mammographic image of fibrocystic change includes extensive fibrosis associated with scattered pearl-like and teacup-like calcifications. When these are the only mammographic findings, there should be no indication for surgical intervention.

Histology

Fibrocystic change with no epithelial cell proliferation.

113A



113B

114

Age 42, asymptomatic. First screening study.

Physical Examination

No tumor is palpable in the breasts.

Mammography

Fig. 114A: Right breast, latero-medial projection. Numerous calcifications scattered throughout the breast. No associated tumor.
Fig. 114B: Right breast, microfocus magnification view, latero-medial projection.
Fig. 114C: Operative specimen radiograph.

Analysis of the Calcifications

Form: crescent-shaped, teacup-like
Density: uniform, fairly high
Distribution: scattered throughout much of the breast

Conclusion

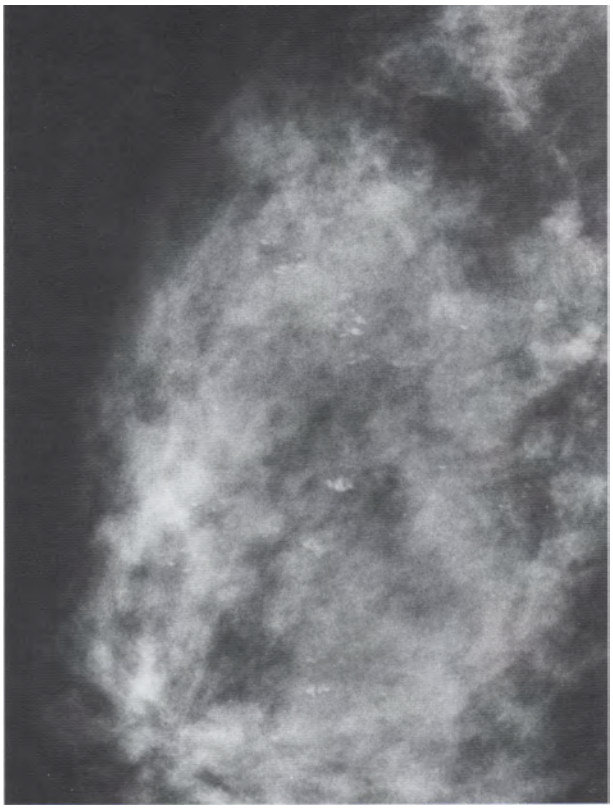
This is a typical mammographic appearance of the benign-type calcifications seen in fibrocystic change. The crescent-shaped calcifications (Fig. 114B) appear to resemble a teacup seen from the side. These same calcifications appear circular and smudgy on the specimen radiograph (taken with a vertical X-ray beam) and resemble a teacup seen from above.

Histology

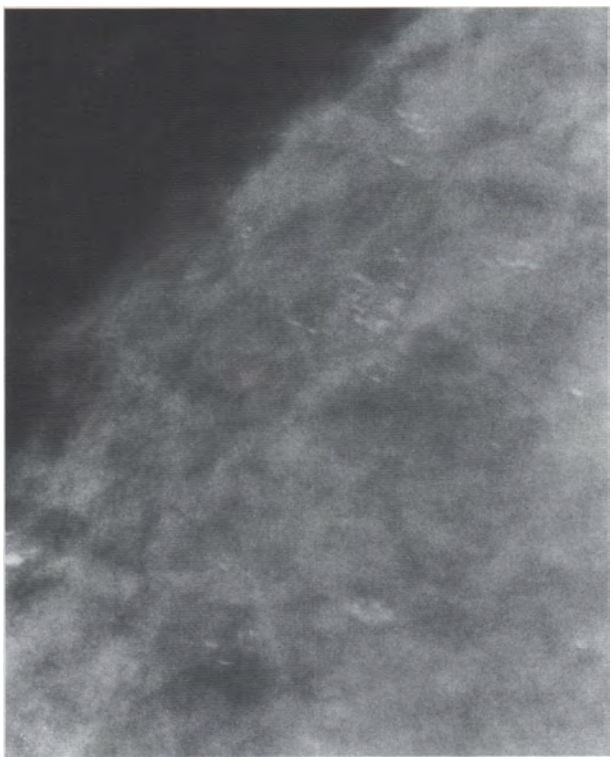
Fibrocystic change with no epithelial cell proliferation or atypia.
Fig. 114D: Cystically dilated ducts and acini containing milk of calcium secretions. (H & E, 40 x)

Comment

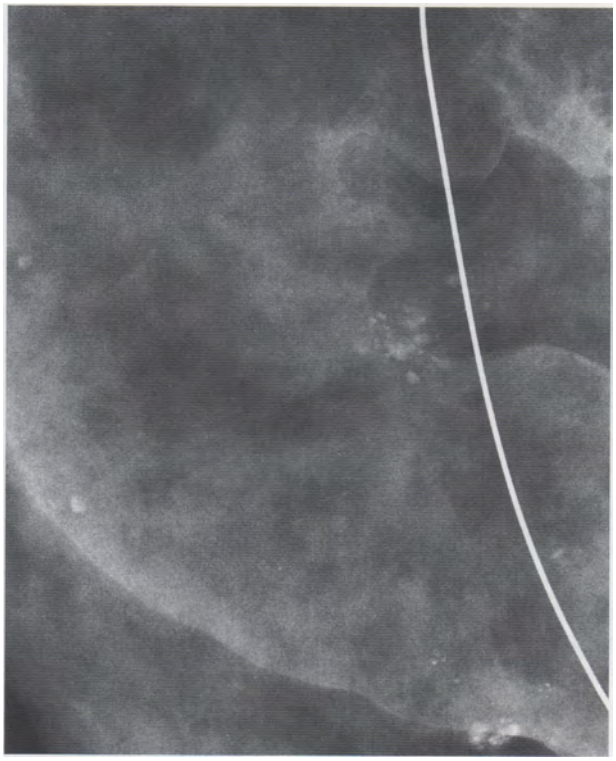
In the late 1970s many such cases were sent to operation, providing the opportunity for detailed histologic-mammographic correlation. These teaching cases serve to demonstrate that these characteristic mammographic findings are not an indication for surgery.



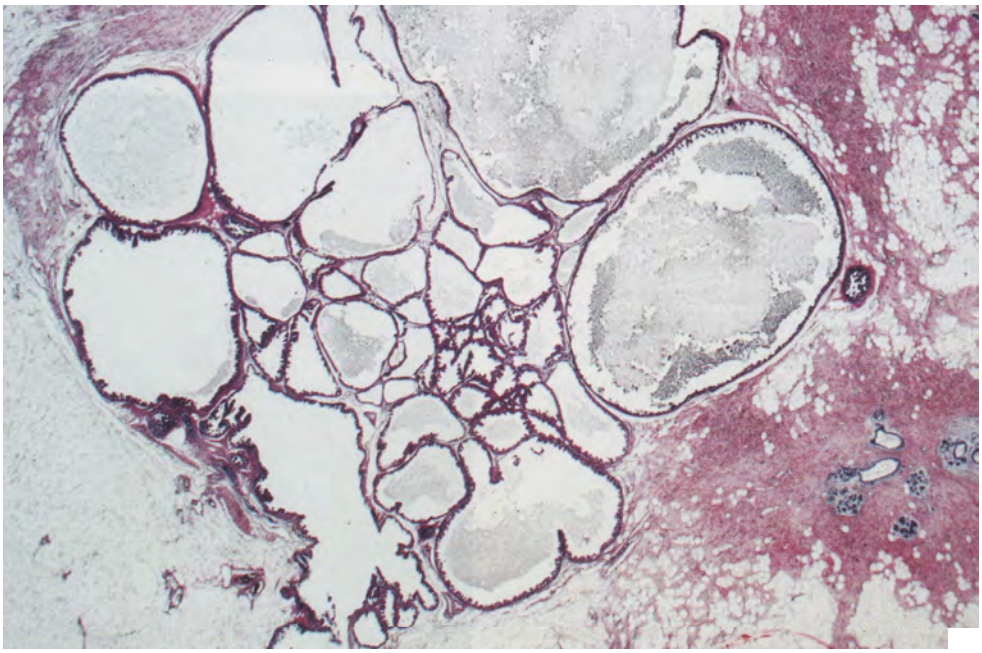
114A



114B



114C



114D

115

54-year-old woman, asymptomatic.

Physical Examination

No palpable tumor in the breasts.

Mammography

Fig. 115 A: Microfocus magnification view of calcifications in the cranio-caudal projection.
Fig. 115 B: Operative specimen radiograph with microfocus magnification.

Analysis of the Calcifications

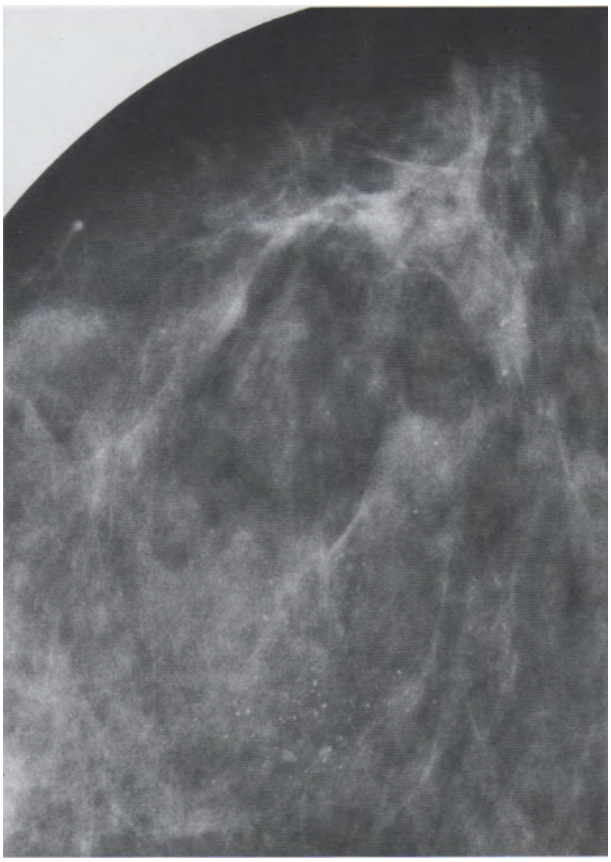
Form: round, some irregular
Density: difficult to evaluate because of the overlying dense fibrosis; density best evaluated from the operative specimen, where it is fairly uniform
Size: variable
Distribution: within the area of a lobe

Conclusion

Mammographically benign-type calcifications localized in cystically dilated lobules, typically seen in fibrocystic change.

Histology

Fibrocystic change with no epithelial cell proliferation or atypia.
Fig. 115 C: Dilated duct containing an amorphous calcification (arrow), most of which has been removed at sectioning. There is also a periductal inflammatory infiltrate. (H & E, 20 x)



115A

115B

115C

116

59-year-old woman, asymptomatic. First screening study.

Physical Examination

No palpable tumor in the breasts.

Mammography

Fig. 116A & B: Right breast, medio-lateral oblique and cranio-caudal projections. A large group of calcifications is seen centrally in the breast with no associated tumor (the left breast shows no abnormality).
Fig. 116C & D: Right breast, microfocus magnifications views, medio-lateral oblique and cranio-caudal projections.

Analysis

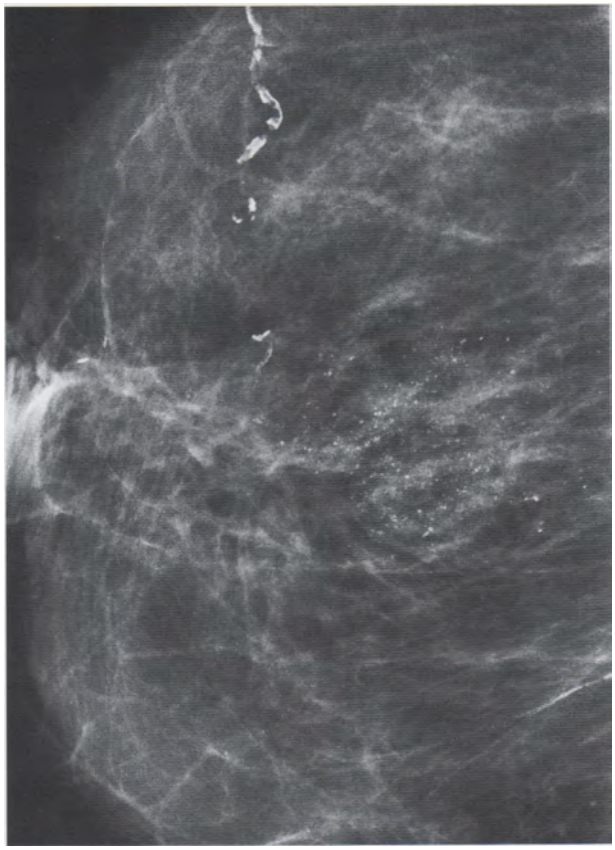
Form: round, sharply outlined
Density: high, little variation
Distribution: scattered within one lobe
Size: variable, mostly very small

Conclusion

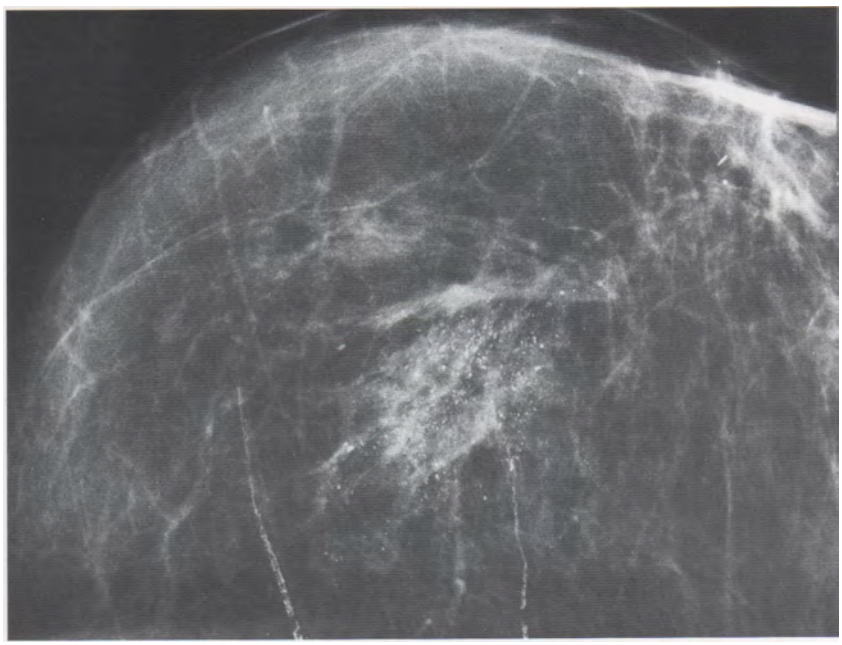
Typical appearance of calcifications within somewhat cystically dilated lobules, mammographically benign. Their distribution and appearance suggest fibrocystic change.

Histology

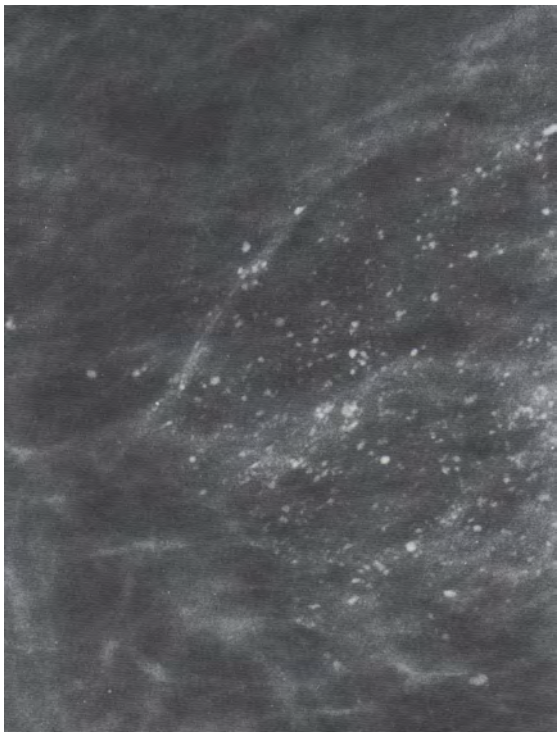
Fibrocystic change, involutional type calcifications. No signs of malignancy.

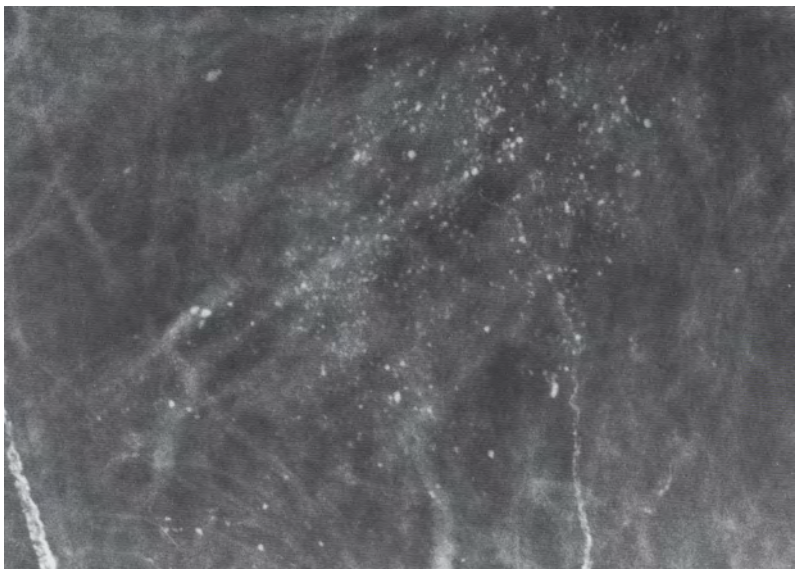


116A

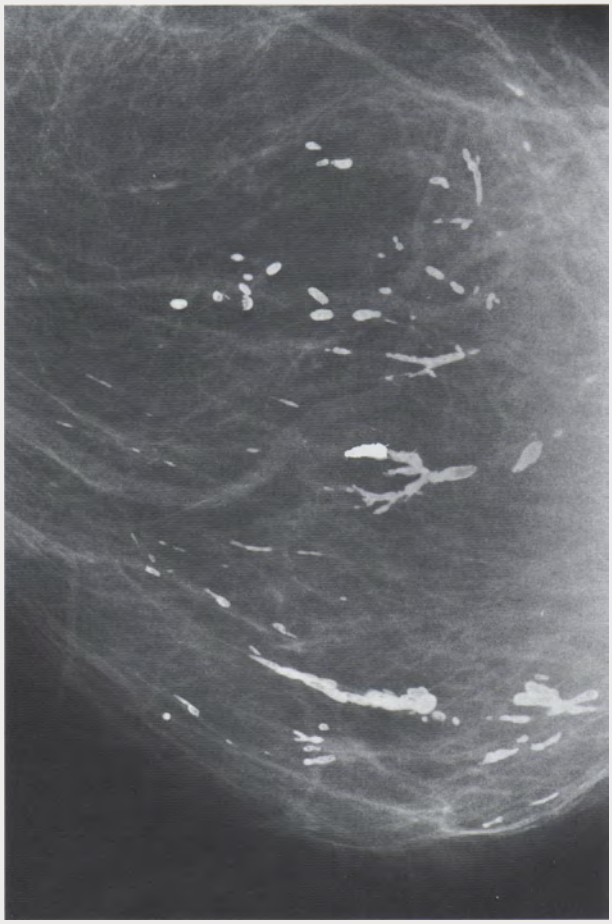


116B





117



Asymptomatic, 65-year-old woman. First screening study.

