GEISEL MEDICAL STUDENTS RADIOLOGY 502

ELECTIVE MANUAL

This document outlines the structure of the elective as well as providing teaching objectives and resources for each clinical rotation through different modalities. Please read this document thoroughly. You are expected to have reviewed the modality specific sections before the appropriate clinical rotation.

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INTRODUCTION

Welcome to radiology. This document is intended to provide you with some guidelines regarding your elective goals and objectives as well as some resources for study.

Before you start, please watch the orientation video at http://www.youtube.com/watch?v=LyuNEbBR4QQ

This will NOT be repeated during the elective and you will need to know the information.

Robert and Dr. Lewis will meet with you at 8 am on the first day of your elective in the Radiology Conference Room for an introductory session, following which Robert will show you around the department before your lecture series begins. At this time he will give you your schedules, books and other information. The elective includes an intensive lecture series which is designed to cover all areas of basic Radiology, with lectures and workshops weighted towards the first couple of weeks of the elective. You also attend the resident teaching conferences and various other joint interdepartmental conferences during the elective.

ELECTIVE DIRECTOR

Petra J. Lewis, MD

Contact via email or cell phone via secretaries petra.lewis@hitchcock.org

Not here on Fridays. Please let me know if there are any problems as soon as they arise or if you have any planned or unplanned absences.

ELECTIVE COORDINATOR

Robert Shaw

Contact via email or 650-7497 Robert.m.shaw@hitchcock.org

CANVAS

Please ensure that you are registered to the RAD502 course on Canvas. Elective documents including lectures slides will be posted there.

PACS WORKSTATIONS

You will need to be able to sign into the PACS (Picture Archiving and Communication System) to be able to access studies. You will be given a sign in on the first day, which you will use with the instructions at the end of this document.

To set up your PACS. A PACS workshop is also held on the first day to demonstrate this and various aspects of the PACS system.
CODE OF CONDUCT IN RADIOLOGY

1. You are expected to be in the assigned clinical area between 8-5p unless you have to be at a required learning activity by your department, post-call or covering clinic. If there is a conflicting required activity, this should be discussed with Dr. Lewis prior to beginning of the elective.

2. Please dress appropriately, as you would in a clinical area. In fluoroscopy and IR, as well as during procedures in CT, US and mammography, scrubs/white coats may be required.

3. The workstations are our offices and consulting rooms. Talking loudly, discussing personal matters, answering a cell phone and similar behaviors are unprofessional and distracting while we are reading studies. Any behavior that would be inappropriate during a clinical interaction is inappropriate in our reading rooms.

4. The PACS workstations are not to be used for email or activities unrelated to work. They can be used for accessing teaching resources but be prepared to make the workstation available if required by a member of radiology staff or resident. I would suggest that you bring your own laptop.

5. The presence of learners requires considerable time and effort by both radiology staff and residents. There are times when the number of learners or the workflow may require that staff ask you to utilize self-learning resources. Please be sensitive to this.

GENERAL LEARNING OBJECTIVES

See also specific learning objectives for each modality

These will obviously depend on your career interests, but global learning objectives for this elective are for you to:

1. Develop basic image interpretation skills of chest and abdominal radiographs, with an emphasis on emergency findings

2. Develop basic interpretative skills in CT, including chest and abdominal anatomy

3. Learn appropriate imaging algorithms for common diagnostic situations, with an emphasis on those in your area of interest

4. Learn where image guided invasive procedures are beneficial

5. Understand some of the risks and benefits of imaging – particularly the risks associated with radiation exposure and awareness of the potential impact of unnecessary or repeat CT imaging in patients. This includes: understanding the concept of high risk groups (children and young patients especially females, pregnant patients) for radiation exposure especially from CT scans and how to minimize the risk

6. Understand how to provide the appropriate clinical information to radiology so that the correct study, with the optimal protocol can be performed and the best interpretations be made of the data.
## ELECTIVE OUTLINE

(May vary certain months)

