Passing the General Surgery Oral Board Exam

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For Lauren, Jamie, and Andrew who have taught me:
"Don't give up, just go on."

Acknowledgements

This book would not have been possible without the remarkable support of countless individuals. I know I will leave some out, and I hope those I do will accept my apologies.

The first "thanks" goes to my immediate family. They have provided the support that helps me get up again each and every morning and remind me that there is life outside medicine. Of all, my deceased father and brother deserve the most thanks. It was they who gave me the inspiration to pursue a career in medicine and continue to inspire my pursuit of excellence. They both were well respected surgeons in their field and died long before their time.

Thanks to my friends. I have been fortunate to have so many friends in my life, each of whom has enriched my experiences in innumerable ways. From elementary school through residency, I have truly been blessed with friends I could trust and depend on. They have contributed greatly to the richness of my life. Sadly, as our paths diverged, some friends were left behind and I miss them all.

Thanks to the attendings, students, residents, and patients that I've had the pleasure of knowing during my medical career. They have provided me on a daily basis with the constant intellectual stimulation to challenge what I know and do. They make my job the best job in the world. They also remind me to never be satisfied in my level of knowledge and inspire me to read through the piles of journals in my office and at home.

Finally, thanks to the many healthcare professionals that have guided my day-to-day experiences in medicine. Without the secretaries, nurses, nurse managers, operators, coders, billers, administrators, phlebotomists, respiratory therapists, dictationists, librarians, and other unsung heroes, the great machinery of the hospital would grind to a halt and we doctors would not be able to function. I remember learning volumes from several experienced nurses who helped to keep me out of trouble during my residency years. I would not be where I am today if we were not all on the same team. Even if it means sometimes fighting a losing battle, together we are all trying to make sick patients well.

Contents

Introduction

We regret to inform you that you were not successful in the Certifying Examination given in Cleveland, OH, in October 2002. It was the consensus of your examiners that your performance during the examination was not of the level required for certification.

That's the way the letter reads if you do not pass the General Surgery Oral Exam. Three more paragraphs followed in that awful letter I read to myself on a cold fall evening in November 2002, less than four days after I had taken the exam. I wondered why I wasn't more upset. Was it because a good friend had informed me earlier in the day that he too had failed? Was it that my gut instinct since I left the Oral Exam had been telling me to prepare myself for bad news? Who knows. After reading that letter, however, I did know one thing: on my next try, I would know *everything* there was to know about the field of General Surgery so there would be no possible way for me to fail a second time.

Out of that sentiment came the thoughts for this book. I couldn't sleep well the night after I opened that letter. As I thought about what I had done to prepare for the exam—two review courses, flashcards, a variety of review texts—I realized that my biggest help had been a book entitled *Safe Answers for the Board*. It was an excellent resource that helped to clarify and crystallize a lot of what I learnt in residency and I recommend it to all potential examinees. However, after a search on the Internet I discovered there is no book that tells you what the *wrong* answers are, or reveals the common curveballs examiners are likely to throw your way. My goal then became to put together a study guide that not only included much of the material necessary to pass the Oral Exam, but that would also prepare an examinee for what actually happens during the exam.

I like to think that the underdog always proves to be the fiercest competitor. I knew that my failure didn't mean I was less of a surgeon than those who passed. I knew it didn't mean that I wouldn't become a successful surgeon, or that I would mismanage or kill my next hundred patients. For me, failing on my first try meant that I was going to "kick it" to those examiners during the next exam.

I will share with you a philosophy from my upbringing in Philadelphia, home to many underdogs over the years: *Who knows how to climb a ladder better—the person who climbed it once and never missed a step, or the person who climbs it, falls, and climbs it again, paying close attention to every rung because he knows what it feels like to fall and is determined to succeed?*

I can offer a couple of general suggestions to those of you preparing for this exam:

(1) Read a general surgery textbook cover to cover (it really doesn't matter which text you choose),
(2) Read lots of previous questions, which you can get from any course or your colleagues,
(3) Remember that self-induced anxiety is your biggest enemy!

If you passed the written exam, you know the material. You just have to keep from freezing or getting tongue-tied when you are asked to sum up verbally two or more weeks of outpatient work-up/inpatient care in about seven minutes per question. The Oral Surgery Certification Exam is overly subjective, so regardless of what you are asked remember that this is a test of your thinking ability and confidence more than a pure test of your knowledge. Consider each question as a real-life situation. You are not an unsafe surgeon, and you should treat the questions the way you would a patient: never make up answers or operations, and don't waste time on history and physical examination if they tell you "that is all you need." The examiners are looking to see whether you can process information and come up with a rational plan of action. You do this everyday.

Above all, remember that the exam starts right after they shake your hand. With all this in mind, let's begin . . .

Organizational Theme

Each chapter/topic will be organized as follows:

Concept

Brief pathophysiologic discussion on the general surgery topic.

Way Question May be Asked?

Common scenario presentations and some variations on the theme.

How to Answer?

Possible way to answer the question based on the author's summary of several references, review courses, and multiple examinee experiences (those of the author and the author's colleagues).

Common Curveballs

Possible ways the Examiners may challenge you. This includes the "change in scenario," in which an examiner satisfied with your initial answer wants to challenge you further by changing results of your diagnostic tests or your interventions. Remember, these are possible real-life situations and approach them as you would any patient in the hospital. Don't expect any question to end without at least one curveball on the Oral Exam. Space following Common Curveballs has been left blank intentionally so you can fill in references to your favorite text or other review material.

Strikeouts

Answers if you miss, say, or fail to say, you're likely coming back next year to try the oral exam again.

Malignancy, General

Concept

Make sure you understand the common nature of spread of the cancer (hematogenous—papillary/thyroid; peritoneal—ovarian; lymphatic—breast). All cancers need to be addressed with regard to:

Staging,
Surgical treatment,
Neoadjuvant/adjuvant therapies.

Way Question May be Asked?

About half the time will be clearly cancer from the outset. The other half, you will get the diagnosis after a long, exhaustive work-up.

How to Answer?

As with everything else, be methodical
Don't leave out of history: important systemic symptoms like change in bowel habits, dysphagia, weight loss, anorexia, jaundice, last mammograms, family history of malignancies.

Don't leave out of physical exam: important information like abdominal masses, examination of important lymphatic basins, complete skin exam in someone with melanoma.

Make sure you do everything you can to work-up pt pre-op both in:

(1) Determining a diagnosis—FNA, U/S, mammogram in breast CA
(2) Appropriate staging—(don't go overboard with ordering tests!)
    (a) LFTs, CXR for breast cancer
    (b) PFTs, CT scan chest to adrenals in lung cancer, +/– mediastinoscopy
    (c) CT scan abd/pelvis, angio, tumor markers, ERCP in pancreatic CA
(3) Make sure to determine if lesion is resectable or if pt needs pre-op chemo/XRT
    (a) rectal CA Stage II or above gets pre-op XRT
    (b) inflammatory breast CA gets pre-op chemo

In the OR, if you don't have a dx yet (as in case of pancreatic mass), must do frozen section
Frozen section also appropriate after resection to check margins in gastric, esophageal, lung CA
Examination of lymph node basins when appropriate
Frozen section of SLNs (controversial—careful here in any CA but melanoma and breast! Not necessarily a right answer, but know your answer and stick to it!)
Be able to describe common lymph node dissections
Don't forget to ask for pathology report—size, margins, lymph nodes, tumor type, nuclear grade (receptor status for breast cancer)
Don't forget to discuss post-op chemo/XRT management

Common Curveballs

Cancer diagnosis unable to determine pre-op (common with pancreatic/cholangioCA)
Margins positive in gastric/breast cancer
Mediastinoscopy positive
Post-op 1 yr with local recurrence or rising tumor markers in first year of post-op follow-up
Post-op 1 yr with metastatic lesion (resect in sarcoma if primary site controlled and in melanoma if single organ met)
Post-op discussion of chemo/XRT regimen
"Scenario switch" where you were working up one diagnosis and find a malignancy (bloody nipple d/c after resection, path reveals small focus ductal carcinoma)
Pt will have synchronous tumor in colon CA
Pt will have post-op leak after GI resection

Pt will want to preserve their breast with advanced breast CA
Pt will have positive SLN on permanent/frozen section
Pt will have non-diagnostic FNA or percutaneous biopsy
Asked to describe your technique for performing SLN biopsies

Strikeouts

Failure to check old CXR if suspect lung CA
Failure to check old mammogram/or order mammogram in breast CA
Failure to complete lymph node dissection for positive SLN (don't get into discussion about most recent NSABP trials randomizing pts to not have complete ALND for + SLN in breast CA)
Failure to know chemo/XRT regimen after resection for breast CA
Failure to check margins after GI resection
Aggressive resection of metastatic lesions in breast CA
Failure to do FNA on palpable thyroid nodule/breast lesion
Failure to get pre-op lymphoscintigraphy if performing SLN for trunk melanoma (can go to at least four different lymph node basins)
Failing to use pre-op XRT in rectal CA stage II or above
Failing to evaluate adrenal glands in evaluation of lung CA
Failing to determine resectability pre-op in pt with pancreatic neoplasm
Failing to examine lymph node basins on pre-op H&P
Failing to ask about prior hx malignancy in pre-op H&P

Breast—Nipple Discharge

Concept

Either from benign or malignant cause. Benign typically are non-spontaneous, bilateral, clear or milky, and from multiple ducts. Bloody discharge typically from an intraductal papilloma (45%), duct ectasia (35%) or infection (~5%). However, it may be a cancer (~5%); this is a common curveball.

Way Question May be Asked?

"A 45 y/o female presents to your office with the complaint of unilateral bloody nipple discharge for the past one month." May be given just nipple discharge and have to work through type, spontaneity, laterality, and recent medications that have been started. May also be given nipple discharge in young female.

How to Answer?

Full History

- Risk factors for malignancy
- Trauma
- Fluid characteristics (clear, milky, serous, bloody)
- Bilateral or unilateral
- When discharge occurs stimulated or spontaneous (spontaneous worrisome)
- Trauma
- Thyroid disorder
- New medications

Full Physical Exam

- Examination of both breasts in upright and supine positions
- Examination of lymph node basins
- Try to determine a responsible quadrant/responsible ducts

Diagnostic Tests

- Must get mammogram
- U/S (subareolar area images poorly on mammogram)
- Hemoccult test
- Cytology (rarely helpful, and negative result doesn't exclude malignancy
- Ductogram (painful, and rarely helpful)
- MRI (rarely helpful for papilloma, but may detect other lesions)

Then, if you have bloody discharge, you are in one of several situations:

(1) Negative mammogram/negative PE for mass/negative responsible quadrant
   Have pt follow-up in several weeks and check for responsible quadrant on breast self-exam. Then, on follow-up:
   (a) Negative mammogram/PE for mass/negative responsible quadrant
      → *total* subareolar ductal system resection
   (b) Negative mammogram/PE for mass/positive responsible quadrant
      → subareolar *wedge* resection ductal system for that quadrant
   (c) Positive mammogram/PE for mass/positive responsible quadrant
      → excisional biopsy of mass and subareolar wedge resection

(2) Negative mammogram/PE for mass/positive responsible quadrant
   → subareolar wedge resection of the ductal system draining that quadrant

(3) Positive mammogram/PE for mass/positive responsible quadrant
   → excisional biopsy or core-needle biopsy of mass on mammogram and subareolar wedge resection

Surgical Treatment

Circumareolar incision (some make incision at nipple/areola border)
Elevate areola
Dissect ducts leading to areola
Identify abnormal duct by dilatation, stent, dye or mass (if can identify single duct otherwise subareolar wedge resection of the ductal system draining that quadrant)
Tie off distal duct or will still drain out of nipple post-op (your seroma!)

Common Curveballs

The pathology won't be a benign intraductal papilloma but a type of breast cancer (may range from LCIS and DCIS to invasive cancer→don't forget about checking lymph nodes and adjuvant therapy!)
The nipple discharge will persist after a subareolar wedge resection
There won't be a responsible quadrant
There will be a mass in the same breast, different quadrant, or in the opposite breast
Not bloody discharge but persistent atypical cells on slide cytology (now what do you do?)
Pt will be pregnant
Pt will be teenager

Strikeouts

Performing surgery for non-spontaneous, bilateral, clear/milky discharge
Failing to check the same breast for palpable masses or examine the other breast
Failing to establish risk factors for malignancy
Failing to check nodal status if pathology returns malignancy
Failing to order a mammogram/U/S
Discussing ductoscopy
Performing mastectomy for bloody nipple discharge
Not being able to shift into discussion of malignancy if pathology doesn't reveal expected papilloma, but rather an invasive carcinoma
Trusting slide cytology/hemoccult tests and not taking pt to surgery with suspicious nipple discharge
Wasting time working up a prolactinoma

Breast—DCIS (Ductal Carcinoma In Situ)

Concept

Premalignant lesion with various subtypes. Pt has about a 1 in 3 chance of developing invasive ductal carcinoma in her lifetime. Several key features from pathologic standpoint: size of tumor, was it unifocal or multifocal, comedo necrosis, how well differentiated was the tumor?

Way Question May be Asked?

"51 y/o female presents to your office with an abnormal mammogram. A cluster of 5 microcalcifications were seen in the UOQ of the left breast. She underwent a core-needle biopsy that revealed DCIS. What would you do?" May be given DCIS in a number of different ways from mammogram showing asymmetric density, nodule, speculated lesion, but most commonly from cluster or branching heterogenous microcalcifications.

How to Answer?

History

Establish risk factors for breast cancer (menarche, breastfeeding, family history of breast/ovarian/ prostate cancer, number of children, previous breast cancer, . . .)

Physical Exam

Symmetry, dimpling, erythema
Try to palpate for any masses
Check both breasts!
Examine for adenopathy

How to Answer?

Need to order bilateral mammograms and compare to previous
Ultrasound useful in palpable masses to determine if cystic or solid
MRI not used for screening purposes

Any suspicious microcalcifications (clustered, branching, heterogeneous) need to be biopsied (stereotactic core needle or needle localization/excisional biopsy)
After biopsy has identified lesion as DCIS, the pt still needs that area excised with adequate (> 2 mm) free margins. If you don't get this after your needle-loc, you'll need to re-excise until you begin to distort the breast, or you get free margins
If DCIS is diffuse: multifocal (scattered in one quadrant) or other quadrants (multicentric), consider total mastectomy
If the tumor is high grade, has comedo necrosis, or is large, a total mastectomy is appropriate (no ALND necessary here unless final path reveals invasive carcinoma)—be sure to offer immediate reconstruction as an option
Pt will need post-op XRT (unless had mastectomy or has low grade, small tumor with > 1 cm margin) to breast and be placed on 5 years Tamoxifen (unless contraindication like endometrial CA or h/o DVTs)

Common Curveballs

There will be a palpable mass (separate from mammographic finding)
There will be more than one mammographically detected lesion
There will be lesion in opposite breast
Pt will have recurrence after mastectomy to chest wall or incision site (changing scenario)
Pt will have invasive carcinoma (changing scenario)
On pathology, resection margin will be positive or less than 1 mm
Pt will be pregnant

Stereotactic core can't be performed (too superficial or too deep or pt can't lay prone on stereotactic table)
Lobular carcinoma in situ on final pathology (maybe even at margins)

Strikeouts

Forgetting to examine both breasts
Forgetting to order bilateral mammograms
Forgetting post-op chemo/XRT treatment when appropriate
Forgetting ALND if invasive cancer identified
Performing ALND for DCIS
Talking about SLN Bx for comedo DCIS (only in research protocols currently)
Talking about use of chemotherapy/Arimidex/or the new med you read about in the journal last week as an experimental trial for your pt with DCIS
Not performing re-excision for margin $\leq$ 1 mm.

Breast—Inflammatory Breast Cancer

Concept

Poor prognosis regardless of therapy offered. Do want to try to provide local control. Need to look for tumor cells in subdermal lymphatics and treat aggressively.

Differential diagnosis includes mastitis, abscess, Mondor's disease, and inflammatory breast CA.

Way Question May be Asked?

"A 58 y/o female presents to your office complaining of a breast infection. Examination reveals an erythematous, edematous right breast. What do you want to do?" May also be given a failed course of antibiotics, a history of trauma, or recent breast-feeding/nursing to try to lead you astray.

How to Answer?

History

Risk factors:
- Family history
- Prior breast surgery
- History of malignancy
- Age menarche, menopause, 1st pregnancy
- Estrogen use (OCPs)

Important questions:
- History of trauma
- Nursing
- Time course
- Breast self exams (palpable masses before inflammation?)

Physical Exam

Examine both breasts (peau d'orange)
Examine lymph node basins (cervical/axillary)
Palpable cord (Mondor's disease)

Diagnostic Tests (in all Breast Questions!)

Mammogram (bilateral)
U/S (if mass)
MRI (usually for palpable lesion not seen on mammo or U/S)

DDx

Mastitis
Breast abscess
Superficial thrombophlebitis (palpable cord)
Inflammatory breast cancer

Surgical Treatment

(1) Okay to try short course antibiotics (1 week)
(2) If fails to resolve or strong suspicion, get incisional biopsy (including skin) through reddened area and include adjacent normal skin (some recommend FNA because clinical grounds confirm stage of disease and you just want a dx of cancer to start chemotherapy, but you get more info from core needle or incisional biopsy—ER/PR receptor status)
(3) If pathology confirms inflammatory breast Ca (tumor in subdermal lymphatics), proceed with metastatic work-up
   (a) CXR
   (b) CT scan head/abd/pelvis (look for metastases)
   (c) Bone scan
   (d) +/– PET scan
(4) Three cycles of chemotherapy (usually multi-agent)
(5) Algorithm
   (a) if pt has complete response→ MRM to augment local control, followed by eight cycles of chemo, chest wall radiation, and tamoxifen if ER/PR positive
   (b) no response→ chest wall radiation, MRM

(6) If already eroding through skin, can give XRT up front to shrink tumor (also works if grossly eroding through skin and infected)

Common Curveballs

Will erode through skin during treatment
Pt will not have response to chemo
Pt will be pregnant
Pt will somewhat respond during antibiotic treatment
Pt will have mass/abnL mammogram for opposite breast
Pt will develop DVT during chemo (switch scenario)
Pt will push towards saving her breast or immediate reconstruction (NO!)
FNA positive but can't get any receptor information (need to do core or incisional biopsy)
Pt will develop lymphedema post ALND

Strikeouts

Not performing FNA instead of incisional biopsy (need receptor status)
Not recognizing inflammatory breast cancer as a T4 lesion
Not performing biopsy at all but proceeding straight to chemotherapy
Not performing mastectomy at end of neoadjuvant therapy (even if complete clinical resolution)
Not treating first with chemotherapy but proceeding straight with mastectomy
Talking about MRI (PET scan only be appropriate here for complete staging purposes)
Trying breast conservation/breast reconstruction
Trying to perform SLN Bx's

Breast—Invasive Ductal Carcinoma

Concept

Malignancy that needs complete staging work-up and then adjuvant treatment. Most women are candidates for breast conservation therapy (BCT). Need to know the absolute and relative contraindications to BCT.

Way Question May be Asked?

"45 y/o female presents to your office with a palpable mass in the UOQ of the right breast. What would you do?" Will likely be presented with pt with either a palpable abnormality, a locally advanced lesion, or a suspicious mammographic abnormality. Just be systematic and do what you would normally do in your practice.

How to Answer?

History

Establish risk factors for breast cancer (menarche, breast-feeding, family history of breast/ovarian/prostate cancer, number of children, age first pregnancy previous breast cancer, previous breast problems, etc.)

Sx's: bone pain, wt loss, change in breast appearance

Physical Exam

Symmetry, dimpling, erythema, edema

Try to palpate any mass (hard/soft, well circumscribed?, mobile/fixed, tender)

Check both breasts!

Examine for cervical/axillary adenopathy

Examine liver

How to Answer

Need to order bilateral mammograms and compare to any previous

Ultrasound useful in palpable masses to determine if cystic or solid (especially in premenopausal breasts and may show characteristics of malignancy)

FNA can be done in office setting of any palpable lesion

Core-needle bx can be done in office or under stereotactic/U/S guidance

Excisional biopsy should be performed on:

Solid mass
Cyst with bloody content
Cyst that recurs more than twice

If FNA reveals malignancy, then can plan full cancer staging in one trip to the OR.

Contraindications for breast conservation therapy:

Tumor ≥ 5 cm
Large tumor to breast ratio (cosmetic outcome)
Two or more primary tumors in separate quadrants (multifocal)
Previous breast irradiation (from prior BCT)
Collagen vascular disease (scleroderma or lupus—can't receive XRT)
Diffuse suspicious or indeterminate calcifications
Subareolar tumor

Surgical Treatment

(1) Lumpectomy (with clear margins), ALND, and post-op XRT
(2) MRM (combines total mastectomy and ALND)

ALND includes level 1 and 2 (lateral to and behind the pectoralis minor muscle) and should be done in all pts

SLN Bx is now accepted technique, but if positive by frozen section or final pathology, would proceed to complete ALND until results of latest NSABP trial are scrutinized (only mention if you know how to do SLN Bx and use lymphazurin blue dye and technetium-99 sulfur colloid)

Adjuvant chemotherapy treatment (Adriamycin/Cytoxan = AC)
(1) All premenopausal women with invasive breast cancer > 1 cm in size
(2) All postmenopausal women with positive lymph nodes
(3) Postmenopausal women with T2 or greater lesions (> 2 cm in size)

Adjuvant hormonal treatment (Tamoxifen)
(1) All premenopausal women with invasive breast cancer > 1 cm in size
(2) All postmenopausal women (unless contraindication)

Adjuvant XRT
(1) 5000 rad in divided doses to chest wall in all pts who underwent BCT (can't give during pregnancy, but can usually delay until after pregnancy as need 6 months chemoTx→no therapeutic abortions!!!)
(2) When > 4 LNs involved with tumor, XRT to axilla reduces local recurrence

Pathology results
Need to know tumor characteristics: nuclear grade, vascular invasion, tumor size, ER/PR receptors, S-phase fraction, Her-2 Neu
Only go into Sentinel Lymph Node Biopsy if you do this in your practice and are prepared to perform complete ALND in any pt with metastatic cancer seen on the sentinel node (whether intra-op frozen section or post-op final histology)

Common Curveballs

There will be a separate mammographic finding
There will be palpable lesion not seen on mammogram
There will be lesion in opposite breast
Pt will have recurrence after your surgical treatment
Don't do pulmonary/liver metastatectomy
Margins will be positive for cancer or DCIS (or less than 1mm)
Sentinel node biopsy won't work or will be only positive lymph node
Pt will be pregnant (no XRT, SLN bx, or antimetabolite based chemoTx)
Can give AC after late 1st trimester (only antimetabolite methotrexate nsafe during pregnancy)
No XRT until pt delivers (needs 24 weeks chemo so ok unless < 14 weeks pregnant)
No Tamoxifen or bone scan
Pt will have contraindication to BCT
Pt will have contraindication to adriamycin (poor EF)
Pt will initially present with nipple discharge
Pt will have clinically positive axillary nodes
Pt will have very strong family history (discussion of BRCA1,2)
Cancer will present in a cyst that had bloody fluid on FNA
Retroarealor cancer—will you perform mastectomy?
T1 lesion, and lymph nodes negative in postmenopausal but receptors are unfavorable→ will you give chemo?
T2 lesion in postmenopausal and receptors are favorable→ will you give chemo and/or hormonal therapy?
T1a lesion (<5mm) in premenopausal woman, will you offer chemo/XRT

Strikeouts

Forgetting to examine both breasts
Forgetting to order bilateral mammograms
Not asking about receptors on pathology
Forgetting post-op chemo/XRT treatment when appropriate
Forgetting ALND if invasive cancer identified
Going into lengthy discussion about sentinel lymph node biopsy when you don't do these routinely in your practice
Performing therapeutic abortion for breast Ca in the pregnant pt
Not knowing contraindications to BCT
Not knowing who gets adjuvant treatment and with what chemo/hormonal agents
Not recognizing Stage IIIB (signs of inoperability → neoadjuvant chemo→mastectomy →XRT):
Chest wall invasion
Inflammatory breast cancer
Ulceration

Breast—Paget's Disease

Concept

Malignant cells that have migrated from underlying DCIS or invasive cancer. Paget's cells are identified in the epidermis. May regress with topical steroids, so don't prescribe them. Bilateral eczematous changes to the nipple areolar complex (NAC) are likely benign.

Way Question May be Asked?

"43 y/o female presents to your office with a 4 week history of itching to her left nipple. Examination reveals a reddened eczematous L NAC and a 1.5 cm mass in the upper outer quadrant approximately 4 cm from the NAC margin. What would you do?" May or may not be associated mass, but always do PE/mammogram/U/S.

How to Answer?

History

Establish risk factors for breast cancer (menarche, breast-feeding, family history, number of children, previous breast cancer, etc.)

Physical Exam

Try to palpate a mass
Check both breasts!
Examine for cervical/axillary adenopathy

How to Answer?

Need to order bilateral mammograms
Now, a couple of situations possible:
(1) No palpable mass, no lesions on mammography→wedge resection of NAC, check pathology, if Paget's cells identified, proceed to simple mastectomy (if CA in mastectomy specimen→don't forget ALND!)
(2) Palpable mass or lesion on mammogram→ wedge resection of NAC and excisional biopsy of mass, if Paget's cells identified and mass is invasive cancer, then MRM
(3) Palpable mass or lesion on mammogram→ wedge resection of NAC and excisional biopsy of mass, if Paget's cells identified and mass is DCIS, then simple mastectomy

Don't forget radiation/chemotherapy/hormonal therapy when appropriate for DCIS or underlying invasive cancer

Common Curveballs

There will be a palpable mass
There will be a mammographically detected lesion
There will be lesion in opposite breast
Pt will have recurrence after mastectomy to chest wall or incision site (changing scenario)

Strikeouts

Forgetting to order mammograms
Forgetting post-op chemo/XRT treatment when appropriate
Forgetting ALND if invasive cancer identified
Forgetting to obtain usual history/physical exam (establish risk factors, checking masses in both breasts)
Forgetting to examine both breasts/axillae
Treating nipple with steroids (Paget's can remit on steroids)

Colon and Small Bowel—Acute Bowel Ischemia

Concept

Pathogenesis includes multiple etiologies but can generally be broken down into occlusive and nonocclusive types. DDx for a patient with suspected colonic ischemia should also include other colonic disorders such as ulcerative colitis, infectious colitis, and pseudomembranous colitis. A breakdown of important types of occlusive and nonocclusive ischemia follows:

Occlusive	*Nonocclusive*
Embolism	Hypovolemia
Thrombosis	Cardiac failure/cardiogenic shock
Vascular compression	
AAA repair	Hypotension

Watershed areas vulnerable to low flow states in the colon: *Griffith's* point (splenic flexure) and *Sudeck's* point (rectosigmoid) for nonocclusive ischemia.

Way Question May be Asked?

"Called to see a 54 y/o male POD#2 after an uncomplicated AAA repair with a massive bloody bowel movement. What do you want to do?" Situation could also be after recent open heart surgery, recent MI, or a more chronic form with post-prandial pain for several months with associated weight loss. Remember "pain out of proportion to physical exam" is classic for acute bowel ischemia. Try to separate generalized intestinal ischemia from colonic ischemia and occlusive from low flow states.

How to Answer?

History

Risk factors: valvular disease, CAD, hypercoagulable state, cardiac arrhythmias
Classic: abrupt onset abdominal pain, diarrhea, hematochezia
Recent surgery (AAA, bypass)
Recent MI (embolus)
Classic triad of: fever, abdominal pain, and heme + stools
Abrupt onset of: pain, diarrhea, hematochezia

Physical Exam

"Toxic" appearance, shock, acidosis, leukocytosis
Keep in mind: "Pain out of proportion to physical exam"
Peritonitis
Heme + Stool
Gross blood (usually late finding)
Irregular heart rate (a. fib)

Diagnostic Tests

Full labs (amylase and lactate also helpful)—acidosis a late finding
EKG (r/o a. fib)
Abd x-ray: free air, pneumatosis intestinalis, portal vein air
CT scan: "thumb printing", bowel wall thickening, pneumatosis, portal vein air
Colonoscopy: mucosal edema, submucosal hemorrhage, mucosal ulceration, bluish-black discoloration, areas of black nonviable mucosa, may be skip areas (keep air insufflation *to a minimum*, may prep with gentle tap water enema)
Arteriography (to evaluate small bowel):
  Could see SMA embolus
  Could see SMA thrombosis
  Could see normal proximal vessels but then distal spasm

Surgical Treatment

(1) Decide if this is acute small bowel mesenteric occlusion vs. colonic ischemia

(2) Initially
Volume support (may need SGC), ICU, O_2, bowel rest, NGT, Foley
Serial labs/exams
Abx when remarkable endoscopic findings or evidence of toxemia

(3) If colonic ischemia improves
colonoscopy 6–8 weeks after for evaluate for resolution/sequelae (stricture) 5% pt with recurrent episodes

(4) If becomes toxic or peritoneal signs
Resuscitate pt and prepare for OR
In OR:
Control contamination
Palpation of celiac, SMA, IMA pulses
Pattern of ischemia may suggest etiology (complete vs. patchy)
Hand-held Doppler, Fluorescein injection/Wood's lamp, warm packs
Left colon involvement: resection w/colostomy + mucous fistula or Hartmann's pouch
Right colon involvement: resection with ileostomy and mucous fistula
Second look laparotomy if any question of viability

(5) For small bowel ischemia, if pt toxic or positive angiogram (angiogram helpful in situations of suspected small bowel ischemia, not for ischemic colitis), proceed to OR:
Prep access to greater saphenous vein in thigh
Expose SMA
(a) SMA embolus (proximal braches of SMA are spared)
Seen 3–8 cm from SMA origin (spares first portion of jejunum only)
Embolectomy through transverse arteriotomy
Heparin post-op
"Second look procedure" within 24 h
(b) SMA thrombosis
Embolectomy to SMA
Assess flow
If poor, SVG between infrarenal aorta and SMA
(can use suprarenal aorta and pass graft behind pancreas to SMA)
Heparin post-op
Resect nonviable segments + "second look procedure" within 24 h

Facts on Aortic Surgery:

Ischemia complicates of 1–2% elective cases
50% mortality rate
Early colonoscopy
reimplantation IMA when:
severe SMA dx, enlarged IMA, loss of Doppler in sigmoid mesentery, hx of prior colon resection, poor IMA back bleeding (stump pressure < 40 mmHg)
If need to take back to OR, perform end colostomy and Hartman pouch

Common Curveballs

Pt will have had prior surgery
Pt will have SMA embolus
Pt will have SMA thrombosis
Will be SMV thrombosis
Pt will need resuscitation pre-op +/– SGC
Pt will have necrotic bowel at second look
Pt will have hypercoagulable syndrome
Pt will have had recent AAA repair with worry about graft contamination
Whole small bowel will initially appear necrotic
Asked how to identify SMA (elevate transverse colon, follow middle colic to SMA, will need to make incision in peritoneum of mesentery, artery is medial to SMV)
Pt will return 6 weeks after colonic ischemia treated non-operatively with stricture

Strikeouts

Performing intestinal anastomosis in setting of ischemia/contamination
Not performing second look if question viability at 1st operation
Not knowing how to deal with SMA embolus/thrombosis
Not resuscitating pt pre-op but taking straight to OR
Discussing urokinase infusion for pt with embolic occlusion of mesenteric vessels or colonic ischemia
Delaying on operation when pt is toxic
Not resecting necrotic bowel
Not understanding difference between acute mesenteric ischemia and colonic ischemia

Colon and Small Bowel—Colon Cancer

Concept

Third most common cancer in the US. Because of its frequency, be prepared for the unusual presentations of this malignancy (familial polyposis, invading surrounding structures, local recurrence, rising CEA levels, metastases to the liver).

Way Question May be Asked?

"54 y/o male presents to the office with a history of iron deficiency anemia and a colonoscopy performed by the referring GI doc reveals a large adenomatous polyp in the cecum." May have a pt with change in bowel habits, blood in stool, weight loss, abdominal pain, strong family history, presentation similar to perforated diverticulitis, or even erosion into genitourinary system (fecaluria or pneumaturia).

How to Answer?

Complete history and physical exam (may have been given all this already)

History

- Risk factors (family history, IBD, previous polyps)
- Change in bowel habits
- Blood in stool
- Weight loss
- Pain

Physical Exam

- Abdominal masses
- Lymphadenopathy
- Digital rectal exam

Diagnostic Tests

- Usual labs (including CEA, LFTs)
- CXR
- Colonoscopy (rule out synchronous lesions)
- +/– Air contrast Barium Enema
- +/– CT scan to r/o metastases (most would do this)
- What if pt sent to you after polypectomy? (remember Haggit's classifications)
- Needs resection if:
- Positive margin of resection
- Invading submucosa
- Poorly differentiated
- Venous/lymphatic invasion
- Cancer in any sessile polyp

Surgical Treatment

- Don't forget mechanical/antibiotic bowel prep (be prepared to discuss your preference)
- Consider pre-op ureteral stents for large/bulky/fixed tumor
- "No touch" technique never proven to be of any clinical benefit
- Resection of the involved segment of colon, its draining lymphatics, and the segmental blood supply

Tumors of cecum and ascending colon→ right hemicolectomy (ligation of ileocolic, right colic, right branch of middle colic, removal of 5–8 cm of ileum to proximal transverse colon)

Tumors of proximal transverse colon→ extended right hemicolectomy (ligation of ileocolic vessels to middle colic artery, removal of terminal ileum to splenic flexure, anastomosis between ileum and descending colon)

Tumors of splenic flexure and descending colon→left hemicolectomy (ligation of left colic with removal of descending colon and splenic flexure with anastomosis of transverse to upper sigmoid)

Tumors of sigmoid and rectosigmoid→sigmoid colectomy (ligation of IMA distal to takeoff of left colic, anastomosis between descending colon and upper rectum)

Subtotal colectomy→ appropriate for pts with synchronous cancers, pts with metachronous cancers found after previous resection, pts with a proximal colon perforation due to an obstructing distal cancer

En bloc resection→ when tumor appears to invade adjacent organs, this does not preclude resection for cure, mark margins of resection with clips for post-op XRT (T4 but still Stage II lesion if lymph nodes negative). Check to make sure no other metastatic disease first (intra-op U/S of liver).

If trigone of bladder involved, need cystectomy and ileal conduit

If invading head of pancreas→ Whipple procedure

If kidney, check IVP to ensure other kidney okay before nephrectomy

Malignant Obstruction→

(1) Can try to convert obstruction lesion +/– colonic stent to near obstructing with NGT, IVF, bowel rest, then pre-op bowel and do appropriate resection
(2) Defunctioning stoma and then second stage resection and anastomosis
(3) Primary resection with anastomosis and on-table lavage thru appendiceal stump and sterilized anesthesia tubing +/– defunctioning stoma (not the conservative answer the examiners like!)
(4) Subtotal colectomy

Perforated Lesions→

(1) If perforated left colon CA→ hemicolectomy/Hartmann's procedure
(2) If perforated right colon CA→ right hemicolectomy with primary anastomosis
(3) If perforated cecum and obstructing left colon CA→
  (a) subtotal colecotmy with primary ileorectal anastomosis if stable
  (b) ileostomy, cecectomy, mucous fistula if unstable and then will need second stage to remove tumor

Liver lesions→ (1) can resect if less than 4 mets and can leave pt with adequate functional liver (~20%), need to excise with 1 cm margin

(2) Don't perform if pt has extrahepatic disease (peritoneal mets, positive lymph nodes, lung lesion)

Adjuvant Treatment

Positive lymph nodes (Stage III pts), invasion of other organs, or distal metastases → 5-FU and levamisole

T4 lesion→XRT to tumor bed to decrease local recurrence

Common Curveballs

Pt sent to you after polypectomy (what histology gets further surgery?)
Cancer will present as large bowel obstruction
Cancer will present as perforated diverticulitis (careful to check frozen section intra-op and do wide resection and if suspicion of cancer)
Cancer will be eroding into surrounding structures (bladder, kidney, duodenum)
Cancer will recur locally
Rising CEA in 1st year post-op
There will be peripheral lesion in the liver
Pt will have a AAA at time of initial exploration (treat life-threatening problem first...depends on size of AAA→ 8 cm AAA gets priority, near-obstructing colon lesion and 5 cm AAA→ colon lesion gets priority)
Pt will have IBD
Ureteral injury during dissection
Bleeding from spleen after mobilizing the splenic flexure
Duodenal/vena cava injury when mobilizing right colon
Synchronous lesions
Prior colon surgery
Recent MI
Unstable pt intra-op
Being asked about adjuvant treatment
Post-op anastomotic bleed, anastomotic leak, enterocutaneous fistula, or wound infection (could even be necrotizing—be wary for scenario change)
Asked to describe the Duke's stage of the cancer you are presented
Asked if you do your own colonoscopies (answer is YES!)