Physical Examination

No palpable tumor in the breasts.

Mammography

Fig. 117: Left breast, medio-lateral oblique projection. Numerous calcifications scattered throughout the breast. No associated tumor.

Analysis

Form: Elongated, branching, some needle-like. There are also a few ring-like and oval, hollow calcifications. All are sharply outlined and smooth bordered.
Density: High. Those with central lucencies are periductal. The remainder are homogeneously calcified.
Distribution: Follow the course of the ducts.

Conclusion

Typical picture of plasma cell mastitis-type calcifications.

118

Age 64. First screening study. Asymptomatic.

Physical Examination

No palpable tumor in the breasts.

Mammography

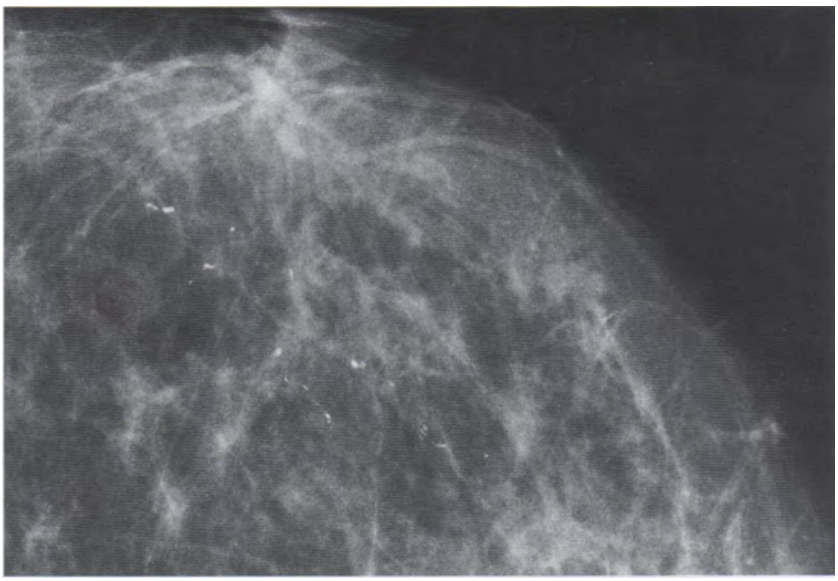
Fig. 118 A: Left breast, cranio-caudal projection. In the central portion of the breast there is an approximately 6 x 6 cm area containing numerous calcifications. No associated tumor.
Fig. 118B & C: Microfocus magnification views, cranio-caudal and medio-lateral oblique projections.

Analysis of the Calcifications

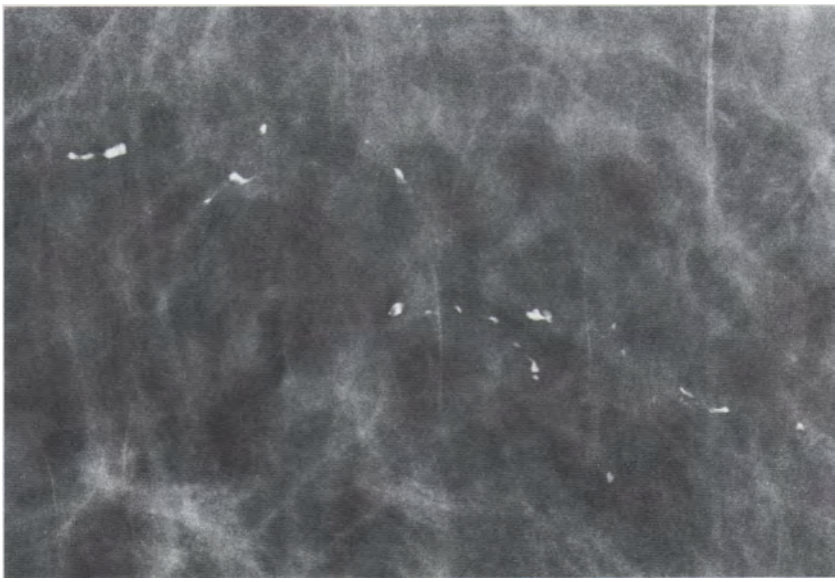
Form: mostly elongated, sharply outlined, smooth bordered; some are needle-like
Density: high; some have a lucent central area (periductal calcifications), but most are homogenous in density (solid, intraductal calcifications)
Size: variable
Distribution: some appear to follow the course of a duct

Conclusion

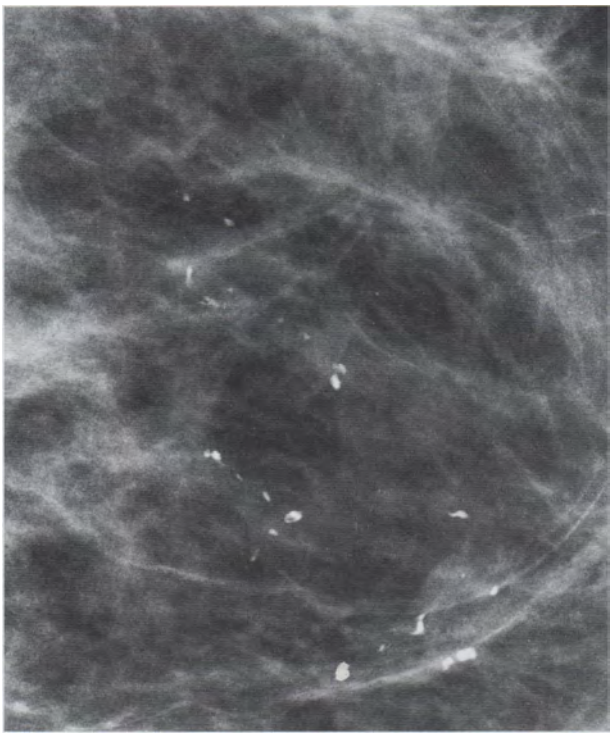
This appearance is of the rarely seen variety of plasma cell mastitis, in which the intraductal fluid petrifies and renders segments of the duct visible.



118A



118B



118C

119

Age 35, pain in the left breast. No palpable tumor.

Mammography

Fig. 119 A: Right breast, cranio-caudal projection. There are numerous scattered calcifications in the lateral half of the breast, scattered within fibrosis. There is no associated tumor mass.
Fig. 119 B: Microfocus magnification view, cranio-caudal projection.

Fig. 119C: Operative specimen magnification radiograph.

Analysis of the Calcifications

Form: round, smooth bordered, sharply outlined
Density: high, variable (equal sized calcifications are of similar density)
Distribution: in the area of one or two lobes.

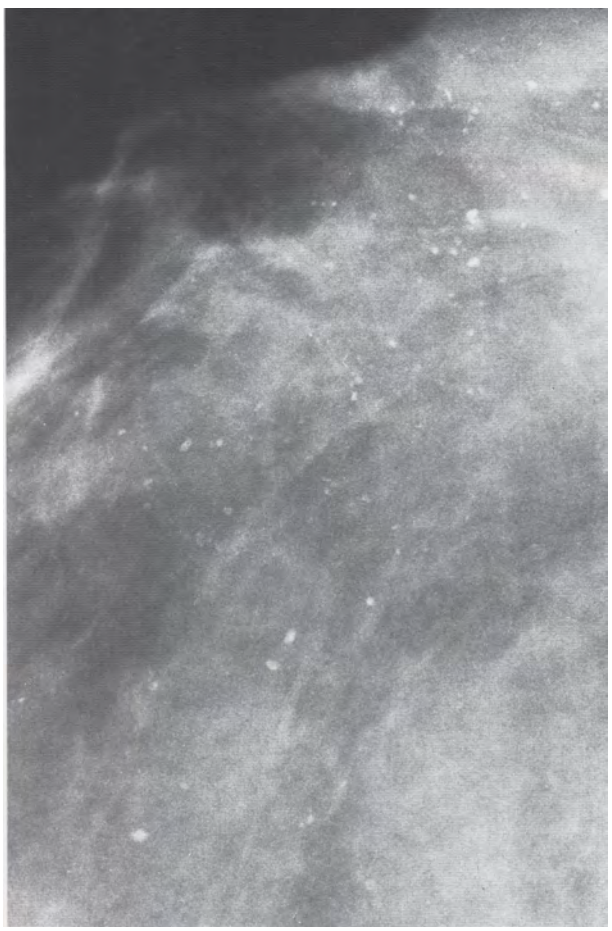
Conclusion

Typical picture of calcifications formed within cystically dilated lobules, mammographically benign.

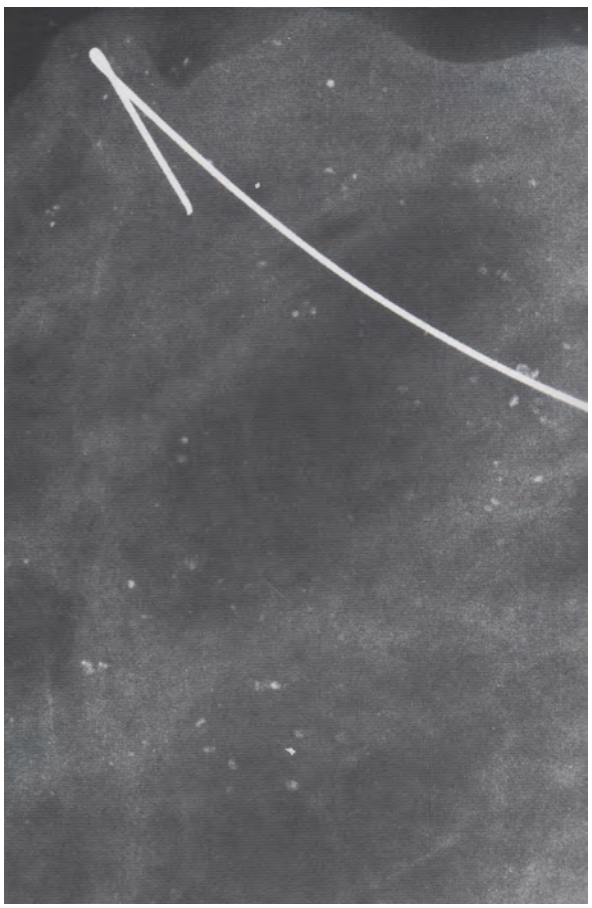
Histology

Fibrocystic change with calcifications. Sclerosing adenosis was also present.

119A



119B



120

First screening study, 49-year-o

Physical Examination

No palpable tumor in the breasts.

Mammography

Fig. 120A: Right breast, medio-lateral oblique projection. Fibrosis throughout the breast. Numerous scattered calcifications of varying size.
Fig. 120B: Microfocus magnification view, medio-lateral oblique projection.

Analysis of the Calcifications

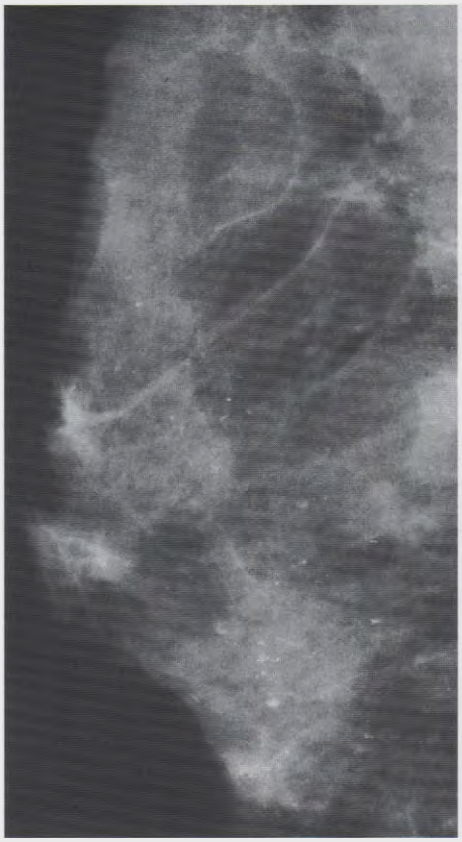
Form: crescent-shaped, teacup-like; there are also tiny, punctate calcifications
Density; variable, mostly low
Size: variable
Number and distribution: numerous, scattered throughout the breast.

Comment

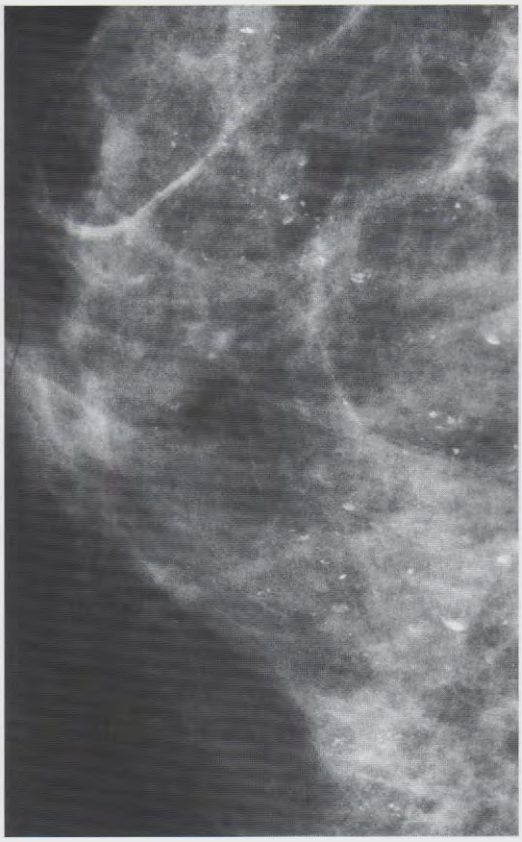
Fibrosis with calcifications settling to the dependent portions of dilated lobules is typical of fibrocystic change.

Histology

Fibrocystic change. No evidence of malignancy.

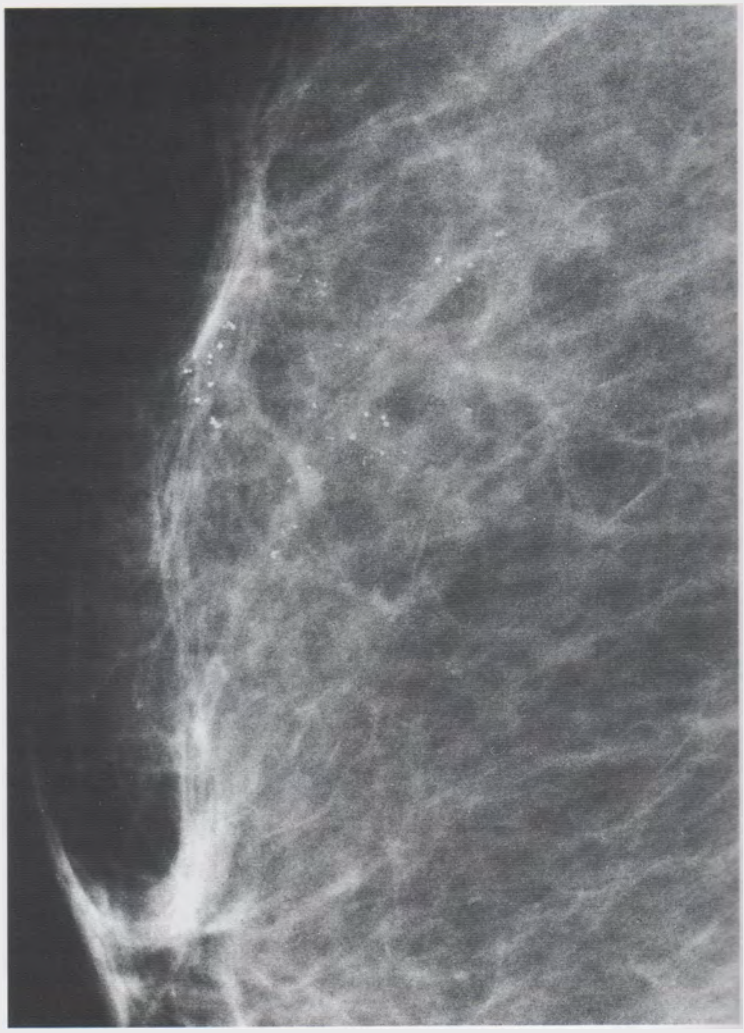


120A



120B

121



51-year-old woman, asymptomatic. First screening study.

Physical Examination

No palpable tumor in the breasts.

Mammography

Fig. 121 A & B: Right breast, medio-lateral oblique projection, contact (A) and microfocus magnification (B) views.
Fig. 121 C & D: Right breast, cranio-caudal projection, contact (C) and microfocus magnification (D) views. Numerous calcifications within a 6 x 6 cm area. No associated tumor. The calcifications are unilateral.

Analysis

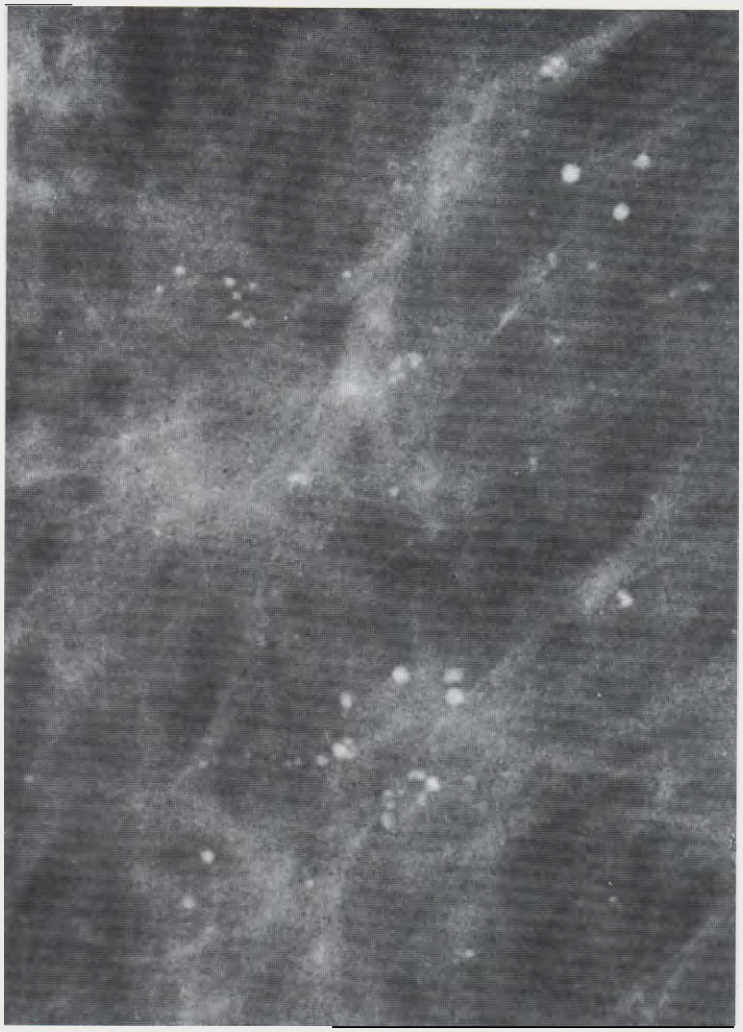
Form: round, some needle-like; sharply outlined, smoothly bordered
Density: high, fairly uniform
Size: variable

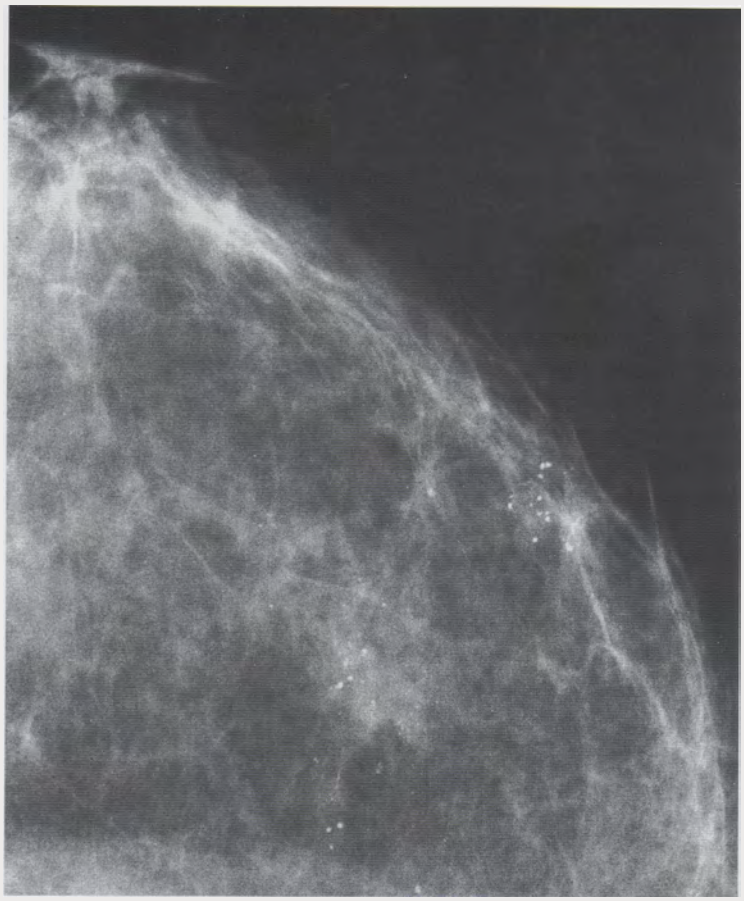
Conclusion

The mammographically benign-type, spherical calcifications are localized within cystically dilated lobules. The needle-like calcifications with homogeneously dense and smooth borders are petrified fluid within short segments of ducts.