<table>
<thead>
<tr>
<th>Day</th>
<th>Time</th>
<th>Element</th>
<th>Preparation required?</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>8:00 am</td>
<td>Departmental tour</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td>8:15 am</td>
<td>Introductory session</td>
<td>Bring manual, emailed cases pdf</td>
</tr>
<tr>
<td></td>
<td>11 am</td>
<td>PACS/Digitization workshop</td>
<td>No</td>
</tr>
<tr>
<td>2-5</td>
<td>Morns</td>
<td>Lecture series</td>
<td>No</td>
</tr>
<tr>
<td>4 usually</td>
<td>5p</td>
<td>Ultrasound workshop</td>
<td>Full bladders!</td>
</tr>
<tr>
<td>Variable</td>
<td>TBA</td>
<td>CORE 1-4, 9-12 workshops</td>
<td>Review CORE cases before</td>
</tr>
<tr>
<td>Weekly weeks 2-4</td>
<td>1 pm</td>
<td>Cool Cases</td>
<td>Yes, bring A# of interesting cases.</td>
</tr>
<tr>
<td>Daily M-Th</td>
<td></td>
<td>Case of the Day</td>
<td>Go to link to do cases</td>
</tr>
<tr>
<td>Fridays</td>
<td>TBA</td>
<td>Review of Case of Day</td>
<td>Go to link to do cases</td>
</tr>
<tr>
<td>TBA</td>
<td>TBA</td>
<td>Imaging Lingo</td>
<td>No</td>
</tr>
<tr>
<td>TBA</td>
<td>TBA</td>
<td>Esac Conference</td>
<td>No</td>
</tr>
<tr>
<td>TBA</td>
<td>TBA</td>
<td>Imaging Algorithm</td>
<td>Yes review cases and consider imaging algorithms</td>
</tr>
<tr>
<td>Wks 1-4</td>
<td></td>
<td>Clinical rotations</td>
<td>We will design schedule day 1</td>
</tr>
<tr>
<td>Week 4</td>
<td>TBA</td>
<td>Image Jeopardy</td>
<td>No</td>
</tr>
<tr>
<td>Friday wk 4</td>
<td></td>
<td>Exam</td>
<td>Study!</td>
</tr>
</tbody>
</table>
**CLINICAL ROTATIONS**

A preliminary schedule of your clinical rotations will be made on day 1 and will be made available on Googledocs™ with that link e-mailed to you. There are 4 elective half days that you can select clinical rotations or self study time.

**TYPICAL 4-WEEK CLINICAL RADIOLOGY ROTATION SCHEDULE (#HALF DAY SESSIONS)**

<table>
<thead>
<tr>
<th>Rotation</th>
<th>4 week student elective</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chest</td>
<td>4</td>
</tr>
<tr>
<td>MSK</td>
<td>1</td>
</tr>
<tr>
<td>Body CT/MR</td>
<td>4</td>
</tr>
<tr>
<td>Fluoro</td>
<td>2</td>
</tr>
<tr>
<td>US</td>
<td>3</td>
</tr>
<tr>
<td>Neuro</td>
<td>2</td>
</tr>
<tr>
<td>Nuclear med</td>
<td>2</td>
</tr>
<tr>
<td>Mammo</td>
<td>1</td>
</tr>
<tr>
<td>IR</td>
<td>2</td>
</tr>
<tr>
<td>Lectures</td>
<td>10</td>
</tr>
<tr>
<td>Self study</td>
<td>4</td>
</tr>
<tr>
<td>Exam</td>
<td>1</td>
</tr>
<tr>
<td><strong>Elective time</strong></td>
<td><strong>4</strong></td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>40</strong></td>
</tr>
</tbody>
</table>
PRIVATE PRACTICE DAY

Students may like to spend a day in private practice (especially if considering radiology as a career), usually at Speare Memorial Hospital, sometimes Cottage Hospital, to see that side of practice. This can be scheduled during the first day.