Strikeouts

Forgetting colonoscopy to rule out synchronous lesions
Not performing staging work-up pre-op
Not performing the correct surgical resection
Not performing en bloc resection when cancer has spread to adjacent organs
Talking about virtual colonoscopy
Forgetting bowel prep
Talking about cryoablation or RF ablation of liver lesions (while acceptable today for pts who aren't surgical candidates, best done in setting of clinical trials and certainly don't mention unless you have experience with this modality)

Doing liver resection (or major en bloc resection) when leaving extrahepatic (or other) disease behind

Talking about laparoscopic colon resection (while acceptable today given multiple randomized, prospective trials, unless you have fellowship training and the 20 precepted cases currently recommended under your belt, you won't likely be able to defend this position)

Colon and Small Bowel—Enterocutaneous Fistula

Pathophysiology

Remember FRIEND mnemonic . . . *f*oreign body, *r*adiation injury, *i*schemia/IBD, *e*pithelialized tract, *n*eoplasm, and *d*istal obstruction as causes for fistula. Important concepts surrounding enterocutaneous fistulae are controlling infection and drainage, maximizing nutrition/electrolytes, and ruling out distal obstruction/associated abscess.

Way Question May be Asked?

"43 y/o female status post an exploratory laparotomy with extensive enterolysis and adhesiolysis and repair of multiple enterotomies for persistent PSBO develops a fever to 100.8 and on exam has erythema and tenderness about the lower portion of her incision." The question typically is open ended with first a discussion about how to manage a post-op fever and then hones in on small bowel contents coming out of the incision the next day (*change scenario*).

How to Answer?

First, the basic approach to postoperative fever which must be systematic (remember 5Ws):

- Atelectasis
- UTI
- IV sites
- DVT/PE
- Wound infection
- Anastomotic leak
- Drug Fever
- Rare entities (parotitis, in sinusitis, decubitus ulcer; acalculous cholecystitis, C. diff, transfusion reaction, thyroid storm, Addisonian crisis)
- Symptoms of cough, abdominal pain, shortness of breath, pain at IV sites

Physical Exam

Close examination of wound for erythema, fluid, SQ air, tenderness, culture any drainage, take out staples early

Diagnostic Tests

- Labs, CXR, AXR, U/A C+S, BCx, (one from any invasive catheters) U/S-abdominal/ extremity, CT scan
- Start antibiotics if evidence of sepsis
- Once you have proved to them you understand how to work-up post-op fever, then the question will likely focus on management of the enterocutaneous fistula:
  - Drain fistula with sump drain: vacsponge and protect surrounding skin
  - Measure output of fistula (gives you information about likelihood of closure)
  - Place CVP and restore lytes and intravascular volume
  - NPO, TPN
  - H2 blockers
  - Somatostatin (+/– any real benefit)
  - Abx if associated cellulitis/sepsis
  - CT scan to r/o abscess and/or place percutaneous drain
  - Fistulogram after 7–10 days to r/o distal obstruction
- Based on fistulogram, one of two possibilities:
  - (1) No distal obstruction or intestinal discontinuation—most low output enterocutaneous fistulae will close within 6 weeks
  - (2) Distal obstruction or failure to close or high output fistula need operative repair involving taking down the fistula, bowel resection, and reanastomosis +/– G- or J-tube if suspected prolonged post-op ileus

Common Curveballs

- Pt has SQ emphysema on examination of the wound and whole focus now shifts to managing a necrotizing soft-tissue infection
- Pt has associated intraabdominal abscess that can't be percutaneously drained
- Complication after placing CVP line (make sure you check CXR)
- CT scan will show multiple fluid collections but no discrete abscess (always describe how you would order CT scan – "with IV/PO contrast")
- Trying to push you into earlier operation
- Skin breakdown at fistula site
- Same pt, but now with a history of Crohn's disease
- Another fistula after you reoperate and take down the first enterocutaneous fistula
- Discussion about TPN (1 gm/kg/day protein, 25 kcal/kg/day CHO) (25% glucose, 3–4% amino acids, 10% FFA want 50% of non-protein calories as glucose and 50% as FFA)

Strikeouts

- Failure to do standard fever work-up
- Operating too early for low-output fistula (give TPN chance to allow fistula to close)
- Failure to consider all possible causes (like distal obstruction) prior to re-operation
- Starting long discussion about use of fibrin glue to close fistula tract
- Failing to be methodical in care of fistula: resuscitation, controlling fistula, expectant management and supplemental nutrition/TPN
- Not being able to discuss basic TPN

Colon and Small Bowel—Hemorrhoids

Concept

Usually a presentation of pain or bleeding. Need to recognize the difference between internal and external hemorrhoids. Know the various stages. Treatment is always initially conservative.

Way Question May be Asked?

"25 y/o male presents to your office with the complaint of a thrombosed hemorrhoid. It occurred about four days ago and hurts whenever he sits down or has a bowel movement." May also present as rectal bleeding, acute thrombosis, or incontinence.

How to Answer?

Again, don't forget your basic H+P or it will turn out to be something other than hemorrhoids

History

- Constipation
- Pain
- Bleeding
- Topical therapy
- History rectal complaints
- Family history IBD
- Prolapse history
- Incontinence

Physical Exam

- Examine abdomen
- Rectal exam
- Anoscopy (with pt in left lateral decub position!)
- Rigid sigmoidoscopy
- May need to do exam under anesthesia
- Look for malignancy, fistula, other rectal pathology (careful for scenario switch)

How to Answer

- Stages of Internal hemorrhoids (above dentate line and therefore usually painless)
  - I Painless rectal bleeding
  - II Prolapse with defecation, spontaneously reduce
  - III Same as II, but reduction only manually
  - IV Unable to reduce
- External hemorrhoids are below the dentate line and hurt when become thrombosed

- Non-operative therapy (4–6 weeks)
  - Bulk agents
  - Increasing water intake (6–8 glasses/day)
  - Topical agents (Tucks, Anusol HC, or Analpram)
  - Sitz baths

Surgical Treatment

For acute thrombosis, bleeding thrombosis, thrombosis with superficial necrosis→ elliptical surgical excision under local anesthesia in your office

Stage I and II internal hemorrhoids→ rubber band ligation (make sure there is not significant external disease or any other benign anorectal disease)

- Banding of only one or two quadrants
- No banding if pt has any prostheses (heart valve, breast implant, pacemaker, joint replacement)

Stage III and IV and recurrent symptomatic external hemorrhoids treated with Ferguson closed hemorrhoidectomy (elliptical incision over each hemorrhoid down to sphincter and closure incorporating some of sphincter fibers to prevent prolapse)

Can also include lateral internal sphincterotomy

During operation:
- Make sure to inject perineum, submucosa, and pudendal nerves
- Tape buttocks apart
- Excise most symptomatic quadrant first
- Excise minimal anoderm (remember risk of stenosis)

Common Curveballs

- Anal carcinoma
- Rectal prolapse rather than prolapsing hemorrhoid
- Anal fissure
- Pt will have postoperative incontinence or anal stenosis
- Pt will have history of portal HTN or be on blood thinners
- Pt will be over age 40 (then need to r/o proximal disease with BE or colonoscopy before instituting therapy)
- Pt will develop postbanding bleeding or infection
- Pt will have internal prostheses and desire hemorrhoidal banding
- Pt will have inflammatory bowel disease (no hemorrhoidectomy!)
- Pt will be pregnant (manage nonoperatively)
- Post-op urinary retention/bleeding/infection/pelvic sepsis after closed hemorrhoidectomy

Strikeouts

- Operating on thrombosed hemorrhoid after 48 hr
- Operating on Stage I or II internal hemorrhoids
- Not trying local measures first
- Discussing new PPH therapy
- Not being able to deal with complications of the procedure you choose
- Operating on pt with IBD
- Not recognizing other anorectal pathology (cancer)

Colon and Small Bowel—Incarcerated Hernia

Concept

Multiple etiologies, but always remember the most common: hernias and adhesions. Don't forget the possibility of a malignancy, like an obstructing proximal colon cancer and an incompetent ileocecal valve. Important to decide in your own mind how long you will manage a small bowel obstruction non-operatively and what you will do intra-op with any compromised or nonviable small bowel.

Way Question May be Asked?

"63 y/o female evaluated in the ED for vomiting and abdominal distension. AXR reveal multiple air/fluid levels. What do you want to do?" Could be asked with a more subtle picture of SBO, or may jump right into a discussion of management decisions. Don't spend too much time on H+P if your examiner clearly doesn't want you to.

How to Answer?

History

Pain
Distension
Previous abdominal surgery
Nausea/vomiting

Physical Exam

Vital signs (dehydration, fever)
Full exam especially checking for hernias
Hyperactive bowel sounds
Peritoneal signs

Diagnostic Tests

Full labs (elevated WBC of peritonitis)
Abdominal x-rays (3 views, look at gas pattern)
CT scan (IV/PO contrast)
+/– SBFT in cases of PSBO that persist over 48 h

Surgical Treatment

(1) NGT/NPO/IVF (always!)
(2) Serial labs/examinations
(3) Volume resuscitation (remember significant third space losses into GI tract!)
(4) Peritoneal signs or suggestion of hernia strangulation→ OR
    (a) If OR for incarcerated hernia, can do through preperitoneal or traditional inguinal approach
    (b) If can't reduce incarcerated femoral hernia, divide inguinal ligament (if strangulated, control strangulated contents and make lower midline incision)
    (c) Make sure to control sac and open under direct vision
    (d) If contents of hernia drop into abdominal cavity, explore either through preperitoneal incision by opening peritoneum, or using laparoscope
    (e) Don't use mesh in situations where possible ischemia (contamination)
    (f) If hernia contents ischemic, try:
    warm packs over area and come back after hernia repaired
    if still ischemic, resect with primary anastomosis

Common Curveballs

Hernia will be incarcerated/strangulated
Strangulated hernia will reduce with induction general anesthesia
Will need to divide inguinal ligament to free femoral hernia
Will need to perform bowel resection
PSBO will fail non-operative management
Asked to describe inguinal anatomy

Won't be able to use mesh (know at least one non-mesh repair)
Pt will have sliding hernia
SBFT/CT scan won't identify point of obstruction
Pt will have malignancy
Might need to open sac/incision ring to reduce hernia

Clean Kills

Trying to perform laparoscopically (only if you have fellowship training in TAPPs and even then, this is a risky answer!)
Not placing NGT or volume resuscitating pt
Not dividing inguinal ligament to free incarcerated femoral hernia
Not performing bowel resection for obviously ischemic bowel
Not knowing how to describe any non-mesh hernia repairs
Getting into discussion of using absorbable mesh (Surgissis or Alloderm) in contaminated field with necrotic bowel
Not inspecting bowel that was incarcerated
Performing bowel resection through inguinal incision (some surgeons have successfully done this but not a safe board answer)

Colon and Small Bowel—Intestinal Angina

Concept

Chronic occlusion of two of the three main visceral arteries (celiac, SMA, IMA). Postprandial pain related to insufficient blood flow 15–60 minutes after meals.

Way Question May be Asked?

"69 y/o male with history of peripheral vascular disease presents with weight loss and postprandial abdominal pain." Don't expect a clear description of "food fear" or weight loss. Many patients actually develop eating habits to avoid the post-prandial pain including "small meal syndrome." Patient may even present with UGI dysmotility or ulcers.

How to Answer?

- Complete history including history of vascular diseases
- Complete physical exam including abdominal bruits
- Be sure to ask about questions that relate to abdominal malignancy

Diagnostic Tests

- Cardiac workup (on all vascular pts)
- Visceral duplex showing stenosis (high flow velocities) in celiac and SMA or reversal of flow in the hepatic artery
- Gold standard = angiogram with AP and lateral views
- Endovascular techniques an option for high risk pts

Be able to describe operative technique:

- Transabdominal approach through midline incision
- Antegrade bypass from distal thoracic aorta
- Bifurcated graft between the supraceliac aorta (approached through the gastrohepatic omentum and both the celiac and the SMA)
- Bifurcated 12 × 7 mm graft
- Left limb anastomosed to celiac trunk in end to side fashion with heel on celiac trunk and toe as onlay path onto common hepatic
- End to end bypass to SMA done below the body of the pancreas
- Aorta-SMA graft commonly placed behind the common hepatic artery
- Must divide crus of right diaphragm to expose supaceliac aorta
- Must divide Ligament of Trietz to expose SMA infrapancreatically
- Good communication with anesthesiologist before supraceliac clamping to permit adequate volume loading and unclamping for expected decrease in BP

A retrograde bypass is another option from a healthy infrarenal aorta and the SMA distal to its occluded segment

Could also place a straight graft from infrarenal aorta to the SMA distal to its area of occlusion

IMA reconstruction increases post-op morbidity

Follow pt with Duplex U/S prior to hospital discharge and closely post-op (every 6 months)

Common Curveballs

- Can't get a mesenteric duplex at your hospital
- Questions about surgical reconstruction of IMA
- Bowel injury and can't use artificial graft
- Pt will have other pathology on initial ex lap
- Pt has had prior abdominal surgery
- Pt has graft thrombosis post-op
- Pt has acute MI

In work-up for chronic mesenteric ischemia, pt develops acute mesenteric ischemia with bowel necrosis
Pt has post-op hepatic or renal failure secondary to supraceliac aortic cross clamp time (tolerance is typically less than 1 hr)

Strikeouts

Not ruling out malignancy in pt with abdominal pain and wt. loss
Not being able to describe operative technique
Not obtaining angiogram
Not performing appropriate pre-op workup/clearance in pt with obvious vascular disease

Colon and Small Bowel—Large Bowel Obstruction

Concept

Broad DDx but likely malignancy in older population. History can be helpful here. You will probably be pushed into an operation on someone with obstruction secondary to malignancy or diverticulitis related stricture or perhaps a patient that has even perforated secondary to their obstruction.

Way Question May be Asked?

"61 y/o male evaluated in emergency room with recent constipation and change in bowel habits, complaining of sudden onset of diffuse abdominal pain/distension and has free air on AXR. What would you do?" Be prepared to see an x-ray here.

How to Answer?

Have a DDx in Your Mind and Work Through

Obstructing cancer
Diverticular/ischemic stricture
Volvulus
Pseudo-obstruction (Ogilvie's)
Don't forget about hx of prior operations

Physical Exam

Examine abdomen
Rectal exam, heme occult test
Rigid sigmoidoscopy (unless true peritoneal signs, will have therapeutic value if volvulus)

Surgical Treatment

If no signs of peritonitis:
Gastrografin enema
CT scan abdomen
NGT/Foley/IVF/NPO/Serial exams
Try to convert to near-obstructing lesion and perform semi-electively after bowel prep

If signs of peritonitis or complete obstruction:
OR after initial evaluation and resuscitation (lines, IVF, Abx)
In OR:
(1) Right hemicolectomy for obstructing lesions of right and proximal transverse colon (can do primary anastomosis here)
(2) Left hemicolectomy/sigmoidectomy with colostomy and mucus fistula/Hartman's pouch for lesions obstructing distal transverse colon/left colon/or sigmoid
(3) Subtotal colectomy with primary anastomosis for obstructing lesion in left/sigmoid with perforation of cecum, useful in pts with metachroncous lesions found after previous resection for pts with synchronous cancers. Not good option in unstable pt given time involved
(4) Right hemicolectomy/ileostomy/mucus fistula for unstable pt with obstructing sigmoid/rectal lesion with perforation of cecum and gross contamination! Pt will then need work-up for malignancy and second operation to remove disease if survives (careful how close together you put stomas unless you want a situation where the appliance will never seal properly!)
(5) Defunctioning stoma (transverse loop colostomy) and then a later operation to remove obstructing tumor/mass in descending colon/sigmoid

Common Curveballs

- Signs of peritonitis
- Perforation of right colon with mass on left
- Rigid sigmoidoscopy won't find cause for obstruction
- Pt will be unstable intra-op
- Pt will have AAA
- Pt will develop post-op abscess or abdominal compartment syndrome
- Pt will develop ischemia at colostomy site
- Pt will become coagulopathic during operation
- Inability to pass rectal tube for volvulus or keep in place to give pt bowel prep
- Cecum will get over-distended in follow-up of pseudo-obstruction or will perforate
- Distal cancer will be fixed to pelvic structures
- Ureter/duodenal/liver injury while mobilizing right colon
- Splenic injury will mobilizing splenic flexure
- Hard peripheral liver lesion identified at time of emergency operation for peritonitis
- Pt will have had prior abdominal/colonic surgery
- Entering into a discussion of various stoma complications (stenosis, hernia, retraction, prolapse)

Strikeouts

- Doing anastomosis in face of frank contamination
- Not knowing how to contruct ileostomy/mucus fistula/Hartman pouch
- Talking about on-table bowel lavage
- Performing long operation in elderly/unstable pt
- Using *Barium* enema rather than water soluble contrast when concerned about cause of obstruction and possible perforation
- Discussing colonoscopically placed stents for malignant obstruction (an option, but risk of perforation high and don't mention unless really familiar with this modality)
- Waiting for CT scan on pt with peritonitis
- Discussing cecostomy tubes or IV neostigmine

Colon and Small Bowel—Lower GI Bleeding (LGIB)

Concept

Broad DDx but three common pathologies need to be ruled out: diverticulosis, angiodysplasia, and cancer. Likely to be self-limited in over 80% pts. AVM's likely to rebleed, but less likely in diverticular disease unless young age. ~10% pts will come to surgery.

Way Question May be Asked?

" 69 y/o female seen in the ED for dizziness after abruptly moving her bowels for a large amount of maroon colored stools. She is tachycardic to 110s, but her BP is stable. What do you want to do?" May be given a pt that is stable or unstable and make that determination in your mind early including if/when you plan to transfuse the pt. The scenario is likely to be pretty basic as the examiners want to get at your management algorithm and your indications for surgery.

How to Answer?

Have a DDx

- Diverticulosis (painless bleeding)
- Angiodysplasia (painless bleeding)
- Cancer
- Ischemia
- IBD
- Infectious
- Anorectal pathology
- Small bowel pathology (tumor, Meckel's diverticulum)
- Don't forget about brisk bleeding from UGI source

History

- Age (<30, consider IBD or Meckel's otherwise diverticulosis dx/AVM most common)
- Previous surgery (especially AAA)
- Medications/known coagulopathy (ASA, coumadin use)
- Prior bleeding episodes
- Trauma
- Radiation (ischemia)
- Pain with bleeding episode
- Amount of bleeding, color
- Dizziness or other evidence of shock

Physical Exam (brief and targeted in pt. with shock)

- Vital signs (r/o shock)
- Signs of liver disease
- Examine abdomen (prior scars)
- Rectal exam

Necessary Parts of Early Algorithm

- Placing NGT and getting bilious aspirate
- Anoscopy
- Rigid sigmoidoscopy (r/o rectal source)
- Assess stability of patient (never at fault for putting in ICU)

Diagnostic Tests

- Full laboratory panel including PT/PTT
- Bleeding time if pt on aspirin
- Tagged RBC Scan (detects bleeding > 0.5 cc/min)
- Angiography (detects bleeding > 2 cc/min and can be SMA injected first, then IMA followed by celiac trunk if first two negative therapeutic)
- Colonoscopy (useful after prep in those pts who don't require urgent operation)

Surgical Treatment

(1) Know when to go to OR:
   transfusion of > 4 U pRBC in 24 h
   LGIB that causes hypotension
   LGIB refractory to maximal medical therapy

Continuous bleeding and can't identify a source
(2) After tagged RBC scan
  (a) If +, proceed to OR if unstable, angiogram if stable
  (b) If −, can still repeat within 24 hr and can prep for colonoscopy
(3) After angiogram
  (a) If +, vasopressin 0.2 U/min to control bleeding, no embolization of colonic pathology!
  (b) If −, prep for colonoscopy
    SMA injected first, then IMA followed by celiac trunk if first two negative
(4) If can identify source
  (a) On right side, resection + primary anastomosis
  (b) On left side, resection with colostomy and mucous fistula/Hartmann's pouch
(5) If can't identify source
  (a) Subtotal colectomy with primary ileorectal anastomosis or ileostomy depending on pts stability
  (b) If see blood in mid-ileum or above, consider small bowel source prior to subtotal colectomy

Common Curveballs

Entire colon filled with blood on colonoscopy
Will be blood in terminal ileum
Colonic infarction after attempt at angiographic embolization of diverticular bleed
Will have to operate on pt before RBC scan or angiogram
Being asked when it is appropriate to perform:
  Tagged RBC scan
  Angiography
  Colonoscopy
  And the advantages/disadvantages of each
Pt will become unstable pre-op or intra-op
Pt will need several transfusions (what is your limit for going to OR?)
Won't be able to identify a source pre-op or intra-op
Ureter/duodenal/liver injury while mobilizing right colon
Splenic injury will mobilizing splenic flexure
Hard peripheral liver lesion identified at time of emergency operation
Pt will have had prior abdominal/colonic surgery
Pt will have had recent MI or severe cardiac disease
Pt will have UGI source (change scenario)
Pt will take aspirin/Plavix/coumadin
Pt will have bleeding from stoma after subtotal colectomy
Pt will be Jehovah's witness and won't accept blood transfusions

Strikeouts

Embolizing colonic lesion identified by arteriogram
Not placing NGT (failing to consider UGI source)
Not performing rigid sigmoidoscopy
Not ruling out/correcting coagulopathy (coumadin, ASA, liver disease)
Performing long operation in elderly/unstable pt
Not performing subtotal colectomy when can't identify source
Sending unstable pt for bleeding scan
Not considering angiogram or bleeding scan but proceeding straight to surgery
Performing segmental ulectomics (very high rebleed rate post-op)

Colon and Small Bowel—Perirectal Abscess

Concept

Constant pain in the rectal area. Arises from an infected anal gland. After drainage, about half will develop an anal fistula.

Way Question May be Asked?

"50 y/o male presents the ED with the complaint of hemorrhoids. It started about 3 days ago, and the patient complains of severe pain, constant, and low grade fever and chills."

How to Answer?

Targetel full H+P, as always

History

Constipation
Pain just with defecation (fissure) or constant (abscess)
Bleeding
Topical therapy
History rectal complaints (incontinence, etc.)
Family history IBD
Fever/Chills
Prior rectal surgery
HIV status
Trauma
Abd Pain

Physical Exam

Examine abdomen
Rectal exam (pt in left lateral decub position)
Anoscopy/Sigmoidoscopy not necessary
May need to do exam under anesthesia
Look for malignancy, fistula, or other rectal pathology (careful for scenario switch)

Data

Labs (elevated WBC)
CT scan of pelvis (may predict level of the abscess)

Types of Abscesses

I Perianal—abscess in SQ tissue adjacent to the anal verge
II Ischiorectal—the infection travels through the sphincters into the ischiorectal space, may be minimal external signs, usually fluctuance a few cm from anal verge
III Intersphincteric—fluctuance/tenderness on rectal exam, abscess between internal and external sphincters
IV Horseshoe—bilateral ischiorectal spaces involved and deep posterior anal space
V Supralevator—from upward extension of intersphincteric or ischiorectal abscess, or from downward extension of pelvic process (diverticulitis, appendicitis, Crohn's)

Surgical Treatment

Immediate incision and drainage
For I, II treatment is I + D under regional or general anesthesia
For III, treatment is drainage into the anal canal
For IV, drainage of deep postanal space by dividing overlying internal sphincter and lower portion of external sphincter and two counter incisions to drain ischiorectal extensions
For V, determine source first, if pelvic pathology, then external drainage of abscess, if rectal source, then drainage with mushroom catheter
Avoid fistulotomy at time of abscess drainage
Low threshold to return to OR if no improvement (especially in supralevator abscesses)

May need diverting colostomy for severe/recurrent supralevator abscess or in pt with IBD

If scenario continues to management of fistula, surgery is always the answer:

Make sure to r/o associated GI diseases (IBD, HIV)
Know pt's baseline continence prior to going to OR
Evaluate entire colon with BE or colonoscopy
Make need to inject H_2O_2 or methylene blue to identify fistula openings
Fistulotomy unless fistula involves > 30% sphincter fibers or is anterior fistula in a female
Must assess the level at which the fistula traverses the sphincters
Treat intestinal disease in IBD and this will often accompany resolution of perianal disease or use Seton as a drain
Liberal use of the Seton (a nonabsorbable suture or rubber band placed through the tract that stimulates scar formation, gradually cuts through the sphincter mechanism as tightened over next several weeks, and minimizes post-op incontinence)

Goodsall's Rule

when the external line lies anterior to the transverse anal line, the track runs in a direct radial line to the internal opening in the anal canal
when the external opening is posterior to the transverse anal line, the track curves backward to the posterior midline

Common Curveballs

Pt will have anal/rectal cancer
Pt will develop post-op anal fistula
Pt will have HIV or IBD
Pt will have postoperative incontinence
Pt will have history of portal HTN or be on blood thinners
Pt will have inflammatory bowel disease
Pt will be pregnant
Won't be able to perform rectal exam in office/ED (→ exam under anesthesia)
Pt will have severe abscess that doesn't improve despite drainage (may need diverting colostomy)

Strikeouts

Not recognizing scenario and mistaking for thrombosed hemorrhoid
Performing fistulotomy during first treatment of anal abscess
Admitting pt, placing on IV abx, and "waiting" for abscess to mature/reach the surface
Not recognizing associated GI diseases
Not ruling out pelvic pathology with supralevator abscess
Not making counter incisions with horseshoe abscess
Not knowing Goodsall's rule
Not knowing how/when to use a Seton

Colon and Small Bowel—Rectal Cancer

Concept

Prognosis worse than for colon cancer stage for stage. Preoperative therapy offered to most patients except those with disease limited to the mucosa. Examiners will likely want to know when you will perform LAR, APR, and transanal excision.

Way Question May be Asked?

"62 y/o female with a history of painless rectal bleeding presents to your office for evaluation and on digital rectal exam, has an ulcerated mass beginning at 5 cm that appears fixed. What do you want to do?" May also be presented with patient that has obstruction, pain, or bright red blood per rectum.

How to Answer?

History

- Risk factors
- Pain
- Change in bowel habits
- Rectal mass
- Previous colorectal surgery
- Continence status (don't want to do restorative resection in pt with high likelihood of post-op incontinence)

Physical Exam

- Digital rectal exam (is it fixed, where is the lesion from anal verge, size/circumference involved)
- Lymphadenopathy (FNA any groin nodes if enlarged)
- Rigid Sigmoidoscopy (mobility of tumor and height from anal verge)

Diagnostic Tests

- Full labs (especially LFTs, CEA)
- CXR (r/o mets)
- Colonoscopy (to evaluate rest of colon!)
- Endorectal U/S (depth of invasion and lymph node status)
- +/– CT scan (most would!)
- +/– Air contrast Barium Enema
- +/– MRI

Surgical Treatment

- Remember try to get 2 cm margins (most agree 0.5 cm at minimum)
- Always total mesorectal excision
- LAR easiest for lesions in upper third of rectum
- If trying for lesions > 5 cm from anal verge, use colonic J-pouch with coloanal anastomosis
- Use loop ileosotomy for any anastomosis constructed less than 5 cm from anal verge (reversed at 8–12 weeks after gastrografin enema demonstrates no leak)
- Involved organs (uterus, adnexa, posterior vaginal wall, bladder) removed en bloc
- APR should be strongly considered for all invasive rectal CA < 5 cm from anal verge (closure of pelvic peritoneum not necessary, consider posterior vaginectomy in women with anterior tumors, have pt marked by stomal therapist pre-op)
- Poor risk pts can be treated by radiation, and re-evaluation +/– fulgeration

Who gets Transrectal/Transanal Excision?

- (must be mobile, non-ulcerated lesion)
- < 3 cm in diameter
- T1 lesions (muscularis propria too deep!) within 8–10 cm of anal verge

Well to moderately differentiated tumor without ulceration
No lymphatic invasion on pathology
Less than 1/3 rectal circumference
Performed in prone-jackknife position and excise tumor with full thickness of rectal wall into perirectal fat with 1 cm circumferential margin (make sure to check path: r/o invasion of muscularis, lymphovascular invasion, or poorly differentiated tumor)
Orient carefully for pathologist

Who Gets Chemo/XRT? (5-FU and Levamisole)

Rectal CA beyond the mucosa (Stage B, C, D)
Try to give XRT pre-op to spare small bowel (tattoo pre-op as tumor may "melt" away
(If local excision comes back stage II depth of invasion, post-op XRT to primary site and pelvis)

Common Curveballs

Testing your indications for local resection
Testing your knowledge of pre-op adjuvant therapy
Post-op anastomotic leak
Post-op pelvic abscess
Being asked to describe surgical technique for an APR
Local excision will come back with final pathology Stage II depth of invasion
Pt will have had prior colon surgery
Pt will have IBD
Pt will have local recurrence (after local transanal excision → APR)
Positive margins after local transanal excision (re-excise!)
Injury to the ureter during LAR
Post-op sexual dysfunction
Presacral hemorrhage
Stomal complications with APR (stenosis, retraction, hernia, prolapse)
Invasion bladder/prostate/vagina

Strikeouts

Performing a local resection when not indicated
Treating anal cancer like rectal cancer
Not doing staging work-up pre-op
Not evaluating rest of the colon pre-op
Discussing transanal endoscopic microsurgery or endocavitary radiation
Attempting laparoscopically (current data support colon CA approached laparoscopically, but not rectal CA)

Colon and Small Bowel—RLQ Pain

Concept

Wide variety of pathologies can contribute to RLQ pain. Much can be gathered by H+P. Plan out a DDx in your head and ask appropriate questions. In OR, be prepared for what to do if the appendix is negative.

Way Question May be Asked?

"21 y/o female evaluated in the ED for RLQ pain. Her temperature is elevated and she has peritoneal signs. You explore the pt through a RLQ transverse incision and find a normal appendix. What do you want to do?" Will likely be placed in the position of taking patient to the OR and finding a normal appendix and asked what to do next.

How to Answer?

History

Character of pain
GI/GU symptoms
Previous surgery
Appetite
Menstrual history (if female)
FHx IBD

Physical Exam

Abdominal exam (tenderness, guarding, rebound, mass (pulsatile?))
Rectal exam
Pelvic exam (if female)—don't trust someone else's exam!
Look for hernia

Data

Full lab panel (including amylase and pregnancy test)
U/A
Abdominal series
EKG/CXR (depending on pt age)
CT scan (in equivocal cases)
U/S—transvaginal helpful in female to r/o gynecologic process

It would be acceptable if unsure to admit pt overnight for observation (no antipyretics or antibiotics!)

Surgical Treatment

(1) Appendicitis
Describe typical resection
If base necrotic, partial cecectomy
If abscess, CT guided drain followed by interval appendectomy
If comes back carcinoid, right hemicolectomy for→
carcinoid > 1.5 cm
located at base of appendix
serosal involvement
+ lymph nodes

(2) Ectopic pregnancy
Unruptured→salpingotomy, evacuate contents, repair
Ruptured→salpingectomy (preserve ovary)

(3) TOA→
Appendectomy (so no confusion in future)
Lavage, drain
Salpingo-oopherectomy if necrotic
Can treat with antibiotics (Ceftriaxone and Doxycycline) if only PID

(4) Meckel's
If negative appy, make sure to examine last 2 feet of terminal ileum
Wedge resection of diverticulum, may need segmental resection with primary anastomosis depending on inflammation
Always do appendectomy before closing!

If incidental finding, remove if pt < 18 years of age or a narrow neck to diverticulum

(5) Terminal ileitis
Do appendectomy if base of appendix is free of disease
Treat medically with Azulfidine, Prednisone, Flagyl
Surgery only for obstruction, bleeding, perforation, non-healing fistulas, failure of medical management

(6) Solid ovarian mass
(a) Postmenopausal—resect with full staging for ovarian cancer (washings, biopsies, omentectomy, para-aortic LN sampling, TAH/BSO)
(b) Premenopausal—washings, biopsies, frozen section after incisional biopsy, if malignant, unilateral salpingo-oophorectomy

(7) Cystic ovarian mass
(a) Postmenopausal—ovarian cancer staging procedure
(b) Premenopausal—treat as "6b" above if > 5 cm, otherwise follow with U/S and refer to Gyn for follow-up

Common Curveballs

Any one of a variety of diagnoses, none of which are appendicitis
Be prepared for scenario to switch right after you describe how to deal with one problem (after answering for Meckel's, expect an examiner to ask a question like "OK, what if the terminal ileum is inflamed?")
Changing scenarios is common here
Inflammatory mass RLQ and can't identify appendix
Other causes not listed above:
Giadiasis
Renal stone
Diverticulitis (right or left sided +/– abscess)
Leaking AAA (take to OR immediately)
Acute mesenteric ischemia
Incarcerated hernia
Testicular torsion/ovarian torsion
Ruptured ovarian cyst
Pt will be pregnant (appendix may not be in pelvic depending on trimester)
Pt will be HIV + (CMV enteritis, TB, lymphoma)
Mesenteric lymphadenitis
There will be no problem in RLQ except bile staining and mass in RUQ (perf duodenal ulcer!—changing scenario)

Strikeouts

Describing complicated laparoscopic procedures
Not looking for Meckel's or into pelvis when appendix normal
Not knowing what to do for Carcinoid or Crohn's disease
Fumbling with the change in scenarios (can happen anytime)
Forgetting pregnancy test in females of child-bearing age
Forgetting pelvic exam in females
Not doing rectal exam
Getting CT scan showing appendicitis and discussing admission, Abx, and interval appendectomy
Not having broad DDx

Colon and Small Bowel—Ulcerative Colitis

Concept

Inflammatory bowel disease of unknown etiology. Affects the mucosa of the rectum and colon. Doesn't have skip areas or full thickness involvement like Crohn's. Surgery performed for intractable disease or toxic megacolon.

Way Question May be Asked?

"25 y/o male presents to the ED with abdominal pain and bloody diarrhea. Physical exam reveals a temperature of 101, moderate abdominal tenderness, and moderate distension. What do you want to do?" Presentation will usually include some form of diarrhea, abdominal pain, and fever. Rarely arthritis, uveitis, and pyoderma. Make sure to differentiate the patient with ulcerative colitis flare from the patient with toxic megacolon!

How to Answer?

History

Family history
Systemic manifestations (arthritis, uveitis, and pyoderma)
Medications (steroids?)
Previous flares

Physical Exam

Vital signs (fever, sepsis)
Abdominal exam (peritonitis?)
Rectal exam (will always be involved in UC)

Diagnostic Tests

Full labs
Sigmoidoscopy
Abdominal series (colon dilatation, free air)
+/– CT scan
Stool for C.diff, O+P, enteric pathogens if unclear etiology

Surgical Treatment

(1) If suspect toxic megacolon
  (a) ICU/IVF/transfusion if necessary
  (b) Antibiotics
  (c) NGT/NPO/bowel rest
  (d) TPN
  (e) Steroids
  (f) Cyclosporine
  (g) Serial labs/x-rays/exams
  (h) Failure to improve within 48 h or worsening exam→OR for subtotal colectomy and Brooke ileostomy (can bring up mucous fistula to lower portion of wound and not open—will open in ~1/3 pts but less risky than rectal staple line leak)
  (i) In unstable pt, can perform *Turnbull* procedure→ diverting ileostomy and blowhole loop colostomy

(2) If responds to medical treatment, or less acute presentation
  (a) Barium enema to evaluate extent of disease
  (b) Colonoscopy and multiple biopsies to evaluate for dysplasia
  (c) UGI with SBFT (r/o Crohn's) if any doubt
  (d) Medical treatment with:
    azulfidine
    prednisone
    steroid enemas
    6-MP
    lomotil
    low residue diet

(e) Surgery for:
UC unresponsive to medical therapy (uncontrolled diarrhea, failure to thrive in children)
Dysplasia or cancer on colonoscopic biopsy
Severe extracolonic disease
(f) Surgical options (choice depends on severity of rectal involvement)
Total proctocolectomy with Brooke ileostomy (if severe)
Total colectomy, anorectal mucosectomy and ileorectal pull through anastomosis (use diverting ileostomy here)

Common Curveballs

Will present as massive bleeding
Will not respond to medical treatment
Pt will be unstable
There will be free perforation
Pt will have post-op intraabdominal abscess
Pt will have leak after ileoanal anastomosis
You'll be asked your medical regimen for the chronic form of the disease
Scenario will change from toxic megacolon to chronic form of UC
Asked differences between UC and Crohn's
Asked to describe extracolonic manifestations
Staple line on Hartmann's pouch will leak
Pt with perirectal abscess/fistula will have Crohn's disease—how will you manage?