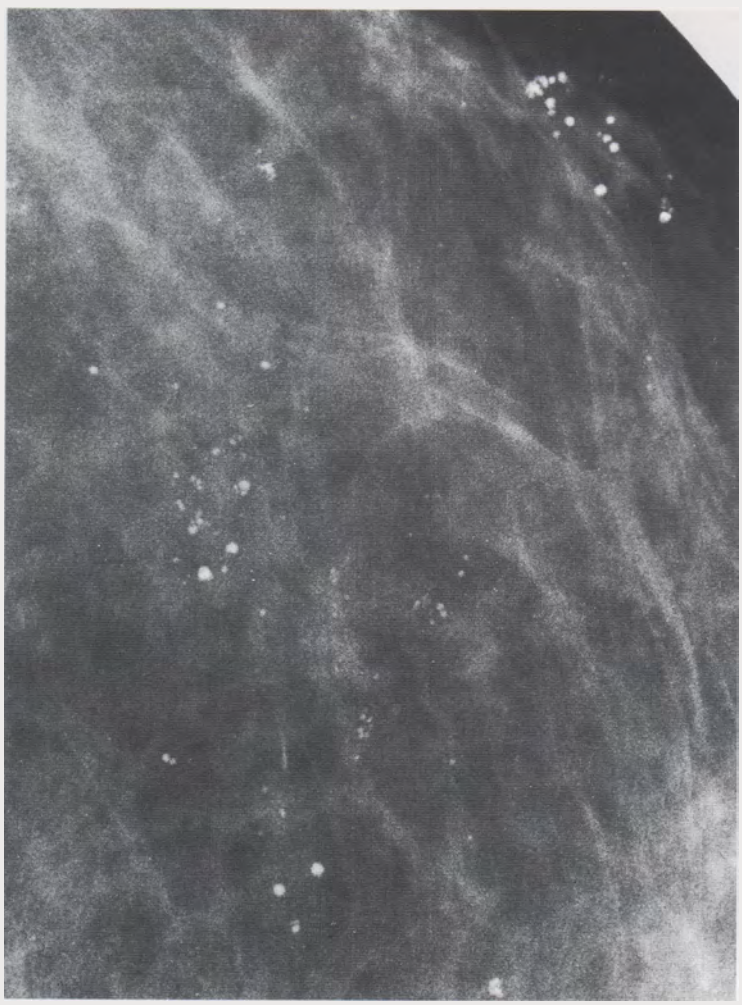
Histology

Fibrocystic change with calcifications. Microscopic examination also revealed sclerosing adenosis and papillomatosis.





121C



121D

122

First screening examination, 52-year-old asymptomatic woman.

Physical Examination

No palpable tumor in the breasts.

Mammography

Fig. 122A & B: Right breast, medio-lateral oblique projection, contact (A) and microfocus magnification (B) views. There is a 4 x 2 cm area of numerous microcalcifications in the upper half of the breast. No associated tumor.

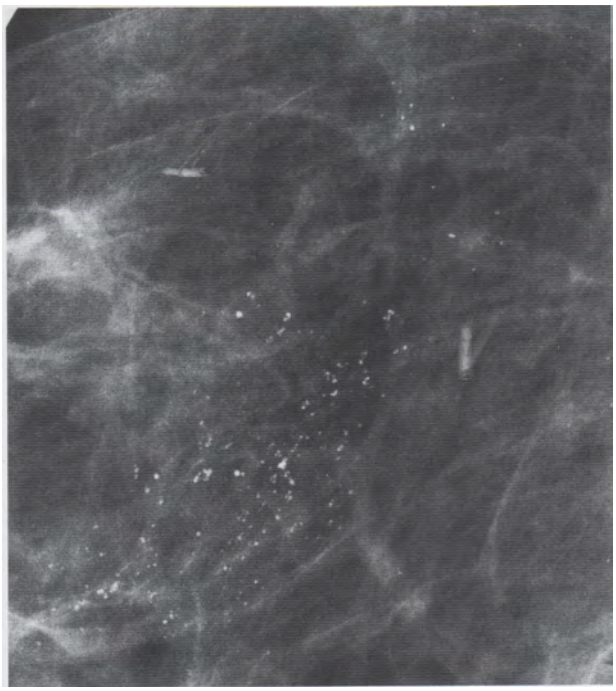
Analysis of the Calcifications

Form: punctate, smooth contour
Density: high, uniform
Size: small, variable
Distribution: localized to an area equal to that of one lobe

Conclusion

Mammographically typical appearance of benign, involutional-type calcifications.

122A



122B

123

81-year-old woman, asymptomatic. First screening study.

Physical Examination

No palpable tumor in the breasts.

Mammography

Fig. 123A: Left breast, medio-lateral oblique projection. Small, centrally located oval density. Calcifications near the nipple, as well as arterial calcifications. Fig. 123 B & C: Enlarged views of the retroareolar region (C) and the centrally located tumor (B), medio-lateral oblique projection.

Analysis of the Density

Form: oval
Contour: sharply outlined
Density: radiolucent and radiopaque combined
Size: 9 x 7 mm

Conclusion

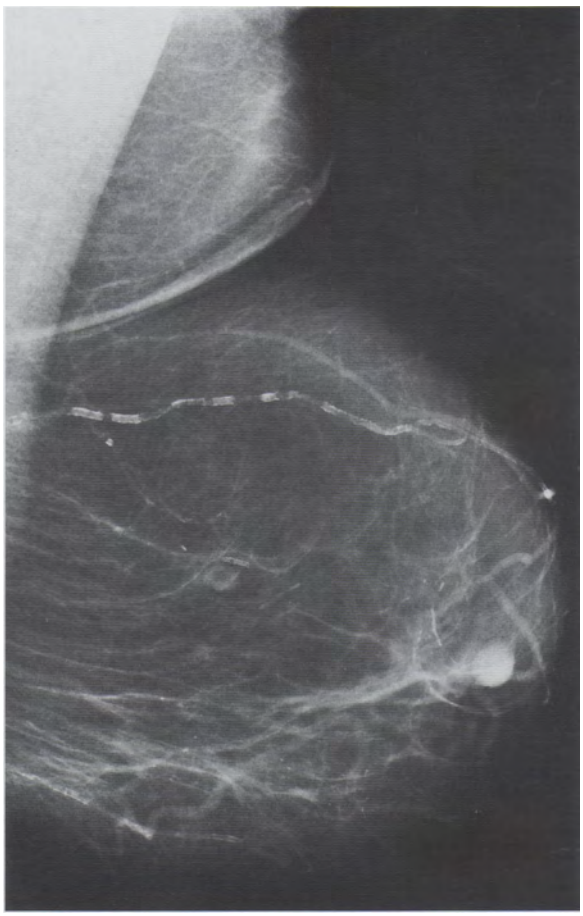
This description is typical of an intramammary lymph node.

Analysis of the Calcifications (arrows)

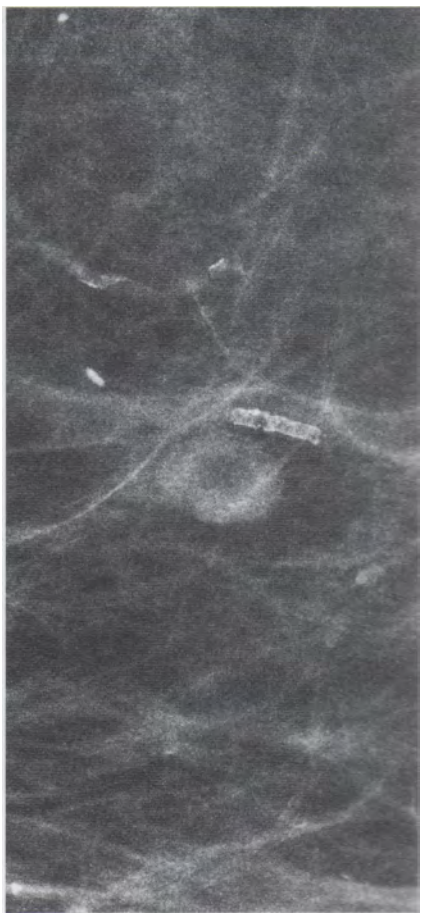
Form: elongated, not fragmented
Density: high, uniform; no hollow centers
Size: length variable, up to 15 mm
Distribution: follow the course of the ducts

Conclusion

Typical appearance of intraductal calcifications resulting from plasma cell mastitis.



123A



123B

123C

124

70-year-old asymptomatic woman, screening study.

Physical Examination

No tumor palpable in the breasts.

Mammography

Fig. 124 A & B: Left breast, medio-lateral oblique projections: numerous scattered calcifications with no associated tumor.
Fig. 124 C: Microfocus magnification view.

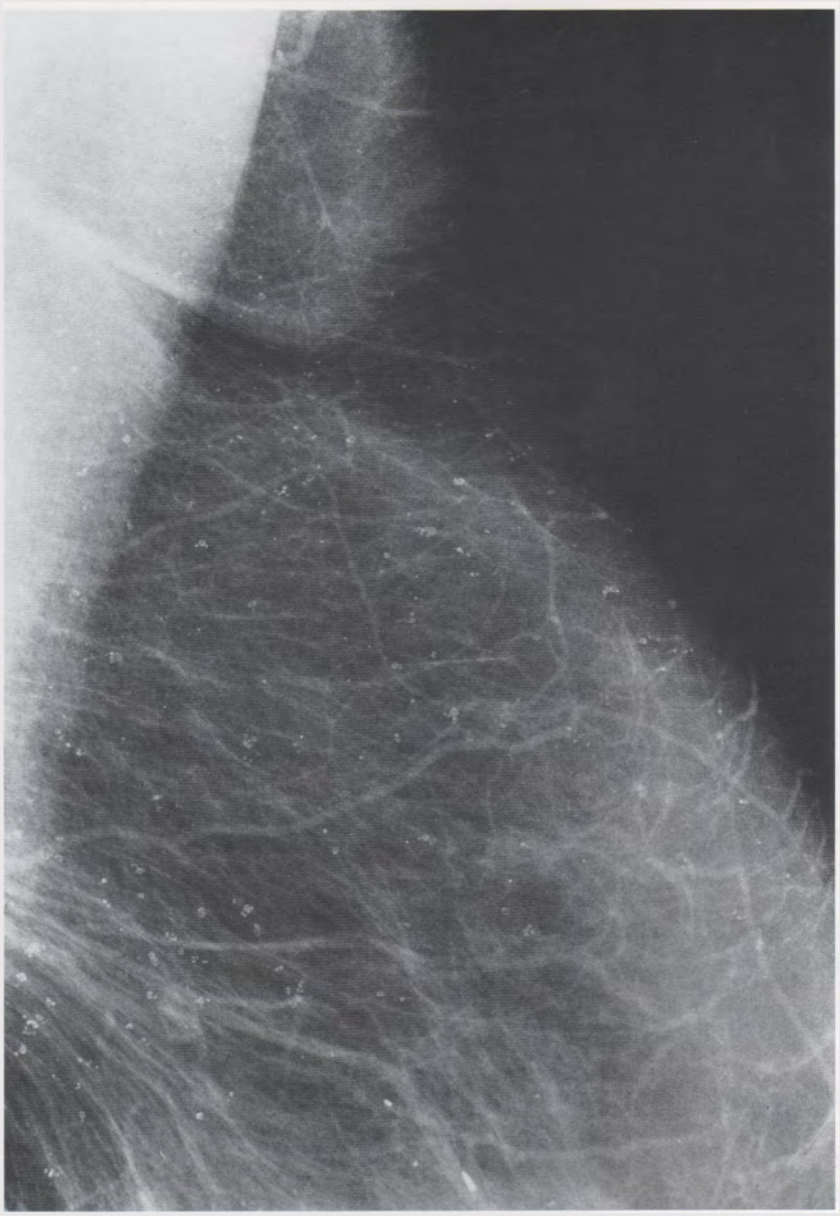
Analysis

Two types of calcifications are present:

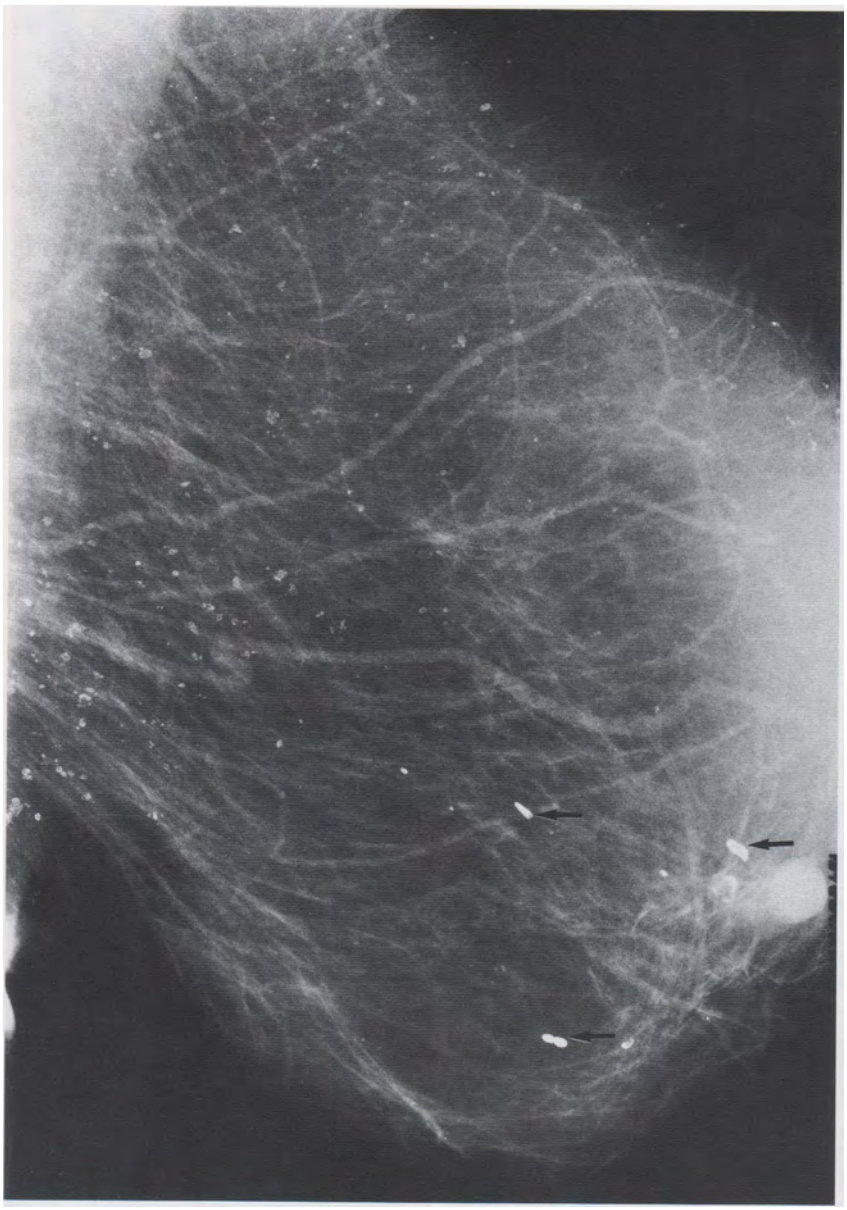
1) The periductal calcifications near the nipple (arrows) are sharply outlined and have high density. These are the plasma cell mastitis-type calcifications.
2) Calcifications seen throughout the mammograms:
   Form: ring-like, oval
   Density: low, lucent center
   Size: same as skin pores
   Number and distribution: numerous, occur within the skin

Comment

The ring-like oval calcifications are typical of calcified sebaceous glands. This unmistakable appearance should not lead to confusion.



124A



124C

125

First screening study, 62-year-old asymptomatic woman.

Physical Examination

No palpable tumor in the breasts.

Mammography

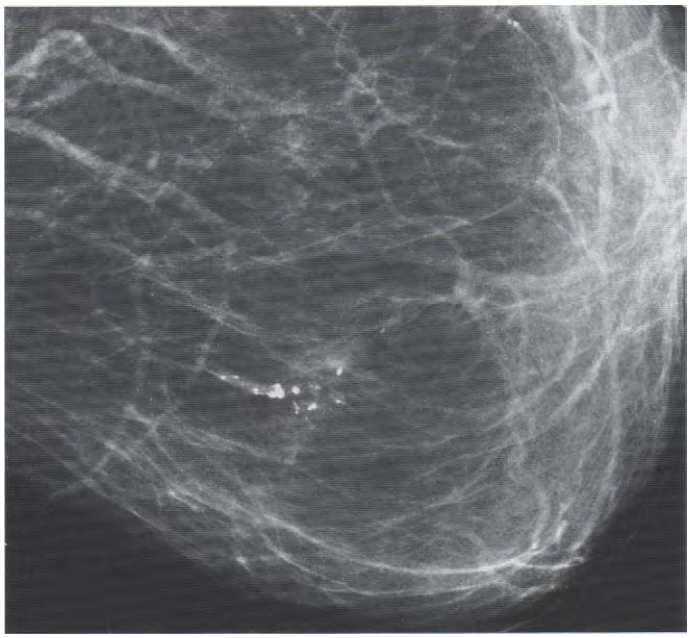
Fig. 125A & B: Left breast, medio-lateral oblique and cranio-caudal projections. A group of calcifications in the lower half of the breast. No associated tumor.
Fig. 125 C: Microfocus magnification view, cranio-caudal projection.