CONFERENCES

You should attend the 12:15 conference for residents in the radiology conference as well as the conferences in BOLD below. All are in the large radiology conference room unless stated differently.

Other conferences that you are welcome to attend depending on your specialty interest are also listed.

Monday: 7am Vascular conf (IR, vascular surgery) Aud A
        4.30p Neuro interesting case 3Z

Tuesday: 7a Rheumatology (3RD TUES OF MONTH)
        7a Cerebral/Vascular – Neuro Surgery Library

Wednesday: 7a GI conference (radiology, GI) GI conference room

Thurs:  7a GU conference (radiology, urology)
        7a Breast-path conference (radiology, pathology) *FIRST THURS MONTH
        8a Pulmonary conference (pulmonary, radiology)  *SECOND THURS MONTH

Friday: 7:15a ENT 3rd Friday of month

There are also a number of tumor boards that may interest some students and residents. These are listed below. Check schedule and staff for attendance.

Monday: 7a GI tumor board

Tuesday: 8a Pulmonary tumor board (CTOP) - GO AT LEAST ONCE
        4p Neuro oncol tumor board
        4.30p Lymphoma tumor board

Wed:  12:00p Breast tumor board Aud F

Thursday: 4:30p GU tumor board
ACR Appropriateness Criteria

A movie explaining how to use the ACR Appropriateness Criteria can be found at: https://www.youtube.com/watch?v=fu8XF6UpXq8

The criteria themselves are at: http://acr.org/ac

These criteria are essential for the Imaging Algorithm Workshops.

Core Cases (Case Based Online Radiology Education)

If you are a DMS student you will already have done some of the core cases. You are expected to complete all current core cases during the time of the elective. The first 4 chest cases must be reviewed prior to the CORE Workshops based on these cases.

These cases can all be accessed at http://www.med-u.org/. These are a series of interactive cases that are designed to teach the student curriculum in radiology. These include cases in chest, GI, GU, neuro, pediatrics, women’s imaging and MSK. They include multiple web-links to expand the learning experience. Your prior login or that from CLIPP or FMcases is valid.

Core Workshops

The CORE workshpds are interactive sessions designed to reinforce the learning, application and integration of the key learning objectives from CORE cases 1-4 and 9-12. You must review these cases prior to the workshops.

Cool Cases

There are 3 Cool Case sessions during the elective. Each is facilitated by a member of staff, but this is when students show cases to each other (using PACS or EDH) that they have seen on the elective and which they think that the other students would be interested in. They do not have to be rare, but should be good teaching examples. Each case should not take more than about 5 mins. If the staff are late, start the session without them.
CASE OF THE DAY

There are 16 Case of the Days.

Robert will send out the links for the week on Mondays, and you can either do a case a day Mon-Thurs or do them all at once. The links are also below.

Each case has several questions attached to it in SurveyMonkey.

On Friday, one of the residents will review the week’s cases along with your responses.

Week 2
Monday  http://www.surveymonkey.com/s/YZNLP92
Tuesday http://www.surveymonkey.com/s/YZBY7VR
Wednesday http://www.surveymonkey.com/s/YZH95SP
Thursday http://www.surveymonkey.com/s/YZPKCXH

Week 2
Monday  http://www.surveymonkey.com/s/YZPSGCK
Tuesday http://www.surveymonkey.com/s/YZL5MZ
Wednesday http://www.surveymonkey.com/s/YZ59B9F
Thursday http://www.surveymonkey.com/s/Y5KSMKH

Week 3
Monday  http://www.surveymonkey.com/s/VX6M7L5
Tuesday http://www.surveymonkey.com/s/VX5BG2S
Wednesday http://www.surveymonkey.com/s/VNLJ2ZG
Thursday http://www.surveymonkey.com/s/VN8TZBB

Week 4
Monday  http://www.surveymonkey.com/s/VN8YJKK
Tuesday http://www.surveymonkey.com/s/VNKZ86D
Wednesday http://www.surveymonkey.com/s/VNXXVWW
Thursday http://www.surveymonkey.com/s/VNK275N

ON CALL

All students should spend one evening “on call” with a resident. The student should stay until 10:00 or 11:00pm but need not stay all night unless they wish to. This is a good opportunity to find out about ‘real’ life as a radiologist. This can be arranged by checking the call schedule and asking a resident if you can join them on call for a few hours. This is totally at the individual resident’s discretion, but most are happy to have a student ‘tag’ along.