Strikeouts

Not making the diagnosis of UC
Not ruling out infectious diarrhea or C. diff and taking out the entire colon prematurely
Not performing sigmoidoscopy
Not attempting to treat toxic megacolon with steroids, antibiotics, serial exams but going straight to OR
Not differentiating from Crohn's
Not knowing difference between UC and Crohn's

Endocrine—Carcinoid

Concept

Malignant neuroendocrine tumor. Usually asymptomatic unless outside of GI tract: bronchus, rectum, mets to liver so that hormones elaborated can bypass the portal system. Symptoms of flushing and diarrhea from excess blood serotonin level.

Way Question May be Asked?

"31 y/o male undergoes a laparoscopic appendectomy for acute appendicitis and the pathology comes back with a 2.1 cm carcinoid at the base of the appendix. What do you do?"

How to Answer?

Treatment depends on three factors:
(1) Size (2 cm is the key—some text say 1.5 cm)
(2) Site (appendix, rectum, duodenum)
(3) Pathology (depth of invasion)

Appendix—appendectomy okay unless
(1) More than 2 cm
(2) Involves base of the appendix
(3) Involves appendiceal fat
(4) Involves lymph nodes

Then right hemicolectomy is appropriate post-op treatment.

Rectum—local excision okay unless
(1) Greater than 2 cm
(2) Invasion of muscular coat
(3) Local recurrence
(4) Fix to surrounding tissue

Then, APR is appropriate post-op treatment.

Small bowel—wide local excision with mesenteric lymph nodes

Duodenum—treat like rectum with local excision unless tumor is > 2 cm, involves muscular coat, or cannot be adequately excised (Whipple resection then appropriate)

Debulking surgery appropriate with liver mets and lymph node involvement

Multiple wedge resections or lobectomy appropriate for liver mets
Selective embolization also a treatment for liver mets

For symptomatic carcinoid tumors, somatostatin is drug of choice.

Chemo streptozotocin in advanced cases with little help

Remember adequate pre-op work-up as right sided valvular fibrosis occurs in late disease
Measurement 5'HIAA in 24 h urine
Octreotide scan to localize neuroendocrine tumors

Carcinoid crisis may occur shortly after inducing anesthesia with:
Cardiac arrhythmias
Labile blood pressure
Generalized flushing
Treatment with octreotide

Multiple synchronous tumors in 1/3 pts so full ex lap

Many pts with small intestinal carcinoid present as SBO in pt without other risk factors

In carcinoid syndrome:
Flushing may be brought on by emotional stress or meals
Diarrhea unrelated to flushing

Common Curveballs

Carcinoid will be less than 2 cm but invade appendiceal fat

Pt will ask for other options besides right hemicolectomy for 1 cm carcinoid at appendiceal base
Pt will have carcinoid syndrome with carcinoid tumor you can't locate
Pt will present with episodic flushing and diarrhea
Pt will have liver metastases and may require lobectomy to fully debulk
Pt will have ampullary carcinoid requiring Whipple to fully excise
Pt will have carcinoid crisis intra-op
Pt will present with SBO secondary to tumor, path = small bowel carcinoid
Asked about use of medication to treat carcinoid syndrome

Strikeouts

Forgetting full physical exam—pt will have rectal carcinoid
Forgetting adequate pre-op w/u in pt with carcinoid syndrome—pt will have tricuspid or pulmonic valvular disease
Forgetting the characteristics that determine surgical treatment of carcinoid tumors
Failing to perform appropriate cancer operation with resection of accompanying mesentery/lymph nodes
Failing to perform full ex lap to r/o other carcinoid tumors in small bowel
Failing to recognize the carcinoid syndrome when present

Endocrine—Cushing's Syndrome

Concept

The majority of Cushing's syndrome cases are from an ACTH secreting tumor of the pituitary gland. Other possible etiologies include: ectopic ACTH producing tumor, adrenal adenoma, adrenal carcinoma, and bilateral adrenal hyperplasia. The treatment of choice is surgical resection.

Way Question May be Asked?

"28 y/o female referred to your office for generalized weakness, new onset diabetes and hypertension. On physical exam, she is obese and has a buffalo hump and moon facies. What do you want to do?" Might be given that the patient is referred to you with the diagnosis of Cushing's syndrome. Examiners will not want to waste time in the history and physical stage, for the most part—but still must know just in case. Most will want to get at your algorithm for managing the patient (this goes for most scenarios).

How to Answer?

History

Steroid use
History of cancer (ACTH producing tumor of lung)
Diabetes
Hypertension
Generalized weakness

Physical Exam

Buffalo hump
Truncal obesity
Striae
Moon facies

Diagnostic Tests

24 h urine for cortisol (most cost-effective test if incidenteloma)
Plasma cortisol level at 8 am and 8 pm (check for loss of diurnal variation)
ACTH level, two possibilities:
(1) If elevated→pt has pituitary tumor or ectopic ACTH producing tumor
(2) Low→ pt has adrenal pathology
Dexamethasone suppression test, two possibilities
(1) Suppress ACTH→ pituitary source
(2) Doesn't suppress ACTH→ ectopic cancer
Then obtain CT scan:
Of head for pituitary source
Of *chest/abdomen/pelvis* for ectopic cancer source
Of *abdomen* for adrenal source
Should see contralateral gland to be atrophied
Should not see bilateral enlargement
If > 5 cm, suspect adrenocortical carcinoma

Surgical Treatment

Posterior unilateral adrenalectomy unless suspect malignancy
For adrenocortical carcincoma, resection includes adrenal, kidney, and continuous structures (spleen, distal pancreas, diaphragm)
If metastatic disease present, debulk
Can use mitotane if metastatic disease or pt not a surgical candidate (adrenolytic agent destroys Zona Fasiculata)

Common Curveballs

Scenario will change with first presentation as pituitary tumor, then presentation as adrenal tumor
Will be malignant tumor

Addisonian crisis post-op
Being asked difference between Cushing's syndrome and Cushing's disease
There will be an ACTH or CRF secreting tumor (typically lung)
Pt won't be a surgical candidate
Will be given results of tests you order (24 h urine cortisol, plasma cortisol levels, ACTH levels, dexamethasone suppression test)
Being asked when to order the above tests
Will present as an incidenteloma
Describing surgical approach to adrenalectomy

Strikeouts

Not being able to diagnose location of tumor
Not knowing treatment for pituitary tumor
Not knowing treatment for adrenal tumor
Performing FNA on the adrenal tumor
Not recognizing the adrenal tumor for what it is and directing therapy towards a pituitary lesion
Discussing bilateal laparoscopic adrenalectomy

Endocrine—Hyperthyroidism

Concept

Multiple etiologies, surgery only for very specific indications. Important to now how to make diagnosis, the various treatment options, when to treat with surgery, and how to treat hyperthyroid crisis.

Way Question May be Asked?

"27 y/o female referred to your office by a family practitioner with the recent diagnosis of hyperthyroidism. What do you want to do?" May have symptoms of hyperthyroidism and you need to make diagnosis first: tachycardia, heat intolerance, weight loss, fatigue, palpitations.

How to Answer?

Always a complete H+P

History

Anxiety
Tremulousness
Weight loss
Sweating
Heat intolerance
Palpitations

Physical Exam

Neck nodules
Exophthalmoses

DDx

Grave's disease (most common)
Toxic Multi-nodular goiter
Hyperfunctioning adenoma
Malignancy
Subacute thyroiditis
Factitious thyrotoxicosis (exogenous T4)
Ovarian (struma ovarii thyroid tissue in ovarian teratoma), testicular, pituitary tumors (rarest)

Laboratory tests

TSH
Free T4
LATS level (Grave's disease!)
Thyroid antibody (thyroiditis)
Thyroid Scan (r/o "hot" nodule)
U/S neck (r/o mass)

Management

(1) Medication (not for pts with toxic nodules)
  (a) PTU or Tapazole—problem is compliance and complications of medications including agranulocytosis
  (b) Can use PTU in pregnant pt
(2) Radioactive iodine I 131
  (a) Good option in older pts
  (b) Single dose usually effective in Grave's disease and cause hypothyroidism in > 50% pts
  (c) Repeat doses possible
(3) Surgery
  (a) *Lobectomy* or subtotal thyroidectomy for toxic nodules
  (b) *Subtotal* thyroidectomy appropriate for:
    cosmesis
    pregnant pt in second trimester who fails PTU
    failure of medical treatment after 1–2 years
    compressive symptoms
    hyperthyroidism in children
    young women who want to become pregnant

thyrocardiac pts
pts with severe exophthalmos

(c) Need to prepare pt for surgery:
PTU until surgery
Beta blockers prn (if use, continue in post-op period!)
Lugol's solution (iodine) 2cc BID starting 10–14 days prior to surgery to decrease vascularity of thyroid gland
Continue beta blocker post-op for 8–10 days (t 1/2 of hormone)

(d) Thyroxin for life post-op (can't tell true thyroid status until 1–2 years post-op

Thyroid Storm—Life-Threatening

Initiated by physiologic stresses (surgery, anesthesia, MI, infection, childbirth)
Presentation of: fever, tachycardia, abdominal symptoms, change mental status
Mortality ~10%
Treatment:
IVF
Sedatives
O_2
Cooling blankets
PTU 250 mg q 4 h
Hydrocortisone 100 q 6 h
Beta blockers (may need IV inderal for control cardiac arrhythmias)
May need intubation
Treat precipitating cause!

Common Curveballs

There will be a hot nodule
Will have post-op complication of:
Laryngeal nerve injury
Hematoma
Hypothyroidism, hypoparathyroidism
Injury to external branch of superior laryngeal nerve
Recurrent hyperthyroidism
Pt will be pregnant
Pt will fail medical therapy
Asked to describe subtotal thryoidectomy (leave 3–5 gm tissue behind)
Ask how to prepare pt prior to surgery
Pt will have nodule that will be a malignancy (changing scenarios) on U/S, FNA, or final pathology
Pt will develop thyroid storm

Strikeouts

Not making correct diagnosis
Not knowing how to treat hyperthyroidism
Not knowing indications for surgery
Not knowing how to treat/recognize thyroid storm
Not ruling out adenoma/malignancy
Not checking LATS/thyroid U/S, T4/TSH
Not being comfortable with discussion of complications of thyroidectomy
Not knowing when to do partial v. total thyroidectomy

Endocrine—Insulinoma

Concept

Tumor in the pancreas that releases insulin. Association with MEN I syndrome (pituitary, pancreas, parathyroid) so be sure to ask about family history. Usually less than 2 cm in size, if > 3 cm, be suspicious of malignancy. Management depends on tumor location, number of tumors, malignancy, and part of MEN syndrome (hyperparathyroidism, pituitary/pancreatic tumors). Need to r/o other causes for hypoglycemia like liver disorder (cirrhosis, Gaucher's dx), pregnancy, and exogenous administration.

Way Question May be Asked?

"37 y/o female presents with a history of repeated bouts of weakness and fatigue after meals, with a fasting glucose level of 40." There are several ways the question can go, but, after ruling out liver disorder, and alcoholism (quickly), start focusing on insulinoma. Rarely will get classic Whipple's triad:

symptoms with fasting
blood glucose < 60 at time of symptoms
symptoms relieved with glucose administration

How to Answer?

Will need to perform complete H&P

History

Syncope
Blurred vision
Sweating → brought on by fasting or exercise
Palpitations
Weakness
Seizures
Confusion
Wt. gain

Be sure to ask about family history for MEN 1
Early pregnancy could be mistaken for this syndrome

Laboratory Studies

Need to have a *fasting glucose* level (should be less than 60)
Need to check *fasting insulin* level (should be greater than 24)
Check *insulin to glucose* ratio (should be > 0.3)
Check *C-terminal peptide* level to rule out exogenous insulin administration (will be elevated only with endogenous insulin) may see needle marks on arms/legs
Could also check *proinsulin* level
Will need to try to localize insulinoma (80% in pancreas, may be multiple if familial variety, only 10% malignant)

Localization studies (don't stop after CT scan!):
(1) CT scan abd/pelvis with thin cuts through pancreas
(2) Arteriogram
(3) Portosplenic vein sampling (be prepared for results of this test!)
(4) Endoscopic U/S
(5) MRI

Even if can't localize (usually *won't* be able to), you start the pt on Diazoxide and prepare pt for surgery (be sure okay surgical candidate)

Surgical Treatment

In OR, you need to fully examine pancreas by division gastrohepatic ligament, Kocher maneuver, medial reflection of spleen, and divide the peritoneum on superior and inferior borders of pancreas.

If perform enucleation, dose of secretin intra-op to check for leak, place omental flap, and leave a drain. Don't try to close defect created by "bovie down" to lesion.

Then you will be in one of the following situations:

(1) You find tumor in the head of pancreas→enucleation distal pancreas→distal pancreatectomy
(2) You find tumor in pancreas with mets→ debulking surgery, and use somatostatin, diazoxide, and streptozotocin post-op
(3) You can't find tumor→ intra-op U/S, rapid venous assays
    (a) If still can't find, try to send to outside facility for rapid venous assays to detect drop in insulin level
    (b) If examiner won't let you do→do distal pancreatectomy and send for frozen section and glucose/insulin measurement
    (c) Don't do near total pancreatectomy unless an endocrine expert
(4) MEN 1→ subtotal pancreatectomy because of high incidence of islet cell hyperplasia

Pt may have mild hyperglycemia for 2–3 days post-op.

Common Curveballs

Won't be able to localize pre-op
Won't be able to localize intra-op (consider intra-op U/S)
Won't have facilities to do rapid venous sampling
Will find a mass and FNA will be a malignant adenocarcinoma
Will be multiple tumors
Will see pancreatic duct leak after enucleation
Will be exogenous administration if don't check C-terminal peptide/proinsulin level
Will be part of MEN syndrome
Will be malignant tumor or borderline tumor on final path
Can't enucleate because deep in head/tail of pancreas (if you do, there will be damage to pancreatic duct
Will get into massive hemorrhage during enucleation
Will do distal pancreatectomy and pt still symptomatic. Examiner will ask you if you regret your decision (stick to your guns if you know you gave the right answer—examiner most likely trying to get at how confident a surgeon you are)

Strikeouts

Whipple procedure for tumor near surface (appropriate if deep in pancreatic head)
Stopping after CT scan and proceeding straight to OR
Failing to ask about family history suspicious for MEN (pituitary, pancreas, parathyroid problems)
Failing to rule out exogenous insulin administration
Performing too radical a surgery before exhaustive work-up including venous sampling and possible referral to center specializing in the disease (always better to refer pt to tertiary care center than doing blind near total pancreatectomy)
Not mentioning controlling symptoms pre-op with small, frequent meals or diazoxide pre-op (suppresses insulin secretion with side effect of fluid retention and nausea)
Failing to rule out liver disease
Failing to recognize insulin-producing tumor in pt with hypoglycemic symptoms reversible with sugar intake
Not knowing Whipple's triad
Performing pancreatic resection when tumor near surface rather than enucleation
Will be pancreatic duct leak after enucleation
    It's better to say "I don't perform this procedure, but the key steps are..." than to describe a procedure you don't do and then get trapped answering questions about technical steps in the procedure.
Describing the exploration and enucleation to be done laparoscopically
Mistaking surgery for gastrinoma for insulinoma and opening up duodenum and palpating for tumor

Endocrine—Pheochromocytoma

Concept

Tumor of adrenal medulla producing excess catecholamines. 10% extraadrenal, pediatric, malignant, bilateral, familial (MEN2a or 2b).

Way Question May be Asked?

"24 y/o female sent to you for evaluation of her frequent headaches, palpitations, and BP of 190/110. What do you want to do?" May be given a history including flushing, sweating, episodic attacks, or young patient with new onset hypertension.

How to Answer?

History

Frequent "attacks"
Anxiety
Sweating/flushing
Headaches
Palpitations
Family history (MENIIa—hyperparathyroid, pheo, medullary thyroid CA)
Other neuroectodermal diseases (von Hippel-Lindau, tuberous sclerosis, neurofibromatosis)

Physical Exam

Blood pressure
Gentle abdominal exam (don't want to compress organ of Zuckerkandl)
Palpate thyroid

Data

24 h urine for VMA, metanephrine, normetanephrine (make sure not on MAO inhibitor)
Ca^{++} and calcitonin levels (r/o MENIIa)

Localization Studies

(1) CT scan abd/pelvis
    Look at adrenals
    Look for extraadrenal tumors
    Look for metastases
(2) I-131 MIBG scan
(3) Portosplenic vein sampling (be prepared for results of this test or to describe how it's done!)
(4) MRI

Surgical Treatment

Need to adequately prepare pt preoperatively
(1) Start alpha blocker two weeks prior to surgery, phenoxybenzamine 20 mg bid and increase by 20 mg/day until BP and symptoms controlled
(2) Add Beta blocker 3 days prior to surgery, inderal 10 mg tid
(3) IVF hydration starting 2 days prior to surgery (typically pts are volume contracted)

In OR, have rapid acting agents ready:
Neosynephrine
Lidocaine
Propranolol
Phentolamine (alpha-blocker)

Have CVP (or SGC) and A-line

Do not use MSO_4/Demerol (stimulates catechol release), or atropine (increases tachycardia)

Be prepared to describe right and left adrenalectomy and anatomy of adrenal vein on both sides!

Surgery

Midline incision
Full exploration of both adrenal glands, aortic bifurcation, bladder, kidney hilum
Control venous drainage first!
Excise tumor with minimal manipulation

Debulk malignant tumors to help reduce symptoms
Bilateral adrenalectomy for bilateral disease, MENII

After tumor resected, give 1 mg glucagons to check for occult tumor (tachycardia/inc. BP signs of residual tumor).

Follow-Up

Urinary studies every 3 months, then yearly
Screen all family members yearly for pheo, medullary thyroid cancer, hyperparathyroidism

Common Curveballs

Won't be able to localize pre-op
Won't be able to localize intra-op (consider intra-op U/S)
Won't have facilities to do rapid venous sampling
Will be multiple tumors
Will be malignant tumor
Will have recurrent symptoms post-op
Will be part of MENII syndrome (which operation is performed first?)
Pt will have fluctuations of BP and HR intra-op

Strikeouts

Failing to ask about family history
Not knowing pre-op work-up or pre-op preparation of pt
Describing laparoscopic operation in pt with evidence of metastases, prior operations, or large tumor (> 8 cm)
Not ligating adrenal vein early in your description of operation
Not placing invasive hemodynamic devices intra-op
Not screening relatives (for RET proto-oncogene) if suspect MENII syndrome

Endocrine—Primary Aldosteronism

Concept

Either unilateral adenoma (85%) or bilateral adrenal hyperplasia (15%) resulting in elevated aldosterone levels, hypertension, and hypokalemia.

Way Question May be Asked?

"32 y/o female with two year history of hypertension, unresponsive to medical treatment." May also have fatigue, muscle cramps, polyuria, weight gain, peripheral edema (often rings on the fingers not fitting is first thing patient notices).

How to Answer?

Have to think about surgically correctable forms of hypertension in young patient with new onset HTN (coarctation, renal artery stenosis, Cushing's, pheo)

Complete History and Physical Exam

Questions to rule out pheo
Family history (if suspicious of pheo)
Make sure pt not taking any medications (especially diuretics—will throw off lab values)

Diagnostic Tests

Check for low potassium
Check aldosterone/renin ratio (should be > 400 or primary hyperaldosteronism)
If renin is high, suspect other etiology (renal artery stenosis)

To differentiate bilateral hyperplasia for adenoma, use *Captopril test*
(1) Give dose of captopril and measure aldosterone level before and after, if decreases, then bilateral hyperplasia

Always try to localize tumor (these are typically small):
(1) CT scan abd/pelvis
(2) Selective venous sampling (especially if CT negative)
(3) NP-59 Iodocholesterol scan (helps rule out hyperplasia too)

Surgical Treatment

If bilateral hyperplasia, treatment is medical with Spironolactone (effective in 90% cases)
If single adenoma, unilateral adrenalectomy is indicated. This could be
(1) A posterior approach through the 12th rib on right or 11th on left
(2) Through midline laparotomy
(3) Laparoscopic
Describe whatever approach you are comfortable with, but remember
(1) On right, the adrenal vein enters posteriorly into the IVC and mobilization of the right lobe of the liver is necessary if going transabdominal
(2) On left, mobilization of the colon, and pancreas +/− spleen may be required and adrenal vein empties into renal vein
(3) Only the venous drainage is consistent in adrenal anatomy

Careful of post-op hypotension→may need to use steroids

Common Curveballs

Pt will have b/l hyperplasia if you don't rule it out
Pt will have no tumor by CT scan so know other localizing studies
Pt will have renal artery stenosis or fibromuscular dysplasia if you don't check renin levels
Pt will have post-op hypotension (from adrenal insufficiency)
Will injure spleen when mobilizing colon for left adrenalectomy
Will injure IVC doing right adrenalectomy

Strikeouts

Not checking potassium, aldosterone, renin levels
Not being able to describe surgical approach (no matter what question, this brings you back next year—and if you can't describe, don't make it up)
Not ruling out other forms of surgically correctable HTN
Not knowing medical treatment for b/l hyperplasia and performing bilateral adrenalectomies
Not knowing how to treat post-op hypotension and doing extensive work-up for hemorrhagic/hypovolemic/cardiogenic shock
Misdiagnosing pt as a pheochromocytoma
Not knowing mechanism of action of aldosterone or renin-angiotensin-aldosterone axis
Not knowing that syndrome is called "Conn's Syndrome"

Endocrine—Neck Mass

Concept

Usually benign in practice, but a neck mass won't be benign during the exam. Differential diagnosis should be complete and your H+P should guide you towards the underlying process. "Rule of 80s" after age 40:

- 80% non-thyroid neck masses in adults are neoplastic
- 80% of neoplastic masses are malignant
- 80% of malignant masses are metastatic
- 80% malignancies in adults are squamous cell carcinomas
- 80% of metastatic are from primaries above level of clavicle

Be wary of a neck mass in an infant, in the midline, or in an HIV+ patient (lymphoma).

Way Question May be Asked?

"43 y/o male presents to the office with a mass in his left neck. It is non-tender and has been there for about 3 months. He has a significant smoking history. What do you want to do?" You will likely have to ask some more questions on your H+P regardless of the way the scenario is given to you. Look for clues as to where the mass is (may be given "left anterior neck") and the age/sex of the patient to help guide you.

How to Answer?

History

- Age (very important here)
- Location (again, very important)
- Duration
- Drainage (brachial cyst?)
- Pain
- Tobacco/Alcohol use
- Hoarseness
- Dysphagia
- History (HIV+, prior malignancy)
- Systemic symptoms ("B symptoms" with lymphoma?)
- Previous head/neck surgery (suspicious mole/melanoma removed? Was it overlying parotid gland?)

Physical Exam

- Location
- Tenderness
- Fixed/Mobile
- Movement with swallowing
- Pulsatile (caratoid body tumor)
- Sinus (cyst)
- Nasopharynx
- Oral Cavity
- Larynx
- Neck (thyroid)
- Other lymph node basins (axillae, groin)
- Skin
- Breast
- Abdomen (palpable liver/spleen)
- Stool guiac (maybe metastatic)

Diagnostic Tests

- FNA (critical here and helpful in neck masses)
- CXR (lung or mediastinal pathology)
- CT Scan of the face/neck (sinuses/oral cavity/nasopharynx/larynx)
- +/– MRI
- +/– U/S of neck (useful to evaluate thyroid/parathyroid)
- +/– Thyroid scan (again, useful to evaluate thyroid/parathyroid)
- Blood tests (as always, complete labs, CBC with differential, in select cases, calcitonin/calcium levels, thyroid hormones, and examination of blood smear)

Differential Diagnosis

Midline
- Thyroglossal duct cyst
- Dermoid cysts
- Pyramidal lobe of thyroid

Lateral
- Lymph node—infected vs. metastatic
- Brachial cleft cyst

Supraclavicular
- Lymph node—infected vs. metastatic

Submandibular/Preauricular mass
- Lymph node
- Parotid gland
- Salivary gland

Don't forget inflammatory etiologies:
- Lymphadenitis
- Tuberculosis
- Tularemia
- Cat scratch
- Toxoplasmosis
- Sarcoidosis
- Viral

Treatment

Thyroglossal duct cyst
- U/S neck to confirm presence of normal thyroid
- Excision with middle portion of hyoid bone and follow any tissue to base of tongue (Sistrunk procedure)

Brachial cleft cyst—always surgical excision, be careful of anatomic pathway!
- First Brachial Cleft
  - Opening at angle of mandible, passes through facial nerve
- Second (*most common*)
  - Opening anterior border of SCM, passes between carotid bifurcation
- Third
  - Opening at lower border of SCM, passes behind carotid

Lymph node = squamous cell carcinoma
- NPL in your office
- Excisional biopsy under anesthesia + exam under anesthesia with:
  - Panendoscopy of upper aerodigestive tract:
    - Direct laryngoscopy
    - Rigid esophagoscopy
    - Rigid bronchoscopy
  - Biopsies of nasopharynx, base of tongue, pyriform sinus
- Excision of primary site (if found) and modified radical neck dissection

Lymph node = adenocarcinoma
- CT scan of neck/chest/abdomen/pelvis
- Bilateral mammograms
- EGD
- BE/Colonoscopy
- If primary found, this represents Stage 4 disease and chemotherapy may be offered
- If no primary found, excisional biopsy + modified radical neck dissection on that side
- Send for ER/PR receptors and mucin stain (r/o breast melanoma/lymphoma)

Lymph node = thyroid
- Thyroid U/S
- Thyroid Scan
- Total thyroidectomy +
  - Enlarged nodes for papillary CA
  - Central lymph node dissection and Modified radical for medullary

Lymph node = lymphoma
- Excisional biopsy of node
- CT scan neck/chest/abdomen/pelvis
- Bone marrow biopsy (Stage IV disease)
- Stage disease (number of nodal groups/which side of diaphragm)
- Staging laparotomy?
- Chemotherapy (CHOP)

Post-op XRT should be considered to neck after radical neck dissection

Important anatomy to remember
- Anterior triangle boundaries
  - Lateral = SCM
  - Medial = midline of neck
  - Superior = inferior edge of mandible
- Posterior triangle boundaries
  - Inferior = clavicle
  - Anterior = SCM
  - Posterior = trapezius

Steps in radical neck dissection:
- T-incision
- Locate and protect mandibular and cervical branches of facial nerves
- Divide anterior facial vessels
- Remove contents of submental and submandibular triangles
- Ligate external jugular vein close to subclavian
- Protect spinal accessory, phrenic, brachial plexus while removing fat/lymphatic tissue in posterior triangle
- Low division of omohyoid behind SCM
- Division of SCM
- Open carotid sheath and ligate IJ close to clavicle
- Ligate submaxillary duct

In modified radical neck dissection, the following are preserved:

Spinal accessory nerve
Internal jugular vein
SCM

Common Curveballs

Metastatic thyroid cancer
FNA will be indeterminate
Scenario will switch several times from squamous cell carcinoma to adenocarcinoma to lymphoma
Melanoma overlying parotid gland (modified radical neck + superficial parotidectomy)
Won't be able to identify primary site
Will find primary site and be asked how to perform resection
Seroma under skin flap
Chylous fistula post-op in left neck dissection
Carotid artery blowout post-op
Damage to any nerve (phrenic, spinal accessory, vagus, hypoglossal)

Strikeouts

Not knowing the different algorithms between FNA yielding squamous cell carcinoma vs. lymphoma vs. adenocarcinoma
Not having a broad DDx
Not performing FNA
Not knowing surgery for:
Thyroglossal duct cyst
Most common branchial cleft cyst
Not being able to describe modified neck dissection or difference from complete radical

Endocrine—Hyperparathyroidism

Concept

One of many possible causes of hypercalcemia. Must rule out common causes of hypercalcemia first, then remember primary, secondary, and tertiary types of hyperparathyroidism.

(1) *Primary* hyperparathyroidism, about 80% adenoma; about 2% double adenoma
(2) *Secondary* hyperparathyroidism from hyperplasia often secondary to renal failure
(3) *Tertiary* hyperparathyroidism from autonomous functioning glands after etiology causing secondary hyperparathyroidism has been treated (most common in renal transplant patients)

Way Question May be Asked?

"61 y/o female with an elevated calcium level on routine blood tests with her only complaint of fatigue. What do you want to do?" Sometimes you will be given more information like renal stones, or abdominal pain, constipation, arthralgia, myalgia, depression, ulcers, pancreatitis, osteitis fibrosa cystica, but rarely all of the symptoms associated with elevated calcium (renal stones, bone pain, constipation, fatigue, ulcer, depression, emotional lability).

How to Answer?

First, need to be able to rule out common causes of hypercalcemia. Many mnemonics here, but all include: malignancy (breast, lung, prostate, multiple myeloma), primary and secondary hyperparathyroidism, sarcoidosis, thiazides, immobilization, familial hypocalciuric hypercalcemia, milk-alkali syndrome, and hyperthyroidism.

Second, to document hyperparathyroidism, need to confirm hypercalcemia on repeat blood tests, then:

(1) Check Cl/PO_4 level (greater than 30 suggestive of 1° HP)
(2) Get PTH level
(3) Low PO_4 (high in renal failure)
(4) +/– x-ray of hands to look for cystic/resorptive changes
(5) 24 h urinary calcium for rare *hypercalcemic hypocalciuria*

Third, localization studies:

(1) CT scan or MRI of neck to mediastinum
(2) Thallium-technetium scan
(3) Ultrasound
(4) Sestamibi scan
(5) Invasive studies like arteriography and selective venous sampling for recurrences
(6) Many believe best localization study is experienced parathyroid surgeon (but don't go there on Oral Exam unless you are one!)

Indications for surgery are two-fold: symptomatic hypercalcemia, or

calcium > 11 with signs of bone disease

Procedure

(1) If single adenoma, excise the adenoma, be careful not to rupture capsule, and biopsy 1–2 other glands to confirm they are normal
(2) If hyperplasia, total parathyroidectomy with autotransplantation in to forearm
(3) If parathyroid Ca (very high pre-op Ca levels), en bloc resection with thyroid lobe on that side and regional lymph nodes
(4) Gold standard is to explore all 4 glands (most traditional answer)
    (a) If not going to do this, may mention intraoperative PTH level
    (b) Even 4 normal glands are found, continue neck exploration for rare presence of 5 or 6 glands

(5) Consider cryopreservation in borderline cases especially if find only 3 hyperplastic glands
   (a) You missed a gland—normal or abnormal
   (b) Patient has only 3 glands

If you cannot find a gland:
(1) If upper gland, check paraesophageal, retrolaryngeal spaces, posterior mediastinum, and do thyroid lobectomy on that side
(2) If lower gland, check tracheoesophageal groove, carotid sheath, thymus, thyroid, anterior mediastinum
(3) If you still can't find gland, *don't* do sternotomy first time around, but follow post-op Ca/PTH levels

Common Curveballs

Post-op has persistently elevated calcium/or comes back six months later with elevated calcium→ be methodical with complete work-up including calcium, phosphorus, and PTH levels; MRI, sestamibi, U/S; one of four choices:
   (1) Missed adenoma (most likely)—could be a 5th gland, in mediastinum, or on same side
   (2) Missed hyperplasia
   (3) Parathyroid carcinoma
   (4) Parathyromosis
Can't find 4 glands
There will be more than 4 glands
Asked when you would consider cryopreservation of any of the glands
Part of a MEN syndrome
Post-op hypocalcemia
Post-op airway compromise
Post-op hoarseness
Pt sent to you after previously failed neck exploration elsewhere
Asked to comment on why four-gland exploration better than exploration on just one side (justify whatever position you offer)
Pt may originally present very subtly with only fatigue or renal stones
Will be asked an innocent question like "How does PTH work?"(→increase bone resorption, increases renal resorption of Ca and renal secretion of phos, and stimulates Vit D formation)
Management of hypercalcemic crisis (treat with IVF, lasix, steroids, calcitonin)
Parathyroid carcinoma

Strikeouts

Failing to rule out MEN syndrome
Failing to rule out common causes of hypercalcemia
Performing median sternotomy first time operation when find only 3 glands
Finding a single adenoma and stopping operation
Going into long discussion about radioguided surgery for minimally invasive parathyroidectomy (very dangerous on the exam to describe any cutting edge surgeries/technologies)
Not knowing how to deal with post-op persistent hypercalcemia
Not knowing how PTH works
Not knowing indications for surgery
Not knowing percentage for finding single adenoma (80%)
Not knowing how to deal with post-op complications
Not knowing where to look for "missing" upper or lower gland

Endocrine—Thyroid Nodule

Concept

May be "hot" nodule, benign adenoma, malignancy, or other neck mass (parathyroid, lymph node)

Way Question May be Asked?

"31 y/o female seen by PMD recently for a sore throat was noted to have a mass in the left side of her thyroid. What do you want to do?" Could be presented with the mass found by a family MD and sent to you, could be given symptoms of hyperthyroidism. After your initial H + P, all patients get U/S *and* FNA.

How to Answer?

Complete H+P
Questions related to hyper or hypothyroidism
- Tachycardia
- Heat intolerance
- Wt loss/gain
- Fatigue
- Depression
- Cold intolerance
- History of radiation to neck (breast/Hodgkin's)
- History of new hoarseness/changes in voice
- Any possibility of MEN syndrome (ask of pheochromocytoma and hypercalcemia—about 10% medullary's associated with MEN)
- Family history: goiter, MENII, thyroid cancer
- Diarrhea (medullary)

Physical Exam

- Attention to description of the mass
- Cervical lymph nodes
- Examination of vocal cords if new onset hoarseness
- Reflexes, pulse, BP (hyperthyroidism)

Diagnostic Tests

- FNA—simple to perform in 1st office visit
- U/S—helps look for other nodules, determine solid vs. cystic
- Thyroid scan (cold vs. hot nodule)
- Blood tests: T4, TSH, thyroglobulin level (for f/u), thyroid antibodies, calcitonin and Ca^{++} level (if suspect medullary CA)
- Be ready for Ca^{++} to be elevated (change of scenario)
- If suspect pheo, get calcitonin, serum calcium, phosphate, urine studies for pheo, RET testing

Results of FNA

(1) Clear fluid, nodule disappears (observe and send fluid to pathology—surgery if large number of follicular particles)
(2) Clear fluid, nodule doesn't disappear or recurs more than twice→surgery)
(3) Bloody fluid—fluid to pathology but pt goes to OR!
(4) Solid
  (a) Clearly benign—thyroxin suppression for small 1 cm nodule non-toxic goiter, OR if nodule persists or enlarges over next 6 months
  (b) Suspicious—follicular cells→ to OR
  (c) Malignant—usually papillary as can can't differentiate malignant follicular neoplasm except with final pathology showing capsular invasion

Surgical Treatment

Papillary CA
- Young pt and tumor less than 2 cm→ lobectomy

All others get total thyroidectomy and removal of any obvious enlarged nodes This allows easy follow-up with radioactive iodine, thyroid scans and thyroglobulin levels

Follicular CA
Total thyroidectomy and sample any obvious nodes

Medullary
Total thyroidectomy +
Central lymph node dissection (from larynx to suprasternal notch) and modified RND on side of palpable mass (if MEN, resect pheo first!)