Analysis of the Calcifications

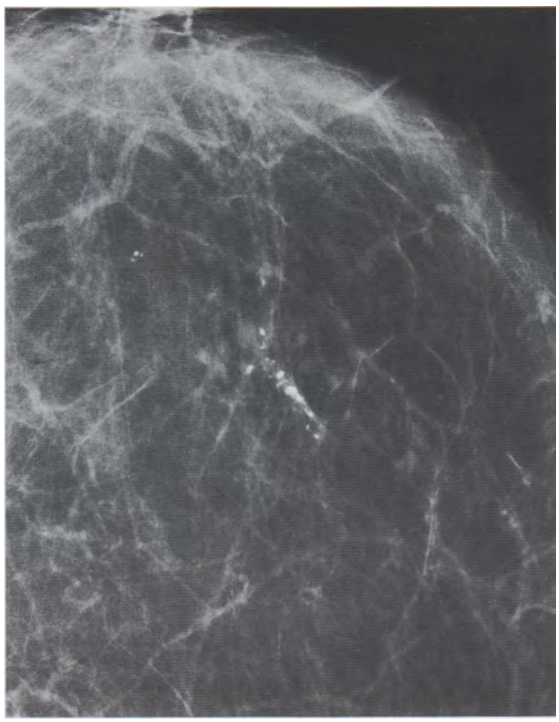
Form: Irregular, sharply outlined, some elongated.
Density: High, nearly all have central lucencies, indicating that they are periductal. The remainder are uniformly calcified.
Distribution: Localized to a small area, probably following the course of a duct.

Conclusion

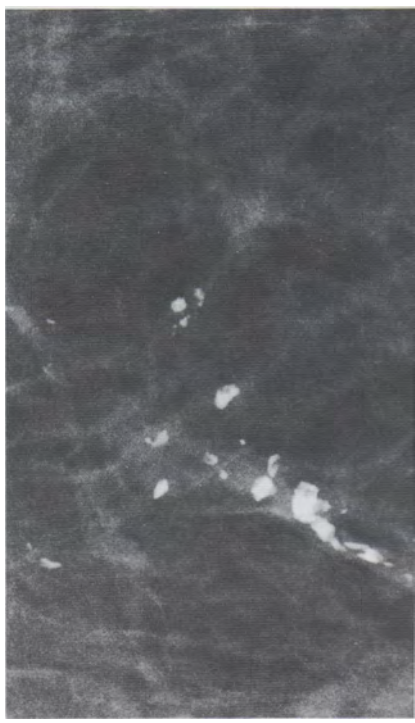
Typical mammographic appearance of plasma cell mastitis-type calcifications, localized to a small region.



125A



125B



125C

126

Age 52, referred for mammography because of cancerophobia.

Physical Examination

No abnormality.

Mammography

Fig. 126A & B: Left breast, micro-focus magnification views in the medio-lateral oblique and cranio-caudal projections. Scattered calcifications throughout the breast. There were scattered calcifications with extensive fibrosis in the right breast as well.

Analysis of the Calcifications

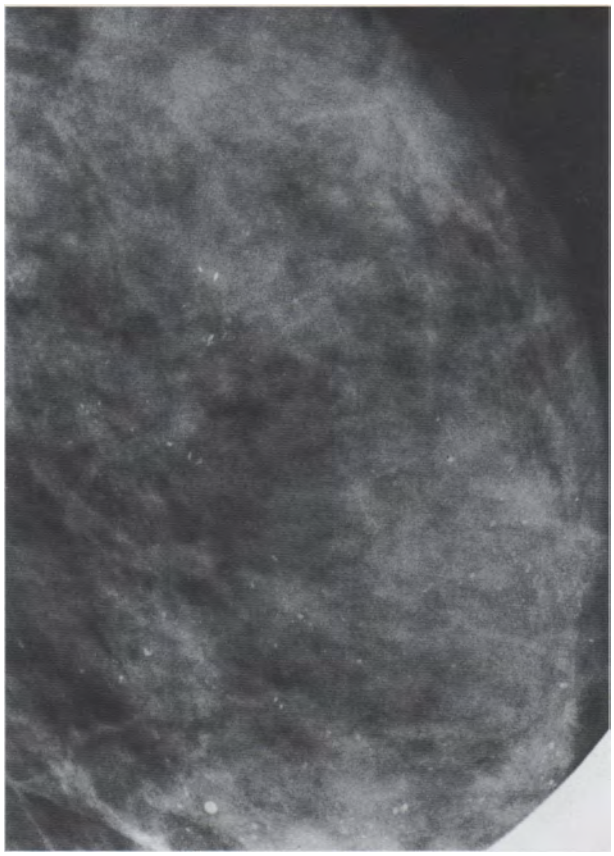
Form: irregular, some spherical
Density: variable
Size: variable
Distribution: scattered throughout the dense parenchyma

Conclusion

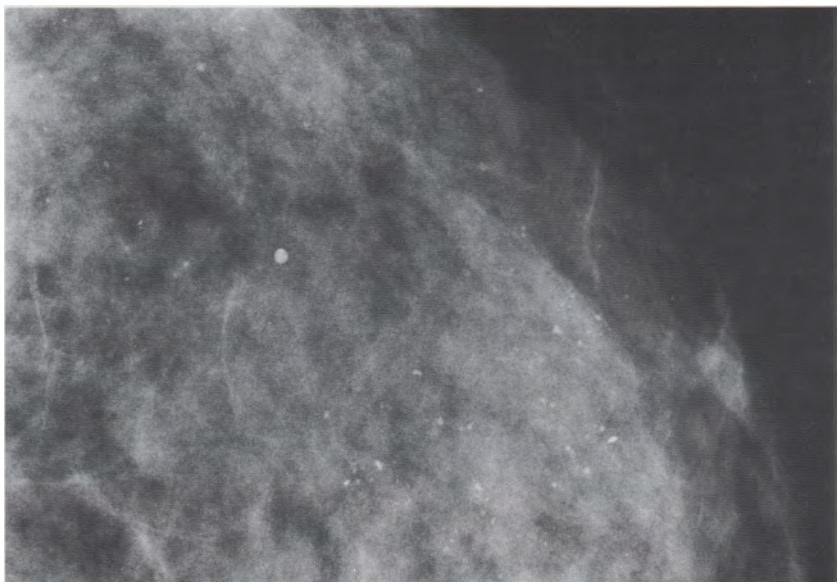
Calcifications so widely varying in form, size, and density necessitate thorough histologic examination and future mammographic control. Fibrocystic change with epithelial cell proliferation?

Histology

Fibrocystic change with intraluminal calcifications. Sclerosing adenosis. Atypical lobular hyperplasia. No evidence of malignancy.



126A



126B

127

52-year-old woman, asymptomatic. First Screening examination.

Physical Examination

No palpable tumor in the breasts.

Mammography

Fig. 127A & B: Left breast, medio-lateral oblique and cranio-caudal projections. Several calcified circular/oval densities are seen in the lower outer quadrant of the breast.

Analysis of the Tumors

Form: circular/oval, lobulated
Density: low density radiopaque
Size: variable, up to 2 cm
Distribution: appear to lie within the same duct system (within one lobe)

Conclusion

Multiple benign tumors, possibly in one duct and its branches.

Analysis of the Calcifications

Form: irregular, shell-like
Density: variable; larger calcifications very dense, smaller calcifications of variable density
Size: coarse, variable
Distribution: within the densities

Comment

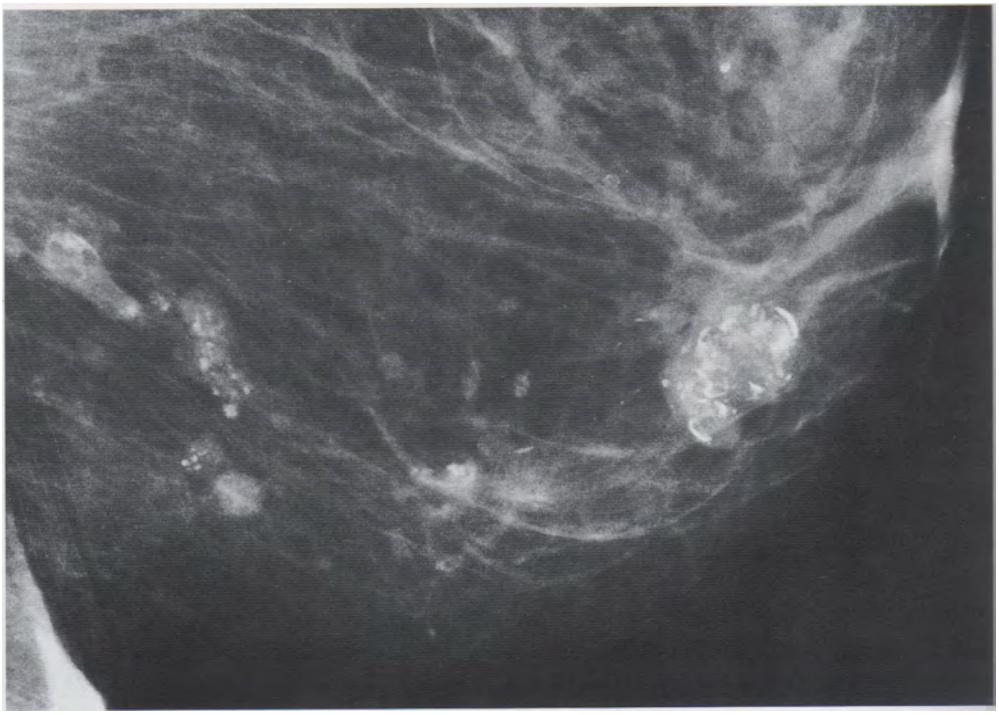
Benign type calcifications.

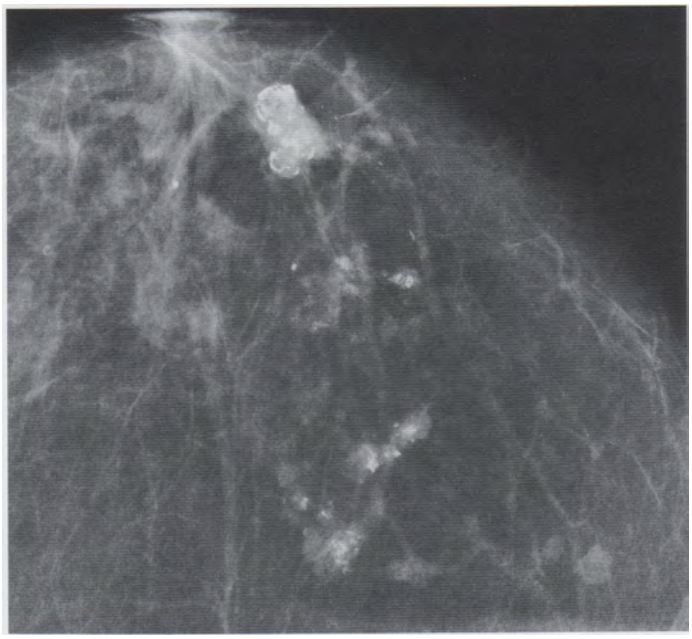
Conclusion

Partially calcified multiple benign tumors in the course of one duct and its branches.

Histology

Multiple papillomas, some calcified.





127B

128

First screening study, 65-year-old asymptomatic woman.

Physical Examination

No palpable tumor in the breasts.

Mammography

Fig. 128A: Right breast, cranio-caudal projection: there is a group of calcifications with a surrounding density 5 cm from the nipple.
Fig. 128 B: Microfocus magnification view, cranio-caudal projection.

Analysis of the Tumor

Form: oval
Contour: partly sharply outlined and partly ill-defined, no halo sign
Density: low density radiopaque, equal to that of the parenchyma

Analysis of the Calcifications

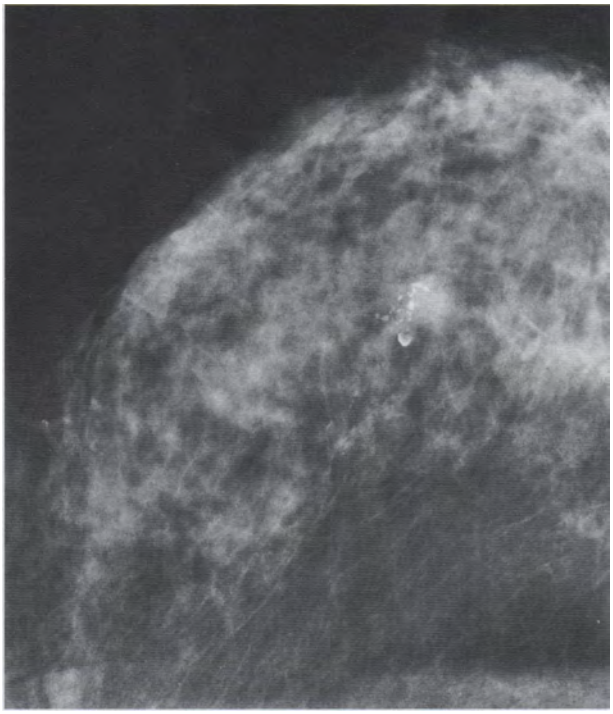
Form: highly irregular, but sharply outlined
Density: high, fairly uniform
Size: variable
Distribution: two groups near to each other; one group is not associated with the tumor

Conclusion

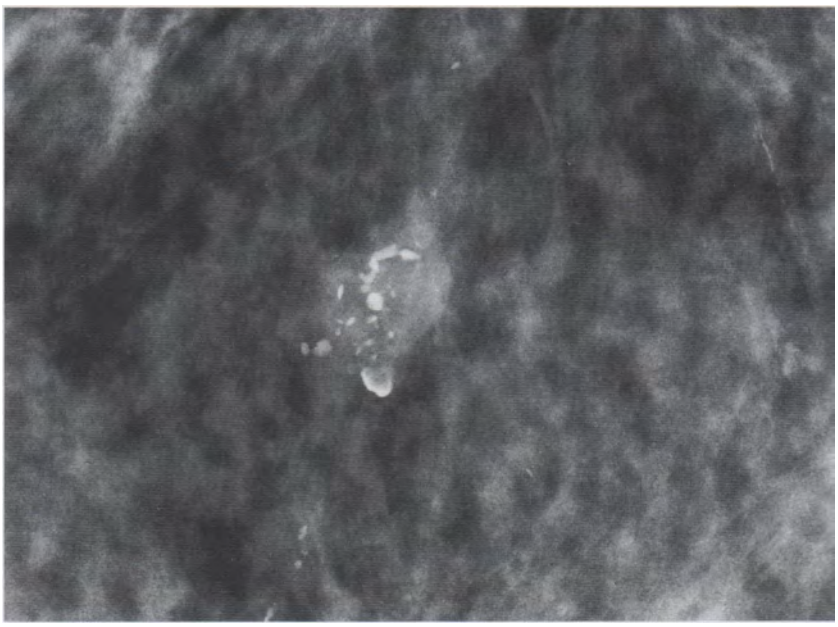
Benign type calcifications in an oval tumor with low density.

Histology

Multiple intraductal papillomas, some of them calcified. No evidence of malignancy.



128A



128B

129

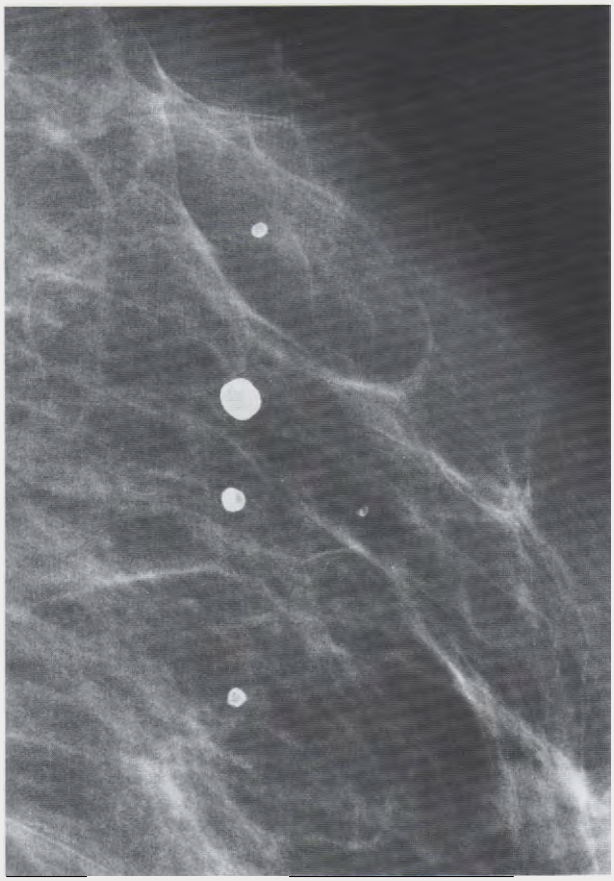
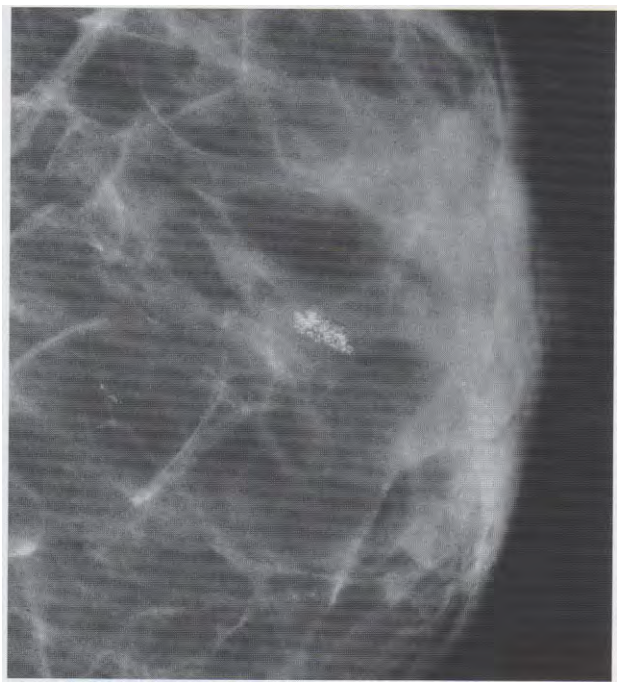


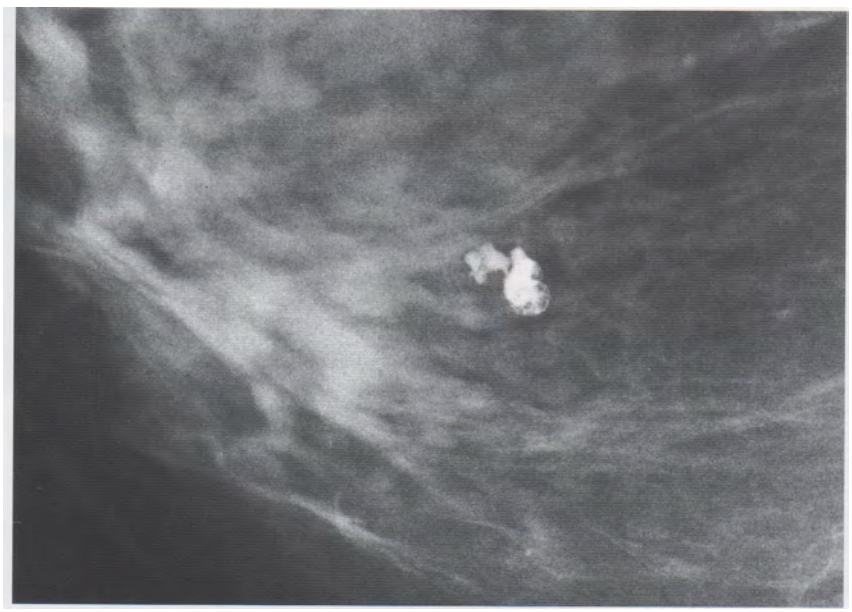
Fig. 129: Five ring-like calcifications with central lucencies. Sharpl outlined, high density, no associated tumor. Typical picture of calcified microhematomas.