END OF ELECTIVE EXAM

You will be given a web-based exam at the end of your elective. This will cover all basic general areas of radiology. This is a 113 question exam that is approximately 50% image based.
BEFORE your elective, go to

- http://radiology.examweb.com
- Sign up (please remember username and password), use Geisel/instructor Lewis. The Classcode will be sent to you.
- A 20 question ‘practice exam’ will be visible in Radiology ExamWeb by the start of the elective, you can take this any time during the elective so you can see what kind of question items you are likely to see and the format. The score from this practice exam does NOT contribute to your grade.

EVALUATIONS

All staff and residents will be surveyed at the end of the elective. Part of the evaluation includes your performance on the final test, as well as the case presentation and submission. No evaluation will be submitted to the medical school unless the student has returned any loaned texts/CDs and submitted an anonymous evaluation of the elective via SurveyMonkey at https://www.surveymonkey.com/r/radelective. Please be constructive and professional in your comments. These evaluations are collated annually and significantly affect the course design for the following year.

GENERAL ELECTIVE RESOURCES

The self-teaching room is available all week. The code for the door is: 135. The computers in there have a login of radstudent/radstudent

TEXTBOOKS

We will lend you a textbook: Lewis and McNulty: Handbook of Radiology. This must be returned at the end of the elective in the condition they were lent.

PACS TEACHING FILES

You can access the elective teaching files (All listed under //Elective.....) on the PACS workstations by using your username and password which should be given to you on the first day. If you have not been given one, contact Luke Hebert. The instructions for logging in, configuring the PACS system and accessing these files is on a separate sheet that should have been in your packet.

There are also various other folders here such as neuro, body MRI, cardiac etc which you are welcome to look at if you wish.

OTHER WEB-BASED RESOURCES

See sectional recommendations and self study resources
CHEST

GOALS OF ROTATION

• Be able to identify normal CXR anatomy and become familiar with the range of normal appearances through seeing multiple examples of normal films

• Review a standardized search system for CXRs [http://www.youtube.com/watch?v=HfNU8DGXFqk](http://www.youtube.com/watch?v=HfNU8DGXFqk)

• Gain a familiarity with the interpretation of portable CXRs

• Identify the different CXR views and when they are helpful, as well as the limitations of each (PA, AP, lateral, supine, upright, decubitus, expiratory, lordotic)

• Identify common conditions on CXRs: Pneumonia, pneumothorax, pleural effusions, pulmonary edema, ARDS, atelectasis, cardiomegaly, pulmonary masses, granulomas, hilar enlargement, COPD/emphysema, aortic rupture

• Identify correct and incorrect tube placements: Central lines, ETT, PICC, NG, Dobhoff

• Be able to discuss common indications for performing CXRs and when additional imaging with CT, MRI or nuclear medicine studies may be helpful

SPECIFIC RECOMMENDATIONS

• Read chest chapter in Lewis and McNulty (provided)

• Review CXR anatomy

• Pre-read films (6-8 at a time) then review with radiologist who will dictate

• Review the Elective PACS collections

ADDITIONAL STUDY MATERIAL

[Learningradiology.com](http://Learningradiology.com) (various modules)

[University Virginia CXR module](http://University Virginia CXR module) [University](http://University)

[Virginia ICU chest film module](http://Virginia ICU chest film module) [Yale](http://Yale)

[cardiothoracic imaging modules](http://cardiothoracic imaging modules)