Anaplastic
Total thyroidectomy, if possible, if not, split gland to relieve any tracheal compression
Usually rapidly fatal
Chemo/XRT

Know how to describe partial and total thyroidectomy and know your position on intra-op pathology consults of follicular adenoma (controversial)

Post-op
All pts get placed on Synthroid (enough to make TSH barely measurable)
Follow thyroglobulin levels (marker for recurrence)
Stop thyroxin for 2 weeks six weeks post-op and do total body radioactive I^{131} scan to detect any residual tumor for ablation
Repeat radioiodine scan q 6 months for next few years
Medullary Ca is followed by calcitonin levels and DMSA scan (nuclear medicine)

Common Curveballs

Be prepared for airway compromise post-op
Be prepared for vocal cord paralysis post-op
Asked about possible nerve injuries (recurrent laryngeal and sup. laryngeal) and their consequences
Be prepared for hypocalcemia post-op
Part of a MEN syndrome
Follicular cells on FNA
Justifying your reasoning for total thyroidectomy
Will be nodules in both lobes
Will be goiter plus a nodule
Thyroglobulin levels will increase several months post-op
Thyroid scan will show “hot nodule”

Strikeouts

Failing to rule out MEN syndrome
Not knowing how to deal with post-op complications
Not performing FNA
Not knowing when to follow calcitonin levels (medullary carcinoma) and when to follow thyroglobulin levels
Not performing central node dissection in medullary carcinoma
Not placing pt on thyroxin post-op and following TSH levels

Esophagus—Zenker's Diverticulum

Concept

Upper esophageal muscle dyscoordination with lower pharyngeal constrictor contracting against an unyielding cricopharyngeus muscle. This causes an *acquired* (false diverticulum) mucosal out-pouching of the esophageal wall between these muscles on the left posterolateral side (Killian's triangle).

Way Question May be Asked?

"A 78 y/o male presents on referral from his family doctor complaining of trouble swallowing with occasional regurgitation of undigested food, mainly at night." Rarely will you get the patient with obvious bad breath, dysphagia to solids and liquids, regurgitation of undigested food, a sensation of a lump in the throat, and gurgling in the neck. Weight loss and aspiration are late symptoms.

How to Answer?

Must work through an algorithm for dysphagia and rule out mainly achalasia and cancer

History

- Solids vs. liquid dysphagia
- Weight loss
- Smoking
- GERD/Barrett's
- Coughing up solid food
- Halitosis (bad breath)
- Gurgling in neck

Physical Exam

Neck and lymph node basins (will never feel diverticulum)

Diagnostic Tests

- Labs, EKG, CXR
- Don't forget in elderly patients an assessment of the preoperative status (pulmonary, cardiac, and renal evaluation if necessary pre-op)
- UGI first maneuver—always before EGD, especially because EGD may perforate a Zenker's as two lumens will be visualized on EGD

Surgical Treatment

- Left cervical incision over anterior border of SCM
- Diverticulum located in plane between carotid sheath and trachea
- Bougie in esophagus to prevent narrowing when performing diverticulectomy with TA stapler
- May invert and perform a diverticulopexy to precervical fascia in elderly, high risk, with diverticulums greater than 3 cm to reduce risk of staple line leak, but they will likely push you to perform resection
- May leave alone if less than 2 cm
- *Always perform a cricopharyngeal myotomy*—gentle cephalad traction on the diverticulum will expose fibers of the cricopharyngeus muscle which are divided and bluntly dissected from the underlying mucosa and continued onto the esophagus for several centimeters
- Always drain the incision!
- Don't mention endoscopic alternatives to open resection

Common Curveballs

- Pt develops a leak or wound infection post-op
- Performing a pexy leads to perforation of the diverticulum

Injury to the rec. laryngeal identified post-op
Diverticulectomy lead to narrowing of the esophagus after not using a bougie
Injury to esophagus intra-op

Strikeouts

Forgetting to leave a drain
Not describing operative procedure properly
Forgetting to perform the cricopharyngeal myotomy
Forgetting to perform UGI or not performing prior to EGD
Discussing the endoscopic treatment that you've never seen (never describe an operation you've never done. It's better to say something like "I do not perform this operation, but I know the key aspects are the following...")

Esophagus—Achalasia

Concept

Esophageal aperistalsis (loss of Auerbach's plexus), failure of the lower esophageal sphincter to relax, and resultant esophageal dilation

Way Question May be Asked?

"37 y/o female presents on referral from her GI doctor with difficulty swallowing liquids and solids and substernal pain after meals for approximately 1 year." Rarely will you be given the diagnosis on referral or shown the typical "bird's beak" on UGI. Patients may also have aspiration or referral for a megaesophagus.

How to Answer?

Must be methodical in your approach to dysphagia because the scenario will end up being something you leave out. DDx includes spasm, achalasia, stricture, tumor-benign and malignant.

First, complete history including risk factors for malignancy as well as for the onset of the dysphagia.

Second, complete physical exam including epigastric masses and lymph node basins (will all be negative but if you leave out the PE, the pt will end up having a pronounced supraclavicular node and the scenario will have changed to esophageal cancer with obvious mets).

Appropriate preoperative studies including full labs, EKG, CXR.

Appropriate work-up of dysphagia which always includes UGI, EGD (risk of malignancy increased in these pts), and manometry

Treatment should also be stepwise with:

(1) Attempts at medical therapy with nitrates and calcium channel blockers

(2) Esophageal dilatation with pneumatic balloon under fluoroscopy to dilate and disrupt the fibers of the LES (be prepared for scenario to change to perforation here~4% risk). Dilatation alone approx. 70% response rate.

(3) BoTox injection with 80 units in four divided doses directed into the LES by endoscopy—consider in older, debilitated pts

(4) Surgical myotomy, can be done laparoscopically or transthoracic. (only describe if you are familiar with minimally invasive techniques otherwise, transthoracic approach.)

Procedure

Left lateral transthoracic approach
Double lumen ETT
Esophageal bougie
Longitudinal myotomy from a point 1 cm onto gastric cardia to inferior pulmonary vein
Muscle edges should separate by 1–2 cm
+/– antireflux procedure (controversy here but many surgeons will perform a partial wrap—Belsey, Dor, or Toupet)
Post-op UGI with gastrografin prior to feeding

Common Curveballs

Pt has a malignancy on endoscopy
Pt won't have classic manometry
Pt will perforate after EGD
Pt will have "megaesophagus"
Pt will have bad reflux post-op if you don't do a wrap
Pt will have bad PFTs and won't tolerate a thoracotomy
You perforate esophagus performing the myotomy (repair with absorbable suture and cover with wrap)

Strikeouts

You forget the UGI, EGD, or manometry

You can't describe the myotomy or forget to mention extending onto stomach

You get stuck in referring pt back to GI doc and in describing medical therapy and won't take pt to the OR for myotomy

Esophagus—Esophageal Cancer

Concept

One of top leading causes of cancer deaths, squamous-cell has traditionally accounted for the majority of esophageal cancers, but the frequency of adenocarcinoma is increasing. Risk factors include achalasia, Barrett's, caustic injuries, diverticula, leukoplakia, Plummer-Vinson syndrome, smoking and alcohol use.

Way Question May be Asked?

"A 61 y/o male smoker presents to your office with a new onset of dysphagia. On review of symptoms, the patient has lost 15 pounds in the last month and the dysphagia is worse for solids compared to liquids." Be careful of the adult patient that presents with an esophageal stricture—must r/o malignancy with both biopsy and brushing of the stricture for cytology.

How to Answer?

Complete H+P (wt. loss, vomiting, palpable mass, risk factors, check for supraclavicular node, enlarged liver)
Laboratory tests (full labs, nutritional status pre-op)

Appropriate Diagnostic Tests

UGI
Endoscopy and biopsy
Bronchoscopy (if CA in upper 2/3 of esophagus to r/o esophagobronchial fistula)
CT scan chest and abdomen (enlarged LN's-celiac/mediastinal), metastases to liver/lungs)
Endoscopic U/S may be used to provide more accurate staging of tumor invasion and regional node status
Barium Enema/Colonoscopy if might use colon as conduit (don't need angio pre-op)

Be complete, but don't dwell on these as the examiner is trying to get to more complicated issues like the indications for surgery/palliation, performance of the surgery, and management of complications after surgery.

Can discuss pre-op nutrition with J-tube feeds or TPN, but must be at least 2 weeks in duration pre-op to see any benefit

Contraindications for Resection

Metastatic disease (must FNA to prove metastatic)
Enlarged mediastinal/para-tracheal/celiac nodes
Fistula to the airway

Non-Surgical Palliation

Metallic stents
Laser fulguration
Feeding tubes
Intraluminal tubes
Chemo/XRT

Surgical Treatment

Can describe Ivor-Lewis procedure or Transhiatal procedure
Remember that cervical anastomosis is safer than intrathoracic
Any transhiatal might need to be converted to thoracotomy if tumor is fixed to adjacent structures
Can perform anastomosis as running or interrupted, single or double layer—staplers associated with increased risk of stenosis here
If performing thoracotomy, remember pre-op tests (PFTs)
Stomach is best organ to replace esophagus with
Always send to pathology to check intra-op margins

Post-op UGI day 5–7 depending on preference
Maintenance of chest tube/J-tube

Key features of Ivor-Lewis:
- Abdominal portion first then right posterolateral thoracotomy
- Abdominal exploration
- Create gastric tube
- Preserve right gastric and right gastroepiploic
- Kocher maneuver to allow gastric pull-up
- Pyloroplasty/pyloromyotomy
- Double lumen tube to deflate right lung
- Anastomosis in left neck

Key features of Transhiatal:
- Be prepared to do thoracotomy
- Blunt mediastinal dissection
- Order = abdominal/cervical/mediastinal/anastomotic

Common Curveballs

Cancer presents as a new stricture in an adult
Anastomotic leak—pt may become septic or may be a silent leak only seen on post-op UGI—management will depend on whether it is in the chest or the neck
Necrosis of the gastric tube
Saliva will come out of your chest tube (leak as above)
Being asked to describe diversion for total disruption of anastomosis post-op
Pt has fever post-op
Being asked how to boost nutritional status pre-op
Pt develops a chylothorax post-op
Delayed gastric emptying post-op
Recurrent laryngeal nerve injury during the surgery
Management of late anastomotic stricture
Questions regarding neoadjuvant chemo/XRT
Pt may have feature suggestive of unresectability
Injury to trachea during cervical or thoracic dissection (usually to membranous portion of trachea and can usually advance ETT so that balloon distal to tear and then perform repair (may need to split upper sternum to accomplish))
Suture line recurrence
Check frozen section of esophageal margin before making anastomosis
If positive celiac node found during surgery, then what? (this is unresectable disease)

Strikeouts

Not treating a stricture as a possible malignancy and performing simply an anti-reflux procedure (getting scenario wrong)
Placing G-tube for pre-op nutrition and destroying stomach as potential gastric tube
Mentioning the use of VATS/laparoscopy in performing the surgical resection
Trying to resect someone with obvious evidence of non-resectability
Not performing pyloroplasty/pyloromyotomy with gastric pull-up
Not being able to describe the operation
Not knowing non-operative methods of palliation
Not being able to manage the possible complications of your procedure (always a strikeout!)

Esophagus—Esophageal Perforation

Concept

Potentially lethal condition that may be spontaneous (Boerhaave's syndrome), result of trauma, swallowed foreign bodies, ingestion of caustic substances, malignancy, or iatrogenic (NGT/endoscopy). Most common cause today is iatrogenic related to endoscopic maneuvers (biopsy/dilatations/cautery).

Way Question May be Asked

"28 y/o male presents to ED with acute onset of epigastric/chest pain after several episodes of vomiting from alcohol abuse." Could also see after dilatation of stricture, achalasia, biopsy for Barrett's, dysplasia, or malignancy. You'll be lucky if they mention to you any of the following: crepitance in the suprasternal notch, diminished breath sounds in the left chest, a left pleural effusion or air in the mediastinum on CXR, or triad of vomiting/low thoracic pain/cervical emphysema.

How to Answer?

As usual, history and physical exam, but make assessment of stability of the patient. A patient in shock needs urgent treatment.

History

- Previous esophageal disorders
- Any history of ulcer disease
- Pancreatitis
- Heart disease
- Ingestions
- Timing of pain to vomiting

Complete Physical Exam

- Vital signs
- Cervical exam (SQ emphysema=more with cervical perforations),
- Diminished breath sounds in left chest

Appropriate Studies

- Full labs (amylase to r/o pancreatitis),
- EKG (r/o MI),
- CXR (pleural effusion, hydropneumothorax, mediastinal air),
- Lateral neck x-ray (SQ emphysema)
- Gastrografin swallow should identify leak. If not, may then get barium swallow.
- *No endoscopy!*

Treatment should also be stepwise with consideration given to:

- Time since perforation
- Location/size of the perforation
- Pt's overall clinical status
- Degree of contamination
- Underlying esophageal disorder (Barrett's/malignancy)

All pts:

- NPO, broad spectrum Abx, NGT
- Non-operative therapy only for pt with walled-off small perforation, minimal symptoms, no sepsis, with frequent reassessments and low threshold to take to OR

Once taken OR, all pts get same basic plan:

- Debridement
- Closure (of perforation)
- Drainage

(1) If within 24 h of perforation, attempt primary repair
   (a) for perforations in upper two thirds of esophagus, right thoracotomy, debridement of all nonviable tissue, myotomy to define extent of mucosal injury, closure in two layers over NGT, cover with tissue flap (pleural/pericardium/intercostal muscle), and place chest tube. Pt is then kept NPO, on TPN or enteral feeds through J-tube, and continue abx.
   (b) for perforation in lower third of esophagus, left thoracotomy and same procedure as above with ability to now cover repair with *Thal* patch, diaphragm muscle, fundoplication
   (c) for perforation in abdominal esophagus, upper midline with low threshold to making left thoracotomy (make sure to prep left chest) and cover repair with fundoplication
   (d) for cervical perforation, incision in left neck along SCM

(2) If after 24 h unstable, perform esophageal exclusion
   (a) debridement of mediastinum/esophagus/lung
   (b) establish effective drainage with two chest tubes
   (c) leave esophagus open
   (d) ligate GEJ with 2 ties of #2 chromic
   (e) place NGT above perforation
   (f) high volume irrigation through NGT
   (g) NPO/TPN or J-tube feeds/abx
   (c) or segmental esophagectomy
   (d) gastrostomy/J-tube
   (e) cervical esophagostomy
   (f) NPO/TPN or enteral feeds/abx

(3) Esophageal resection is appropriate if there exists pathology in the esophageal wall, this is delayed if the pt is unstable, or can be performed immediately with stomach and a left cervical anastomosis

   Post-op UGI with gastrografin prior to feeding once resolution of sepsis and repair has chance to heal!

Common Curveballs

No leak seen on gastrografin swallow
CXR/neck x-ray will be negative
Pt will be unstable
Location of the leak will change after you suggest an algorithm
Time to detection of the leak will change after you suggest an algorithm
Examiners pushing you towards non-operative therapy
Nonoperative therapy will fail
Pt will have leak after your repair (esophageal diversion)
Pt will have perforation during dilatation of achalasia or during examination of Barrett's (esophagectomy appropriate here)
Management late stricture

Strikeouts

Performing endoscopy to identify leak (and spread infection/create tension pneumothorax)
Not performing *water* soluble contrast enema
Attempting to perform immediate resection/reconstruction with unprepped colon
Not ruling out distal obstruction
Not attempting primary repair on early perforation
Not r/o MI/pancreatitis/perforation PUD/aortic dissection

Esophagus—Esophageal Varices

Concept

Life-threatening complication of portal hypertension. A major concern is often stabilizing these patients and knowing appropriate timing of surgical intervention. Also, make sure to rule out other potential sources for UGIB.

Way Question May be Asked?

"A 51 y/o male presents to the emergency department with three episodes of massive hemoptysis. His social history is remarkable for extensive alcohol abuse and his past medical history is remarkable for multiple admissions for alcoholic pancreatitis." May be referred to you with the diagnosis of bleeding varices from another hospital, or simply a patient with an UGIB.

How to Answer?

Brief, focused H+P while resuscitating the patient

History

Alcohol use
Episodes of encephalopathy, bleeding varices
History of pancreatitis
History of PUD
(you must do this while resuscitating, or you will have great history on a dead pt!)

Physical Exam

Stigmata of liver disease
Ascites

Resuscitation

IV access, CVP, labs (especially coags), T+C, transfusion pRBC/FFP
NGT, lavage stomach

Treatment

Can consider Sengstaken-Blakemore tube after intubating pt (be prepared to describe technique)
Start Pitressin drip 0.4 U/min (add nitroglycerin gtt if h/o CAD and consider SGC)
Start Somatostatin gtt (25 micrograms/hr)
Beta blocker to lower HR if not lower than 100 (give slowly as may precipitously drop SBP)

(at the back of your mind, should be considering Child's class as Child's C pts need liver txp—Bilirubin > 3, albumin < 3, severe ascites)
Endoscopy (once hemodynamically stabilized)
At EGD, can consider
Sclerotherapy
Banding
(neither will be available or will work!)
If EGD fails, can consider TIPS
(won't be available!)

Surgical Treatment Indications—Uncontrolled Bleeding

Emergency portosystemic shunt (mesocaval 8 mm PTFE shunt b/w SMV and IVC) →identify middle colic vein, follow distally to SMV (to right of SMA), identify IVC through right colonic mesentery adjacent to duodenum, anastomose to IVC first, then to side of SMV (can use left IJ if contaminated field). This

shunt doesn't dissect in porta hepatis so doesn't compromise potential for future liver txp

Other choices:
Gastric devascularization
EEA limited esophagectomy with ligation of the left gastric vein
Gastrostomy and suture ligation

Common Curveballs

UGIB secondary to PUD, esophagitis, gastric varices
Bleeding will continue post-op
Pt will become encephalopathic post-op
Pt will have had prior abdominal surgery
Pt will be Child's class C
Pt will aspirate or perforate after balloon tamponade
Pt with thrombosed splenic vein and bleeding gastric varices (needs only a splenectomy)
Pt will develop hepatic failure or hepatorenal syndrome post-op
Asked to describe other shunting procedures

Strikeouts

Performing distal splenorenal shunt
Not being able to describe your surgical procedure
Describing the Suguira procedure (you don't want to do something you've never done before and this is rarely done in the U.S.)
Rushing to the operating room
Not performing EGD/trying sclerotherapy/banding
Not knowing how to use Sengstaken-Blakemore tube
Not resuscitating the pt properly

Esophagus—GERD

Concept

Incompetent lower esophageal sphincter related to inadequate pressure (< 6 mmHg), inadequate length (< 2 cm), insufficient intraabdominal esophagus (< 1 cm). Hiatal hernia, delayed gastric emptying, and bile reflux may complicate the picture.

Way Question May be Asked?

"45 y/o man presents to your office with a history of heartburn, choking at night, and recent onset of asthma." Symptoms may be many and can include chest pain, water brash, adult onset asthma, dysphagia, odynophagia, sinusitis, aspiration pneumonia, choking feeling at night, regurgitation, excessive salivation, and chronic hoarseness. Also, patient may present with a complication of their reflux disease: Barrett's, stricture, or ulcer.

How to Answer?

Must be methodical in your approach to not get caught by the pt with abnormal motility who you decide to perform a complete wrap on.

First, complete history including relationship to meals, solids versus liquids, maneuvers tried (loose clothing, caffeine cessation, trial of H2 blockers or PPIs)

Second, complete physical exam including epigastric masses and lymph node basins (will all be negative but if you leave out the PE, the pt will end up having a pronounced supraclavicular node and the scenario will have changed to esophageal cancer with obvious mets).

Appropriate preoperative studies including full labs, EKG, CXR.

Appropriate work-up of GERD which always starts with *Barium UGI*
- Look for reflux, hernia, shortened esophagus, diverticula, other motility disorders

The next test should be an *upper endoscopy* to evaluate the severity of the reflux
- Stage I erythema and edema
- II ulcerations
- III stricture

The rest of the work-up must include:
- *Manometry* to r/o ineffective motility that will affect your type of anti-reflux procedure, to document the low LES pressures, and determine location of LES
- *24 h pH monitoring* to document the relationship between pt's symptoms and reflux as well as provide a baseline for post-op evaluation of success of surgery
- (A gastric emptying study should be added in any pt with a history of significant belching or bloating after meals and/or history of duodenal ulcer as a delay in gastric emptying contributes to 10% of Nissen failures)
- *Remember, the indications for surgery are failure of medical therapy or complications of reflux disease (young age is a relative indication)*

Procedure = Nissen Fundoplication (usually performed laparoscopically)
- Lithotomy position
- 5–6 ports
- Nissen performed over a bougie (54–56)
- Start dissection at gastrohepatic ligament
- Mobilize esophagus well into mediastinum
- Divide short gastrics down 1/3 along greater curve
- Crural repair
- 3 cm anterior wrap

Take care not to injure the vagus nerve, perforate stomach, esophagus, injury spleen, or make wrap too tight/too long/ or twist the stomach when passing it around esophagus
Belsey, Dor, or Toupet can be performed in pts with ineffective esophageal motility
Post-op UGI with gastrografin prior to feeding

Common Curveballs

Pt has a malignancy/Barrett's/stricture on endoscopy (non-dilatable stricture=OR)
Pt won't have normal manometry (don't Nissen)
Perforation during procedure by you, by advancing bougie, or seen post-op on UGI
Pt will present with a stricture where first you must r/o malignancy and dilate prior to any studies
Pt will have "shortened esophagus" (be prepared to describe Collis gastroplasty)
Pt will develop pneumothorax or bleeding from liver/spleen during procedure
Fundoplication herniates into chest post-op (poor hiatal closure, didn't mobilize esophagus enough)
Fundoplication falls apart post-op (technical failure)
Pt has "gas bloat" syndrome post-op (inadequate gastric emptying)
Pt has difficulty swallowing post-op (made wrap too tight)

Strikeouts

You forget the UGI, EGD, or manometry
You can't describe the fundoplication or forget to mention taking the short gastrics
You take pt to surgery right away without trying medical therapy (only 5 to 10% GERD pts need surgery)
You don't take an adequate history or order manometry and perform Nissen on pt with achalasia
Discussing endoscopic measures to treat Barrett's (cryotherapy or phototherapy)
Discussing endoscopic measures to treat GERD ("Plicator," "Stretta," or newly approved injectable agents)

Esophagus—Hiatal Hernia

Concept

Four types:

I	Sliding hernia, GEJ in chest
II	Paraesophageal, GEJ in abdomen
III	Type II with shortening of esophagus and GEJ in chest
IV	Additional abdominal organs (spleen, colon) in hernia defect

Oral Exam questions seem to be surrounding the treatment of Type II and III paraesophageal hernias that are symptomatic.

Way Question May be Asked?

"53 y/o female presents to the office complaining of fullness in her chest immediately after eating and associated weight loss." May also have postprandial pain, may not be related to any specific solid or liquid foods. Pain likely epigastric.

How to Answer?

Complete history and physical exam (may have been given all this already):

History

Character of pain
Relation to meals
Relation to solids/liquids
Previous esophageal problems/diagnoses
Heartburn
Dysphagia
Vomiting
Anemia
Early satiety

Physical Exam

Abdominal masses
Lymphadenopathy

Diagnostic Tests

Usual labs (check H/H as often pts are anemic)
CXR (may see gastric bubble behind heart shadow)
Barium Swallow
Upper endoscopy (examine for ulcerations, malignancies, diverticula)
Manometry (helpful when deciding what degree of wrap to perform)
Indications for surgery: (all paraesophageal hernias get surgery)
  Volvulus
  Ulcerations
  Anemia

Surgical Treatment

Abdominal incision (can consider thoracic if believe shortened esophagus or prior abdominal operations)
Reduction of stomach (herniated contents) and inspection
Excision of hernia sac
Closure of diaphragmatic defect (interrupted, non-absorbable sutures +/– mesh)
Anchoring stomach (Stamm gastrostomy or gastropexy to abdominal wall or to arcuate ligament)
"Floppy" Nissen (unless severely abnormal manometry)

Common Curveballs

Pt has a malignancy on endoscopy
Pt will have shortened esophagus (→Collis gastroplasty)
Pt will have esophageal/gastric mass on UGI

Incarcerated contents (stomach) will be strangulated and need resection
Can't close crura without the use of a mesh
Abnormal manometry so can't do 360 degree Nissen wrap
Being asked if it is necessary to perform anti-reflux procedure
Pt will have pneumothorax from dissection of adhesions from sac to pleura
Post-op recurrence of hernia
Being asked how tight to reapproximate the crura
Injury to stomach or esophagus during procedure (change scenario!)

Strikeouts

You forget the UGI or EGD
You forget to anchor the stomach or perform a wrap
You try to treat the pt medically/non-operatively once you've diagnosed a paraesophageal hernia
You treat your pt with strangulation in the hernia sac as having angina or an MI

Genitourinary—Renal Mass

Concept

Unusual question, but more important in everyday surgical life. Variety of renal masses including abscess, cyst, benign tumors, and malignancy—primary or metastatic. Look for suggestive history. Don't fall prey to percutaneous biopsy of suspected malignancy, and don't confuse with adrenal lesion!

How to Answer?

History

- Flank pain
- *Hematuria*
- Fever, chills
- Family history of Renal Cell Carcinoma (RCC)
- Prior malignancy (lung or breast can metastasize to kidney)
- New varicocele (especially left renal mass)
- Hypercalcemia
- Tuberous sclerosis
- Renal insufficiency

Physical Exam

- Unlikely to feel the mass
- Varicocele
- Evidence of metastatic disease

How to Answer?

Need complete labs, CXR, U/A
Diagnostic tests can include:

- IVP—usually the first test to evaluate a pt with hematuria
- U/S—can determine if cystic or solid, can evaluate for simple cysts with no septa or calcifications (these can be symptomatic but almost always benign)
- CT—can evaluate solid lesion, inspect renal vein and IVC, look for metastatic lesions
- MRI—if any doubt about IVC thrombus
- CT guided needle bx—rarely done for solid lesions as risk of bleeding and tumor seeding
- Angiogram—pre-op embolization of large lesions is a consideration

Surgical Treatment

- Dependent on lesion
- RCC gets radical nephrectomy
- Transitional Cell Carcinoma (TCC) gets radical nephroureterectomy
- Don't go into describing these—say you would refer to a urologist!
- Make sure to assess renal function and contribution from side you are planning to remove—pt may need post-op hemodialysis

Common Curveballs

- Lesion will be cystic with internal echoes/septae
- Pt will need hemodialysis post-op
- Lesion will be TCC if you don't rule it out with ureteroscopy/bx
- Pt will bleed from any percutaneous bx attempt
- Pt will be symptomatic from simple cystic lesion (just need to unroof)
- Will actually be an adrenal lesion (changing scenario)

Strikeouts

- Offering laparoscopic kidney resection
- Percutaneous bx of solid lesion
- Not referring to urologist (at least try before taking on a case outside of your specialty)
- Not ruling out metastatic disease IVC thrombosis—can extend to right atrium
- Not checking for possible lung/breast CA with met to kidney
- Performing radical nephrectomy only for TCC

Genitourinary—Scrotal Mass

Concept

On the oral exam, most likely to be a testicular mass. Don't forget however that hydrocele, varicocele, inguinal hernia, testicular torsion, and spermatoceles can all present as scrotal masses. Important points for your DDx are: is it painful and does it transilluminate?

Way Question May be Asked?

"You are called to the ED to evaluate a 27 y/o male resident who has noticed a 2 cm mass in his left testicle. What do you do?" Age group most at risk is young males.

How to Answer?

History

Pain (timing)
Hernia
Does patient perform own testicular exams?

Physical Exam

Hernia
Transillumination
Tenderness
Lymphadenopathy

Diagnostic Tests

Labs (AFP, HCG, LDH)
CXR (r/o metastatic disease)
U/S of scrotum (all pts)
CT scan (look for paraaortic lymph node enlargement)

Surgical Treatment

(1) Inguinal orchiectomy (control spermatic cord early to minimize tumor spread
(2) Seminoma (check HCG here)
   (a) negative markers + minimal enlargement paraaortic nodes→ radiation to paraaortic and ipsilateral pelvic nodes
   (b) bulky retroperitoneal nodes, positive markers, or distant mets→ platinum based chemotherapy
(3) Non-seminomatous tumors (embryonal, teratoma, teratocarcinoma, choriocarcinoma)
   (a) retroperitoneal lymph node dissection followed by chemotherapy unless enlarged retroperitoneal nodes, then chemo first
   (b) chemotherapy with bleomycin, etoposide, and platinum

Common Curveballs

Scenario will change from seminoma or non-seminomatous tumor
Pt will have enlarged retroperitoneal nodes on CT
Pt will have evidence of metastatic disease
Pt will have post-op ejaculatory dysfunction
Tumor markers will be positive or rise in post-op follow up
Post-op recurrence—abdomen/chest

Strikeouts

Not performing *inguinal* orchiectomy
Not ordering tumor markers
Not knowing that seminoma is very radiosensitive
Not knowing what to do with regards paraaortic lymph nodes
Not performing CT scan to evaluate retroperitoneum

Hepatobiliary—Gallstone Ileus

Concept

Mechanical obstruction in the terminal ileum from a large gallstone that has eroded through the gallbladder into the duodenum. Seen in elderly patients with SBO who have no hernia and no previous surgeries.

Way Question May be Asked?

"A 74 y/o female is seen in the emergency department for a small bowel obstruction. Obstruction series confirms the small bowel obstruction with air in the biliary tree. What do you want to do?" May be given AXR with stone in the RLQ or air in the biliary tree or patient with episodes of SBO.

How to Answer?

H+P while resuscitating the pt

History

Prior surgery
Malignancy history
Overall medical condition
History suggestive of gallbladder disease
History of intermittent obstruction classic

Physical Exam

Vital signs (pt may be unstable)
Check for surgical scars
Check for hernias!

Diagnostic Tests

Full lab panel (including LFTs—may be other stones)
Obstruction series
CT scan (not usually necessary)

Surgical Treatment

Resuscitate the pt, NGT, IVF, then:
OR for exploration:
- Full ex lap (be prepared to describe this)
- Check status of RUQ (extensive scarring prevents definitive procedure)
- Enterotomy is performed proximal to palpable stone lodged in the terminal ileum
- "Milk" stone back gently
- Close enterotomy in two layers
- Check rest of intestine for additional stones (~5%)
- Attention to RUQ (mortality less in retrospective series if done in separate procedures!)
  - → takedown of fistula and closing the bowel in two layers, cholecystectomy and cholangiogram (to look for other stones)
    (only if inflammation not severe, pt is stable, and scarring will not preclude safe dissection)

Common Curveballs

Pt will have history of malignancy
Pt will have associated intraabdominal process
Pt will have severe scarring in RUQ precluding definitive procedure
Pt will have bowel obstruction post-op (missed a second stone)
Pt will be septic/unstable
Stone will have eroded through hepatic flexure of colon rather than duodenum
Being asked how to close the fistula
Gallbladder cancer that led to the perforation (change scenario)

Pt will develop cholangitis or intraabdominal abscess post-op
Post-op biliary leak

Strikeouts

Not checking for hernias
Not getting obstruction series but skipping to CT scan
Not checking for prior surgeries
Not recognizing the problem
Not "milking" back the stone but making enterotomy in terminal ileum
Performing takedown of fistula in unstable pt

Hepatobiliary—Liver Abscess

Concept

Usually a complication of an underlying disease process (appendicitis, biliary disease, diverticulitis). Less likely the result of amebic infection. More commonly today associated with immunosuppression (HIV) or IVDU (endocarditis).

Way Question May be Asked?

"A 35 y/o male is evaluated in the ED for fever, chills, and a constant, dull ache in the right flank. He has a history of IVDU, and his CT scan shows multiple liver abscesses. What do you want to do?"

How to Answer?

Full H + P

History

- IVDU
- HIV
- Recent abdominal infections
- Travel hx
- History of malignancy (could this be presentation of metastatic disease)

Physical Exam

- Full physical especially abdominal exam (liver enlargement, tenderness)
- Lymphadenopathy

Diagnostic Tests

- Hepatitis panel/LFTs (still working up RUQ pain)
- CBC
- Ultrasound RUQ
- CT scan abdomen/pelvis
- Agglutination/compliment fixation tests to r/o amebic abscess

Surgical Treatment

- Amebic abscess (Entamoeba histolytica) →Flagyl unless:
  - Secondary infection
  - Rupture into biliary tree or abdominal cavity
  - Failure to initially improve on abx (may need to be on abx for months if see initial improvement)
- Pyogenic abscess
  - (Either from biliary tree or from portal venous system from direct extension from adjacent organ)
  - → Percutaneous drainage and IV Abx (can try to treat multiple small abx with IV abx)
  - → Open drainage if percutaneous is not possible: (depends on location of abscess)
    posteriorly through bed of 12th rib and extraperitoneal approach interiorly through subcostal incision and extraperitoneal approach transperitoneally

Common Curveballs

- Pt will have history of malignancy
- Pt will have associated intraabdominal process
- Pt will have history of IVDU/HIV
- Pt will have amebic abscess
- Will have multiple abscesses
- Will need to perform open drainage and be asked to describe your approach
- Amebic abscess will rupture into abdominal cavity or biliary tree
- Will need to describe treatment of diverticulitis or cholangitis (change of scenario) once you take care of abscess

Strikeouts

Not checking for pyogenic abscess from abdominal source
Not ruling out amebic abscess
Not getting biopsy of abscess wall to r/o malignancy
Mixing up treatment of Ecchinococcal cysts and amebic abscess

(Ecchinococcal/hydatid cysts identified by electrophoresis, initially treated with mebendazole, failure to resolve demands first ERCP to r/o communication with biliary tree, then surgery and injection of cyst with hypertonic saline, avoiding any spillage—anaphylaxis—and performing pericystectom y)

Hepatobiliary—Liver Mass

Concept

Usually found during an exploratory laparotomy performed for colon cancer, GI bleed, or other unrelated reasons. May also be diagnosed incidentally on CT or U/S performed on a patient with abdominal pain. Make sure to differentiate solid from cystic lesions here. Hemangioma is most common benign tumor. Half of adenomas present with spontaneous bleeding.

Way Question May be Asked?

"A 37 y/o female is evaluated in the ED for abdominal pain and the CT scan shows a 3 cm mass deep in the right lobe of the liver. What do you want to do?" May be in the scenario of doing an ex lap and finding an incidental lesion in the periphery of the liver or patient may present hypotensive with abdominal pain.

How to Answer?

History

Hepatitis
Previous malignancy (colon CA)
OCP use
Weight loss/anorexia
Race (Africa/Southeast Asia associated with HCC)
Abdominal pain

Physical Exam

Full physical especially abdominal exam (liver enlargement, tenderness)

Diagnostic Tests

Hepatitis panel/LFTs
+/– AFP (if suspect HCC)
+/– CEA if suspect colorectal recurrence
CBC
Ultrasound RUQ (used to r/o solid lesion from cyst/abscess—*different scenario*)
CT scan abdomen/pelvis (central scar associated with FNH)
MRI
+/– Tagged RBC technetium scan (r/o hemangioma)
+/– Angiography—helpful in evaluating primary malignancies

DDx

Hemangioma
FNH
Adenoma
Malignancy (primary or metastatic)

Surgical Treatment

(1) FNA under CT guidance—helpful if diagnoses malignancy (don't do if suspect hepatocellular cancer (elevated AFP, hepatitis B positive, cirrhosis)
(2) If FNA negative, need core needle bx by laparoscopy or open surgery
(3) Treatment
  (a) FNH—observation unless becomes symptomatic
  (b) adenoma—stop BCP and observe for 6 months, resect if:
    becomes symptomatic
    increases in size during observation period
    pt intends on becoming pregnant
  (c) malignancy—
    (1) Can resect metastatic disease if colon or neuroendocrine malignancy as long as primary site controlled
    (5 yr survival ~30% from metastectomy for colorectal ancer if < 5 mets and less than 5 cm in size)

(2) Hepatocellular—be prepared to describe liver resection
(d) hemangioma—dx by CT, MRI, or tagged RBC scan
observe unless very large or symptomatic
can cause pain, hemolysis, CHF
spontaneous rupture rare (1–2%)
embolization 1st choice if symptomatic
often surgically treated by enucleation
(4) Incidental Liver Lesion
biopsy necessary
FNA to make sure not cystic or hemangioma
Consider intra-op U/S
Can perform wedge resection if small and peripheral

Common Curveballs

Pt will have history of malignancy
Being asked when you will perform resection for metastatic disease
Liver nodule found during exploratory laparotomy—"what would you do?"
Change scenario and pt will have cystic rather than solid lesion in the liver
Adenoma/hemangioma will bleed spontaneously during your observation period and pt will present in hemorrhagic shock
FNA will be negative but pt. has bleeding when doing open biopsy
You get into bleeding during open biopsy (change scenario)

Strikeouts

Not ruling out a cystic lesion
Not knowing treatment for FNH or hepatoma
Sticking needle into hemangioma
Not knowing how to describe your liver resection
Not trying to biopsy a liver lesion found during an exploratory laparotomy
Not performing CT scan with contrast
Performing metastatectomy for breast, stomach cancer
Performing FNA on hepatocellular cancer
Performing liver resection laparoscopically
Getting lost in a discussion about angiographic embolization when pt clearly needs to go to OR (resuscitate/check coags first)

Hepatobiliary—Post-cholecystectomy Cholangitis

Concept

Suggestion here is that a stone was missed and the patient returns with an obstructed biliary tree and septic from ascending cholangitis. Prompt treatment is important here as well as stabilizing patient in ICU setting.