130
131
132

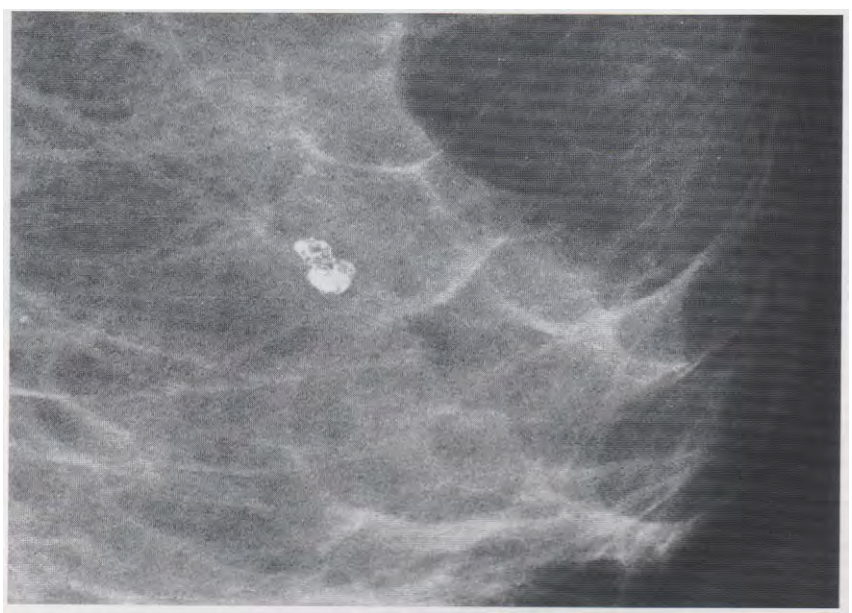
Figs. 130, 131, & 132: Three typical mammographic appearances of totally calcified solitary intraductal papillomas.



130



131



132

133

First screening study, asymptomatic 44-year-old woman.

Physical Examination

No palpable tumor.

Mammography

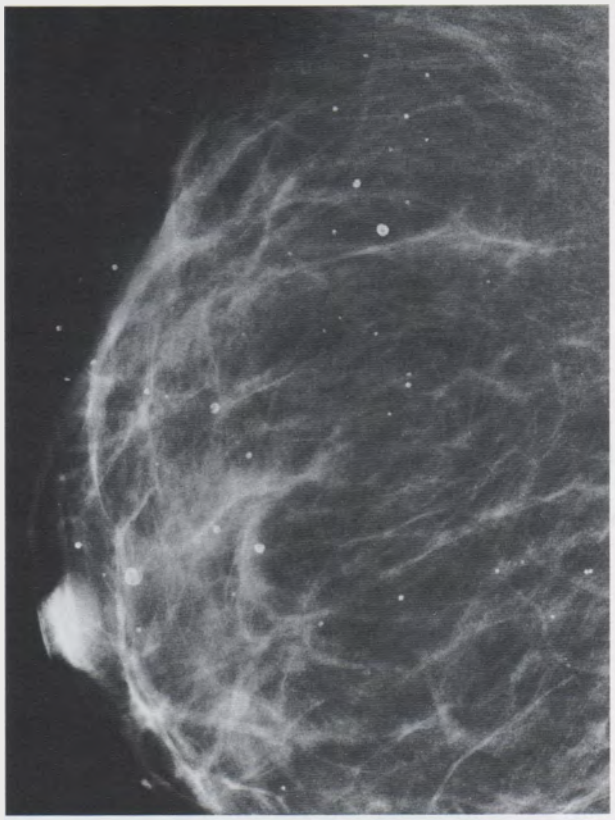
Fig. 133 A & B: Right and left breasts, medio-lateral oblique projections. Numerous calcifications are seen throughout the breasts.

Analysis

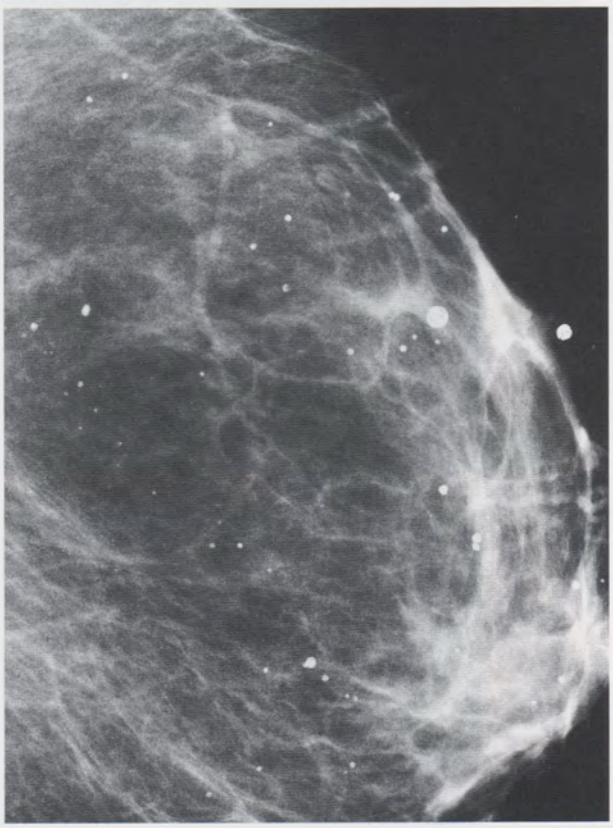
Form: circular
Size: from very small to 3 mm
Density: very dense calcifications with central radiolucencies
Distribution: many if not all of the calcifications lie within the subcutaneous fat

Conclusion

Calcifications with a radiolucent center are benign-type, calcified microhematomas.

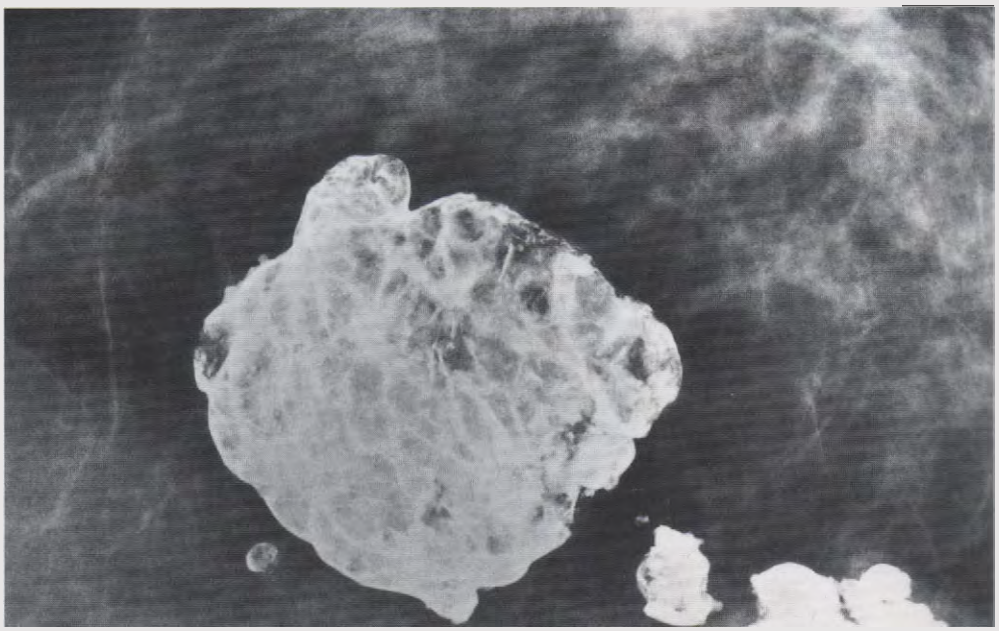


133A



133B

134

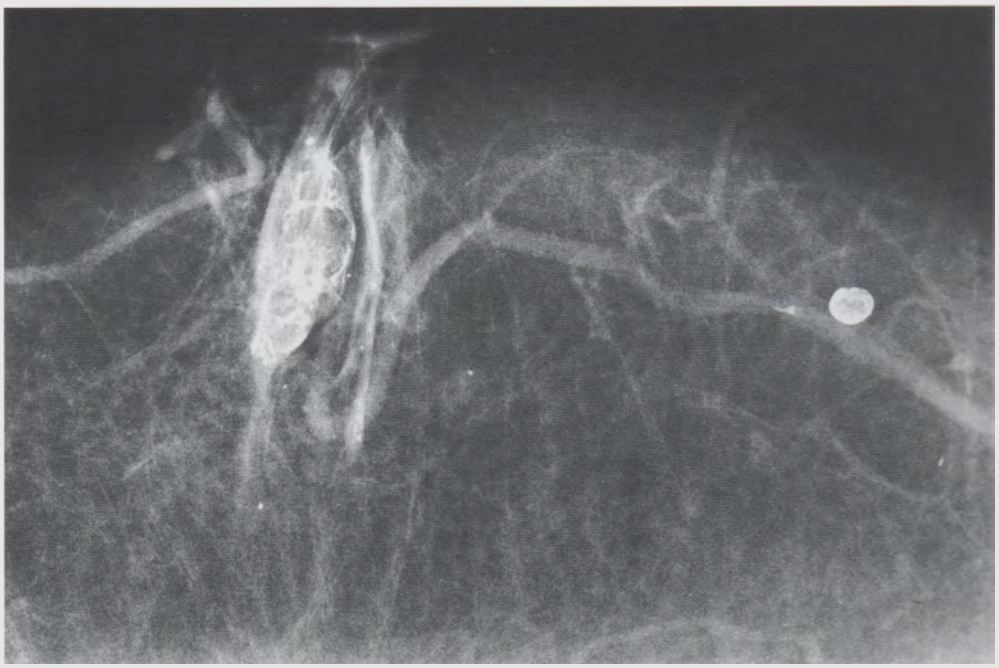


Breast biopsy 15 years earlier.
Fig. 134: Detailed view in the cranio-caudal projection. There are several large, amorphous calcifications.
Form: irregular, eggshell-like, sharply outlined
Density: high with numerous central radiolucencies
Size: variable, largest 5 x 3 cm

Conclusion

The history of operation and the central radiolucencies lead to the diagnosis of a calcified oil cyst developing from a calcifying hematoma.

135



58-year-old woman, who underwent plastic surgery to the breast 15 years earlier. First screening examination.

Mammography

Fig. 135: Left breast, cranio-caudal projection. A long subareolar scar is seen adjacent to a calcified lesion.

Analysis

Form: elongated, lobulated, eggshell-like
Size: 3 x 1 cm
Density: high, radiolucent center

Comment

Cysts, oil cysts and fibroadenomas can all have shell-like calcification, but only the oil cyst has a radiolucent center.

Conclusion

Calcified oil cyst. The previous operation provides further evidence for this conclusion.
A small calcified oil cyst **is located laterally** at the site of **the surgical drain.**

136

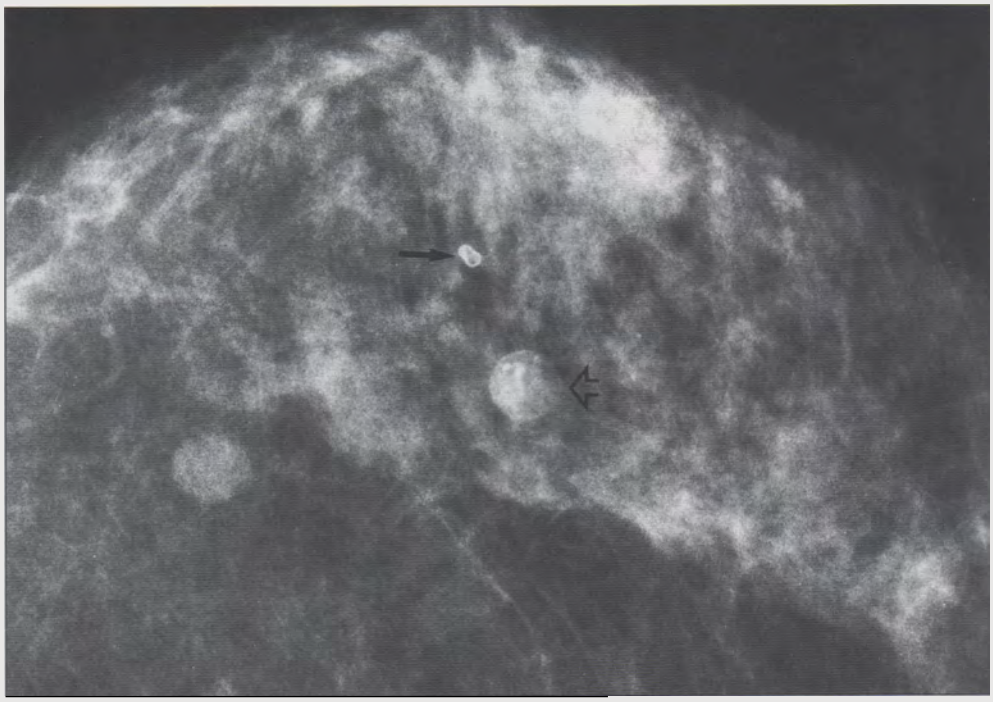


Fig. 136: Cranio-caudal projection. There is a 7 x 6 mm oval shaped circumscribed tumor centrally in the breast (open arrow) with a calcified rim (eggshell-like). This is a partially calcified cyst. There is also a solitary, ring-like calcification (solid arrow) (small calcified hematoma).

137

78-year-old woman, referred for a hard retroareolar tumor, first noted one year earlier.

Mammography

Fig. 137A & B: Right breast, medio-lateral oblique and cranio-caudal projections. There is a solitary, calcified retroareolar tumor.

Analysis

Form: oval
Contour: sharply outlined, with eggshell-like calcification
Size: 15 x 20 mm

Comment

An eggshell-like calcified, oval circular tumor can be either an oil cyst, a calcified fibroadenoma or a calcified cyst (with or without an intracystic tumor).

1) An oil cyst can be excluded in this case because the contents are not radiolucent.
2) A fibroadenoma has coarse calcifications differing considerably from this lesion (case 138).
3) Cysts calcify in a manner similar to that of this lesion. The thin, faintly calcified shell is the result of bleeding. The bleeding may result from an intracystic growth, especially in lesions located behind the nipple.

Needle biopsy helps in the final diagnosis.

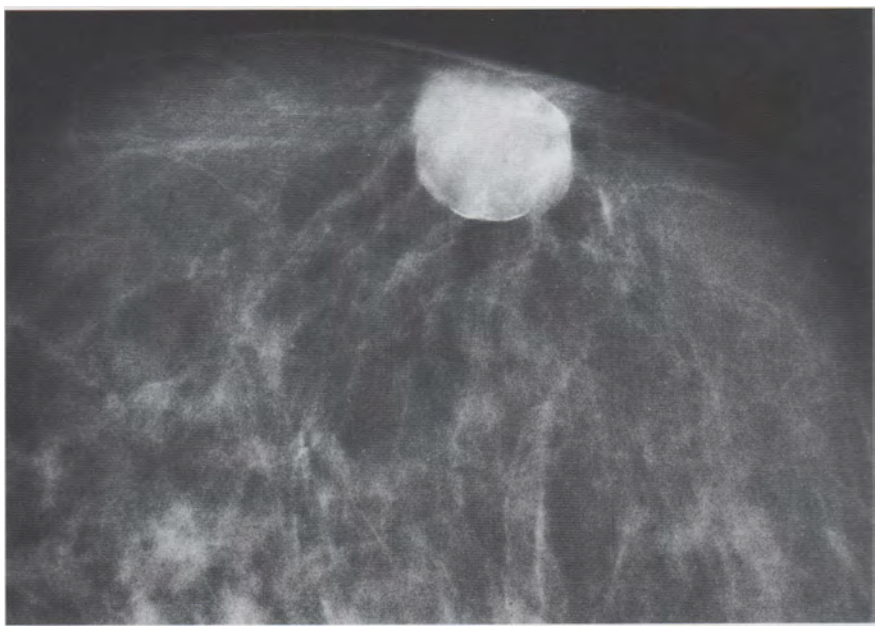
Cytology

Malignant cells.

Histology

Subareolar papillary carcinoma.

137A



137B

138

56-year-old woman, referred to mammography for a calcification seen on the chest X-ray. The patient has been aware of this palpable tumor for many years.

Mammography

Fig. 138A & B: Left breast, detailed views of the medio-lateral oblique and cranio-caudal projections. A large, calcified tumor is seen immediately behind the nipple.

Analysis of the Tumor

Form: oval, lobulated
Contour: sharply outlined (arrows)
Density: low density radiopaque, equal to the parenchyma
Size: 3.5 x 3 cm
Location: retroareolar

Analysis of the Calcifications

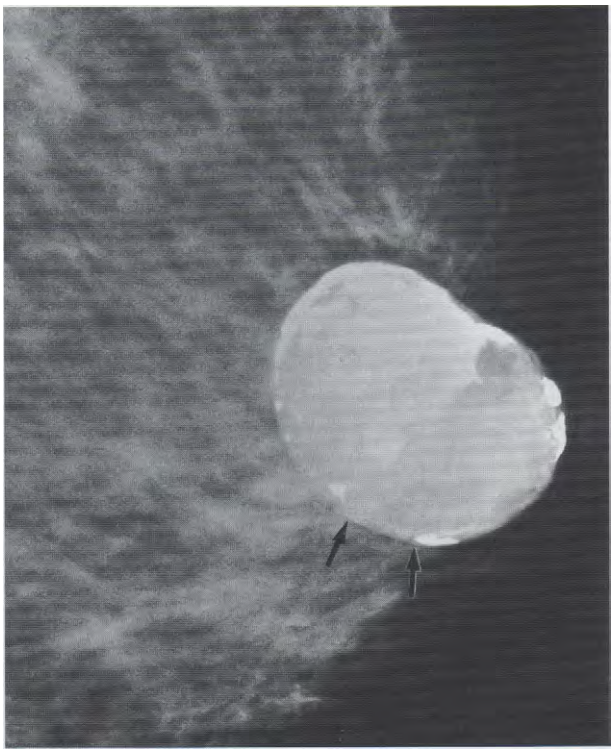
Form: eggshell-like, coarse
Density: very high
Location: surround much of the tumor

Conclusion

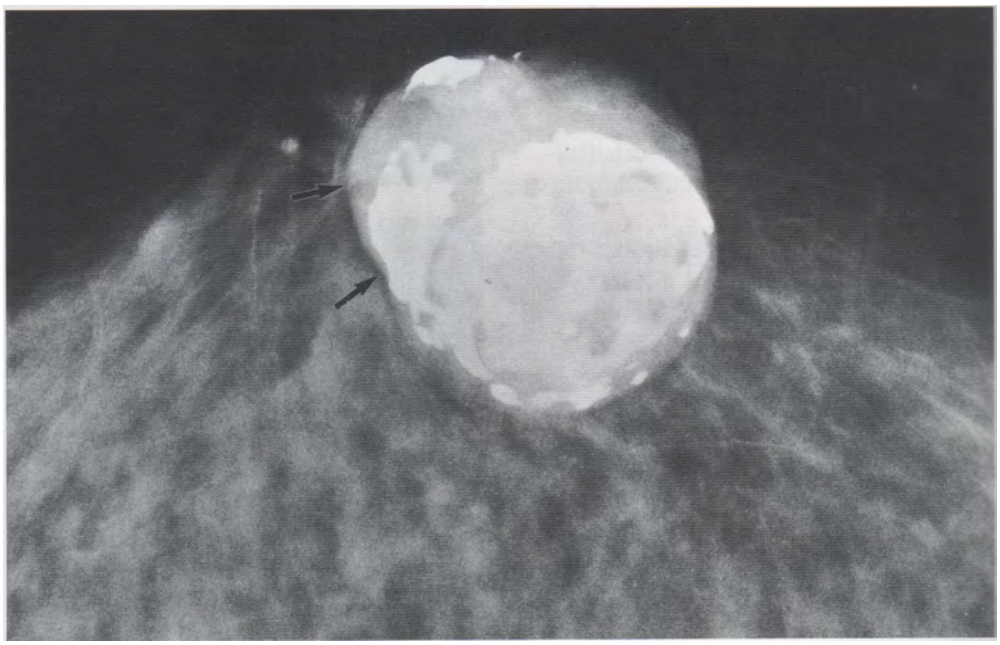
Benign-type calcifications in a benign tumor, typical of fibroadenoma.
On the basis of the above characteristics **the** tumor is mammographically benign.