Way Question May be Asked?

"55 y/o male seen in the ER one year after a laparoscopic cholecystectomy with fever, chills, RUQ pain, and jaundice. What do you want to do?" May be a variable interval after lap chole. Your DDx needs to include: retained stone, new stone, stricture, tumor, extrinsic compression.

How to Answer?

Start with ABCs here if pt is septic from cholangitis obtaining any relevant H + P while resuscitating the pt

History

Time course
History of hepatitis
History of hemolysis
Malignancies
Previous operative indications/report *a must*

Physical Exam

Abdominal exam
Confirm jaundice

Data

Full laboratory panel including LFTs
Plain x-rays of abdomen (look for number/position clips)
RUQ U/S (look for dilated ducts, evaluate CBD, biloma mass?)

Surgical Treatment

(1) ABCs
(2) IVF resuscitation
(3) ICU
(4) CVP
(5) Abx (broad spectrum)
(6) U/S RUQ
(7) ERCP→to drain CBD, remove stone if possible (needs to be under 1.5 cm in size), biopsy any mass
(8) PTC if ERCP fails→to drain biliary tree
(9) OR if ERCP/PTC both fail after best attempts to stabilize pt:
Goal here is to drain biliary tree by whatever means possible!

(a) CBD exploration, extract any stone, if cannot, place T-tube and close remember:
always to do cholangiogram when placing a T-tube and use absorbable sutures in CBD closure
use choledochoscope
biliary fogarties
irrigation
stone forceps
bring out T-tube through abdominal wall with as straight a course as possible

(b) other options:
choledochoduodenostomy (and leave stone behind)
sphincteroplasty (description below)
choledochojejunostomy as possible

Common Curveballs

- Porta hepatic severely scarred down and you cannot safely mobilize the duodenum
- GI doc not available for ERCP
- Stone cannot be removed by ERCP
- PTC won't work to decompress biliary system
- May be iatrogenic injury to CBD (change scenario)
- Being asked to describe transduodenal sphincteroplasty
- Open duodenum longitudinally, open medial wall of ampulla directly onto stone itself, identify pancreatic duct orifice (may need to give IV glucagon here), suture ductal mucosa to duodenal mucosa with fine absorbable suture
- Pt will have a malignancy
- Pt will have a stricture
- Pt will have other comorbidities (recent MI, ARF, and scenario will change to ICU management)

Strikeouts

- Not trying ERCP or PTC but rushing to surgery
- Not knowing other options besides CBD exploration and placing T-tube
- Not being able to describe CBDE
- Trying to perform anything laparosocpically
- Not stabilizing pt prior to any maneuvers
- Discussing endoscopic lithotripsy
- Seeing stone on cholangiogram and doing post-op ERCP rather than CBDE

Remember Indications for CBDE:

- Positive intraoperative cholangiogram
- Large stone
- Impacted stone (usually distally impacted)
- Multiple stones
- Cholangitis and failed ERCP/PTC

Hepatobiliary—Post-cholecystectomy Jaundice

Concept

Variety of postcholecystectomy problems you could be faced with. Always be methodical in your work-up of these patients and don't rush to the OR.

Way Question May be Asked

"A patient returns to your office one week after an uneventful laparoscopic cholecystectomy performed by your partner for symptomatic cholelithiasis and jaundice. What do you want to do?" May happen more immediately after surgery. May be given a difficult intra-op dissection. May be given a history of CBD stones.

How to Answer?

History

- Hepatitis
- Hemolysis
- Indications for surgery
- Operative report (was IOC performed?)
- Timing of Jaundice
- Change color of urine/stool
- Sxs/sgs of cholangitis

Physical Exam

- Check for icterus
- Check incisions
- Full abdominal exam

Data

- General labs especially LFTs, amylase
- Abdominal x-rays
- U/S of RUQ
- Hepatobiliary scan (HIDA)
  - Look for CBD occlusion or leak
  - Look for cystic duct/duct of Lushka leak
- CT scan
  - Look for biloma (extrinsic compression of biliary tree)
  - Drain percutaneously

Surgical Treatment

- Admit to hospital
- Start antibiotics
- Get appropriate studies as above
- Surgical management based on HIDA/ERCP findings
  - (1) CBD leak
    - stent across with ERCP
    - drain biloma percutaneously
  - (2) Cystic duct leak
    - stent across with ERCP
    - drain biloma percutaneously
    - all will close if no distal obstruction
  - (3) CBD occlusion
    - ERCP to determine nature of obstruction, retrieve stone, phincterotomy
    - If iatrogenic, schedule pt for exploration (wait 3–6 weeks as long as pt not septic) for clip removal, repair of CBD over T-tube or choledochojejunostomy)
  - (4) Duct of Lushka leak
    - drain biloma
    - ensure no distal obstruction
    - observe (these may need a return to OR for suture ligation)
  - (5) If create choledochojejunostomy, use a roux limb, end to side with end of jejunum against abdominal wall so you have some access to biliary tree if need be

(6) Don't forget other options appropriate in certain scenarios:
hepaticojejunostomy
choledochoduodenostomy

Common Curveballs

ERCP not available (don't forget about PTC)
Pt develops cholangitis
Being asked how you will discuss with your pt an iatrogenic injury
Asked to treat injury to CBD (can repair primarily if < 50% over T-tube)
Asked how to treat retained stone that fails ERCP (describe CBDE → change scenario)
Asked how to construct choledochojejunostomy
Won't be enough length to perform primary repair to CBD
Simple drainage of biloma won't work
Electrolyte abnormalities from high drain output

Strikeouts

Rushing back in to reoperate
Not getting U/S, HIDA, or ERCP
Not knowing ways to treat CBD leak or occlusion
Not recognizing possible iatrogenic injury to CBD
Not being *honest* about injury if asked the ethical question of how do you discuss the situation with your pt

Pancreas—Acute Pancreatitis

Concept

Life-threatening condition representing a massive retroperitoneal burn with tremendous amounts of third-spacing. May be secondary to alcoholism, gallstones, tumor, elevated triglycerides, medication, or even perforated ulcer.

Way Question May be Asked?

"Called down to the ER to evaluate a patient with severe epigastric pain, vomiting and history of recent alcohol use. What do you want to do?" May or may not be given history of gallstones or alcohol use. May be given elevated amylase. Need to rule out other causes of severe epigastric abdominal pain including gastritis, perforated ulcer, rupture of esophagus if history of emesis, AAA, ischemia, and gastric volvulus.

How to Answer?

Key parts: assessment of severity, determining etiology, aggressive volume resuscitation, appropriate support (nutrition/vent), operative intervention when appropriate, recognition of possible complications

History

Gallstones
Alcohol use
Recent new medications
Timing of pain with retching/vomiting
History of PUD/AAA

Physical Exam

Complete PE including:
Crepitus over chest/neck (r/o Boerhaave's)
Abdominal exam (peritonitis, evidence of hemorrhagic pancreatitis)
Prior incisions
Hernias (could this be simply obstruction)

Diagnostic Tests

Complete laboratory panel including amylase, lipase, calcium, albumin, LDH, ABG (depending on severity of illness)
CXR (r/o esophageal rupture)
AXR (look for ileus/sentinel loop/obstruction/aortic calcifications/free air/gallstones)
Ultrasound (look for gallstones, ductal dilatation, examine pancreas, r/o AAA)

Ranson's criteria

On admission: age > 55
WBC > 16
Glucose > 200
SGOT > 250
LDG > 350
During first 48 h:
Hct fall by 10
BUN rise by 5
Calcium < 8
Fluid sequestration > 600 mL
PO2 < 60

Surgical Treatment

(1) supportive care with:
IVF, NPO, NGT, serial labs, H2 blockers, IV analgesics
(2) CT scan to evaluate for complications, necrosis
(3) Ventilatory/nutritional support where appropriate (pt will likely deteriorate on Oral Boards and will need txfr to ICU, CVP, intubation, TPN)

(4) Most pts should improve in next several days (on the exam, of course, your pt will not)
(5) If fails to improve, check repeat CT
  (a) FNA if any necrosis present and pt having fever (can observe sterile necrosis)
  (b) if FNA +, necrosectomy:
    chevron incision
    open up lesser sac
    debride all devitalized necrotic tissues
    large volume lavage of abdomen
    leave large drains in lesser sac
    jejunostomy
(6) Pt will develop epigastric mass
  (a) CT or U/S to confirm pseudocyst
  (b) Do not do FNA
  (c) +/– ERCP to r/o ductal communication
  (d) feed past ampulla or TPN for 8 weeks and reassess (allow wall to mature)
  (e) various options for internal drainage depending on location
(7) Pt gets better and cause was gallstones
  (a) need MRCP or ERCP pre-op if suspect choldecholithiasis, possible sphincterotomy and stone retrieval
  (b) be prepared for intra-op cholangiogram and CBDE
  (c) lap chole same admission

Common Curveballs

Pt will develop pancreatic necrosis
Pt will develop pseudocyst
Pt will develop pancreatic ascites
Pt will develop ascending cholangitis (change scenario to discussion of how to drain dilated biliary tree)
Pt will be pregnant
Pt will have gallstone pancreatitis
Pt will later present with symptoms of chronic pancreatitis
Pt will develop UGIB related to splenic vein thrombosis
Asking you to discuss use of antibiotics/somatostatin
Discussing Ranson's criteria
Pt will have obstructing tumor/gallstone as cause for pancreatitis
Pt will need nutritional/respiratory support and asking you to discuss these modalities
Pt will develop DTs as result of alcohol withdrawl

Strikeouts

Trying to percutaneously drain infected necrosis
Not recognizing/appropriately treating complications of pancreatitis
Failing to rule out other possible causes of severe epigastric/abdominal pain
Not being aggressive in your supportive care for the pt
Not trying to identify etiology of pancreatitis
Not performing MRCP/ERCP pre-op or IOC intra-op when doing lap chole after bout of pancreatitis

Pancreas—Chronic Pancreatitis

Concept

Etiology: alcohol abuse, hyperparathyroidism, cystic fibrosis, pancreatic divisum, trauma. Alcohol related most common in developed countries. Variety of suggested mechanisms: hypersecretion of protein from acinar cells, plugging of pancreatic ducts with protein precipitates, and pancreatic ductal hypertension. Pathology: acinar loss, glandular shrinkage, proliferative fibrosis, calcification, ductal stricturing

Way Question May Be Asked?

"45 y/o alcoholic with a history of several episodes of pancreatitis presents now with worsening abdominal pain and is taking narcotics around the clock. What do you want to do?" Could be presented with any of the complications of chronic pancreatitis. Be careful to rule out other complications of pancreatitis (ascites, pseudocyst, acute pancreatitis) before diving into discussion of the management of chronic pancreatitis.

How To Answer?

History

Abdominal pain, epigastric, radiation to back, continuous or relapsing,
Anorexia
Weight loss
IDDM in 1/3 pt
Steatorrhea in 1/4 pt.
Classic Tetrad: abd pain, wt loss, DM, steatorrhea
Narcotic use
Flares of pancreatitis
Etiology of pancreatitis

Physical Exam

Palpable mass (pseudocyst)
Stigmata of alcoholic liver disease
Abdominal exam (ascites, epigastric tenderness c/w acute pancreatitis)

Diagnostic Studies

Lab tests (only for completeness—IV secretin and CCK stimulation with collection of pancreatic effluent, 72 h fecal fat, glucose tolerance testing to measure endocrine function)
AXR: pancreatic calcifications 95% specific if seen
CT: evaluate parenchymal disease, pseudocyst, ductal dilatation
ERCP: ductal dilatation, strictures, calculi, *chain of lakes* pancreatogram

Surgical Treatment

(1) Nonoperative therapy
  (a) Control abd pain: abstinence from alcohol, dietary manipulation (low fat, small volume meals, non-narcotic analgesics 1st . . . . often failure of this is indication for surgery
  (b) Tx for endocrine insufficiency: exogenous insulin carefully,' (hypoglycemia can arise as result of poor nutrient absorption)
  (c) Tx for exocrine insufficiency: low fat diet, exogenous pancreatic enzymes,

If medical therapy fails (which of course it always will on the Oral Exam!):

(2) What is size of pancreatic duct
  (a) *large*→Peustow procedure
    Peustow/Gillesby 1958—side to side pancreaticojejunostomy, success rates 60–90%, decompresses entire duct, need duct greater than 7 mm in diameter, pancreatic calcifications, pancreatic-jejunal anastomosis longer than 6 cm, does not affect endocrine/exocrine insufficiency

Chevron incision, divide gastrocolic ligament to enter lesser sac, expose entire anterior surface of pancreas, create Roux-en-Y and anastomose to entire pancreatic duct

(b) *small*→ pancreatic resection
Pylorus—preserving pancreaticoduodenectomy for pt with chronic pancreatitis, no ductal dilatation, and disease primarily in head of gland, preserves endocrine function in body/tail

(3) Ampullary stenosis→
(a) *ampullary procedures*: transduodenal sphincteroplasty helpful if focal obstruction at ampullary orifice, in pt with pancreatic divisum and stenosis of minor pancreatic duct papilla (these procedures have generally fallen out of favor)

(4) Celiac block considered for pts who fail operative interventions

Common Curveballs

Pt will present with complication of chronic pancreatitis:
Pain
Pseudoaneurysm
Splenic vein thrombosis
Obstruction (GI or biliary tract)
Exocrine/endocrine deficiency
Pseudocyst

Anastomotic leak after Peustow procedure
Asked to describe Peustow procedure
Pancreatic duct will be "large" initially, then asked to comment on surgery for "small" duct
Pt will develop hepatic failure post-op (alcoholic liver disease)
Pt will have DTs post-op

Strikeouts

Not getting ERCP/CT scan
Not knowing what operation to offer for "large/small" pancreatic duct
Not knowing complications of chronic pancreatitis
Not being able to describe the Peustow procedure
Offering pt total pancreatectomy or 95% pancreatectomy in favor of the more standard options

Pancreas—Pancreatic Cancer

Concept

90% of pts will be unresectable with mean survival of 3 months. Key is to determine who is a candidate for resection. You will likely be given a pt you will need to explore to determine resectability.

Way Question May be Asked?

"61 y/o male comes to your office with recent weight loss and a CT scan ordered by his family doctor shows a mass in the head of the pancreas. What do you want to do?" May present as just weight loss, obstructive jaundice, or examiners may be direct and get right into the thick of it.

How to Answer?

Be methodical!

History

Smoking
Anorexia
Alcohol use
Weight loss
Back pain/abdominal pain (classic is *painless jaundice*)

Physical Exam

Mass in RUQ (liver or distended gallbladder)

Data

Full laboratory panel including LFTs, Albumin, CA19-9, CEA
Routine pre-op studies (EKG, CXR)
CT scan—with thin section through pancreas
look for metastases, enlarged lymph nodes
→ don't do percutaneous bx of possibly resectable tumor risk dissemination along tract
ERCP—obtain biopsy/brushings/cytology
Stent pt only if severely jaundiced, unrelenting itching or abnormal L LFTs (especially coags)
Angiogram with venous phase—look for encasement of SMA, SMV, portal vein and r/o replaced right hepatic artery
Endoscopic U/S—not necessary but can help stage tumor and assess resectability

DDx

Remember other causes of obstructive jaundice if this is what you are presented with:
Stricture
Stone
Extrinsic compression
Malignancy (duodenal, ampullary, cholangio)

Surgical Treatment

(1) Can laparoscope pt before you open to look for peritoneal implants
(a) if find, then do biliary and gastric bypass laparoscopically
(2) Chevron incision
(3) full abdominal exploration and evaluate for respectability (check for hepatic mets, lymph node mets outside of resection zone and liberal use of frozen section)

Clockwise Resection

(4) Cattell–Braasch maneuver
ligate Middle colic vein
exposing SMV

(5) Extended Kocher maneuver
ligate right gonadal vein
(6) Portal dissection
ligate gastroduodenal
dissect out gallbladder
Transect CHD just proximal to cystic duct
(careful, a hepatic artery can course posterior to portal vein)
(7) Transect stomach
at level of third/fourth transverse vein on lesser curve and confluence of gastroepiploic veins on greater curve
+/– pylorus preserving
(8) Transect jejunum
10 cm distal to ligament of Treitz
(9) Transect pancreas at level of portal vein
if adherent, proximal and distal control and resect anterior wall and repair with vein patch
frozen section to check pancreatic/biliary margins
(10) Vagotomy

Counter-Clockwise Reconstruction

(11) End to side pancreaticojejunostomy
2 layers over a stent
(12) End to side choledochojejunostomy
(13) End to side gastrojejunostomy antecolic in two layers
(14) Gastrostomy
(15) Jejunostomy
(16) Lots of drains

Common Curveballs

Replaced right hepatic artery—what is its course?
Tumor invading portal vein (discovered during course of operation)
Can't determine it is malignancy even with intra-op biopsies→"will you do a Whipple?"
Complications of Whipple
Leak at any of the anastomoses
Abscess
Delayed gastric emptying
Marginal ulcer
Pancreatic fistula
Bile leak
Intra-op injury to middle colic vein
Peritoneal implants and asked what type of bypass operation you will perform
Tumor may be in tail of pancreas (→distal pancreatectomy)
May present as acute pancreatitis (change scenario)
How to determine resectability?
Pt will be malnourished and asked to discuss TPN
Asked when will you place biliary stent pre-op?

Strikeouts

Not performing adequate staging work-up to r/o unresectable disease
Not knowing how to describe Whipple operation
Not knowing how to describe bypass operation
Performing percutaneous biopsy of pancreatic mass in potentially resectable lesions
Performing total pancreatectomy

Pancreas—Pancreatic Pseudocyst

Concept

A walled-off collection of pancreatic enzymes and inflammatory fluid typically in the lesser sac (with the boundaries formed by the lesser sac) or within the pancreas itself that is bounded by a nonepithelialized wall of fibrotic tissue. Can develop symptoms related to size (obstruction, pain) or erosion into other structures (bleeding).

Way Question May be Asked?

"A 48 y/o male with history of alcohol abuse and pancreatitis presents to ER with abdominal pain and work-up reveals a 4 cm pancreatic pseudocyst." Question could be abdominal pain in a patient with a history of pancreatitis, or could be given the formation of a pseudocyst after an initial bout of pancreatitis with the patient still in the hospital.

How to Answer?

Complete H+P

Weight loss
Vomiting
Abdominal mass
Trauma
Alcoholism
Bouts of acute or chronic pancreatitis
Palpable mass

Diagnostic Tests

Appropriate laboratory tests (amylase, WBC)
U/S good for screening
CT gold standard

Be complete, but don't dwell on these as the examiner is trying to get to your management here:

Differentiate pseudocysts based on size and symptoms.

Non-symptomatic less than 4 cm in size should be followed by serial U/S/CT scans—can continue to follow as long as decreasing in size.

Be prepared for pseudocyst to: rupture, obstruct, bleed, get secondarily infected, or increase in size.

Cysts with duration greater than 6 weeks, enlarging on CT, greater than 4 cm, or are associated with chronic pancreatitis are unlikely to resolve without operative intervention

6 cm or greater pseudocysts or symptomatic ones should undergo interventional treatment:

TREATMENT

(1) ERCP to see if communicates;
   (a) if doesn't, can consider CT aspiration (~40% success rate) or leaving a catheter in cyst cavity (these options will fail or the cyst will get secondarily infected)
   (b) if does, and symptomatic or larger than 4 cm→surgical drainage

(2) Choices for internal drainage (remember cyst wall takes about 6 weeks to mature):
   (a) *cystgastrostomy* (anterior gastrostomy, palpation and needle aspiration to find cyst in back wall of stomach and then open cyst, send part of wall for bx, and suture posterior wall of stomach to mature cyst wall, opening should be 5 cm, use interrupted absorbable sutures)
   (b) *cystojejunostomy* (use Roux loop when cyst is not adherent to posterior wall of stomach (can check by opening gastrocolic omentum and seeing if there is plane b/w posterior stomach and cyst) or multiple cysts (using side-to-side anastomosis)
   (c) *cystoduodenostomy* (if in head of pancreas close to duodenum, Kocher maneuver to check, 3 cm opening into first or third portion of the duodenum, transduodenal approach)

(d) *distal pancreatectomy* (option if pseudocyst in pancreatic tail or has eroded into surrounding structures)

(3) External drainage only for
(a) infected pseudocysts
(b) unstable pt with free rupture or bleeding

(4) bleeding in pt with a pseudocyst can be from:
(a) bleeding into the bowel from erosion into bowel wall
(b) bleeding from gastric varices (splenectomy treatment of choice here as varices form secondary to splenic vein thrombosis)
(c) bleeding into the cyst (erosion into one of the pancreatic vessels)
(d) bleeding from a ruptured pseudoaneurysm (usually splenic artery)
(e) bleeding may occur into cyst, into bowel, or free into peritoneal cavity

Angiogram helpful here if pt stable enough, otherwise, laparotomy, ligate offending vessels, open cyst, pack and return or go to angiogram as necessary

Common Curveballs

There will be multiple cysts
Try to get you to change your management strategy so the size may change during the questioning from 4 cm to 8 cm
Try to get you to operate before a mature wall has formed
Pseudocyst will rupture into thoracic cavity (pancreatic hydrothorax)
Your first choice of internal drainage will not be an option (prior surgery, . . .)
The pt with known pseudocyst will develop bleeding into the pseudocyst and present in shock (see above for DDx; angiogram to embolize bleeding vessel, otherwise ex lap, ligation splenic or gastroduodenal, then open and pack cyst and ligate bleeders within cyst wall)
The pseudocyst will get infected if you try to aspirate it
If you leave a drainage catheter for non-communicating cyst, the pt will get a pancreatic fistula
GI doctor will not be available for ERCP or endoscopic cystgastrostomy or endoscopic cystgastrostomy will result in free perforation/bleeding at the anastomotic site
Biopsy of the wall will reveal malignancy
Pt will have pancreatitis flare after ERCP
Pseudocyst will actually be cystic neoplasm by intra-op frozen section biopsy (change of scenario)
Pt that you decide to follow will develop complication from pseudocyst such as:
cyst rupture—pancreatic ascites
infection (fever, inc. WBC, inc. abd pain→open surgical drainage)
bleeding (hemorrhagic shock)
duodenal obstruction
pseudoaneurysm
splenic vein thrombosis

Strikeouts

Forgetting to biopsy the wall of the pseudocyst
Not waiting for wall to mature
Not obtaining a CT scan
Not knowing how to perform internal drainage procedure
Not getting ERCP pre-op to determine if communicates with pancreatic duct
Taking pt with bleeding from pseudocyst to OR rather than angiogram to embolize offending vessel
While has been performed by several authors, *don't mention* laparoscopic cystogastrostomies

Pediatric Surgery—Neonatal Bowel Obstruction

Concept

Bilious vomiting is always a surgical emergency in the newborn. Multiple possible etiologies:

- Annular pancreas
- Duodenal web
- Malrotation
- Jejunoileal atresia
- Meconium ileus
- Hirschprung's
- Infection/NEC Cl^-
- Metabolic abnormalities (K^+, Mg^{++})

Always look for associated anomalies such as cystic fibrosis (meconium ileus) and Trisomy 21 (duodenal atresia, malrotation).

Way Question May be Asked?

"Called to NICU to evaluate a baby that has had bilious vomiting since birth. What do you want to do?" Always look for congenital anomalies, Down's stigmata, and remember that this is a surgical emergency.

How to Answer?

History

- Maternal polyhydramnios
- Onset of bilious emesis (w/every feeding)
- Delayed meconium passage
- Prematurity
- Family history

Physical Exam

- Evidence dehydration (sunken fontanelle, skin turgor)
- Abdominal distension or scaphoid abdomen
- Any congenital anomalies (perforate anus?)

Diagnostic Tests

"Babygram"—look for pattern of the gas
- "double bubble"—duodenal atresia or malrotation with volvulus
- dilated SB loops—jejunoileal atresia

UGI if suspect proximal obstruction or malrotation
BE if suspect distal obstruction

Surgical Treatment

(1) NPO/IVF/NGT/Correct electrolytes
(2) determine if obstruction is *proximal or distal*
(3) OR for any evidence peritonitis
(4) Duodenal Atresia→OR once resuscitated
   (a) duodenojejunostomy through transverse RUQ incision
   (b) obstruction usually immediately post-ampullary
   (c) G-tube
(5) Malrotation (often associated with diaphragmatic hernia, abdominal wall defects, and jejunoileal atresia)
   (a) counterclockwise detorsion if volvulus present
   (b) second look for questionable viability
   (c) Ladd's procedure
      dividing peritoneal bands crossing duodenum (extend from ligament of Trietz)
      positioning duodenum and jejunum to right of midline
      positioning colon to left of midline
      incidental appendectomy
   (d) treat other anomalies if present
   (e) cecopexy/duodenopexy not necessary
(6) Jejunoileal atresia
   (the more distal the obstruction, the more abdominal distension child will have)
   (a) BE to document normal colon
   (b) resect atretic portion

(c) inject saline to make sure no distal obstruction (web/atresia)
(d) end to end anastomosis

(7) Duodenal web
(a) longitudinal duodenotomy
(b) partial membrane excision

(8) Meconium ileus—failure to pass meconium < 24 h with bilious emesis, abdominal distension, perforate anus
(produces obstruction from inspissated meconium secondary to pancreatic exocrine insufficiency)
(a) evaluate for Cystic Fibrosis
(b) ground glass appearance on AXR instead of A/F levels
(c) gastrografin enema, pancreatic enzymes by NGT, and mucomyst for uncomplicated presentation
(d) complicated meconium ileus→OR
resect nonviable bowel
repair perforations
drain any abscesses
enterotomy + injection mucomyst

Common Curveballs

Double bubble on x-ray will be malrotation and not duodenal obstruction
Scenario will change from proximal to distal obstruction
Pt will have multiple atretic areas in jejunum/ileum
Pt will have appearance of total small bowel infarction
Pt will have associated anomalies (only cardiac affects your decision to operate)

Strikeouts

Not identifying malrotation
Not knowing Ladd's bands or details of Ladd's procedure
Not knowing what "double bubble" means on "baby-gram"
Not looking for associated anomalies
Not treating bilious vomiting as surgical emergency

Pediatric Surgery—Pyloric Stenosis

Concept

Thickening of the muscle of the pylorus resulting in functional outlet obstruction. Most common surgical cause of emesis in infants. Unknown etiology.

Way Question May be Asked?

"Called to ED to evaluate a 9 week old infant with a history of intermittent non-bilious emesis that is now projectile vomiting. What do you want to do?" May be given an infant with clear signs of dehydration and may be an older infant (up to 2 years old). Key is whether or not the vomiting was bilious.

How to Answer?

History

FHx of pyloric stenosis
Bilious vs. non-bilious vomiting
Vomiting of undigested formula shortly after feeding
Intermittent emesis progressing to projectile
Infant hungry between episodes of vomiting

Physical Exam

Sunken fontanelle
Dry mucous membranes
Decreased skin turgor
Abdominal exam:
  Thickened pylorus or "olive" in epigastrum
  (need infant to be quiet and stomach empty)
  Observation of gastric peristaltic waves

Diagnostic Tests

Full labs especially K+ (hypokalemic, hypochloremic metabolic alkalosis)

U/S

  Elongated pyloric channel
  Thickened pyloric diameter
  Increased pyloric wall thickness

Barium UGI

  Elongated narrow pyloric channel ("string sign")
  Gastric outlet obstruction

Surgical Treatment

(1) Correct electrolyte abnormalities (this is an elective surgical procedure)
(2) D51/2NS
(3) Pyloromyotomy (Ramstedt technique)
  general anesthesia
  transverse epigastric or RUQ incision
  grasp pylorus between two fingers
  incision with scalpel into serosa/muscle
  back of scalpel handle to blunt complete pyloromyotomy
  should see bulging mucosa
  careful not to perforate underlying mucosa
  (if perforate, close and cover with omental patch, or close myotomy and rotate pylorus 45° and perform pyloromyotomy again)
(4) Can start feeding 6–12 h post-op with dilute milk and advance as tolerated
(5) Small episodes of emesis not uncommon in immediate post-op period, pursue with UGI for incomplete pyloromyotomy if extends past POD#2.

Common Curveballs

Pt will have low K+ and asked how you will manage
Being asked when you will start feeding the child
Mucosal perforation during your pyloromyotomy, now what?
Scenario will change and pt will have malrotation, antral web, or duodenal stenosis

Incomplete pyloromyotomy
Asked to describe *Paradoxic Aciduria*

(vomiting leads to loss of fluid with high K+, H+, and Cl-concentrations. Volume deficit leads to aldosterone mediated Na+ resorption with loss of K+ and body tries to hold onto K+ leading to excretion of H+ ions leading to paradoxic aciduria)→treat by replacing volume before administering K+!

Being asked how to calculate volume of fluid to be administered to the infant and given a weight in kg

Strikeouts

Mistaking diagnosis for one of the many etiologies for neonatal bowel obstruction

Not being able to describe how to resuscitate the pt preop

Describing laparoscopic pyloromyotomy

Not being able to explain the hypokalemic, hypochloremic metabolic alkalosis that typically accompanies these pts

Pediatric Surgery—Tracheoesophageal Fistula

Concept

Common cause of respiratory distress in the infant. Several variants:

(A) esophageal atresia and distal TEF (most common)
(B) atresia without fistula
(C) H-type TEF
(D) atresia with proximal and distal TEF

Approximately 50% of infants will have other congenital defects (VACTERL—vertebral, anorectal, cardiovascular, TEF, renal, limb) and you need to rule these in/out prior to operation.

Way Question May be Asked?

"Called to NICU to evaluate a newborn who is small for his gestational age that had an episode of choking and desaturation with his first two feedings. What do you want to do?" Should consider any newborn with respiratory distress. Key is that problems are associated with feeding. Most should be identified preterm by U/S.

How to Answer?

History

Maternal polyhydramnios
Respiratory distress with first feeding (choking, coughing, regurgitation)
Desaturation with eating

Physical Exam

Can't place NGT
Small for gestational age infant
Scaphoid abdomen (if atresia without TEF)
Imperforate anus or limb abnormalities
Cardiac exam

Diagnostic Tests

"Babygram"
  air in GI tract rules out atresia without TEF
  r/o duodenal atresia, vertebral anomalies
0.5 cc barium down NGT (identify blunt pouch)
Pre-op echo to r/o cardiac anomalies (affects anesthesia management)
Renal U/S before or after repair

Surgical Treatment

(1) NGT in pouch
(2) Elevate head of bed
(3) abx if pneumonia
(4) OR in first 24 h for repair:
  (a) extrapleural approach/right thoracotomy
  (b) divide fistula
  (c) close trachea
  (d) end to end esophageal anastomosis
  (e) gastrotomy for early post-op feeding
  (f) leave drain next to esophageal anastomosis
  (g) alternative is gastrotomy only and spit fistula in neck and delay repair until one year old (colon interposition→usually in cases of atresia without TEF)

Common Curveballs

Post-op complication:
  Leak
  Stricture
  Recurrent fistula
  Reflux

Will enter pleura during extrapleural approach
Will be associated anomalies (Down syndrome, valvular defect, etc.)
Won't be able to perform primary end to end anastomosis because of long "gap"
Pt will present with H-type fistula (repeated episodes of pneumonia in infancy)
Scenario will switch to management of associated imperforate anus

Strikeouts

Not making the diagnosis
Not knowing most common type/how to repair most common type
Not ruling other associated anomalies pre-op (especially cardiac!)
Not trying to place NGT (alternatively, continuing to try to advance when meet resistance)
Not placing G-tube at operation

Perioperative Care—Hypotension in the Recovery Room

Concept

Easy to get lost in the myriad of possible diagnosis. The key is to be methodical and stepwise. Approach patient like a trauma patient working through your ABCs. DDx includes any form of shock: hypovolemic shock (inadequate fluids intra-op), hemorrhagic shock (pt still bleeding), cardiogenic shock (MI, pneumothorax), also sepsis (unlikely so quick), transfusion reaction, malignant hyperthermia, Addisonian crisis, air/fat embolism.

Way Question May be Asked?

"You are called to evaluate a 63 y/o male status post a AAA repair who was stable in the recovery room for about 2 h and now his BP has dropped to 80/40. What do you want to do?" Question could be asked in many different ways with the patient status post any major abdominal operation, had received blood intra-op, may or may not be given other vital signs at the start.

How to Answer?

Be methodical
ABCs while resuscitating the pt

Airway

Is pt on ventilator?
What is RR and Pulse ox?
Does pt need to be intubated?

Breathing

Are both lung sounds present?
Does patient need chest tube?

Circulation

Pulses
Cold extremities (hypovolemic shock) vs. warm (anaphylactic)

"AMPLE" History

Type of procedure
Length of surgery
Fluids/blood
Previous PMHx
CVP placed intra-op?

Physical Exam

Vital signs (fever very suggestive)
Neck veins (flat or distended)
Heart rate (arrythmia)
Rash (petechiae with txn reaction)
Generalized oozing (DIC)
Pulses in extremities
Abdominal exam

Surgical Treatment

(1) Order:
CXR, EKG, ABG, complete laboratory panel, U/A
Send pt's blood along with transfused bags if suspect txn reaction (also check urine for Hgb)
(2) CVP or SGC to direct fluid management
(3) Treat specific underlying problem
(a) for hypovolemic shock, fluid resuscitation
(b) for cardiogenic shock, SGC plus pressors
(c) for pneumothorax, chest tube
(d) for malignant hyperthermia, cooling, supportive care, *dantrolene*
(e) for Addisonian crisis, bolus steroids (100 mg hydrocortisone)

(f) air/fat embolism, supportive care
(g) transfusion reaction (key is to keep up urine output and avoid precipitation of Hgb in renal tubules)
fluids to maintain UO 100 cc/hr
2 amps bicarb plus add to IVF to alkalinize urine (check pH > 7)
mannitol (1–2 mg/kg) (osmotic diuretic)

Common Curveballs

Pt will have MI and you'll be asked your management/pressors
Pt will have refractory hypotension to anything you do
Pt will have txn reaction and you'll be asked your specific management including how to alkalinize the urine
Pt will need to be intubated
Pt will need CVP/SGC
You'll be given a set of SGC parameters to interpret
Pt will develop renal failure (change scenario)

Strikeouts

Taking pt back to OR (usually, they are not trying to get you to take pt back to OR,
Not being methodical and going through ABCs
You'll miss a mucus plug)
Miss a pneumothorax or tamponade from CVP line anesthesiologist placed
Miss a kinked ETT
Missing vital signs (fever and hypotension point you in some specific directions)

Perioperative Care—Postoperative Fever

Concept

Multiple causes, but should be systematic. Remember the number of days post-op and the most common causes. Never forget to check the wound for a necrotizing soft tissue infection or change the CVP for possible line sepsis.
DDx:

Days 0–2: atelectasis, necrotizing soft tissue infection
Days 3–5: UTI, pneumonia
Days 5–7: wound infection/abscess
Day 7–10: DVT, anastomotic leak, C. diff
Immediate post-op: Addisonian crisis, thyrotoxicosis
Anytime: line sepsis, drug fever, transfusion reaction (soon after txn pRBC, platelets, FFP, cryo)

Way Question May be Asked?

"You are called to see a pt 3 days s/p a right hemicolectomy for an adenomatous polyp who is febrile to 101.4. What do you want to do?" Question may be after any operation and any number of days post-op. Key is to resuscitate the unstable pt in the ICU, perform a complete exam with attention to the wound and IV sites, to get appropriate diagnostic tests, and then be aggressive with the management when appropriate. Common scenarios will include necrotizing soft tissue infection, anastomotic leak, enterocutaneous fistula, and intraabdominal abscess.

How to Answer?

History

Type of surgery (how dirty was the case?)
Antibiotic use
Recent transfusions
Associated symptoms (cough, chills, rigors, pain, dysuria, diarrhea)
IV sites (how old ?)
Diarrhea
Immunosuppression (txp pt, HIV+, chemotherapy, steroid use?)

Physical Exam

Vital signs (shock?)
Complete physical exam
Wound
IV sites
Foley?

Diagnostic Tests

Complete labs (including CBC w/diff, LFT's, amylase, U/A)
Culture and Gm stain any wound drainage
Low threshold to open up any wounds
Sputum Gm stain/culture
Blood cultures (useful only if your pt is still alive 48 h later when the results return!)
CXR
+/– CT scan (to r/o abscess)
+/– Duplex U/S of lower extremities
+/– thyroid hormone levels
+/– stool for C. diff toxin assay

Surgical Treatment

(1) Low threshold to open wound
(2) Low threshold to change CVP and send tip for Cx
(3) Low threshold to transfer unstable pt to ICU
(4) For necrotizing wound infection
  (a) open wound
  (b) gm stain, C+S
  (c) take immediately to OR
  (d) wide debridement to viable tissue
  (e) close with VAC sponge, Bogata bag, cadaveric skin, or pack

(f) return to OR following day to repeat debridement and then daily until only viable tissue remains
(g) treat with PCN G or broad spectrum abx based on Gm stain, Cx's
(h) typical organisms: Clostridia, Strep, and mixed infections

(5) For retained foreign body
(a) need AXR/CXR +/– CT scan to identify
(b) promptly take to OR
(c) may be asked how you will describe situation to pt and family (honesty is the best policy!)

Common Curveballs

Pt will have necrotizing wound infection and you'll be asked how to manage
Pt will have retained foreign body left behind from surgery
How will you discuss with pt/family a retained foreign body
Pt will have necrotizing infection and asked how to treat/close wound
Pt will have C. diff enterocolitis and need emergent abdominal surgery
Being asked your antibiotic selection and why
Scenario will change on you from POD #2 to #5 to #10
Pt will have anastomotic leak
Pt will have fistula
Pt will have intraabdominal abscess
Pt will have transfusion reaction
Pt will have Addisonian Crisis
Pt will have thyrotoxicosis
Pt will have DVT

Strikeouts

Getting lost in zebras like paraneoplastic syndromes, SBE, drug fever, parotitis, otitis
Pursuing a work-up for sinusitis and acalculous cholecystitis in any pt other than the debilitated ICU pt
Not considering line sepsis
Not evaluating wound
Not recognizing and appropriately treating necrotizing wound infection
Waiting for blood culture results before making any definitive management decisions (usually are waste of money as results take >24 hrs.)

Perioperative Care—Recent MI

Concept

Many patients will have elevated operative risk given cardiac history. Risk factors include HTN, DM, angina, vascular disease, + family history.

Way Question May be Asked?

Any common general surgery issue, with the patient having had a recent MI.

"56 y/o male, heavy smoker, with recent MI, now presents with signs and symptoms c/w acute cholecystitis." The examiners may actually throw the scenario at you where the patient has multiple problems, like obstructing or bleeding rectal cancer, and will have had a recent MI.

How to Answer?

Goldman criteria
aortic stenosis, MI within 6 months, emergency surgery, nonsinus rhythm, age > 70 years, JVD, poor medical condition (PO2 less than 60, CR > 3.0, chronic liver dx
Emergency operations performed without cardiac preparation have an up to 5% perioperative risk of MI
No type of anesthesia (local, epidural, or general) is better than any other when administered by good anesthesiologist
Preoperative work-up as best as possible to determine cardiac status (EKG, CXR, ECHO—ejection fraction)
If find reversible defect on stress thallium→ cardiac cath
If find a lesion, have bypass performed
Pre-op SGC and NTG gtt and maximize hemodynamics with invasive monitoring
Pt with conduction system disease may require temporary pacemaker support during surgery
~10% perioperative mortality with:

(a) recent MI (risk, ~30% if less than 30 days, 6% if less than 3 months, 2 % if 3–6 months)
(b) decompensated heart failure
(c) unstable angina
(d) severe valvular disease (less than 0.9 cm^2 for aortic valve and 1.5 cm^2 for mitral valve)

Common Curveballs

Intraoperative ischemia
Intraoperative arrhythmias
Post-op ischemia
Post-op arrhythmias (a. fib particularly popular as a complication in any scenario whether recent MI or not—don't forget your ACLS!)
Post-op pulmonary edema
How will you manage pt pre-op

Clean Kills

Not knowing any of Goldman criteria (don't need to know all of them)
Not adequately working up pt pre-op
Forgetting about intra-op monitoring
Believing one type of anesthesia superior to another—risk itself is just anesthesia so do the surgery you need to do
Not appropriately dealing with post-op complications

Perioperative Care—Renal Failure

Concept

Multiple causes, but can be broken down into prerenal, intrarenal, and postrenal causes. Certain information on H+P and your diagnostic tests will help you here.

Prerenal

- Hypovolemic shock
- Hemorrhagic shock
- Septic shock
- Third space losses (burns, pancreatitis, long operation, cirrhosis)
- Vascular (emboli, renal artery occlusion)
- Abdominal compartment syndrome
- Pump failure

Intrarenal

- ATN—from ischemia—secondary to inadequate perfusion (from prerenal cause above)
- Acute interstitial nephritis—secondary to medication

Postrenal

- Urethral obstruction (catheter/prostate)
- Bilateral ureteral obstruction (intra-op injury, retroperitoneal fibrosis)

Always want to convert oliguric renal failure into non-oliguric. Most often cause will be hypovolemia in surgical patients.

Way Question May be Asked?

"You are called to see a patient 6 h s/p AAA repair whose urine output has been 15 cc the past 3 h. What do you want to do?" Question may be after any operation or in the management of any patient for example, s/p multiple trauma, burns, APR.

How to Answer?

History

- I/Os
- Intra-op fluids
- Clamp time on AAA (supra or infrarenal)
- History of renal disease
- Nephrotoxic meds
- Diuretic use
- Recent transfusions (hemolysis with precipitation in renal tubules)
- Trauma with major muscle injury (myoglobinuria)

Physical Exam

- Vital signs (shock?)
- Skin (turgor?)
- Mucous membranes
- Chest (CHF?)
- Abdomen (distended bladder?)
- Check Foley (is one in place? has it been flushed?)
- Bladder pressures (compartment syndrome)

Diagnostic Tests

- Complete labs
- BUN/Cr ratio
- U/A (protein with glomerular disease, eosinophils with interstitial nephritis)
- Urinary electrolytes (urinary Na < 20 suggests prerenal etiology)
- U/S to evaluate kidneys
  - Obstruction
  - Confirm two kidneys
- CVP or SGC to determine volume status
- +/– IVP to evaluate kidney function
  - Confirm no postrenal obstruction
  - (careful—die load—use non-nephrotoxic contrast agents)

+/– Renal Scan—MAG3 scan, useful to assess kidney perfusion

Surgical Treatment

(1) *Low threshold for* CVP, *txfr to ICU*, SGC
(2) D/C any nephrotoxic drugs and supplemental K+
(3) Go through your DDx for renal failure
(4) Fluid resuscitation and monitor hourly UO
(5) +/– Dopamine at renal doses
(6) Lasix to convert to non-oliguric renal failure
(7) +/– Mannitol
(8) Monitor electrolytes closely
(9) Consider dialysis

Common Curveballs

Indications for dialysis
Asked to describe how to measure bladder pressures? Their significance?
Asked how to treat abdominal compartment syndrome
Patient will be unresponsive to all resuscitative measures
Patient will have myoglobinuria and asked your management (alkalinize urine)
Patient will have transfusion reaction and development renal failure and you'll be asked how to manage
Patient will have only one kidney
Patient won't respond to fluid boluses
Patient will be elderly with brittle heart/prone to CHF/low EF
Won't be able to place foley catheter
Patient will have hematuria

Strikeouts

Not breaking DDx down into prerenal, intrarenal, and postrenal causes
Not placing at least CVP after two fluid boluses without a response
Not being aggressive with resuscitation of patient
Not identifying abdominal compartment syndrome
Performing angiogram acutely
Performing renal biopsy acutely

Skin and Soft Tissue—Melanoma

Concept

Four main subtypes—superficial spreading, nodular, lentigo maligna, and acral lentigenous—with several special situations (anal, subungal). Work-up should be systematic—establish risk factors, biopsy, stage the patient, sample lymph nodes, and then determine any adjuvant treatment. Expect questions regarding lymph node sampling, especially groin dissections.

Way Question May be Asked?

"52 y/o male presents to your office with a skin lesion on his leg (or arm, or abdomen, or back) that has recently changed in both color and size." You may also be shown a picture of an obvious melanoma, or get the patient sent to you after a biopsy performed by a dermatologist.

How to Answer?

History

Changing skin lesion (A,B,C,D,E mnemonic)
Bleeding lesion
Ulceration
Itching

Establish Risk Factors for Melanoma

Excessive sun exposure
Fair skin
+FHx
Hx of melanoma
Dysplastic nevus syndrome
Xeroderma pigmentosum

Physical Exam

Examination of lesion (color, size, symmetry)
Examination of regional lymph node basins

Consider the Differential

Benign nevus
Seborrheic keratosis
Pigmented wart
Squamous cell cancer
Basal cell cancer

Biopsy Lesion

If not in cosmetically sensitive place, excise with 1–2 mm margin
If large, punch bx through thickest portion of lesion or incisional bx
Always orient the specimen
If subungal, split open nail—only need diagnosis here

Staging the disease (Clark's system has really fallen out of favor—mostly based on Breslow depth)

TNM system:	I primary	< 1.5 mm depth, no nodes
	II	> 1.5 mm depth, no nodes
	III	regional nodal disease or in-transit mets
	IV	distant metastases

Histological staging (Breslow)

Thin	0–0.75 mm
Intermediate	0.76 to 4 mm
Thick	> 4 mm (80% chance of mets)

Diagnostic Studies

- CXR
- CBC, LFT, LDH
- FNA any palpable nodes
- If palpable nodes:
  - CT scan to evaluate nodal and next nodal basin
  - CT liver and brain
- Margins of resection (will likely need to re-excise after biopsy)
  - 5 mm for in-situ lesions
  - 1 cm for < 1 mm depth
  - 2 cm for > 1 mm depth
  - head/neck—twice the diameter of the lesion
  - subungal finger—split nail to biopsy, amputate distal phalanx (elective node dissection if > 0.75 mm)
  - subungal toe—ray amputation
  - ear— full thickness wedge resection twice the diameter of the lesion
  - anal—local excision, APR only if pt is incontinent or has severe pain from invasion of the sphincters
  - anterior to ear—re-excision + modified radical neck dissection and superficial parotidectomy

Lymph Node Sampling

- SLN bx should be offered to all pts with extremity and truncal primaries greater than 1 mm in depth (except subungal)
- Get pre-op lymphoscintigraphy
- Use combo of handheld gamma counter and Lymphazurin blue dye
- Send sentinel node for frozen section
- Complete node dissection if sentinel node positive
- Only do deep node dissection in groin if have *gross* disease in apical nodes (sapheno-femoral/Cloquet's node) or CT shows suspicious iliac adenopathy
  - →Not if only *microscopic* disease in superficial nodes or CT suggests nodes that are positive to level of aortic bifurcation as unlikely to have any therapeutic benefit and downside of severe leg edema!
- Prophylactic node dissection if:
  - b/w 1–4 mm and lesion overlies the primary nodal basin (parotid, inguinal, axillary)
  - lesion > 1 mm in head or neck
- Adjuvant therapy
  - Stage II melanomas deeper than 4 mm or Stage III disease get offered vaccine or high-dose interferon
- Treatment of in transit/recurrent disease
  - Re-excision, local radiation, and isolated hyperthermic limb perfusion with melphalan and TNF has received a lot of attention recently
- Treatment of Stage IV disease
  - Isolated mets (liver, lung, brain) should be resected assuming no other evidence of disease

Common Curveballs

- Melanoma won't be on extremity but on trunk and pre-op lymphoscintigraphy will light up several nodal basins
- Lymph nodes in groin will be clinically palpable
- Sentinel node biopsy won't work
- Will be other melanomas if don't do complete skin survey
- Expect pulmonary/brain metastases during first several years of follow-up of your pt
- Depth will be 0.74 or 0.77 mm
- Pathology may turn out to be squamous cell or basal cell
- There will be in-transit disease
- The pt will have two melanomas
- Microscopic disease in Cloquet's node—will you do deep inguinal dissection?
- Management of subungal/anal melanoma
- Decline in pulse ox reading during operative procedure (typical artificial side effect of blue dye)
- Pt. may have allergic reaction to blue dye

Strikeouts

- Not being able to justify your reasoning on doing or not doing a deep inguinal node dissection when appropriate
- Performing a shave biopsy or FNA of a suspected melanoma
- Not performing physical exam to lymph node basins
- Not knowing difference between Clark's levels and Breslow depth
- Not knowing re-excision margins for different depth melanomas
- Not orienting the specimen for the pathologist
- Not getting CT to evaluate next echelon of nodes with palpable nodes clinically
- No SLN bx in head and neck, subungal and anal melanomas!
- Trying to perform SLN bx when lesion overlies a lymph node basin
- Trying to offer chemotherapy to pts with isolated metastases
- Discussing vaccine therapy (experimental)

Skin and Soft Tissue—Sarcoma

Concept

Pathologic type is not as important as size, grade, location, and resection margins. Lymph node involvement is rare and therefore, lymph node dissections are only done if grossly involved. Chemotherapy is controversial and marginally beneficial.

Way Question May be Asked?

"39 y/o man presents to the office with a growing mass on his right anterior thigh. On exam, it is hard and fixed to the underlying tissues. What do you do?" May be in the extremity of a female after axillary dissection (Stewart-Treeves syndrome) or in patient with history of radiation.

How to Answer?

Brief History

- Trauma
- Radiation
- Café au lait spots (von Recklinghausen pts)
- History of prior lymphadenectomy

Physical Exam

- Examination of tumor
- Lymph nodes
- Neurovascular deficit in the affected extremity

Studies

- CXR
- MRI/CT for extremity sarcomas (MRI more helpful in retroperitoneum to allow evaluation of the IVC)

Biopsy Lesion

- If less than 3 cm, may excise, but don't shell out due to tumor pseudo encapsulation→ aim for 2 cm margin
- If larger, incisional biopsy *parallel* to the muscle group (won't compromise future resection)
- Core needle biopsy is acceptable but tattoo site of bx for later excision
- Need to ask pathologist: histologic grade

Treatment

- Surgical excision for grossly clear margin
- In extremity:
  - 2 cm margin, remove entire muscle group *only* if necessary
  - Mark the excision site for adjuvant XRT that may reduce incidence of local recurrence
  - Can leave microscopic disease if this preserves vital neurovascular structures as post-op XRT will clean up residual disease
  - Extremity arteries are expendable and can be replaced with vein or conduit
  - Femoral nerve can be sacrificed, but not sciatic (generally, can sacrifice sensory nerves, but try to preserve motor nerves)
  - Removing large central extremity veins leaves pt with severe edema
  - Amputative procedures only for joint involvement (hip, knee, elbow, shoulder, pelvis)
  - For small-cell sarcomas (Ewing's), can consider neoadjuvant chemo/XRT to cytoreduce tumors to allow for limb salvage or salvage of vital neurovascular structures (sciatic nerve)
- In retroperitoneum:
  - Wide local resection for grossly clear margins only
  - Resect en bloc only organs where sarcoma is clearly invaded

- Dissect sarcoma free if adherent to an intra-abdominal structure
- No indication for use of adjuvant RT in retroperitoneal sarcomas (too much visceral toxicity)
- Only do percutaneous biopsy if there is extensive peri-aortic adenopathy and the dx is most likely lymphoma
- Can excise IVC if involved and replace with Gortex if pt hasn't already developed sufficient collateral around it.

Pulmonary Mets
- Acceptable to remove if primary disease site is controlled and number of pulmonary mets < 8

Common Curveballs

- Retroperitoneal sarcoma will abut or invade multiple intraabdominal organs
- Extremity sarcoma will invade neurovascular bundle
- Recurrence locally (re-excise in extremity if possible or amputate)
- Development of lung metastases
- IVC will be invaded in retroperitoneal sarcoma
- Upper extremity sarcoma

Strikeouts

- Attempt an FNA of mass
- Incisional biopsy transverse to underlying muscle group
- Trying to treat only with chemotherapy (only small cell sarcomas!)
- Removing adjacent organs in retroperitoneal sarcoma if no actual invasion
- Removing entire muscle group when clear margin can be achieved with less aggressive surgery
- Not attempting pulmonary metastectomy when sarcoma recurs in lungs
- Resecting sciatic nerve
- Not preparing pt pre-op for possible paralyzed leg or amputation in attempt to perform adequate resection

Skin and Soft Tissue—Skin Cancer (Other than Melanoma)

Concept

Usually we are talking here about squamous cell cancer or basal cell cancer. Can consider other types of benign skin lesions in your differential, but question will be how to manage the malignant type. Basal cell is most common and may present as nodular, superficial, or ulcerating lesion.

Way Question May be Asked ?

"66 y/o male presents to office with bleeding scalp lesion. Fungating large mass on physical exam. When patient's hat is removed. What do you want to do?"

How to Answer?

Brief H+P

Risk factors:
- (Excessive) Sun exposure
- Radiation
- Inherited skin disorders

Physical Exam

Characteristics of lesion (size, shape, color)
Full skin survey (include axillae, groin, scalp)
Examine lymph node basins related to lesion

Treatment

Briefly consider DDx and then proceed to
- Surgical excision
- Review pathology

For Squamous cell → want 5 mm margins for lesions < 2 cm in size
→ want 1 cm margin for lesions > 2 cm in size node dissection if palpable nodes or if Margolin's ulcer

For Basal cell → want 2 mm margins

For lesion on head/neck → would want to resect and close defect with:
(1) Free full thickness skin graft from behind ear or base of the neck
(2) Rotation flap

Mohs Surgery Indications

Recurrent basal/squamous cell CAs
Tumors of face, invasive into nasal, periorbital, periauricular structures

Adjuvant Treatment (XRT)

Close margins of resection (< 1 mm)
Neuro/vascular invasion
BCC/SCC in medial canthus of eye/nose

Lymph Node Dissection

Only for clinically involved nodes (modified radical neck + suparotidectomy if tumor invading parotid)

Common Curveballs

Path will come back melanoma (change scenario)
Lymph nodes will be palpable
Excised lesion will recur
Lesion will be on face and needs full thickness skin graft
Tumor will be large and ulcerating
There will be palpable nodes
Tumor will be preauricular invading parotid gland

Treating a lesion that develops in chronic wound (Margolin's ulcer)

Strikeouts

Discussing electrodessication and curettage
Discussing Mohs surgery when not indicated
Discussing simply treating with radiation/chemotherapy
Talking about SLN bxs or elective lymph node dissection

Stomach and Duodenum—Duodenal Ulcer

Concept

Majority of questions will be related to obstruction, bleeding, or perforation. Most ulcers are related to *H. pylori* or NSAID use. Nonoperative therapy may be appropriate for initial discovery of ulcer and for initial bleeding ulcer. Be sure to rule out ZE syndrome, ulcerogenic medications, hyperparathyroidism, and antral G cell hyperplasia when appropriate.

Way Question May be Asked?

"A 43 y/o man presents to ED with acute onset of severe epigastric pain with a rigid abdomen on physical exam. Upright AXR reveals free air." Unlikely to get a presentation this classic. Be sure to go through your DDx for epigastric pain ruling out MI and pancreatitis, or your DDx for UGI bleeding if appropriate.

How to Answer?

History

NSAID, smoking, ethanol use
History of ulcer symptoms (chronic hx affects your choice of operation!)
H. pylori treatment
Family history (MEN I)
H_2 blocker therapy
Foreign body ingestion
Diarrhea (gastrinoma)

History should also focus on symptoms being sure to r/o other possibilities:

Pancreatitis
MI
Pneumonia → all less likely if see free air, make sure AXR is upright!
Esophagitis
Gastritis
Gallbladder dx
Aortic dissection

Physical Exam

Check vital signs
Look for peritoneal signs (guarding, rebound)
Remember findings are more subtle in elderly and in pt on steroids

Labs

Full laboratory panel including amylase/lipase
Gastrin/Ca^{++} if suspicion of gastrinoma, hyperparathyroidism or chronicity

Radiologic Studies

For *perforated ulcer*, need:

Upright AXR
CT scan could demonstrate free air and r/o diverticulitis

For *bleeding ulcer*, need EGD → will r/o other pathology, help predict course, treat bleeding, and check for *H. pylori*

Treatment of bleeding ulcer by EGD:
Electrocautery
Heater probe
Injection therapy

Endoscopic appearance
- Clean-based ulcer (rarely rebleed)
- Adherent clot (likely to rebleed)
- Non-bleeding vessel (likely to rebleed)

For *obstruction*, need UGI

Treatment

For Perforated Ulcer:

- No role for conservative treatment!
- Need to initially resuscitate pt (IVF, antibiotics, H2 blockers)
- Take to OR, upper midline incision
- Three choices:
  - *High risk pt* (elderly, > 24 h, unstable, advanced peritonitis)
    - Omental patch and abdominal lavage (> 5 liters saline)
  - *Good risk pt* (young, < 24 h, stable, early peritonitis)
    - Omental patch, parietal cell vagotomy, lavage
  - *Good risk pt with hx of PUD:*
    - Antrectomy (will include ulcer)/vagotomy, lavage

For Bleeding Ulcer:

- *Treatment* initially is conservative with EGD, transfusions, H_2 blockers
- Should have your limit of transfusions before going to OR (> 6 in 24 h or hemodynamic instability)
- Should know what endoscopic appearance is relative indication for OR
- Three choices here too:
  - *High risk pt:*
    - Vagotomy/pyloroplasty/oversew of ulcer (U stitch)
  - *Good risk pt with small ulcer*
    - Oversew ulcer and parietal cell vagotomy
  - *Good risk pt with large ulcer* (> 2 cm) or hx PUD
    - Antrectomy/vagotomy

For Obstruction:

- Initial conservative Tx with trial of NGT decompression
- H_2 blockers
- Check UGI to confirm
- If this fails (which it will), then proceed to OR
- Two choices here:
  - *High risk pt:*
    - Gastrojejunostomy +/– vagotomy
  - *Low risk pt:*
    - Antrectomy and vagotomy (Bilroth I reconstruction)

Notes about Surgery:

Should always try for Bilroth I (avoids afferent/efferent problems with Bilroth II and problems with second anastomotic line). Be sure to extend at least 0.5 cm beyond distal edge of pylorus and check proximal antrectomy line with frozen section to show parietal cells.

If doing pyloroplasty, may not be able to do typical Heineke-Mikulicz pyloroplasty with a scarred duodenum, so do a Finney or a Jaboulay (anastomosis involving distal stomach to second portion of duodenum). If all three are impossible, gastrojejunostomy is effective emptying procedure.

Truncal vagotomy involves stripping the esophagus bare of areolar tissue in the distal 5–7 cm of esophagus.

If pt has had prior surgery, and pre-op work-up reveals no specific cause for recurrence, take next most aggressive option:

If prior vagotomy with drainage→antrectomy

If prior antrectomy with vagotomy→subtotal gastrectomy

Common Curveballs

- EGD will see adherent clot or visible vessel
- Perforation will be over 24 h old
- Perforation will be in pt with long hx refractory ulcer dx
- Perforation will be in elderly pt
- Pt will have had prior abdominal surgery
- Won't be able to close duodenal stump after antrectomy
- Pt will keep requiring blood transfusions, but spread out over several days
- Nonoperative treatment will work and pt will later present with gastric outlet obstruction
- Asked to describe how to perform vagotomy/pyloroplasty/antrectomy/ and/or "U stitch" for bleeding duodenal ulcer
- Gastrojejunostomy will be complicated by marginal ulcer, afferent loop syndrome, bile reflux, gastritis, dumping syndrome.
- Duodenal stump will leak post-op
- Pt may rebleed post-op after U stitch performed (consider angiographic embolization of gastroduodenal artery)
- Pt will have ZE syndrome
- Pt will have had prior ulcer surgery

Strikeouts

- Not ruling out other etiologies of epigastric pain
- Trying to treat perforated ulcer conservatively
- Not trying to conservatively treat a bleeding ulcer at first presentation
- Not being prepared to perform a different operation in someone with chronic sxs
- Not performing EGD for bleeding ulcer
- Trying to treat gastric outlet obstruction with endoscopic balloon dilatation
- Performing any operation laparoscopically
- Not knowing how to manage the difficult duodenal stump
- Not knowing how to manage duodenal stump leak
- Not oversewing bleeding site when performing vagotomy/pyloroplasty
- Not having an idea in your head about recurrence/mortality rates after different operations
- Forgetting *H. pylori*
- Trying to perform highly selective vagotomy in unstable pt

Stats vary with literature quoted, but rough rates cited below:

	Recurrence	Mortality	Morbidity
Vagotomy/ pyloroplasty	10%	1%	15%
Vagotomy/ antrectomy	1%	2%	20%
Parietal cell (HSV) vagotomy	10%	0%	5%

Stomach and Duodenum—Gastric Cancer

Concept

Will likely present as a large ulcer and biopsy proven malignancy. Patient may not be candidate for anything but palliation. Be prepared to describe your work-up and operation. Remember that gastric lymphoma is a different beast from gastric cancer.

Way Question May be Asked?

"A 63 y/o man presents to ED with UGIB. After stabilization, an EGD is performed that reveals a large ulcer on the greater curvature, biopsies return with well-differentiated adenocarcinoma. What do you do?" May also present as a non-healing ulcer with pain, perforation, obstruction, or in work-up for melena or heme + stool.

How to Answer?

History

Risk factors
Weight loss
Abdominal distension

Physical Exam

Evidence of weight loss/malnutrition
Palpable abdominal mass
Prior surgical scars
Lymphadenopathy (supraclavicular, periumbilical)
Rectal exam (Blummer's shelf)

Labs

Full laboratory panel

Diagnostic Studies

UGI
EGD
CT scan (to r/o metastatic disease)
Can consider laparoscopy at onset of operation (r/o liver mets/carcinomatosis)
Measure basal acid output (achlorhydria assoc. with malignancy)

Location of tumor:

(1) Tumors in antrum/distal third of stomach → radical subtotal gastrectomy involving 3 cm of first part of duodenum, hepatogastric omentum, greater omentum, and a D1 resection (immediately adjacent perigastric lymph nodes)
(2) Tumors in corpus/middle third of stomach→ subtotal or total depending on size of tumor
(3) Tumors in proximal third → total gastrectomy, reconstruction with Roux-en-Y
(4) Palliation → total gastrectomy (not gastroenterostomy!)

Comments on Surgery

Resection with 5 cm margins (if within 5 cm of GE junction, needs total gastrectomy
Only resect spleen if gross tumor involvement
No evidence for resection of hepatic metastases
Check margins of resection by frozen section
En bloc resection of any directly invaded organ (spleen, tail of pancreas, kidney), except CBD or head of pancreas
No evidence for Japanese style D2 resection
Should perform D1 resection which includes: suprapyloric, infrapyloric, and nodes along the greater and lesser curvature
Can consider adjuvant and neo-adjuvant treatments

Don't forget vagotomy (anastomosis is ulcer producing procedure)
Don't forget different types of reconstruction (BII if cancer)

Common Curveballs

Anastomotic cancer 20 years after prior gastric surgery
Pt will have postoperative anastomotic bleed (especially if didn't do vagotomy)
Pt will have leak post-op
Pt will be malnourished
Complication of gastric surgery post-op:
Dumping syndrome—conservative measure first, then Roux-en-Y
Postvagotomy diarrhea—conservative measure first, then reversed jejunal segment
Alkaline reflux gastritis—confirm by hepatobiliary scan, conservative measure first, then RY gastrojejunostomy
Anastomotic bleed—EGD, suture ligation if EGD fails
Afferent loop syndrome—side to side jejunojejunostomy
Gastroperesis—conservative measure first, completion antrectomy or gastrectomy, depending on prior surgery, may be necessary
Ulcer will be high on greater curve near GE junction
Tumor will have penetrated into surrounding structures (spleen, kidney, distal pancreas)
Being asked the difference between R1, R2 and R3 nodes
Pathology will be lymphoma
May actually be esophageal cancer and need traditional Ivor-Lewis Resection
Pt will present later with evidence of metastatic disease/obstruction
Celiac node will be positive→ "what does that mean"
Pt will have peritoneal mets → how to palliate pt
Treatment for duodenal stump leak (if early, duodenostomy, drains, NPO, TPN)
(if late/abscess, CT guided drain, NPO, TPN)

Strikeouts

Resecting hepatic metastases
Performing less than total gastrectomy for tumor < 5 cm from GE junction
Not staging pt appropriately
Discussing laparoscopic resection of gastric cancer
Not checking margins of resection by frozen section
Offering any therapy besides surgery for "cure"
Discussing photodynamic therapy
Discussing endoscopic mucosal resections

Stomach and Duodenum—Gastric Ulcer

Concept

Four basic types of gastric ulcers categorized by location and etiology. Always, ALWAYS, have a high index of suspicion for malignancy and do everything possible to rule it out. Four types of gastric ulcers:

I	Lesser curve, unrelated to acid
II	Gastric ulcer with associate duodenal ulcer, related to acid exposure
III	Prepyloric ulcer (within 3 cm of pylorus), related to acid exposure
IV	Adjacent to gastroesophageal junction (juxtacardial), unrelated to acid

Way Question May be Asked?

"45 y/o male with history of UGIB who has a gastric ulcer identified on EGD. He has been on omeprazole for 8 weeks and repeat EGD shows ulcer still present. What do you want to do?" Question may go in the direction of how to initially treat this patient, how long to trial acid suppressive therapy, and when to operate, or it may jump right into a discussion of how to manage a bleeding or perforated gastric ulcer. Size and pH are particularly important as most ulcers > 3 cm and most ulcers in the achlorhydric patient will eventually need surgery.

How to Answer?

History

Risk factors for PUD
H. pylori treatment
Steroid/NSAID use
History of epigastric pain
Iron deficiency anemia
Vomiting/bloating (from gastric outlet obstruction)
FHx ZE syndrome
Use of anti-ulcer medications
Relevant medical history (heart disease)
Prior surgeries (especially prior surgery for PUD)

Physical Exam

Vital signs (tachycardia/hypotension to suspect shock)
Abdominal exam (rigidity/peritoneal signs to suggest perforation)
Rectal exam (heme +, Blummer's shelf)

Diagnostic Studies

Routine labs including T+C and coags especially if bleeding
Do lytes show evidence of gastric outlet obstruction (low K, low Cl, high bicarb)?
Abdominal x-rays (r/o free air)
+/– Barium UGI (no Barium if suspect perforation)
Gastric acid analysis (achlorhydria suggestive of Ca)
EGD + bx! (at least 10 biopsies)
Any attempt at biopsy should include four quadrant margins, central biopsy, and brushings!

Surgical Treatment

(1) Resuscitate the unstable pt
(2) Repeat EGD/biopsy at 6–8 weeks for the chronic ulcer, treat medically, and repeat EGD at 6–8 weeks, if improving, repeat EGD at 6–8 weeks:
no improvement at 1st 6–8 week follow-up → OR
failure to disappear at 2nd 6–8 week EGD → OR
(3) Indications for surgery:
Intractability
Bleeding
Perforation
Obstruction

(4) For Type I (lesser curve) ulcer (most common):
antrectomy to include ulcer (goblet cells on duodenal side indicate adequate resection)
reconstruction with BI (make sure frozen section is negative for malignancy before reconstruct with BI)
recurrence rate 2%
(5) For Type II and III ulcers:
antrectomy and truncal vagotomy
(6) For Type IV ulcers:
resection with Roux-en-Y esophagogastrojejunostomy
(Csendes' procedure)
(7) For *bleeding ulcer*:
EGD + biopsy
+/– Angiogram with vasopressin/embolization
Have threshold in your mind of when to operate on pt (more than 6U pRBC in 48 h—remember baseline comorbidities in your limit)
In OR:
(a) pt stable→ antrectomy to include ulcer when possible suture ligate ulcer/biopsy + antrectomy vagotomy for Type II,III ulcer
(b) unstable pt→ wedge resection or suture/biopsy to ulcer + vagotomy/pyloroplasty
(8) For perforated ulcer:
(a) stable pt→ antrectomy to include ulcer or antrectomy + omental patch and biopsy ulcer
(b) unstable pt→ biopsy and omental patch (wedge resection of ulcer always an option if easy to do)

Common Curveballs

Biopsies will come back malignant, indeterminant, benign
Type of ulcer (I-IV) will change during scenario
Asked your method to test for *H. pylori*
Pt will fail medical management
Will turn out to be gastric cancer (check frozen section before reconstruct)
Asked your treatment algorithm for *H. pylori*
Will be asked how to manage type IV ulcer intra-op
Won't be able to encompass ulcer in antrectomy
Ulcer will perforate
Pt will bleed post-op
Gastric acid measurements will show achlorhydria
Discussion of postgastrectomy complications:
Bleeding
Dumping
Afferent/efferent obstruction
Postvagotomy diarrhea
Carcinoma

Strikeouts

Describing any laparoscopic approach
Not knowing how to treat postgastrectomy syndromes
Not knowing how to describe your chosen operation
Misdiagnosing a gastric cancer as a benign ulcer
Not testing for or treating *H. pylori*
Not knowing importance of achlorhydria and its link to malignancy
Not rescoping/re-biopsying pt with chronic non-healing ulcer
Not knowing indications for surgery
Spending too long with angiographic or nonoperative methods to control bleeding
Not checking for malignancy before performing reconstruction (BII is preferred for malignant gastric ulcer)

Stomach and Duodenum—Mallory–Weiss Tear

Concept

UGIB in a patient after forceful vomiting. The result of a linear tear in the mucosa of the gastric cardia.

Way Question May be Asked?

"A 23 y/o man presents to ED with hematemesis after binge drinking." Pain should not be a prominent feature, if so, consider Boerhave's syndrome. May see in patients with vomiting from other causes such as pancreatitis or chemotherapy.

How to Answer?

Resuscitate pt while doing focused H+P

History

- NSAID/ethanol use
- History of PUD
- *H. pylori* treatment
- Portal HTN
- Hiatal Hernia (tear usually in gastric cardia rather than at GEJ)
- *History of Violent retching*

Remember your DDx of UGIB:

PUD, esophagitis, varices, Mallory-Weiss Tear,

Physical Exam

- Check vital signs
- Look for peritoneal signs (guarding, rebound)

Labs

- Full laboratory panel including coags
- T+C

Management

- Two large bore IV's
- Large caliber NGT
- Irrigate via NGT to estimate ongoing blood loss
- Correct coags
- Resuscitate the pt
- IV H_2 blockers
- Blood transfusion if unstable
- EGD→identify and control bleeders r/o other pathology
- heater probe, sclerotherapy, electrocautery
- Angiography→ to diagnose bleeder
- Embolization of branches of left gastric
- Selective infusion of vasopressin
- NO SENGSTAKEN–BLAKEMORE TUBES here

Surgery Indications

- Over 6 U PRBC transfused
- Failure of EGD to stop bleeding
- Failure of angiographic embolization (used in pts with severe comorbidities)

Surgical Treatment

- Upper midline incision
- Explore UGI (may see subserosal hematoma at GEJ along lesser curve of stomach)
- Gastrostomy
- Oversew of mucosal tear with absorbable, locking suture

Can pack proximal and distal stomach with lap pads to locate bleeding source

May need to intubate pt with significant hematemesis before EGD (otherwise pt will aspirate)

Common Curveballs

EGD will not see mucosal laceration
There will be evidence of perforation
Stomach will be full of blood
EGD will pick up other pathology (change scenario)
Endoscopic control/Angiographic control will fail
Pt will have portal HTN
Sclerotherapy will result in esophageal perforation
Pt will have had prior abdominal surgery
Tears will be in distal esophagus (may need left thoracotomy and esophagotomy and then suture ligation)

Strikeouts

Jumping to angiography rather than EGD first
Using Sengstaken-Blakemore tube
Not resuscitating the pt
Mistaking for Boerhave's syndrome
Performing any type of anti-ulcer surgery (V+P, A+V, subtotal gastrectomy)
Not looking for other pathology on EGD
Trying to do any of the above with a laparoscope

Stomach and Duodenum—Upper GI Bleeding

Concept

Important to pay attention to the broad DDx here as well as close attention to the ABCs as the patient with massive hematemesis may exanguinate while you are still performing a history with questions related to alcohol use, vomiting, and liver disease.