Histology

Calcified fibroadenoma.



138A



139

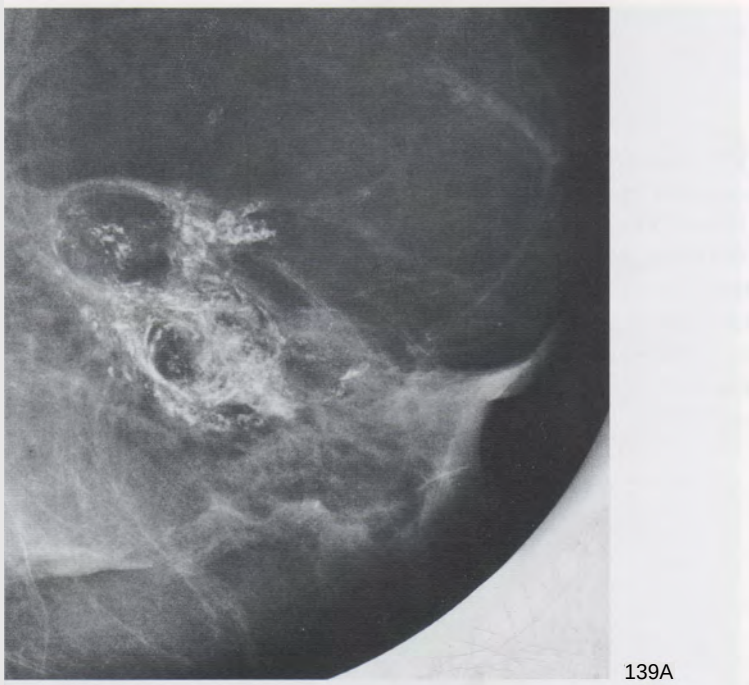
56-year-old woman, underwent plastic surgery 12 years earlier. The patient has observed gradual nipple retraction on the left side and has noticed a hard retroareolar tumor.

Mammography

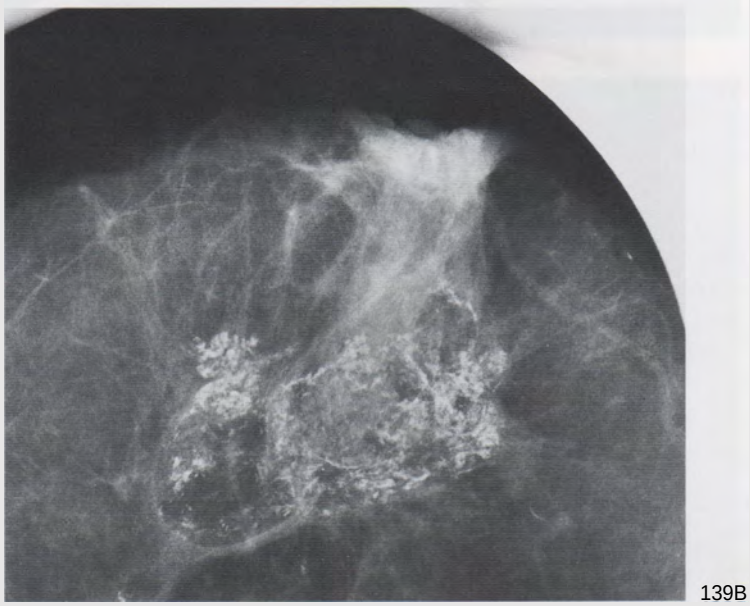
Fig. 139 A & B: Left breast, microfocus magnification views in the medio-lateral oblique and cranio-caudal projections. Calcifications surround several oval-shaped radiolucent lesions. There is associated retroareolar fibrosis with nipple retraction.

Conclusion

Eggshell-like calcifications and the history of breast surgery lead to the unmistakable diagnosis of a group of oil cysts.



139A



139B

140

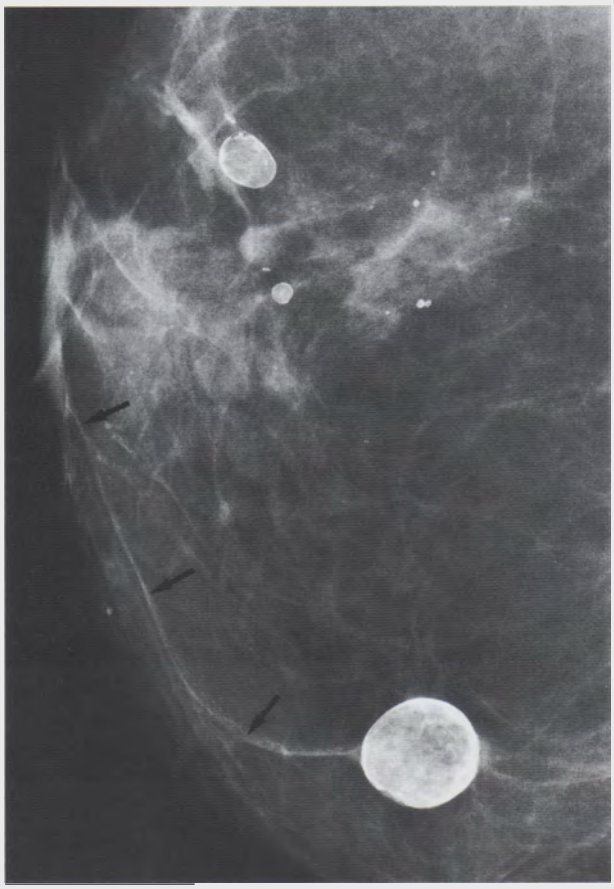


Fig. 140: Plastic surgery to the breast 15 years earlier. There are several eggshell-like calcifications, the largest 15 mm. A scar (arrows) extends from the largest calcification to the nipple. The calcified lesions have lucent centers, giving the typical mammographic appearance of calcified hematomas (oil cysts).

141

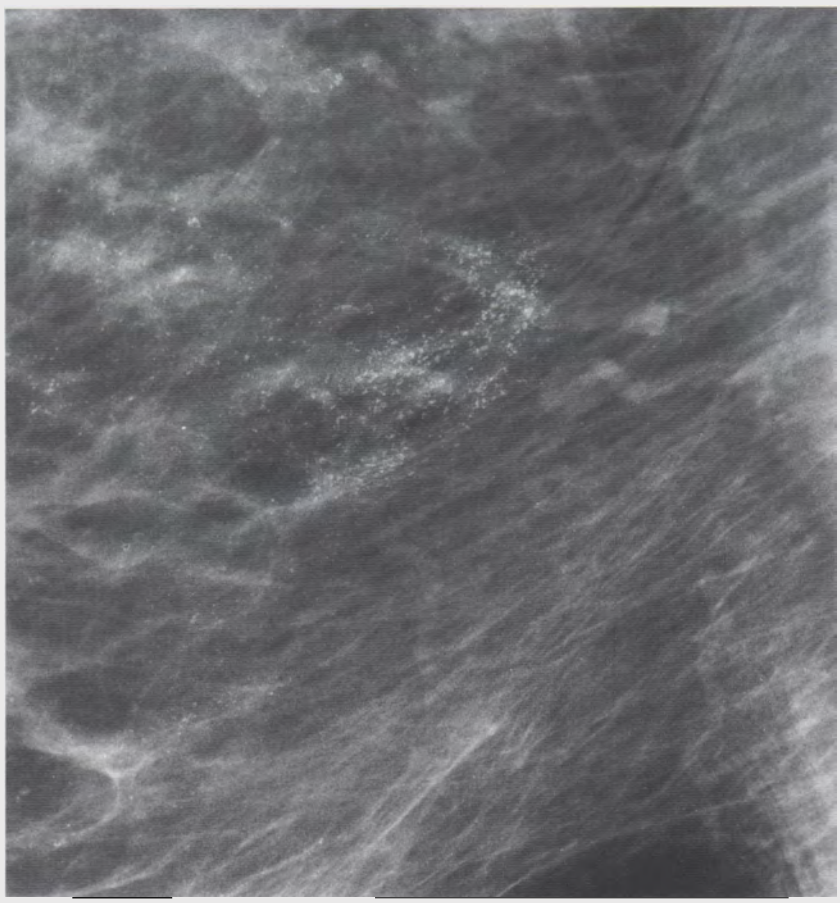


Fig. 141: Detailed view of the medio-lateral oblique projection. Microfocus magnification. Numerous calcifications are seen over an area several cm across. No tumor mass.

Analysis

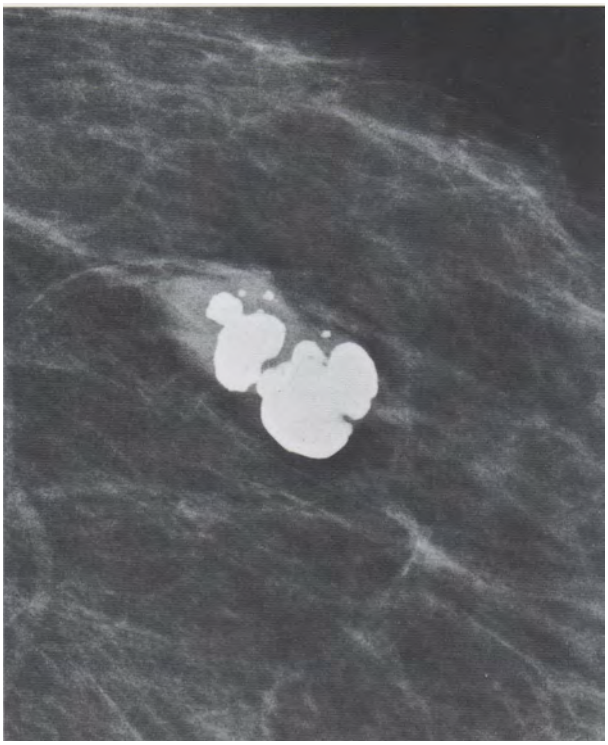
Form: punctate
Density: high, uniform
Size: extremely small, uniform
Distribution: within one or two lobes

Conclusion

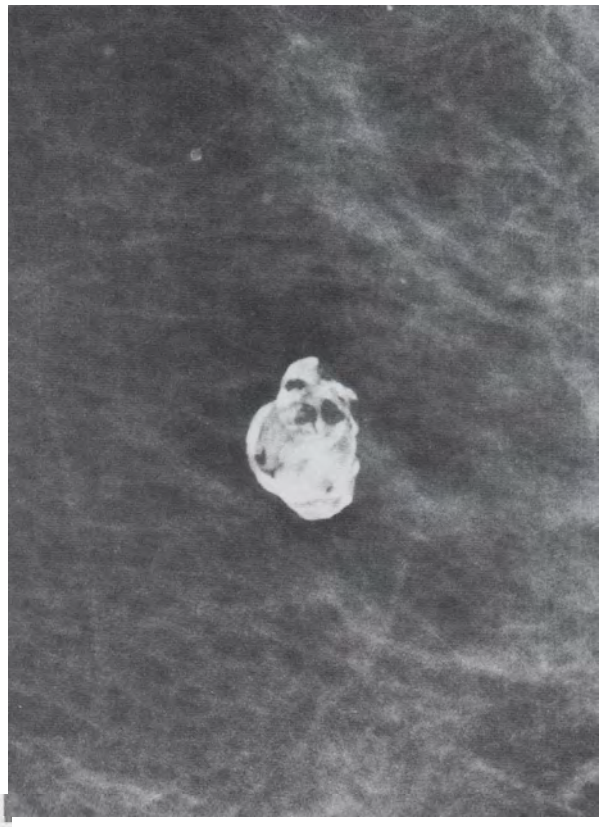
Mammographically benign (involutional-type) calcifications.

142
143
144

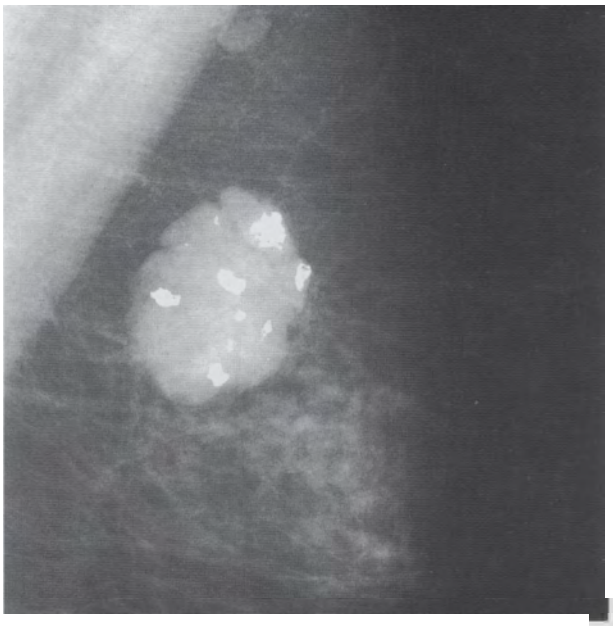
Figs. 142, 143, & 144: Three examples of hyalinized fibroadenomas. The calcifications are coarse, amorphous, sharply outlined and of extremely high density, situated within a lobulated, low-density radiopaque tumor.



142



143

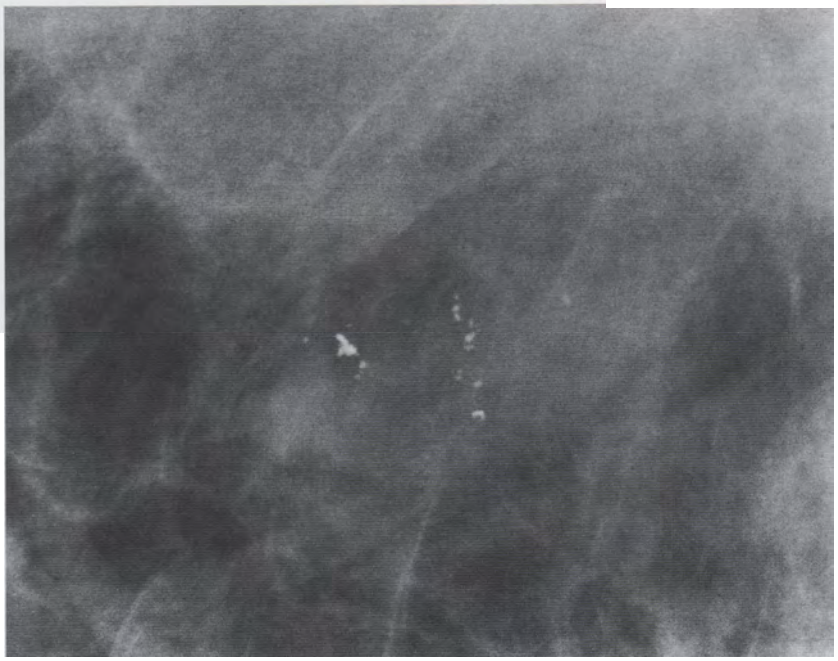


144

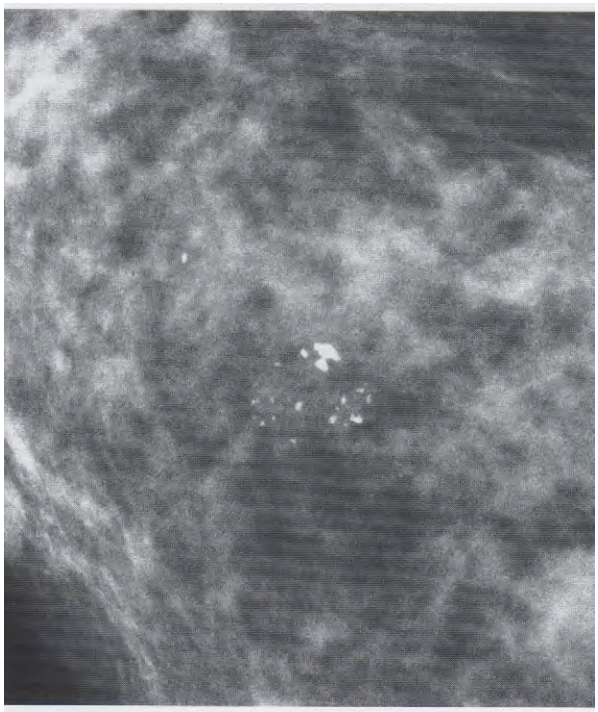
145–149

Figs. 145, 146, 147, 148, & 149: Coarse, popcorn-like calcifications associated with fibroadenomas should cause no differential diagnostic problems (cases 142-144). However, the small, superficially located calcifications within fibroadenomas (Figs. 145-149) may cause considerable diagnostic difficulties, since they may easily be confused with granular-type calcifications seen in intermediate nuclear grade carcinoma in situ. Large core needle biopsy is of great help in differential diagnosis.
Fig. 148 B: A sclerotic fibroadenoma with extensive peripheral microcalcifications near an artery. (H & E, 12.5 x)
Fig. 148 C: Higher magnification of one area of calcified stroma. (H & E, 40 x)

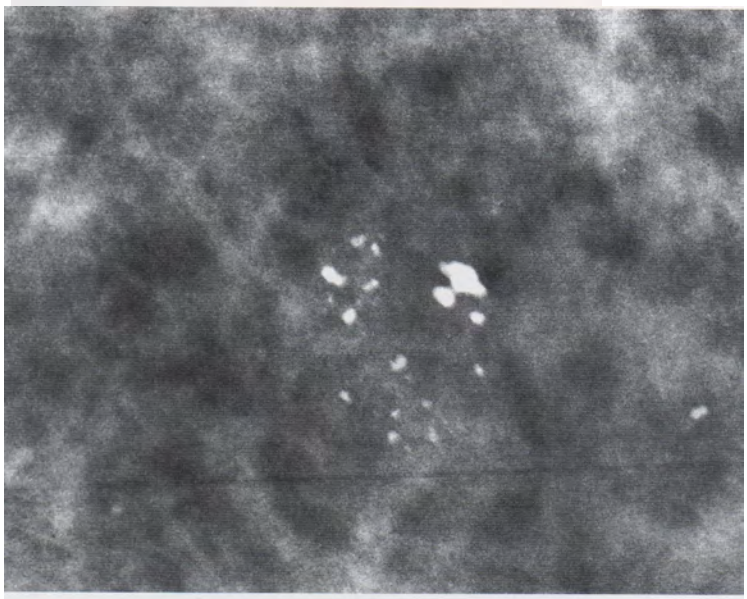
145 A



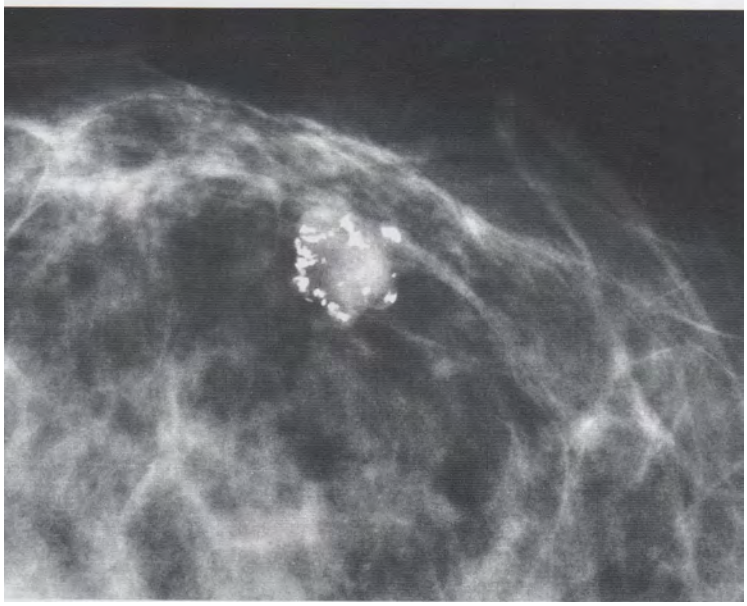
145 B



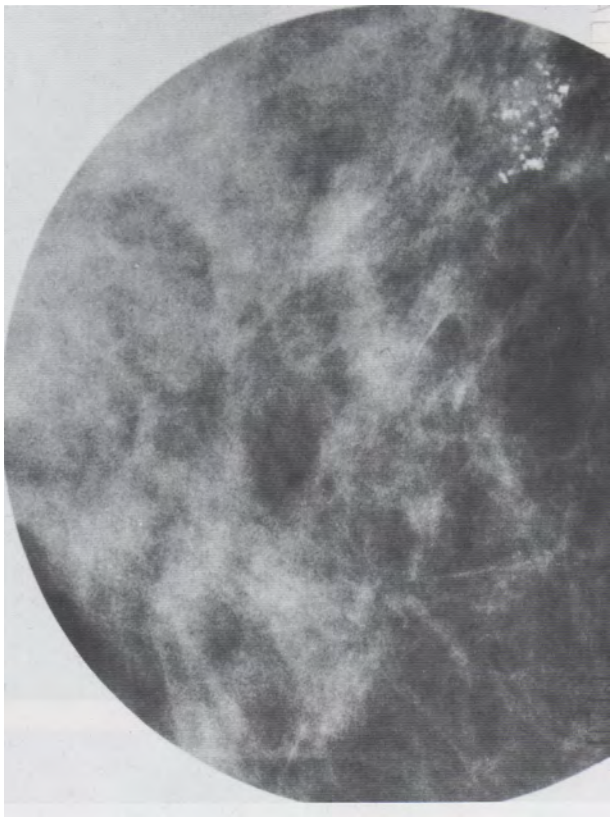
146 A



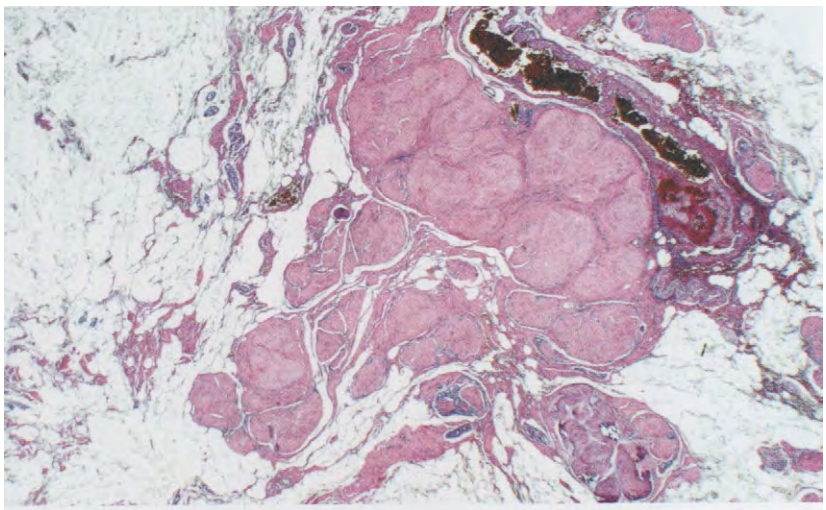
146 B



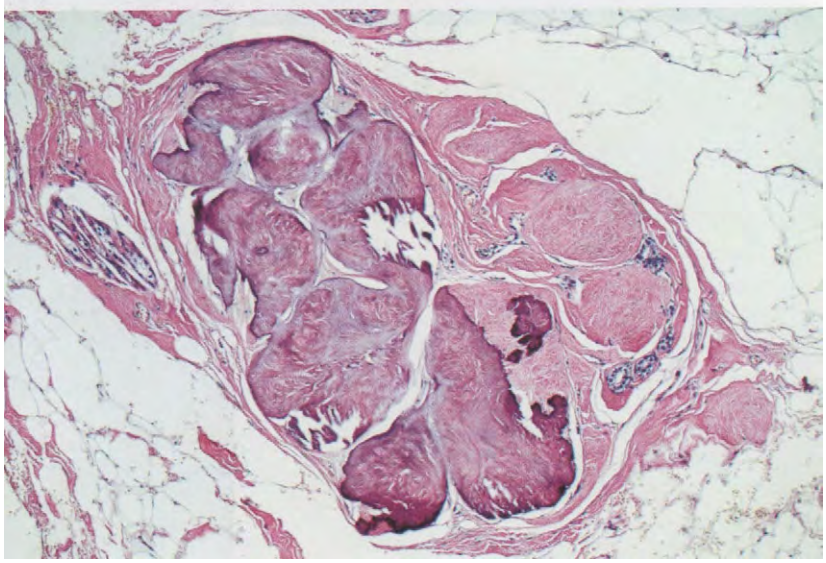
147



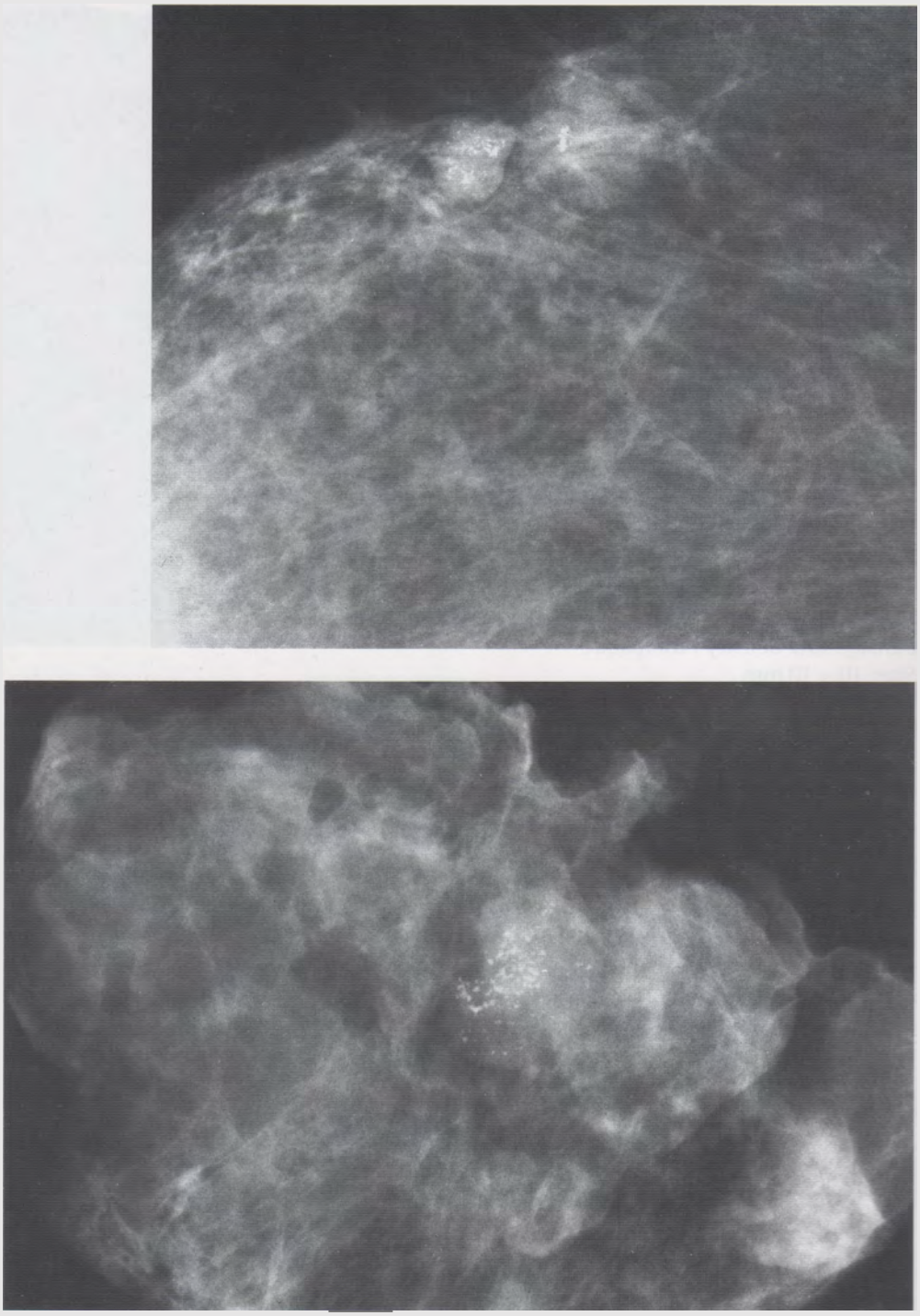
148 A



148 B



148 C



150

This 63-year-old woman noted a lump in her right breast, below the areola, six months earlier.

Physical Examination

Freely movable 1 cm tumor, clinically benign.

Mammography

Figs. 150 A & B: Coned-down compression views of the tumor, which is associated with calcifications.

Analysis of the Tumors

Form: oval, slightly lobular

Contour: unsharp, no halo sign; there is a comet tail (arrows, Fig. 150A)

Density: low density radiopaque

Size: 10 X 10 mm

Analysis of the Calcifications

Form: coarse, irregular

Density: high

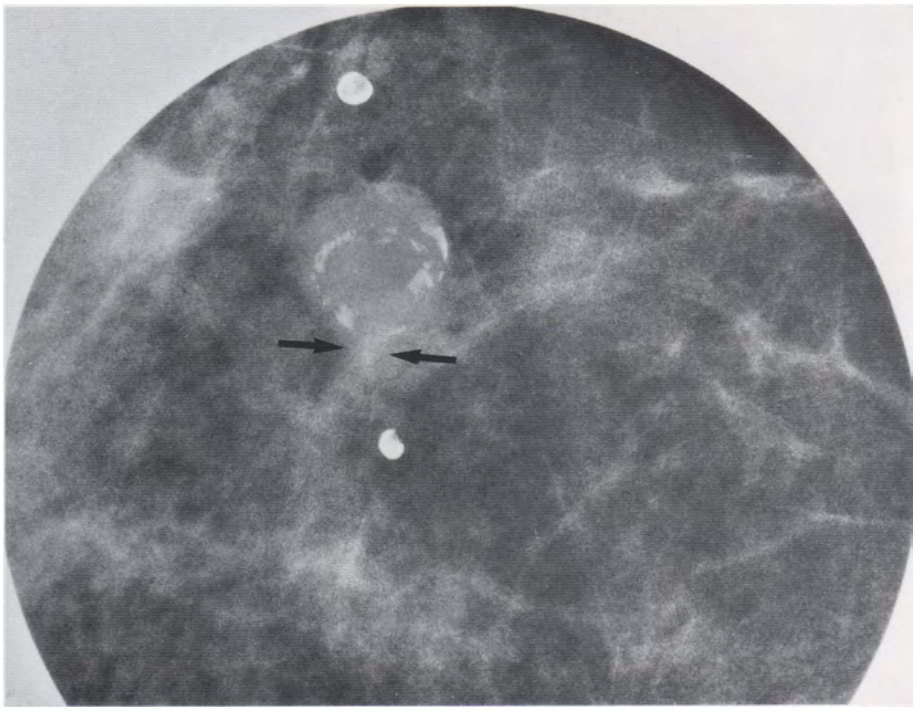
Distribution: eggshell-like (partially)

Conclusion

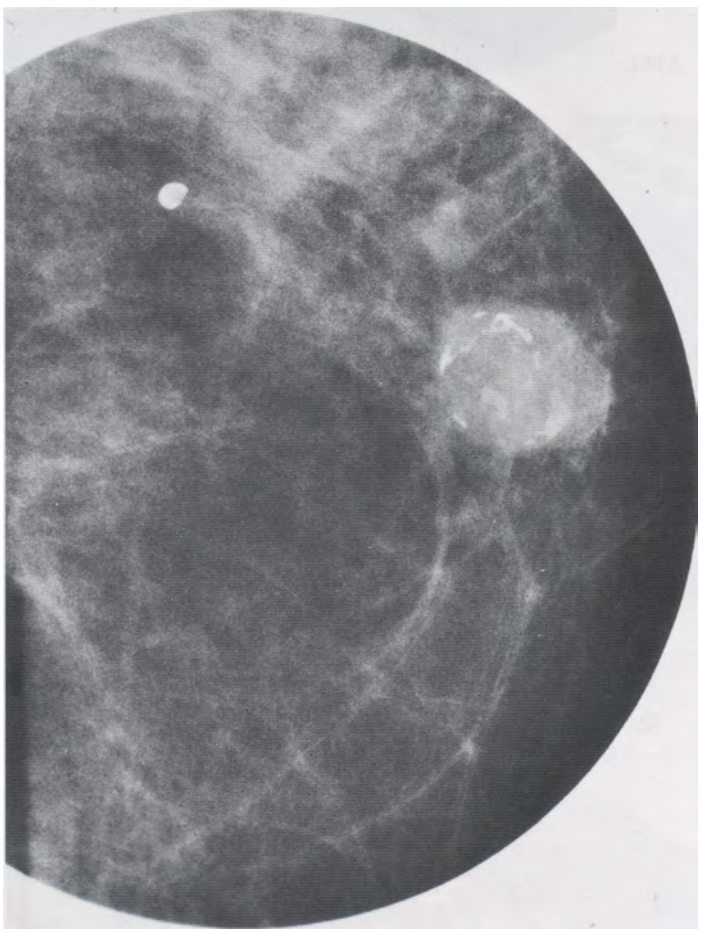
The calcifications are of the benign type encountered in a partially calcified fibrodenoma of low density (Fig. 150B). The tumor, although of low density, is not sharply outlined and there is a comet tail, necessitating histologic examination.

Histology

Carcinoma in an old, hyalinized fibroadenoma.



150A



150B

151

First screening examination. 61-year-old woman.

Physical Examination

Hard, freely movable tumor in the upper inner quadrant of the right breast. The tumor and been present for 20 years; the overlying skin is bluish.

Mammography

Fig. 151 A: Right breast, cranio-caudal projection. A calcified tumor is seen in the upper inner quadrant.
Fig. 151 B & C: Microfocus, magnification coned-down spot compression views before and after puncture

Analysis of the Tumor

Form: oval, lobulated
Contour: fairly sharply outlined, with a partial halo sign seen
Density: low density radiopaque, parenchymal structures can be seen superimposed
Size: large, 4 x 3 cm

Conclusion

Mammographically benign tumor.

Analysis of the Calcifications

Form: highly irregular, bizarre
Density: high
Size: coarse, variable
Location: inside the tumor

Conclusion

The extremely high density and coarseness indicate a benign character.

Puncture

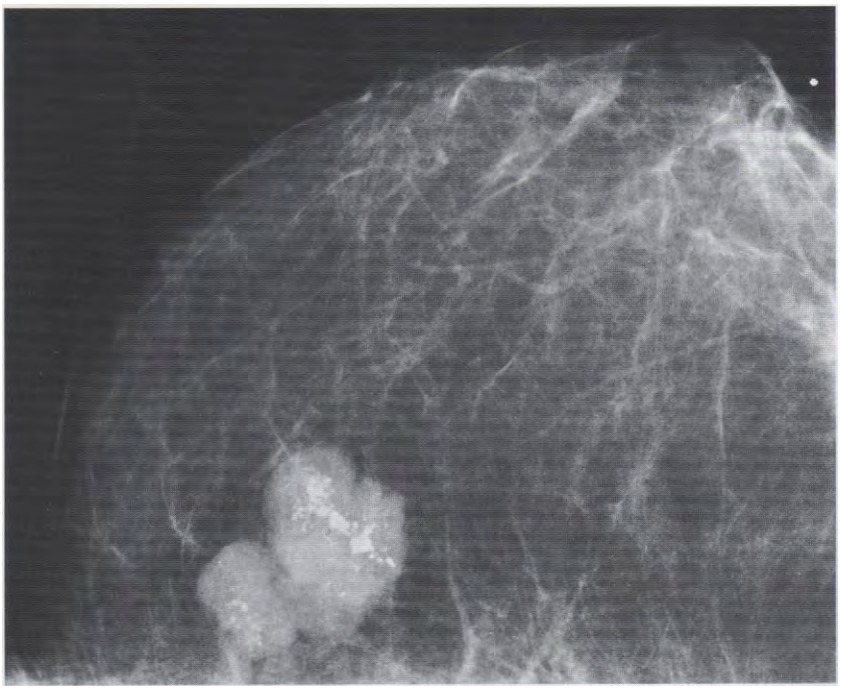
Several ml dark blood aspirated. Note the defect at the site of puncture (arrows).

Cytology

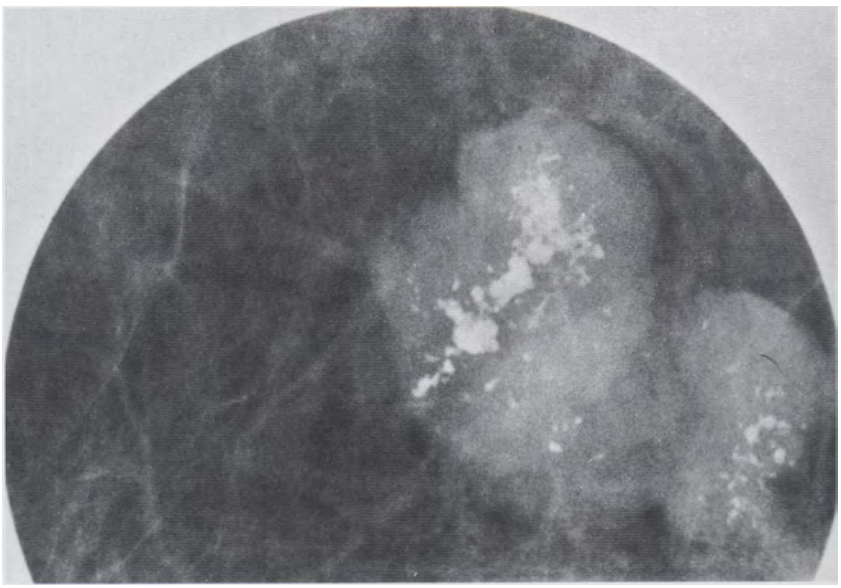
Blood, no epithelial elements.