Way Question May be Asked?

"51 y/o male presents to ED with vomiting blood twice at home. BP is 80/50. What do you want to do?" May have patient that presents with more chronic blood loss with black, tarry stools. Presentation will guide how quickly you move into treatment options.

How to Answer?

Brief H+P While Resuscitating the Patient

- History of PUD
- Associated pain
- Age
- ASA, NSAID, steroid/alcohol use
- Recent retching/vomiting (Mallory-Weiss Tear)
- Liver disease
- Trauma
- History of UGI surgery (marginal ulcer)
- History of AAA repair (aortoenteric fistula)

Physical Exam

- Stigmata of liver disease
- Evidence of prior surgery (always note any surgical scars)
- Melena (never leave out rectal exam)

Algorithm

- ABCs
- Resuscitation (IVF, full labs including PT/PTT, T+C, NGT)
- Gastric irrigation through NGT
- +/– endotracheal intubation depending on severity of bleed
- Endoscopy (localization and possibly therapeutic)
- +/– angiography

Endoscopic Methods to Control Bleeding

- Heater probe
- Electrocautery
- Epinephrine injection
- Band ligation/sclerotherapy (esophageal varices)
  - (appearance important here as overlying clot/visible vessel have higher chance of rebreeding than clean ulcer base)

Angiography

- Can treat certain bleeds with intra-arterial gelfoam, metal coil springs, vasopressin
- Useful for gastric/duodenal ulcers
- If bleeding controlled, don't forget:
  - Antacids, H_2 blockers, treatment of *H. pylori*

Surgical Treatment

- Reserved for pts with continued or recurrent bleeding (6 U pRBCs), complicated ulcer disease, massive UGIB, non-healing ulcers
- For gastric adenoCA: resect with 5 cm margin, if within 5 cm of GEJ= total gastrectomy
- For stress gastritis: total gastrectomy, or gastric devascularization if unstable (quicker)

For gastric ulcer:
→stable pt antrectomy to include ulcer or suture ligation/biopsy/+ antrectomy
→ unstable, wedge resection or suture ligation/biopsy/vagotomy/pyloroplasty

For duodenal ulcer:
→ high risk/unstable, vagotomy/pyloroplasty/-oversew ulcer (U stitch)
→ stable pt, no hx PUD, small ulcer, oversew and parietal cell vagotomy
→ giant ulcer/stable/hx PUD→ antrectomy +vagotomy

For bleeding from anastomotic line from recent surgery:
→ EGD, if/when fails, re-explore and ligate bleeder

For Mallory–Weiss:
→ gastrotomy, suture ligation of mucosal tears (if tears in esophagus, left thoracotomy/esophagotomy, suture ligate bleeders

For Aorto-enteric fistula:
→control bleeding, then extra anatomic bypass

For varices
→TIPS or emergency portacaval shunt

Common Curveballs

Angiogram won't localize lesion, and/or embolization won't work
Endoscopy won't localize lesion
Pt will have had prior ulcer surgery
Pt will have had prior AAA repair
All coags will be abnormal
NGT won't get bilious return
Bleeding will be from duodenum despite non-bloody, bilious NGT aspirate
Bleeding will recur after endoscopic treatment
Large ulcer will be malignant
May need to make gastrotomy/duodenotomy to localize bleeding
May be from nasopharynx or hemoptysis from lungs
GI doc won't be available to perform EGD
Any nonoperative therapy will fail
"U-stitch" won't work→ligate gastroduodenal

Strikeouts

Not placing NGT
Taking too long in H+P
Not resuscitating pt prior to surgery
Not taking pt to surgery when appropriate
Not treating for *H. pylori*
Not biopsying an ulcer seen at EGD
Placing Sengstaken/Blakemore tube for Mallory-Weiss tear
Performing *distal splenorenal shunt* emergently for bleeding varices

Thoracic—Empyema

Concept

Infection localized in the thoracic cavity outside of the lung. May be the result of any neighboring infection (pneumonia, esophageal perforation, bronchopleural fistula, recent surgery, subphrenic abscess, generalized sepsis, undrained pleural effusion).

Way Question May be Asked?

"55 y/o male in the ICU with persistent left loculated effusion and thoracentesis performed reveals purulent material. What do you want to do?"

How to Answer?

History

- Tobacco use
- Chest pain
- Fever
- Recent pneumonia or infection
- h/o Cancer
- HIV

Physical Exam

- Auscultation of chest
- Examine for any adenopathy

How to Answer?

Need CXR prethoracentesis/chest tube
- Look for lesion
- Look for air-fluid level (bronchopleural fistula)

Need CXR post thoracentesis/chest tube
- To confirm complete evacuation of effusion
- To check for trapped lung, loculations, unexplained atelectasis (endobronchial lesion)

Send fluid for:
- Cultures (aerobic, anaerobic, acid fast, fungal)
- Cytology (r/o malignancy)
- LDH, cell count, pH, LDH, glucose

CT scan of chest
- Adenopathy
- Loculations
- Mass lesion

Bronchoscopy
- If suspect endobronchial lesion

Empyema stages:
- Exudative < 7 days
- Fibropurulent 7–14 days
- Organized > 14 days

Surgical Treatment

Exudative stage—Thoracentesis (usually prior to CT placement)
Chest tube drainage + Abx

Fibropurulent stage—VATS exploration/pleurodesis (pleural biopsy/cytology if suspect malignancy) or limited thoracotomy

Organized stage—VATS decortication
Open decortication
Rib resection and Eloesser flap (skin sutured to parietal pleura)→ used in high risk pt!

Common Curveballs

- Cytology will be positive for malignancy (switch scenarios)
- Empyema will fail treatment with chest tube
- Pt will develop bronchopleural fistula post thoracotomy
- Stains for acid-fast bacilli will be positive
- Lung won't re-expand after chest tube drainage of effusion/empyema
- Empyema will be the result of some extra-pulmonary process (perforated esophagus, subphrenic abscess, . .)—scenario switch!

Strikeouts

- Forgetting PFTs if proceeding towards thoracotomy
- Describing VATS as an option if you don't do know how to do this procedure
- Mentioning Eloesser flap if don't know how to perform it/its indications
- Not checking cytology on drained effusion
- Not performing bronch for persistently unexpanded lung fields

Thoracic—Lung Cancer

Concept

Surgical treatment is the only potential cure. Key is to determine if patient is resectable or not. May present as a solitary pulmonary nodule where only 1 in 20 turns out to be actually malignant.

Way Question May be Asked?

"64 y/o female found to have a new lesion, ~ 2 cm in diameter in the LUL found on a pre-op chest x-ray prior to a hysterectomy for fibroids. What do you want to do?"

How to Answer?

History

- Tobacco use
- Asbestos exposure
- Chemical exposure
- Travel hx
- History of prior cancer (mets?)

Symptoms

- New voice changes/ neuro symptoms
- Weight loss
- Chest/bone pain
- Shortness of breath
- Hemoptysis

Physical Exam

- Auscultation of chest
- Examine for any adenopathy
- Palpate liver

How to Answer?

- Need prior CXR to compare (if > 3 cm and present on prior CXR, unchanged, can follow)
- Need CT scan (chest including liver/adrenals)
  - Evaluate mass size and location
  - Evaluate for metastases
  - Evaluate lymph nodes
- Need three morning sputum cytologies and cultures
- Need flexible bronchoscopy
- Need biopsy of lesion
  - Brush biopsy
  - Trans-bronchial
  - Percutaneous by CT
  - Thoracotomy
- Need pre-op pulmonary tests:
  - ABG
  - PFTs
  - V/Q scan (to predict post-op FEV1)

Staging of Lung CA:

T1	=	< 3 cm
T2	=	> 3 cm
T3	=	< 2 cm from carina or tumor invading chest wall, diaphragm, or mediastinal pleura
T4	=	tumor invades any mediastinal structure (esophagus, heart, great vessels, trachea) or satellite tumor nodules within ipsilateral lobe, or malignant pleural/pericardial effusion
N1	=	hilar LN involved
N2	=	ipsilateral mediastinal/subcarinal nodes involved
N3	=	contralateral mediastinal nodes, ipsilateral scalene/supraclavicular nodes involved

Contraindications to Surgical Resection

T3 or T4 lesions
N3 lesions
Predicted post-op FEV1 < 0.8

Surgical Treatment

Mediastinoscopy for left sided nodules
Chamberlain procedure for right sided nodules and enlarged left para-tracheal nodes
Lobectomy
Pneumonectomy (if hilar lesion, lesion encompasses all lobes on a given side (crosses fissures)

Common Curveballs

No lesion will be benign (even if on prior CXR)
Lesion will turn out to be metastatic disease (scenario switch—will you perform pulmonary metastatectomy? For what tumors?)
Tumor will have characteristic of unresectability:
- Horner's syndrome
- Positive cytology from pleural effusion
- Positive cervical lymph nodes
- Tracheoesophageal fistula
- Recurrent laryngeal nerve or phrenic nerve paralysis

Will present as hemoptysis
Will present as pleural effusion
Will present as lung abscess
Tumor will be hormonally active:
- ACTH
- PTH-like
- ADH

Pt will have post-pneumonectomy:
- Bronchopleural fistula
- Atrial fibrillation
- Hemoptysis
- Mediastinal shift in recovery room

Strikeouts

Forgetting PFTs prior to thoracotomy
Describing VATS or segmentectomy or wedge resection as an option if you don't do (know how to do) this procedure
Not performing bronch
Not checking prior CXR
Operating on small cell carcinoma
Not performing mediastinoscopy pre-op when indicated
Offering palliative resections
Not knowing staging system (important to understanding Contraindications to surgical resection)

Trauma and Critical Care—Abdominal Compartment Syndrome (ACS)

Concept

Increased pressure in a confined space will lead to decreased perfusion of all organs in the abdomen

Way Question May be Asked?

Commonly a disguised question like—"You are called to see a 68 y/o male in the recovery room 5 h after a LAR, performed by your partner who just left on vacation, begins to have a decreasing urine output. What do you want to do?" It very well could be a patient you are called to see because of high ventilatory pressures where you have to rule out ARDS, pneumothorax, mucus plug, too little sedation, . . .)

How to Answer?

Have to understand that ACS will affect all intraabdominal organs. Elevated intraabdominal pressure will effect the cardiopulmonary system and increase ventilator peak pressures and decrease cardiac output. It will also precipitate renal failure because of direct pressure effects on the kidney, as well as decreased kidney perfusion

Have to be systematic and work through algorithm for renal failure including:

- Prerenal
  - Shock-Hemorrhagic
    - Septic
    - Third-space losses related to burn or long operation
  - Pump failure
    - Acute MI/CHF
    - Compartment syndrome
  - Vascular
    - Emboli after suprarenal aorta clamp
- Intrarenal
  - ATN from any hypotension (sepsis, intra-op)
  - Toxic Medication (aminoglycosides)
  - Systemic diseases (SLE,TTP)
- Postrenal
  - Bilateral ureteral occlusion/injury (rare)
  - Foley problems (kink, clogged)

Answer should include a discussion of:

- Pt's volume status (place CVP or SGC after thorough H&P although examiner is likely to tell you that pt is intubated)
- Pt's baseline renal function
- Intra-op events—transfusion, hypotension, placement of CVP with tension pneumothorax, or meds administered
- Review meds—any excreted only by kidney (digoxin)
- Is Foley patent?
- All this done quickly so examiner can focus on ACS with discussion of how you diagnose (bladder pressures or gastric O_2 measurements) and how you treat (open abdomen and close with mesh or Bogata bag)

Common Curveballs

- Pt had several liters of NSS intra-op to lead you away from thinking further boluses (insensible loses alone up to 6 cc/kg per hour OR time)
- Pt has normal SGC parameters
- Pt had history of renal insufficiency, MI, or only has one kidney
- Nothing you do will work (just testing your thinking—make sure you follow labs for electrolyte abnormalities, especially K^+, change any meds that need renal dosing, and consider early hemodialysis)

Strikeouts

Not considering compartment syndrome (check bladder pressures!)
Not ruling out other causes of renal failure (it will be whatever you leave out!)
Not being invasive to determine volume status (CVP or SGC)
Not checking CXR to r/o pneumothorax from intra-op line or CHF
Not placing Foley catheter or checking its patency
Giving diuretic before ensuring adequate volume status
Not frequently reassessing pt if all else fails (labs/PE)
Not being complete:
not performing physical exam (JVD, rales, skin tugor, abdominal distension, ventilator pressures) or checking labs (lytes, BUN, Cr, U/A, urine lytes)

Trauma and Critical Care—Colon and Rectal Trauma

Concept

Likely to be seen in the context of multiple other injuries for example, GSW to abdomen with small bowel and colon injury or in the setting of a pelvic fracture with an obvious rectal injury. Again, go through the ABCs in all these questions to avoid missing an injury.

Way Question May be Asked?

"36 y/o male is being evaluated for a pelvic fracture in the ED and, on rectal examination, there is gross blood. What do you want to do?" This may be in the setting of a pelvic fracture in the OR after an exploratory laparotomy was performed, in the setting of a GSW to the pelvis or thigh, or from direct rectal trauma. Remember to deal with life-threatening injuries first.

How to Answer?

In trauma setting, always the ABCs:
- Airway and C-spine control (intubate with C-spine control if necessary)
- Breathing and Ventilation (does pt need chest tube—place before CXR)
- Circulation and IV access
- Disability (Neuro status)

Don't skip secondary survey either, or you will miss some key finding!

History

Pelvic fracture
Penetrating abdominal injury (remember abdomen stretches from nipples to groin)

Physical Exam

Rectal exam
Rigid sigmoidoscope

Diagnostic Studies

DPL
CT scan

Surgical Treatment

Resuscitate the pt
Rule out other life-threatening injuries

Colon injuries:
- (1) Primary repair if:
  - Pt stable
  - Small laceration (< 1 cm)
  - Contamination minimal
  - Not on anti-mesenteric border
- Debride to healthy tissue
- Close in one or two layers
- (2) Colostomy for left sided injuries in:
  - Pt in shock
  - Multiple other injuries
  - Peritonitis
- (3) Resection and anastomosis for right sided injuries in:
  - Destructive wounds but pt stable with minimal injuries

Rectal injuries:
- Diverting stoma
- Presacral drainage:
  - 3 cm curvilinear incision b/w coccyx and rectum and

Posterior dissection carried up to level of injury
Distal rectal washout
2 liters of GU irrigant following an anal stretch

Common Curveballs

Pt will have other associated injuries (intra- and extraabdominal)
Missed bowel injury
Pt will be unstable intra-op
Pt will develop abdominal compartment syndrome post-op
Pt will leak for primarily repaired colon wound
Pt will have open pelvic fracture (gets diverting sigmoid colostomy regardless of whether rectal injury or not)
Pelvic fracture will have coincident bladder injury

Strikeouts

Not knowing how to treat rectal injury with diversion, drains, and washout
Not knowing to primarily repair small colon injuries
Not looking for other injuries
Not looking for rectal injury in pelvic fracture
Not looking for bladder injury in pelvic fracture

Trauma and Critical Care—Extremity Compartment Syndrome

Concept

Elevated pressure in a closed compartment that leads to ischemia damage to muscle and nerve that may lead to limb loss and myoglobinuria with resulting renal failure. Most commonly in the extremities as the result of crush injuries, vascular injuries, reperfusion after prolonged ischemia, compression by cast, or burns. Key is high index of suspicion.

Way Question May Be Asked?

"You have just finished repairing a GSW to the femoral artery and vein and you notice that it took you about 6 h to perform. The nurse wants to know if there is anything else you would like to do." Rarely would the question be so leading, but remember in any case of vascular trauma, orthopedic trauma, or vascular repair. Also, consider in patients with deep burns to the extremity.

How to Answer?

History

- Mechanism of injury
- Pain out of proportion to injury
- Pain distal from site of injury
- Tingling/numbness in extremity

Physical Exam

- Tense, swollen extremity
- Pain with passive range of motion
- Sensory deficit
- Absence of pulses is *late* finding
- In leg, examine:
  1. Sensation in first web space (deep peroneal nerve. = anterior compartment)
  2. Sensation of dorsum of foot (superficial peroneal nerve = lateral compartment)
  3. Sensation of plantar surface (tibial nerve = deep posterior compartment)
  4. Pain with passive dorsiflexion and plantar flexion of great toe

Diagnostic Tests

- Measuring compartment pressures
  1. Use specific device such as Stic catheter
  2. Attach 16 g needle to A-line setup with three way stop cock and sterile saline, zero monitor and inject 1cc into compartment
- Should measure all compartments at risk
- Repeat exam at intervals if suspicions remains high especially during resuscitation

Surgical Treatment

- Decompression for:
  - Strong clinical suspicion
  - Compartment pressure > 40 mmHg
  - Compartment pressure within 30 mmHg of diastolic BP
- Bivalve any cast
- OR for fasciotomy:
  - In leg:
    - Two incisions
    - First incision from knee to ankle and centered between anterior and lateral compartments
    - Divide fascia 1 cm above and below intermuscular septum to free anterior and lateral compartments respectively
    - Careful to avoid superficial peroneal nerve in lateral compartment
    - Second incision also from knee to ankle and is 2 cm posterior to posteromedial border of tibia

    - Avoid saphenous vein
    - Divide fascia overlying gastrocnemius and soleus muscles (medial compartment)
    - Detach soleus from posterior tibia to reach fascia of deep compartment and incise
- Apply loose dressings
- Keep extremity at heart level (don't raise!)
- Return to OR q36 h to debride necrotic tissue/dressing changes
- Keep pt well hydrated to avoid renal failure
- STSG if can't close after 7 days

Common Curveballs

- Pt will have altered sensorium/be intubated and you won't be able to obtain H+P
- Compartment pressure will be 30 mmHg
- Compartment pressure will change on repeated recordings
- Asked to describe how to perform fasciotomy
- Pt will have necrotic muscle after fasciotomy and asked if you debride (no, wait and return to OR, necrotic tissue may improve)
- Pt will develop myoglobinuria and renal failure

Strikeouts

- Not correctly diagnosing compartment syndrome
- Only performing escharotomies when fasciotomy indicated
- Not being able to describe fasciotomy
- Waiting until extremity is pulseless before performing fasciotomy
- Trying to describe one incision quadruple fasciotomy for the leg

Trauma and Critical Care—Duodenal Trauma

Concept

Low incidence of injury and typically in conjunction with injury to other organ systems. Diagnosis is likely not made preoperatively. Often times may be in a young teenager after blunt abdominal trauma.

Way Question May be Asked?

"You are exploring a patient for a splenic laceration and find a periduodenal hematoma on your exploratory laparotomy. What do you want to do?" May be given the diagnosis of a hematoma on pre-op CT scan, might get the history of the patient receiving a blow to the epigastric region, or might get a patient referred to your hospital for definitive management after diagnosis made.

How to Answer?

As with nearly everything covered on the Orals, this is a management question.

Surgical Treatment

To identify/expose intra-op:
Wide Kocher maneuver to visualize posterior duodenum (extend mobilization to ligament of Trietz)
Careful inspection of pancreas

(1) If find pre-op:
can observe if isolated injury
no evidence of leak on gastrografin swallow followed by negative Barium swallow
observation limited to 2 weeks, at which time you should explore pt

(2) If find intra-op (or take to OR):
fully expose duodenum
determine amount of duodenal tissue loss
determine location of injury (part 1 vs. 4)
type/severity of other injuries (liver, spleen, colon, ureter, . . .)

(a) simple laceration→ two layer closure, omental patch
(b) intramural hematoma→ can observe, usually no leak but once in OR, safer to explore and rule out laceration or leak
(c) more complicated lacerations→ debridement and closure as long as no luminal compromise/undue tension
(d) large laceration to second portion of duodenum or whenever unable to do primary repair→ Roux-en-Y or loop duodenojejunostomy
(e) multiple complex lacerations→ duodenal exclusion pyloric closure (staples or sewn)
diverting gastrojejunostomy
primary repair of duodenal lacerations
tube duodenostomy, external drainage, +/– T-tube
(f) always leave drain!
(g) always decompress post-op:
NGT decompression post-op or tube duodenostomy remote from injury!
(h) if associated contusion to head of pancreas, must look for CBD or pancreatic duct injury
(i) avoid temptation to perform the "trauma Whipple"→ only in the *stable* pt with combined pancreaticoduodenal injury where all other measures fail or *severe* ampullary injuries
(j) leave J-tube for post-op feeding

Common Curveballs

Pt will have multiple other injuries
Pt will have pancreatic injury

Pt will become acidotic/coagulopathic intra-op and you will need to perform "damage control" surgery
Pt will fail nonoperative management
Post-op leak
Pt will develop intra-op DIC (change scenario)
Pt will have post-op fever
Asking your post-op management
Marginal ulcer post-op pyloric exclusion (change scenario with pt having UGIB)

Strikeouts

Not looking for other injuries (including pancreas)
Not adequately visualizing duodenum (need to be able to describe intra-op techniques)
Not having a variety of ways to treat duodenal injuries
Not using NGT post-op or leaving an external drain
Not considering "damage control" when appropriate

Trauma and Critical Care—GU Trauma

Concept

Will usually be couched in another question, for example, the multiple injured trauma patient who has a retroperitoneal hematoma seen after exploration of a penetrating abdominal injury. Could also be seen in the setting of blunt trauma with a pelvic fracture. Don't forget the priorities in trauma patients . . . ABCs.

Way Question May be Asked?

"19 y/o male seen in the emergency room after a GSW to his right flank with a SBP of 90 and gross hematuria after placement of a foley catheter. What do you want to do?" Could also have presentation after a fall from a height or a car accident with a pelvic fracture secondary to blunt trauma. Make decision on stability of the patient early and frequently reassess throughout the scenario.

How to Answer?

ABCs
Primary Survey
Secondary Survey

History

AMPLE history (Mechanism of injury, . . .)
Pre-existing renal disease

Physical Exam

Full exam in secondary survey especially
Blood at urethral meatus
Stool guiac for possible rectal injury
"High riding" prostate in male

How to Answer?

Need complete labs, CXR, U/A (hematuria)
DPL in *unstable pts* (this is a common Oral Exam theme!)
CT scan in *stable pts* with IV contrast (evaluate both kidneys)
Retrograde cystourethrogram to define urethral injury

Surgical Treatment

Be sure to r/o other intra/extraabdominal injuries:

(1) Bladder injuries
  (a) extraperitoneal female—Foley catheter or suprapubic cystostomy
  (b) extraperitoneal male—suprapubic cystostomy
  (c) intraperitoneal—primary repair and suprapubic cystostomy
(2) Ureteral injuries—key is the level of injury
  (a) lower third—ureterneocystostomy +/− psoas hitch
  (b) middle third—end to side ureteroureterostomy to other ureter (most urologists hate this option)
  (c) proximal third—nephrostomy tube in ipsilateral kidney
  (d) if tissue loss minimal, can try primary repair over a stent

  ALWAYS drain site of repair!
(3) Renal parenchymal injury
  (a) non-visualization on CT/IVP→ angiography and/or exploration promptly (1 h warm ischemia time too much!)
  (b) renal vein injury→repair in stable pts, otherwise ligate
  (c) renal artery→repair in stable pts otherwise nephrectomy
  (d) extravasation→repair or partial resection in stable pt otherwise nephrectomy
  (e) pedicle avulsion→nephrectomy

(4) Retroperitoneal hemotomas
   (a) all hematomas in penetrating trauma should be explored unless subhepatic
   (b) can observe hematoma in blunt trauma as long as not expanding
   (c) should explore central, portal, and pericolonic hematomas
(5) Urethral injuries whether partial or total, gets cystostomy and delayed urethroplasty
(6) To expose retroperitoneal structures
   Mattox maneuver on left
   Cattell maneuver on right

Common Curveballs

Pt will be unstable
Will have intra-op retroperitoneal hematoma
Will have one kidney
Will have bladder injury, first extraperitoneal, then intraperitoneal
Will have ureteral injury in a variety of locations
Post-op hypertension from activation of renin/angiotensin/aldosterone axis
Post-op extravasation of contrast from bladder/kidney injury
Asked when you will perform a nephrectomy
There will be injury to other retroperitoneal organs (duodenum, pancreas, colon)
Will be asked to describe performing psoas hitch or nephrostomy tube placement

Strikeouts

Any sort of laparoscopic treatment/evaluation
Getting stuck on therapeutic embolization for renal laceration
Not checking meatus/rectum in pelvic fracture pt
Not exploring retroperitoneal hematoma when appropriate
Not performing nephrectomy when appropriate
Not ruling out other, more life-threatening injuries
Not looking for injuries to other retroperitoneal organs
Performing CT scan in unstable pt

Trauma and Critical Care—Liver Trauma

Concept

Frequently injured abdominal organ. Remember to resuscitate patient and rule out other injuries. Can consider nonoperative management in the stable patient, with no other indications for abdominal exploration.

Way Question May be Asked?

"You are called to the trauma bay to help out your partner who has a 26 y/o motor cyclist injured after impact against a guard rail who is tachycardic, hypotensive, and has contusions about the right side of his chest and abdomen. What do you want to do?" May also be given the intra-op setting of multiple injuries—liver, spleen, small bowel, and ureter and asked how you will proceed.

How to Answer?

Brief H+P while resuscitating the pt:
- ABCs
- PMHx
- Meds
- Allergies

Physical Exam

Head to toe physical exam

Algorithm

- ABCs
- Resuscitation (IVF, full labs including PT/PTT, T+C, NGT, Foley)
- C-spine
- CXR
- Pelvis x-ray

Nonoperative Management

- For blunt trauma with minimal other injuries, no indications for abdominal exploration, and no hemodynamic instability
- Have low threshold to take to OR

Operative Management

- Prep chin to knees
- Midline incision
- 4 quadrant packing
- *Rapid abdominal survey* and control any intestinal spillage
- Mobilize liver (divide falciform, triangular/coronary ligaments)
- +/– pringle maneuver with vascular clamp if major hemorrhage (will stop hepatic artery and portal vein branch bleeding)
  1. *Simple laceration*—direct pressure, topical hemostatic agents, cautery, argon beam coagulator
  2. *Deep laceration*—Pringle maneuver, ligation individual vessels, pack laceration with vascularized tongue of omentum mobilized from transverse colon
  3. *Hepatic vein injury*—Pringle maneuver, Rummel tourniquet around infrahepatic (suprarenal) IVC, median sternotomy, open pericardium, Rummel tourniquet around intrapericardial IVC, +/– atriocaval shunt
  4. *Extensive injuries* (bilobar, hepatic venous injury, retrohepatic cava)—remember lessons from "damage control" surgery

(a) *mobilize liver*
(b) *gauze packing*—anteriorly and posteriorly to tamponade bleeding
(c) *temporary abdominal wall closure*
(d) *return to OR*—24 hours when no longer coagulopathic and blood products available
(e) *place drains*

Common Curveballs

Pt will become coagulopathic intra-op
Pt will have transfusion reaction
Pt will have associated intra/extra abdominal injuries
Pt will have retrohepatic caval injury
Pt will have post-op abscess or biloma (→ percutaneously drain)
No simple methods of controlling bleeding will work
Questions about how to perform Pringle maneuver
Pt will develop post-op hemobilia/hepatic artery pseudoaneurysm (→ angiographic embolization)
Pt undergoing nonoperative management will get septic from small bowel injury

Strikeouts

Not performing DPL but CT scan in unstable pt
Not taking pt to OR when clearly indicated
Not knowing several techniques to control bleeding
Not doing "damage control" surgery when indicated
Not ruling out other injuries prior to going to OR
Taking unstabl pt to angiography suite for embolization

Trauma and Critical Care—Pelvic Fracture

Concept

High frequency of associated injuries given the force needed to fracture the pelvis. Often associated with falls and motor vehicle accidents. Usually classified by the vectors of force that produced the injury:

Anterior-posterior compression
Lateral compression
Vertical shear
Combined vector injury

Way Question May be Asked?

"33 y/o male is brought into the emergency room after falling off of the second story of a building. He is tachycardic and has a systolic blood pressure of 90. What do you want to do?" May get the scenario with patient status post MVA, fall, or crushed in an industrial accident. Be systematic in the work-up and on guard for the associated ureteral/rectal injuries and the ongoing blood loss requiring angiography.

How to Answer?

In trauma setting, *always the ABCs first*:
- Airway and C-spine control (intubate with C-spine control if necessary)
- Breathing and Ventilation (does pt need chest tube—place before CXR)
- Circulation and IV access
- Disability (Neuro status)

Don't skip secondary survey either, or you will miss some key finding (high riding prostrate, blood at urethral meatus, blood on rectal exam)!

History Should be an "AMPLE" one

Allergies
Meds
Past medical history
Last meal
Events surrounding trauma

Physical Exam

Head to toe
Finger/scope in every hole/orifice
Pelvic and rectal exam

Labs/Diagnostic Studies

Full panel including T+C
Lateral C-spine
CXR
Pelvis x-ray
DPL if unstable
CT scan abdomen/pelvis if stable (include head if neuro sx's)

Surgical Treatment:

(1) Resuscitate the pt and treat any associated life-threatening injuries:
   (a) 2 large bore peripheral IVs
   2 liters crystalloid (20 cc /kg), can repeat once if no response, followed by blood if hemodynamically unstable
(2) DPL if suspect intra-abominal injury in unstable pt (incision above the umbilicus to avoid entering pelvic hematoma!)
   (a) take to OR only if grossly bloody, otherwise, unlikely to be enough hemorrhage to be source of pt's hypotension

(b) if grossly bloody, position in lithotomy to be able to perform rigid sig to evaluate rectum

(3) Blood at urethral meatus
   (a) urethrogram first→ suprapubic cystotomy if positive urethrogram
   (b) cystogram if urethrogram negative
   (c) if cystogram positive, is injury intra or extraperitoneal?
   (d) intraperitoneal gets primary repair in layers
   (e) consider all bladder injuries get suprapubic cystotomy

(4) If rectal injury,
   (a) diverting sigmoid loop colostomy
   (b) presacral drains
   (c) rectal washout

(5) if retroperitoneal hematoma,
   (a) don't explore unless ruptured or expanding
   (b) if explore, ligate internal iliacs, pack, and go to angiogram for embolization if necessary

(6) Stabilize all unstable fractures early with external fixator in ER (after DPL if hemodynamically unstable)

(7) Angiogram to embolize bleeders especially if pt is bleeding externally

(8) All open pelvic fractures get diverting sigmoid colostomy

Common Curveballs

Associated injuries and how to manage:
- Ureteral
- Rectal
- Spleen
- Liver
- Chest
- Small bowel
- Pancreas

Pelvic fracture will be unstable

Pelvic fracture will be "open"

DPL will be grossly positive

DPL will only be positive by RBC count (don't do laparotomy first)

Pelvic hematoma will be expanding/ruptured

Pt will have neurologic injury and be hypotensive with grossly positive DPL (testing your priorities→ explore abdomen first as this is most life-threatening)

Pt will develop DVT/PE during hospitalization (change scenario!)

Strikeouts

Not knowing how to proceed or proceeding expeditiously in unstable pt

Not performing DPL in unstable pt

Performing DPL with incision below umbilicus

Not identifying associated injuries

Not knowing what to do with pelvic hematoma

Exploring stable retroperitoneal hematoma

Trauma and Critical Care—Penetrating Neck Trauma

Concept

Mortality as high as 10% with many important structures in close proximity. Systematic evaluation necessary and should include evaluation of potential injuries to airway, esophagus, and vascular system. Classically, broken down into three zones:

(I) clavicles to cricoid cartilage
(proximal carotid, subclavian, vertebrals, esophagus, trachea, brachial plexus, spinal cord, thoracic duct, and upper lung)

(II) cricoid to angle of mandible
(carotid, vertebral, jugular, larynx, esophagus, trachea, vagus, recurrent laryngeal, spinal cord)

(III) angle of mandible to base of skull
(pharynx, distal carotid, vertebrals, parotid, cranial nerves)

Way Question May Be Asked?

"You are called to the ED to evaluate a 26 y/o male who was involved in a bar fight and sustained a stab wound to his left neck. On exam, he has a 1 cm laceration at the level of his thyroid cartilage just anterior to his left SCM. What do you want to do?" Presentation may vary and don't expect much time wasted on differentiating between Zone I-III. May be given an injury to esophagus, carotid, trachea, . . . or some combination and asked how you will manage. Be sure to secure the airway early!

How to Answer?

Your history and physical exam come second here to basic ATLS, key points:
Airway Management—endotracheal intubation if any doubt
Hemorrhage—external pressure
Control C-spine if any concern about injury
Secondary survey in stable pts to include:

History

Mechanism of injury
Size of weapon
Amount of bleeding
Change in neurologic status
Stridor

Physical Exam

Hematoma
Bruit
Crepitance
Hemoptysis
Hoarseness
Bubbling from wound
Loss of pulses in upper extremity
Horner's syndrome

Diagnostic Tests (Stable Patients Only)

Laryngoscopy/Bronchoscopy—to assess for airway injuries
Lateral C-spine—SQ emphysema, tracheal deviation
CXR—widened or pneumo-mediastinum, pneumothorax, hemothorax, tracheal deviation
Gastrografin swallow—assess esophageal injuries
Angiography—All Zone I and Zone III injuries

Surgical Treatment

(1) Management of the airway—
(a) intubate any pt with difficulty in respiration, depressed level of consciousness, expanding hematoma

(b) careful of cricothyroidotomy as it may release an underlying hematoma
(c) if tracheal injury, can place ETT directly through wound into trachea
(d) watch for tension pneumothorax that might compromise respiration and need urgent decompression

(2) Hemorrhage—
(a) usually controlled by direct pressure
(b) avoid blindly applying hemostats
(c) if pulsatile or rapidly expanding, intubate, and go to OR
(d) do not probe the wound!

(3) Zone I (CXR very important!)
(a) stable—work-up as outlined above
(b) unstable—OR for urgent exploration
(i) sternotomy to obtain proximal control for everything except injury to left of left midclavicular line (then left anterolateral thoracotomy)
(ii) right subclavian
median sternotomy
(iii) inominant artery
median sternotomy
(iv) left subclavian
trap door incision

(4) Zone II
(a) explore anything that penetrates the platysma
(b) prep earlobe to umbilicus and upper thigh for possible SVG harvest
(c) anterior SCM incision
(i) esophageal injuries
If < 24 h, repair injury in 2 layers if early
If > 24 h, T-tube drainage to create controlled fistula or Esophagostomy
(ii) tracheal injuries
Repair primarily with 3'0 vicryl
Tracheostomy if severe injury
(iii) thoracic duct
Injury may occur in Zone I or II
Ligation acceptable
(iv) jugular vein
Repair if possible
Can ligate unilaterally only
Watch for air embolism
(v) carotid injury—
Repair even if comatose as this may be secondary to drugs or shock
Ligate if unstable or other life-threatening injuries
Ligate sup. thyroid and repair carotid end to end for small defects, interpose SVG for defects longer than 2 cm
Can reach high carotid artery by:
anterior subluxation of mandible
division of omohyoid/digastric
using Fogarty balloon to control proximal bleeding

Common Curveballs

Combined injuries to multiple structures in neck
Tension pneumothorax at presentation or after intubation
Trans-cervical injury (collar incision unless above thyroid cartilage)
Multiple GSW with abdominal, chest, and neck injuries—what are your priorities?
Thoracic duct injury becomes apparent several days post-op
Questions regarding for which injuries median sternotomy vs. anterolateral thoracotomy vs. trap-door incisions
Carotid injury in comatose patient
Tissue loss and circumferential carotid injury

Strikeouts

Not securing the airway
Removing impaled foreign body in ED/Trauma Bay
Not evaluating for tracheobroncheal or esophageal injuries
Not performing angiography for Zone I or III injuries
Discussing use of U/S instead of angiography
Performing endoscopy before of gastrografin swallow for esophageal injuries
Probing neck wounds in Trauma Bay

Trauma and Critical Care—Pulmonary Embolism

Concept

Life-threatening postoperative complication. Will likely be from femoral or iliac DVT. Usually associated with trauma, stasis, and hypercoagulability (Virchow's triad). Don't spend time here worrying about inherited defects like FV Leiden or Protein C/S deficiencies—question is regarding resuscitation, diagnosis, and definitive treatment.