Histology

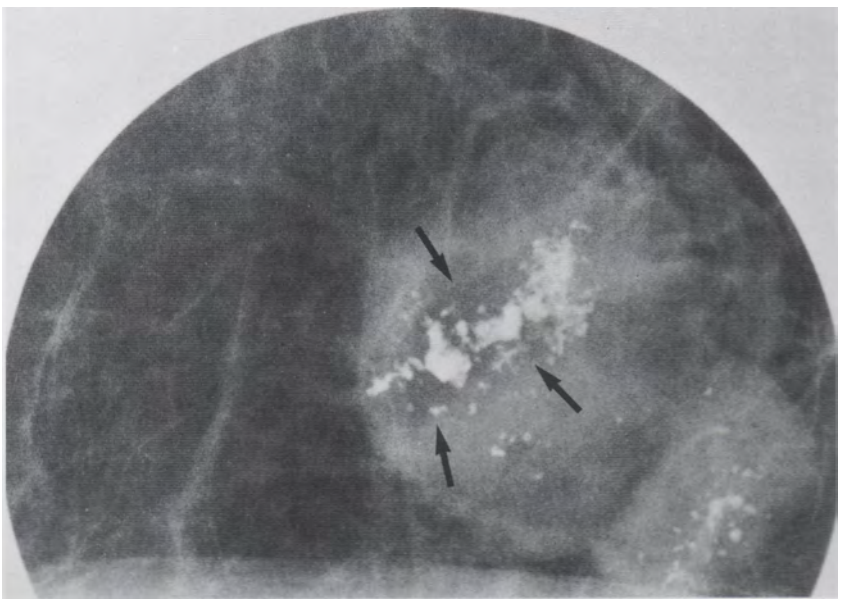
Calcified hemangioma. No evidence of malignancy.



151 A



151B

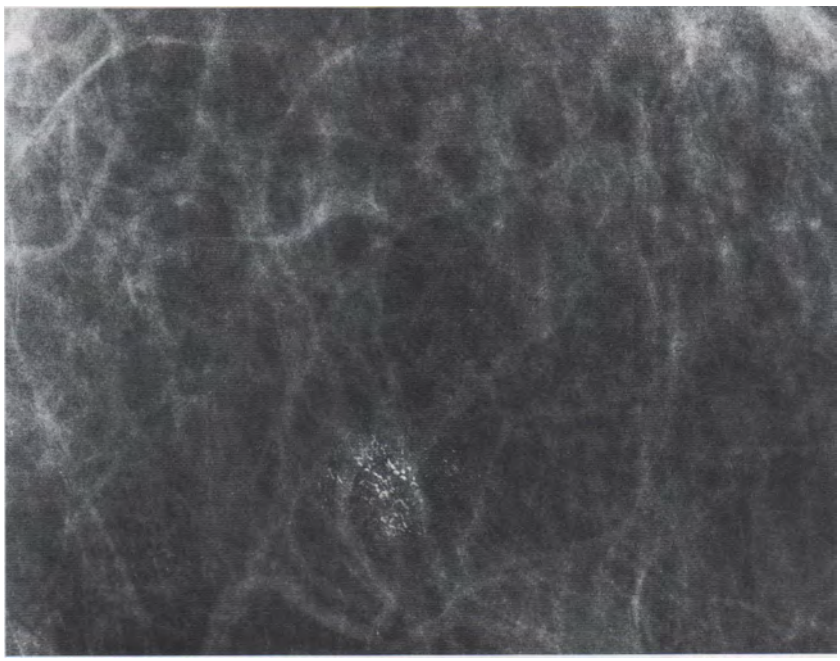


151C

152

Fig. 152A & B: Calcified wart in the medio-lateral and cranio-caudal projections. The calcifications localized within warts may be deceptive, but inspection should clarify the issue. Occasionally it will be necessary to mark the wart with a lead pellet on a repeat mammogram.

152A



152B

VII. Thickened Skin Syndrome of the Breast

This is a syndrome produced by lymphedema usually secondary to obstruction of the axillary lymphatics (Fig. XXX).

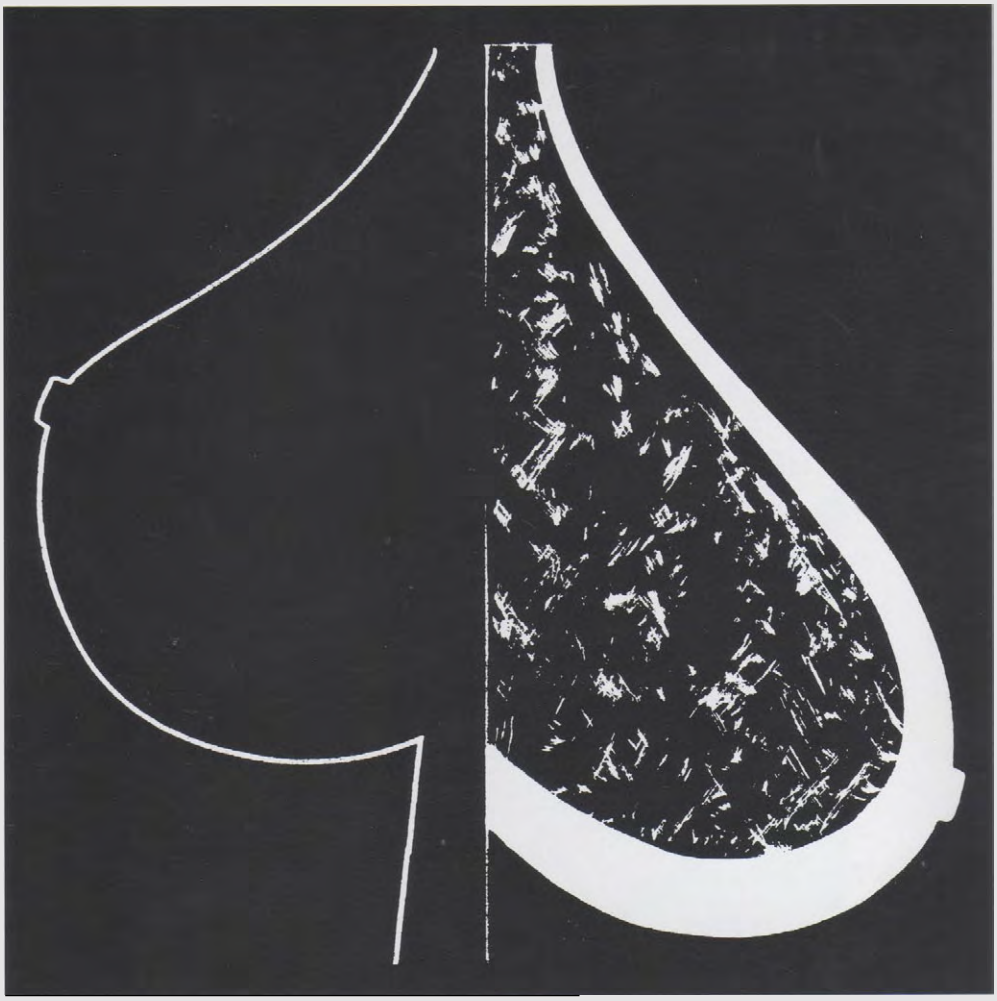


Fig. XXX: Thickened skin syndrome: Thickened skin over much or all of the breast, associated with increased density and a reticular pattern.

Physical Examination

a) The affected breast is larger and heavier due to increased fluid content.
b) There is obvious *peau d'orange.*
c) Enlarged axillary lymph nodes are frequently palpable.
d) The skin is inflamed in the socalled inflammatory carcinoma, in acute mastitis and frequently in abscesses.

Mammographic Appearance

a) The skin is obviously thickened, usually many times normal thickness. This occurs initially and to the greatest extent in the lower, dependent portion of the breast.
b) The overall density of the breast is increased due to the high fluid content. In comparison to the other breast there is a coarse reticular pattern on the mammogram.

Lymphedema May be Caused by the Following:

a) Axillary lymphatic obstruction blocking lymphatic drainage of the breast. This may be secondary to:
   1) Breast carcinoma metastases. In many cases an aggressive carcinoma may spread throughout the breast and axilla (case 153). A carcinoma may also be located high in the axillary tail and metastasize directly to the axillary lymph nodes.
   2) Primary malignant lymphatic diseases (lymphomas, etc.).
   3) Advanced gynecological malignancies (ovarian, uterine) which may rarely block primary lymphatic drainage in the lesser pelvis (37). The lymph flow then passes through the thoraco-hypogastric collaterals, overloading the axillary and supraclavicular lymphatic drainage (case 154).
   4) Advanced bronchial or esophageal carcinoma may cause blockage of the mediastinal lymph drainage, also resulting in the thickened skin syndrome of the breast(s).
b) Lymphatic spread of breast carcinoma cells from mastectomy side towards the opposite breast. This spread blocks intradermal and intramammary lymph channels in the remaining breast.
c) Inflammation, particularly large retromammillary abscesses that may produce skin thickening over the areola and the lower part of the breast. An important differentiating factor is that the axillary portion of the breast does not then show the reticular pattern on the mammogram (cases 38, 42).
d) Right heart failure, chonic renal failure, anasarca. This may be restricted to one breast in a bedridden patient lying on one side.

153

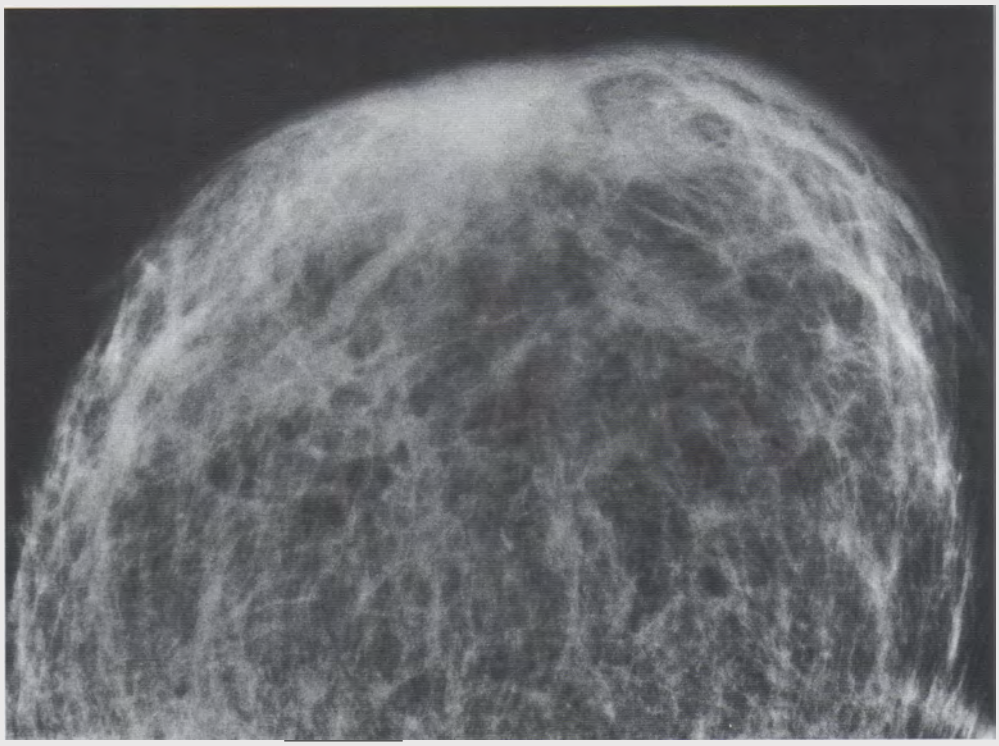
62-year-old woman noted increase in size of the right breast over the past six months.

Physical Examination

The right breast is erythematous, heavy and remarkably larger than the left. There is *peau d'orange* and an enlarged axillary lymph node is palpable. The left breast is normal.

Mammography

Fig. 153: Right breast, cranio-caudal projection. Extreme skin thickening over the entire breast. Extensive, prominent reticular pattern. No localized tumor. No associated calcifications.



Conclusion

An extensive reticular pattern reflects lymphedema resulting from obstruction of the axillary lymphatics. Massive lymphedema usually results from axillary lymphatic obstruction by malignant disease. In the absence of a tumor mass one should suspect a diffusely infiltrating malignant breast tumor.

Histology

Diffusely infiltrating breast carcinoma. Metastases to the axillary lymph nodes.

154

72-year-old woman with metastatic ovarian carcinoma. Operated and irradiated four months earlier.

Physical Examination

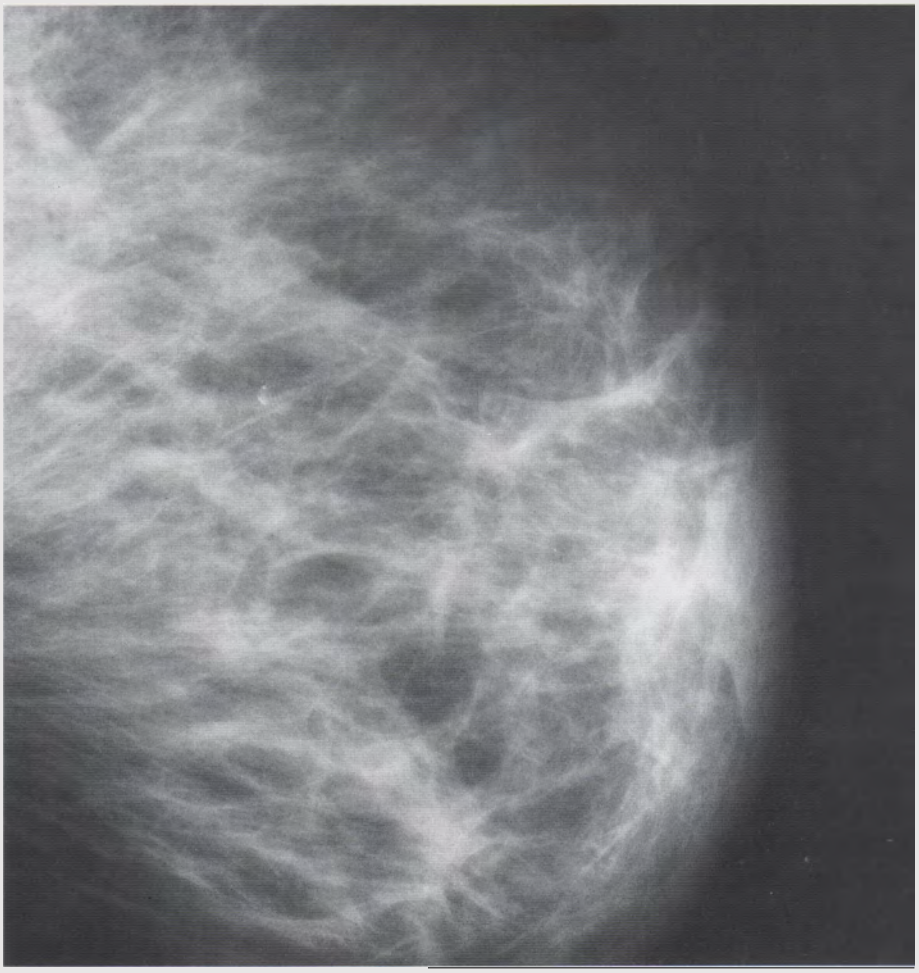
The patient now has enlarged, hard axillary and supraclavicular lymph nodes. Both breasts are heavy and erythematous with *peau d'orange.*

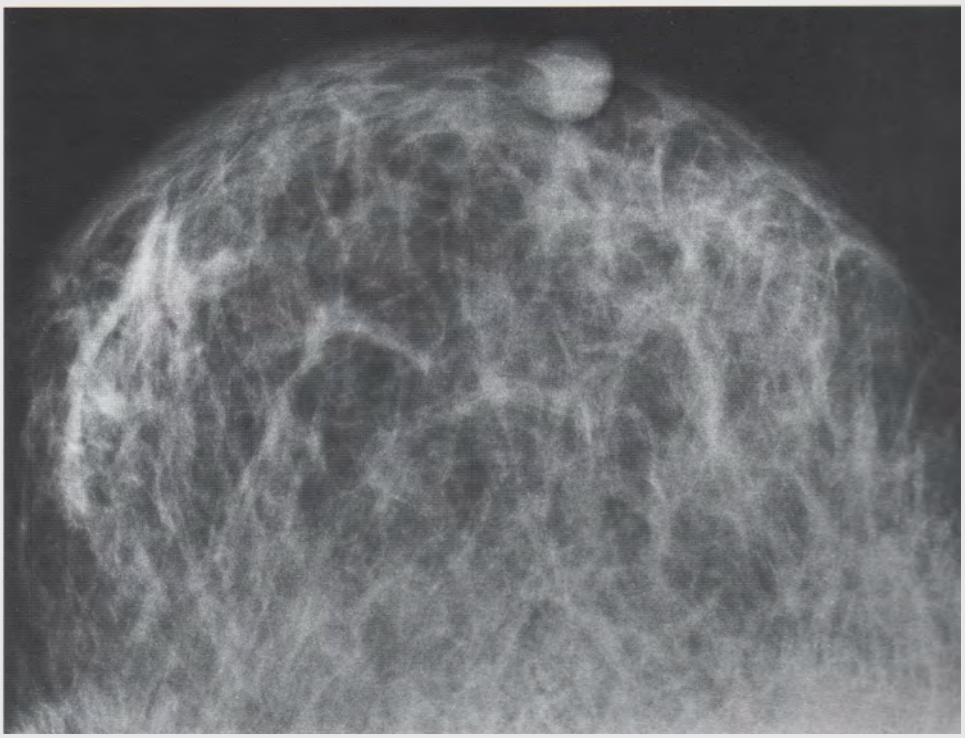
Mammography

Fig. 154A: Left breast, medio-lateral oblique projection.
Fig. 154B: Right breast, cranio-caudal projection.
Extreme bilateral skin thickening, increased radiopacity and extensive reticular pattern throughout both breasts. No localized tumor, no associated calcifications.

Conclusion

The history is crucial in this case. Advanced gynecological malignancies (uterine and ovarian) as in this case may block the lymphatic drainage in the lesser pelvis. The lymph flow then passes through the thoraco-hypogastric collaterals, overloading the axillary and supraclavicular lymphatics. This leads to lymphatic stasis in the breasts which accounts for the above-described clinical and mammographic picture.





VIII. Overall Strategy

Perception of pathological lesions in the breast can be difficult, especially of stellate tumors. Superior picture quality, optimal viewing conditions and a systematic viewing technique are prerequisite to the perception of breast abnormalities.
Analysis of the perceived lesion should be carefully performed as outlined.
The strategy differs according to the type of the tumor.

a) Circular/oval tumors: Usually no perception problem. Careful analysis of the mammograms and the frequent use of ancillary methods such as ultrasound, fine needle and large core needle biopsy can often make surgical biopsy unnecessary. The most frequent examples of this are the cyst and many of the fibroadenomas.

b) Stellate lesions: Most breast carcinomas present as stellate tumors. Once found, 92% of stellate tumors will represent an invasive carcinoma; the remainder being radial scars, post-surgical scars or, rarely, ductal carcinoma in situ. The radiological differential diagnosis can be highly accurate and important for the direction of further management. Finding the cancers in the early stage, when they are small (< 10 mm) may cause considerable perception problems.

c) Most *calcifications* in the breast represent benign processes. Since *only 20%* of consecutively biopsied clusters of calcifications represent malignant disease (9, 12), detailed mammographic analysis of the calcifications and the frequent use of large core needle biopsy may help to avoid many unnecessary surgical biopsies. All powderish calcifications require surgical removal.

d) The *thickened skin syndrome* presents with a striking clinical and mammographic appearance. The underlying cause of this syndrome can be determined through careful analysis of the clinical and mammographic picture.

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