Way Question May be Asked?

"Called by nurse to evaluate a 45 y/o male POD#5 sigmoid colectomy now anxious, with HR 110s and pulse ox 85% on supplemental O_2. What do you do?" Question may be asked several different ways with unexplained anxiety, change in mental status, new hypotension in ICU patient, or sudden onset, pleuritic chest pain. Need to be methodical, but expeditious, or your patient will die and you'll be back to take the exam next year.

How to Answer?

Think of history and physical exam while resuscitating pt:
Supplemental O_2, IVF, EKG, CXR, ABG, transfer to ICU

History

Risk factors:
- Prior DVT
- Malignancy
- Pregnancy
- Obesity
- Prolonged immobility/Length of sugery
- Recent trauma
- Recent surgery (especially lower extremity fractures)

Symptoms:
- Chest pain
- Dyspnea
- Hemoptysis
- Anxiety

Physical Exam

Check vital signs, pulse ox (tachycardia, tachypnea)
Lung sounds
Neck veins

Diagnostic Tests

CXR (usually normal but may show decreased pulmonary vascularity, will r/o CHF or pneumothorax)
EKG (may show signs of right heart strain with T wave and ST segment changes, need to r/o MI)
Blood gases (*hypoxia and hypocarbia*, very unlikely to be PE if PO2 > 90)
+/– CVP (will be elevated)
V/Q scan
Spiral CT scan (good for large PE's)
Pulmonary Angiogram (gold standard)

Surgical Treatment

(1) Resuscitate the pt
O_2, fluids, transfer to unit
(2) Anticoagulation
heparin bolus to keep PTT 2–3 times normal value
80U/kg bolus followed by 18U/kg continuous infusion
(Can use LMWH-lovenox at dose of 1mg/kg Q12)
(3) Thrombolytics
for pt with ongoing shock despite maximal supportive care (pressors, fluids, intubation, Swan-ganz catheter)

can't use in pt with recent hemorrhagic stroke, intracranial neoplasm or recent trauma, recent intracranial procedure, active/recent internal bleeding

(4) Surgical embolectomy
for pt with contraindication to thrombolytics or failure of thrombolytics with impending cardiovascular collapse
can support pt with femofemoral AV partial bypass until operation

(5) IVC filter
for pt with recurrent PE despite therapeutic anticoagulation
for prophylaxis in pt with DVT and contraindication to anticoagulation
for pt s/p pulmonary artery embolectomy

Common Curveballs

Fresh post-op pt (colectomy, AAA repair)
Pt will have recent bleeding duodenal ulcer or diverticular bleed
HIT after administering heparin
Recurrent PEs on therapeutic heparin
Being asked how to dose heparin/coumadin
Forcing you to do surgical embolectomy or use thrombolytics
Pt will be pregnant (can't use coumadin in first trimester of pregnancy)

Strikeouts

Giving thrombolytics to fresh post-op pt, or pt with recent intracranial bleed/trauma/procedure
Not knowing indications for IVC filter
Sending pt for V/Q scan/Spiral CT scan/angiogram before starting Heparin
Missing diagnosis (treating as MI or sepsis)
Discussing suction catheter embolectomies
Spending too much time on hypercoagulable work-up or on H+P in unstable pt.
Not putting patients in ICU

Trauma and Critical Care—Splenic Trauma

Concept

Most commonly injured organ in abdominal trauma. Will be in the setting of penetrating or blunt trauma. Gunshot wounds to the abdomen need exploration. Stab wounds can be managed by local wound exploration + DPL. Blunt trauma means CT scan in stable pts, DPL in unstable pts.

Way Question May be Asked?

"14 y/o male is brought into the emergency room after falling off of his bike onto his left side. His chest x-ray shows rib fractures of ribs 10–12. He is tachycardic to the 120s, but not hypotensive. What do you want to do?" May get the scenario with pt comatose and have to work through the whole ABC's and DPL may show gross blood and be faced with splenic injury on ex lap. May get the diagnosis given to you and asked your indications to proceed to the OR.

How to Answer?

In trauma setting, always the ABCs:
- Airway and C-spine control (intubate with C-spine control if necessary)
- Breathing and Ventilation (does pt need chest tube—place before CXR)
- Circulation and IV access
- Disability (Neuro status)

Don't skip secondary survey either, or you will miss some key finding!

History should be AMPLE:

- Allergies
- Meds
- Past medical history
- Last meal
- Events surrounding trauma

Physical Exam

- Head to toe
- Finger/scope in every hole/orifice

Labs/Diagnostic Studies

- Full panel including T+C
- Lateral C-spine
- CXR
- Pelvis x-ray
- DPL if unstable
- CT scan abdomen/pelvis if stable (include head if neuro sx's)

Resuscitate the Patient

- 2 large bore peripheral IVs
- 2 liters crystalloid (20 cc /kg), can repeat once if no response, followed by blood if hemodynamically unstable

Surgical Treatment

To OR when:
(1) Adult pt (the incidence of OPSS is very low) so if there are multiple associated injuries (neuro injuries won't tolerate hypotension and will preclude serial abdominal assessments) or if the pt is unstable or in DIC→ splenectomy
(2) Pediatric pt, don't transfuse more than 2 units of blood to try to stabilize the pt, if more necessary or pt becomes unstable (some won't even transfuse as risk of transfusion > risk of OPSS)→ operate

(3) Penetrating trauma will usually bring you to the OR (can try local wound exploration if stab wound, but nothing wrong with ex lap

Nonoperative Management

(1) Blunt trauma→nonoperative management as long as no free blood in abdomen on CT scan
(2) Grade 1, 2, 3 injuries
(3) Pt has minimal other injuries
(4) Will perform serial exams, labs, CT scans and have low threshold for operative management
    (1) Pack all four quadrants of the abdomen, suction blood with cellsaver, try to determine source of bleeding (clamp aorta at hiatus if necessary)
    (2) Mobilize spleen from ligamentous attachments and inspect
    (3) Splenorraphy can be considered for stable pts with Grade 1,2, and 3 injuries
    (4) Splenorraphy→
        topical agents—fibrin glue (for peripheral injuries)
        mattress pledgeted sutures (for deeper lacerations)
        dexon/vicryl mesh wrap (multiple injuries with out time to repair)
        argon beam coagulator (superficial lacera tions/capsular tears)
        partial resection if polar injury
    (5) Don't spend time on splenorraphy if pt unstable or multiple other injuries
    (6) If doing splenectomy, be careful to ligate short gastrics (not gastric wall), not to injure pancreatic tail, and don't need drain unless suspect pancreatic injury
    (7) Do not perform autotransplanation

Common Curveballs

Pt will have other associated injuries (intra and extra abdominal)
Pt will fail nonoperative treatment
Splenorraphy will fail
Pt will get OPSS (*overwhelming postsplenectomy sepsis*)
Will be asked how to manage pediatric pt after splenectomy
Abscess in splenic bed post-op
Pt will have bowel injury missed in the nonoperative management until pt becomes septic
Pt will be cirrhotic, be on anticoagulants, have h/o severe CAD
There will be pancreatic or gastric injury during splenectomy

Strikeouts

Not knowing how to manage pt after splenectomy
Not knowing techniques for splenorraphy
Not doing adequate trauma work-up
Not having clear criteria for nonoperative management
Discussing autotransplantation of splenic fragments
Not knowing what OPSS is or what immunizations to give pt after splenectomy

Trauma and Critical Care—Thoracic Trauma

Concept

Major cause of trauma mortality. Life threatening problems should be treated as they are identified. Multiple, possibly lethal, injuries that must be identified and treated promptly:

- Tension Pneumothorax
- Massive hemothorax
- Tracheobronchial tree injuries
- Cardiac tamponade
- Traumatic aortic injury

Examiners will also be interested in determining if you know when and when not to get additional tests versus move directly to pericardial window, thoracotomy, or median sternotomy. Don't forget to rule out other non-thoraic injuries.

Way Question May be Asked?

"Called to ED to see a 24 y/o male who suffered a GSW to the chest. His HR is 130 and his SBP is 90/palp. What do you want to do?" Will usually be a question testing your management priorities and if you know how to take care of the unstable patient.

How to Answer?

Brief H+P while resuscitating the patient:
- ABCs then:
- PMHx
- Meds
- Allergies

Physical Exam

VS (if unstable, you will be doing procedures during your evaluation)
Distended neck veins and hypotension (tamponade, tension pneumothorax)
Head to toe physical exam
Chest auscultation (to determine pneumothorax)
Do not remove any foreign bodies (knives are removed in OR!)
SQ emphysema
"Sucking chest wound"
Flail segment

Algorithm

ABCs (airway first!)
Resuscitation (IVF, full labs including PT/PTT, T+C, NGT, Foley)
Lateral C-spine
CXR (r/o widened mediastinum, hemothorax, apical cap, depressed left mainstem bronchus, deviated NGT)
Pelvis x-ray

Diagnostic Tests

CT scan (not in unstable pt)
Angiogram (any pt with suspicion of traumatic rupture of aorta but not in unstable pt—traumatic rupture doesn't explain hypotension in trauma pt)

Surgical Treatment

(1) When to place chest tube?
   Absent breath sounds, even prior to CXR
   Penetrating injury to one side of chest
   Initial output > 1000 cc, or > 200cc/h for four consecutive h→OR!
(2) When to do ED thoracotomy?
   Penetrating trauma with actual or impending cardiac arrest or "Signs of life" in the field and lost en route to ED

Done through sixth intercostal space, left anterolateral incision
Rib spreader, hold lung superiorly with sponge stick or assistant's hand
Open pericardium anterior to phrenic nerve
Clamp descending aorta jut above diaphragm (feel for NGT)
Not for blunt trauma or when lost "signs of life" and > 10 minutes resuscitation en route

(3) When to take to OR for thoracotomy?
CT output > 1000 cc initially
CT output > 200 cc for 4 consecutive hours
Large air leak with hypoxemia (on side of injury)
Esophageal injury (right thoracotomy unless distal third esophagus)
Left subclavian and descending aortic injury

(4) When to do median sternotomy?
Left supraclavicular stab wound
Suspicion of great vessel injury (pulmonary hilum)
Suspicion of injury to right inominant artery (can't reach this through anterolateral thoracotomy)
Tracheal injury
Allows access to ascending aorta, inominant, proximal right subclavian, right carotid

(5) When to do pericardial window?
Stable pt with transmediastinal GSW
Dilated neck veins/high CVP and pt in shock

(6) Diaphragmatic injuries
High index of suspicion (CT, MRI, U/S, fluoroscopy, laparoscopy)
Look for displaced NGT into left chest
Repair in two layers with non-absorbable sutures and place G-tube if on left side
Repair transabdominally if diagnose early, through thoracotomy if diagnose late secondary to intra-thoracic adhesions
May need a mesh if very large defect (Gortex)

(7) Mediastinal injuries
Make sure to do bronchoscopy, esophagoscopy, gastrografin swallow to rule out tracheobronchial/esophageal injuries in penetrating trauma

(8) Cardiac contusion
Rarely the cause of shock in trauma pts
Check EKG, enzyme levels, observation on telemetry
If any ischemic changes, treat as MI pt in ICU
Echo will diagnose contusion, dyskinesia, tamponade, valvular injury

(9) Flail chest
Aggressive pulmonary toilet
Careful fluid management
Pain control (+/– epidural, intercostal blocks)
Will be underlying lung contusion
Follow ABGs/CXR
Selective intubation based on associated injuries/respiratory status

Common Curveballs

When to do thoracotomy
When to place chest tube
When to take to OR
When to do angiogram to r/o aortic injury
Pt will be unstable
Pt will have tracheo/esophageal injury
Pt will need lung resection
Pt will have visceral herniation through diaphragmatic hernia
Pt will need median sternotomy
Pt will have coincident closed head injury (which do you approach first)
Pt will have obvious intraabdominal injury (which do you approach first)
To describe where aortic injury typically occurs and how to repair
There will be contralateral injury
There will be post-op thoracic duct leak
There will be post-op empyema

Strikeouts

Not knowing when to do ED thoracotomy (never in blunt trauma)
Not knowing when to place CT tube (before Cxe)
Not knowing how to diagnose aortic injury
Performing CT scan in unstable pt
Not knowing how to repair diaphragmatic injury
Not going through ABCs

Vascular—Abdominal Aortic Aneurysm

Concept

An aneurysm is defined as a greater than 50% increase in the normal vessel diameter. Incidence in normal population ~ 2%, increase risk in patients with Peripheral Valvular Disease, coronary disease, and popliteal or femoral artery aneurysms. Also, an association with family history of AAA.

Way Question May be Asked?

"56 y/o female seen in ER with complaints of back pain, and is hypotensive and has a pulsatile epigastric mass on exam." Rarely will get the patient with the classic triad of flank/back/abdominal pain, hypotension, and pulsatile abdominal mass. Mass is palpable above the umbilicus. Should also be prepared to answer for the patient referred to you from the PMDs office after a routine physical exam discovers an asymptomatic pulsatile abdominal mass.

How to Answer?

In the unstable pt, you don't have too much time to do your routine H+P:
- Focused H+P while resuscitating the patient and getting them ready for the OR
- Stat bedside Ultrasound
- Flat or lateral abdominal (lumbar) x-ray
- CT scan with IV contrast is a really bad choice here
- Fluids to keep SBP 90 is OK! (higher is associated with increased risk of rupture)
- T+C 6–8 U PRBC and send to OR with FFP, platelets, cryo, O-neg blood
- Prep pt including neck, chest, abdomen, and thighs
- Do not anesthetize pt until completely prepped and draped!!!
- Xiphoid to pubis incision with knife
- Get proximal control of aorta quickly:
  - If free intraperitoneal rupture, can consider balloon occulusion of the aorta, otherwise:
  - Divide hepatogastric ligament
  - Pull stomach to left
  - Retract left hepatic lobe superiorly
  - Aortic occluded placed against aorta and compress against spine
- Distal control by clamping both iliacs
- Then enter retroperitoneal hematoma (often hematoma does dissection for you)
- Identify aneurysm neck and place proximal clamp in infrarenal position
- Then give anesthesiologist time to catch up (lines, fluids, blood and blood products)
- Don't need systemic heparinization if ruptured
- Then open aneurysm, evacuate thrombus, suture ligate any lumbars, place graft (tube graft 24 mm if iliacs non-aneurysmal)
- Close peritoneum over top of graft
- Return to ICU
- Be prepared to deal with hypothermia, acidosis, coagulopathy, renal failure, loss of pulses in an extremity, abdominal compartment syndrome, and post-op MI
- Don't perform aorto-bifem if mild ectasia/aneurysmal dilation of iliacs (it's just a longer operation in already unstable pt!)

In Asymptomatic Patient

- Complete H+P
- Size of AAA by U/S
- CT scan is best preoperative study for AAA evaluation
- Risk of rupture increases with size
- Any AAA more than 5 cm in size is candidate for repair or AAA showing rapid growth (> 0–0.5 cm over 6 months) during follow-up
- If ≤ 5 cm, ultrasound q 6 months

Cardiac work-up in all pts: persantine thallium stress test
If positive finding on cardiac work-up→ cardiac cath/surgery
A-line, SGC, Foley intra-op and post-op

Operative Approach

If elective, can discuss retroperitoneal approach through left flank incision:
  Less post-op ileus and pain
  Useful in pt with prior abd surgery
  Easier access to suprarenal aorta
  Only describe if have seen this before
  Harder to access right iliac through this incision
Open transperitoneal approach:
  Better pelvic exposure
  Used in cases of rupture
  Careful of injuring duodenum/iliac veins/intra-op coagulopathy

Common Curveballs

Aneurysm will be suprarenal
Aneurysm will be 4 cm
Asked when you will reimplant IMA (don't need to if strong backbleeding or no backbleeding)
Pt will also have obstructing or near obstructing sigmoid colon lesion (key to answer here is size of AAA vs. how close to obstructing is colon lesion)
Pt will have had prior transverse colectomy for cancer (need to reimplant the IMA if stump pressure < 70 and check arteriogram pre-op)
Aneurysm will present in atypical fashion: embolization to the legs, inflammatory, aortacaval fistula, acute AAA thrombosis with pelvic and lower extremity ischemia
Pt will present later with: graft infection, aortoenteric fistula (ax-bifem 1st followed by ligation aorta), pseudoaneurysm at anastomosis
Being asked to describe your pre-op cardiac assessment (stress thallium)
There will be an intra-op anomaly: horseshoe kidney, retroaortic renal vein, left-sided IVC
Pt will be in shock and they will ask you if you want to get a CT or go straight to the OR (go to the OR and resuscitate en route!
Being asked what to do with pt with dementia, metastatic cancer, or elderly
Pt will have had prior abdominal surgery (colectomy→reimplant IMA!)
Being asked your feelings about "stent-grafts" (results good so far and done in symptomatic pts, but always be the conservative surgeon on the Oral Exam)
Be prepared to deal with common post-op problems (pt will likely have at least one of the following):
  hypothermia
  acidosis
  coagulopathy
  renal failure—(abdominal compartment syndrome, ATN, atheromatous debris, ureteral injury, hypovolemia—favorite question of the examiners is post-op AAA low UO!!!)
  loss of pulses in an extremity
  abdominal compartment syndrome
  ischemic left colon (reimplant IMA if stump pressure < 40 or Hartmann procedure post-op)
  post-op MI
  spinal cord ischemia
  impotence

Strikeouts

Not knowing how to gain control of rupturing aorta
Not prepping pt widely enough (include neck and thighs . . . "chin to knees")
Not ruling out MI or other abdominal processes
Not palpating pulses
Addressing AAA first in pt with + persantine thallium or cardiac cath
Not knowing how to manage the common postoperative problems (see above)
Trying to perform any endovascular stent graft
Not taking asymptomatic pt with rapid AAA growth to the OR

Risk of Rupture

5 cm AAA→ annual risk ~5%
7 cm AAA→ annual risk ~20%

Vascular—Acute Lower Extremity Ischemia

Concept

An acute event characterized by the "6 Ps": pain, paresthesias, pulselessness, pallor, paralysis, and pulselessness. Often hard to determine if it is secondary to thrombosis on top of chronic PVD vs. acute emboli. History is very important here to make the right decision.

Way Question May be Asked?

"A 63 y/o man was admitted to the hospital status post an inferior wall MI and just before he goes home, 5 days later, he develops the sudden onset of acute left leg pain. On exam the leg is cool to the touch and pulses are absent on the left except for the left femoral." You're lucky if the scenario points you in the direction of an embolus. Need to act promptly if you don't want to end up doing fasciotomies (which you'll likely have to describe anyway). Checking the pulses is critical and should tell you the level of the likely occlusion which helps you plan your operative management.

How to Answer?

History should focus on risk factors:
- History of embolic episodes
- Cardiac arrhythmia (a. fib)
- Recent MI with mural thrombus
- AAA
- PVD
- Recent bypass surgery (Aortobifem, fem-pop)

Physical exam should look for signs of vascular disease
- Document pulses! (and compare to previously recorded pulses)
- Neuro exam
- Hairless skin, changes in nails
- Ankle-Brachial Index (ABI)
- Check for abdominal/femoral/popliteal bruits/-pulsatile masses

Pre-op Labs Including:

- Coagulation studies
- Hypercoagulability (if time and history don't elucidate a cause)
- CPK levels (you'll need these to make sure patient doesn't develop rhabdomyolysis and renal failure)

Nonoperative Therapy

- All pts get started on Heparin
- Only for the pt with acute on chronic that you think is a thrombosis
- Take pt to angiography suite for catheter-directed thrombolytics

Operative Approach

History and PE very important here

If both femoral pulses are absent:
- Explore bilateral groins for aortic saddle embolism
- Prep abdomen in case need to obtain control of aorta
- Prep infraclavicular area in case need to do extra-anatomic bypass (ax-bifem)

If unilateral absent femoral pulse:
- Dealing with iliac embolism or thrombosis of a stenotic iliac
- Explore unilateral groin
- Again, need to be prepared to get to aorta and axilla

If unilateral absent popliteal pulse and femoral present:

Dealing with an embolism at the femoral bifurcation or below (but above popliteal)
Explore unilateral groin
Transverse arteriotomy in common femoral

If femorals and popliteals present but pedal pulses absent:
Embolus at popliteal trifurcation or below
Explore popliteal below the knee
Need to perform thromboembolectomy for all three tibial arteries

If after recent aorta bifem, make a longitudinal incision on the distal femoral limb just proximal to the anastomosis
If pre-existing SFA disease, an emergency fem-pop bypass could be the correct choice
Could try revising the distal anastomosis

If after recent fem-pop:
Need to expose both anastomoses
Hard to embolectomize a vein graft
Usually need to revise the distal anastomosis
May need to take down vein graft and replace with Gortex

Remember always to get proximal and distal control before opening a vessel
Fogarty balloon embolectomy
Can do angiogram initially in the OR and use thrombolytics
Always do completion angiogram in OR
Don't forget to consider bicarb and mannitol to protect the kidneys
Keep track of time in the OR as fasciotomies may be necessary

Common Curveballs

Pt will have just had some sort of bypass surgery
Post-op compartment syndrome will develop
Post-op rhabdomyolysis
Post-op acidosis, hyperkalemia from reperfusion injury
Pt will need amputation for severe ischemia
Pt will develop renal failure
Being asked to describe your fasciotomies
Aortic saddle embolism will need extra-anatomic bypass
Pt will still not have pulses after your balloon embolectomy

Strikeouts

Trying to avoid the OR with catheter-directed thrombolytics or suction thromboembolectomy
Not taking fresh post-op pt back to the OR and exposing the graft and being prepared to revise or replace the graft
Forgetting to anticoagulate the pt pre-op, intra-op, and/or post-op
Start discussing angioscopy to identify the clot
Forgetting to check the pulses pre-op
Forgetting to check intra-op completion angiogram/checking pulses post-op

Vascular—Carotid Stenosis

Concept

Usually described as extracranial cerebrovascular disease. Must have appropriate indications for surgery here! Be sure to differentiate from the rare "posterior" ischemia that comes from the basovertebral system.

Way Question May be Asked?

"A 53 y/o female seen in the ED for a TIA which resolved in the next several hours is later referred to your office for evaluation for a carotid endarterectomy. She has a bruit on the left side."

How to Answer?

History should focus on risk factors:
- HTN
- DM
- Elevated cholesterol
- Vascular disease elsewhere
- History of TIA (ocular or hemispheric symptoms)
- History of stroke

History should also focus on symptoms being sure to r/o other possibilities:
- Recent MI
- A. fib
- Ataxia, gait disturbances, bilateral lower extremity weakness→basovertebral ischemia
- Intracranial pathology

Physical Exam

- Look for signs of vascular disease
- Neuro exam
- Bruits
- BP gradient between the two arms

Remember non-invasive testing (these pts have vascular disease everywhere):
- Arrhythmias on EKG
- Carotid duplex scanning—plaque characteristics, flow velocities, % stenosis
- CT or MRI of brain in symptomatic pts
- MRA if available (if not, angiogram to include aortic arch and proximal common carotid artery)

Indications for Surgery

- Symptomatic pts with ≥ 70% stenosis
- Symptomatic pts with < 70% and ulcerated plaque or failure of medical therapy
- Asymptomatic pts with ≥ 80% stenosis
- Crescendo TIAs

Nonoperative Therapy

- Asymptomatic pt is treated with aspirin or Plavix
- Q 6 month follow-up with repeat non-invasive testing

Operative Approach

- Position pt supine with head elevated and turn to opposite side
- Gentle prepping of neck (don't want to injury fragile plaque)
- Oblique incision along anterior border of SCM
- Dissect common carotid along medial border to avoid vagus nerve injury
- Expose common carotid, internal carotid, and external carotid with minimal manipulation
- Divide facial vein as usually enters IJ at level of bifurcation
- Apply clamps/tourniquets in disease free areas
- Anticoagulate pt with Heparin 100U/kg
- Select shunt (safest on the oral exam to shunt all pts and perform surgery under general anesthesia)

Arteriotomy begins on proximal CCA and extends onto ICA (above and below gross intimal disease)
Make sure to carefully back-bleed shunt free of air/debris
Dissect plaque free of arterial wall with blunt dissector
Make sure there is no loose flap or tack down shelf (6-O prolene double arm, vertically placed so as not to constrict lumen of ICA, knots on outside of vessel)
Close vessel with vein patch or Hemashield patch
Flush all vessels before closure and releasing ICA clamp
Open external first again to flush air/debris away from ICA distribution
Reversal of heparin with protamine and use of drains is surgeon dependent

Common Curveballs

Carotid artery will be completely occluded at time of surgery
Pt will have post-op stroke or stroke after you order an angiogram
Pt will have 78% stenosis and be asymptomatic
Pt will have 68% stenosis and be symptomatic
Pt will have ulcerated plaque
Consulted to see a pt with carotid occlusion
Consulted to see a pt with recent stroke (check CT, if no stroke, heparin and CEA in 1 week, if stroke, CEA in 2 months)
Restenosis after CEA
Post-op: MI, neurologic deficit in recovery room, headache, bradycardia in recovery room
Pt will have acute stroke in your follow-up of an asymptomatic lesion (don't rush to operate→get CT of head, treat with TPA if in first 3 h, otherwise ASA, physical therapy, and CEA in 6 weeks)
Pt will have expanding hematoma in neck post-op
Disease/plaque will continue up into base of skull
Won't be an appropriate vein to harvest to use as a patch
Post-op MI
Post-op hypertension/hypotension (NTG/nitroprusside or volume replacement/dopamine respectively)
Post-op nerve injury
Management of crescendo TIAs (→OR!)
Management of pt with triple vessel heart disease and 90% R carotid (CEA+CABG)
Management of carotid if at time of surgery, completely thrombosed

Strikeouts

Not being clear on your pre-op indications
Not differentiating from basovertebral ischemia
Operating on fresh ipsilateral stroke
Not getting cardiac work-up, angiogram or MRA pre-op
Don't start discussing things like anterior subluxation of the mandible to extend exposure unless you do this procedure!
Not being able to describe your operation or ways to minimize debris in ICA
Performing blind endarterectomy (need to visualize distal endpoint to avoid distal flaps!)
Discussing carotid angioplasty/stents (only pt with clear fibromuscular dysplasia unresponsive to medical Tx gets dilatation)

Vascular—Chronic Lower Extremity Ischemia

Concept

Peripheral vascular disease in the extremities that may present in several ways. Often times the examiners here will be testing your knowledge of the indications for surgery and your nonoperative management of PVD.

Way Question May be Asked?

"45 y/o male presents to the office for evaluation of pain in his right thigh and calf after walking 3 blocks. He is a smoker, overweight, and is currently on no medications."

How to Answer?

Be specific in your indications for surgery:
- Rest pain
- Non-healing ulcer
- Gangrene
- Intermittent claudication that:
  - Fails to improve with nonoperative therapies
  - Severe enough to interfere with person's lifestyle

History should focus on risk factors:
- Smoking
- DM
- HTN
- Overweight

Physical exam should look for signs of vascular disease
- Document pulses!
- Neuro exam
- Hairless skin, changes in nails
- Ankle-Brachial Index
- Check for abdominal/femoral bruits

Remember to perform pre-op cardiac work-up

Nonoperative Therapy

- Risk reduction (smoking cessation, weight reduction, control of glucose levels and SBP)
- Graded exercise program
- Anti-platelet therapy (Trental)

Non-Invasive Vascular Laboratory

- Doppler ultrasound
- Segmental PVRs
- Exercise treadmill testing

Invasive Tests

- Aortogram with distal run-off or
- MR Angiogram

Only take claudicant to surgery after long term follow-up has shown failure of nonoperative therapies and the pt has been committed to risk reduction (smoker doesn't get bypass!

Operative Approach

- Always need adequate inflow and adequate outflow
- Isolated aortoiliac lesion is amenable to angioplasty/stent
- Try to use vein if possible (in-situ or reversed SVG)—assuming pt has not had cardiac surgery—
  - SVG harvesting (autogenous grafts have best patency rates)—
  - pre-op duplex will evaluate the suitability of vein and can map location

If using prosthetic graft, use PTFE
Choice of distal target depends on pre-op arteriography
Vertical incision to expose *common femoral* artery at groin

Medial approach to expose *popliteal* above the knee

Exposure of *peroneal and posterior tibial* below trifurcation are best exposed by detaching the soleus muscle from the tibia

Anterior tibial exposed by a longitudinal incision two fingers-breadths lateral to the anterior tibial border exposing the anterior tibial between the anterior tibialis and extensor digitorum longus

For in-situ grafts, valves are incised through side branches using Mills valvulotome

Patency rates for infra-inguinal bypass for disabling claudication:
~70% at 5 years

Completion angiogram in OR
Don't forget to give heparin intra-op

Common Curveballs

Post-op hemorrhage
Post-op graft thrombosis or infection
Any stent placed will occlude
Angioplasty performed will restenose
Angioplasty performed will lead to vessel dissection
Post-op compartment syndrome will develop
Pt will develop heparin induced thrombocytopenia

Strikeouts

Not being clear in your indications for surgery
Not trying nonoperative therapy for the intermittent claudicant
Not knowing your non-invasive vascular studies
Not taking pt back to surgery for immediate post-op graft thrombosis
Trying to describe a technique you don't do (in-situ SVG)
Not being prepared for postoperative complications
Not being able to read angiogram if handed to you
Spending lots of time on endovascular techniques.

Vascular—Venous Stasis Ulcer

Concept

Spectrum of valvular incompetence and chronic venous outflow obstruction with resultant venous hypertension, edema, cellulitis, ulcers. Valvular incompetence accounts for 90% cases, DVT for other 10%.

Way Question May be Asked?

"A 49 y/o female G_4P_4 comes to your office complaining of pain and swelling in the lower legs, varicose veins, and a non-healing ulcer on the medial aspect of her right ankle. What do you want to do?" May even be given the increased skin pigmentation and the varicosities.

How to Answer?

History

Vascular disease
h/o DVT
Clotting disorders
Prior treatments
Professions with "long standing" periods
Pregnancy

Physical Exam

Complete vascular exam
Varicosities (size, location, firmness)
Calf tenderness/swelling (DVT)
Edema
Brawny induration/discoloration
Dermatitis
Ulceration (most occur medial)
Brodie-trendelenburg test (elevate leg until drained of venous blood, place tourniquet below knee, have pt stand, see if more blood flows into varicosities when tourniquet released after they fill from arterial pressure (30 seconds)→tests superficial reflux

Data

Labs including PT/PTT, Factor V Leiden, Protein C and S, ATIII level
Check ABI (if < 0.6, question your diagnosis)
Duplex scanning to determine sites of obstruction and incompetence (deep, superficial, perforators), evaluate for DVT

Surgical Treatment

(1) Conservative treatment with:
compression therapy
leg elevation/antibiotics
weekly application of Unna boots
topical agents (PDGF, EGF)
if ulcer heals (on the exam, it won't), pt is fitted for graduated compression stockings (30–40 mmHg)
(2) *For superficial vein incompetence alone*→ high ligation and stripping of greater saphenous vein surgery
(3) *For superficial and perforator incompetence*→ subfascial endoscopic perforator veins
(4) *For deep vein obstruction*→ air plethysmography to delineate anatomy and choose appropriate surgical procedure
(a) deep venous obstruction from femoral/iliac thrombosis→ cross femoral and/or saphenopopliteal bypass
(b) deep venous reflux→ valvuloplasty

(5) May also need STSG for healing of ulcer

Common Curveballs

Conservative therapies will fail
Trying to get you do to variceal ablation in pt with deep vein obstruction/incompetent perforators
Asking you to describe physical exam tests—Trendelenburg test
Pt will have associated vascular disease (changing scenario)
Pt will be pregnant
Pt will have recent DVT
Pt will have some coagulopathy

Strikeouts

Confusing with arterial ischemic ulcer
Not performing adequate H+P
Not trying conservative therapies
Not performing duplex scan
Performing variceal ablation in pt with deep vein obstruction (this is an important collateral in these pts and can cripple venous outflow)

Conclusion and Common Curveballs

As a final conclusion to the information I've presented in this book, I have some parting words of advice:

(1) dress conservatively,
(2) don't appear hesitant,
(3) don't quote the textbooks or the literature,
(4) never mention a test or procedure you can't fully describe and
(5) remember that the stress of the exam will do strange things to you.

I recommend a single dose of Immodium, a good movie, and possibly a "shot" of alcohol the night before.

I've also included a list of the most common curveballs to anticipate. We all see these in real life and know how to manage them, but it's easy to end up with a swing and a miss when one comes at you on the exam. The examiners are trying to determine whether or not you are a safe surgeon. Keeping that in mind, anticipate the following ahead of time and you won't get shelled in anyone scenario and you may avoid a return trip to the Oral Exam:

The pt with a bowel obstruction will have had a recent MI
The incarcerated/strangulated hernia will reduce on induction of anesthesia
The trauma pt will have multi-system injury especially abdominal and neurologic trauma
Consultants will never be available
Pts needing laparotomy will often have had prior abdominal surgery
There will be a synchronous mass in the colon cancer patient
The obstructing left colon cancer will have a cecal perforation
The pt will have a cervical leak after a Zenker's diverticulectomy
The pt will perforate after upper/lower endoscopy
Percutaneous drains won't work
The pt will be hypotensive/hypoxic in the recovery room
The pt will have multiple GSWs
The pt will have neurologic findings after a GSW to the abdomen
The chest tube placed for a hemothorax will clot off and make you think the output has truly decreased
The AAA will have post-op: MI, colonic ischemia, renal failure
The pt started on Heparin will develop HIT
The low anterior resection will leak
Medical therapy will always fail
The MI pt will throw a clot to the SMA 6 weeks post-op
The pt will develop a pseudoaneurysm
The pt will develop a enterocutaneous fistula after extensive LOA
The FNA will not be definitive in any solid mass
The sarcoma will involve an artery/nerve
The colon cancer will have a colovesical fistula
Dissection in the pelvis for diverticulitis/cancer will injure the ureter
The colon cancer will involve the ureters
The rectal cancer pt will present with large bowel obstruction
The young pt with HTN will have an MEN syndrome
The ERCP will fail to remove an impacted stone or diagnose malignancy
The uneventful lap chole will develop post-op jaundice
The gallstone ileus will have more than one stone in the small intestine
The pregnant pt will need surgical intervention
The pre-op lymphoscintigraphy for a SLN in melanoma will light up two lymph node basins
Sarcoma will locally recur
A.fib complicating any scenario
Gastric MALT-oma won't respond to *H. pylori* treatment
Lung resection pt will have continued air-leak
Abscess will complicate every operation
The ex lap/splenectomy/lap chole will have an unanticipated ovarian mass
Mobilizing the left colon will injure the spleen

Mobilizing the right colon will injure the ureter/IVC
The colostomy will become ischemic post-op
The post-op thyroidectomy will have parathyroid or laryngeal nerve injury
Vascular prosthetic grafts will thrombose/get infected
The DVT will fail medical therapy or develop phlegmasia
Post-op trauma pt will get abdominal compartment syndrome
Excisional biopsy for DCIS will have positive margins
Stomach cancer will be high on lesser curve adjacent to GEJ
Post-op Whipple will have pancreatic leak
Duodenal stump will blow out on BII
Pancreatic necrosis will get infected
Pseudocyst will erode into adjacent structures (stomach, colon, splenic vessels)
Results of percutaneous biopsies will always be inconclusive

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