MUSCULOSKELETAL

GOALS OF ROTATION

• Be able to recognize some of the common plain film MSK abnormalities: Hip fracture, ankle fractures, scaphoid fracture, wrist fractures inc. buckle fractures, osteoarthritis, rheumatoid arthritis, knee and elbow effusions, spinal compression fracture, shoulder dislocation
• Understanding how we describe fractures
• Understand the importance of obtaining the appropriate views (scaphoid, radial head, shoulder internal and external rotation)
• Know some of the indications for and benefits of obtaining further imaging with MRI, CT or arthrography
• Be able to briefly describe the procedure for an arthrogram to a patient

SPECIFIC RECOMMENDATIONS

• Spend time part with primary and third listed MSK staff
• Observe one arthrogram
• Pre-read films (6-8 at a time) then review with radiologist who will dictate
• Review the Elective PACS collections

ADDITIONAL STUDY MATERIAL

• Bone and joint anatomy and review system
  http://radiologymasterclass.co.uk/tutorials/musculoskeletal/principles/bones_joints_x-ray_start.html

• CT anatomy and interpretation modules
  http://www.med-ed.virginia.edu/courses/rad/CTAbdominalAnatomy/CTAnatomyoftheAbdomen.htm

• MSK trauma modules
  http://radiologymasterclass.co.uk/tutorials/tutorials.html
  Recognizing and describing fractures from Learning Radiology

BODY IMAGING

GOALS OF ROTATION

• Develop a method, or systematic approach to evaluate CT scans of the chest, abdomen and pelvis
• Review normal CT anatomy of the chest, abdomen and pelvis
• Describe different scanning protocols and understand why they are performed. Be familiar with some general protocol categories: CT angiography, multiphase imaging protocols, CT enterography
• Be able to identify patients at risk for contrast allergies, the contraindications to iv contrast, and know how to access steroid pretreatment regimes.
• Observe diagnostic CTs and CT guided procedures being performed so that you can explain them to future patients
• Describe radiation risks of CT, including how those risks differ in different patient populations. Describe methods which can be used to reduce the risk: Dose reduction techniques, Limiting the region scanned, limiting repeat CTs

• Describe and identify CT findings of commonly encountered acute conditions: Diverticulitis, colitis, appendicitis, pancreatitis, renal stone disease, pulmonary embolism, aortic dissection, pneumoperitoneum, hemoperitoneum, aortic rupture and dissection.

• Describe and identify CT findings of commonly encountered chronic conditions: Solid organ tumors, metastases, ascites, lymphoma, aortic aneurysms

SPECIFIC RECOMMENDATIONS

• If a workstation is available, pre-read appropriate CT scans (one at a time) before reviewing with staff radiologist

• Towards the end of the rotation, sit down with the resident who is doing the protocols and learn about how we choose which protocol to use.

• Spend time in the CT core area observing the technologists performing at least 2 scans; one of these should include an iv contrast injection.

• Observe or participate in a CT guided biopsy. Review the patient history, learn the indication for the procedure, understand the technique used

• Observe or participate in a CT guided drainage. Review the patient history, learn the indication for the procedure, understand the technique used.

ADDITIONAL STUDY MATERIAL

CT anatomy from Wiki Radiology (this is comprehensive and good but adverts a bit irritating) CT chest anatomy from Geisel Anatomy

CT abdominal-pelvic anatomy from Geisel Anatomy

NEUROIMAGING

GOALS OF ROTATION

• Compare the strengths, weaknesses and limitations of CT vs. MRI in the evaluation of patient’s with central neurologic symptoms and diseases

• Compare the strengths, weaknesses and indications of spine CT, MRI, and myelography in the evaluation of the spine and spinal cord

• Understand the role of imaging (including MRI vs. CT) in the evaluation of common clinical complaints, including stroke, headache, trauma, mass lesions, back pain, radiculopathy and demyelinating disease

• Know some of the uses of contrast in MRI and CT
• Review basic neuroanatomy on head CT and MRI

• Know indications, process, and risks of common procedures done in neuroradiology, including the use of nerve root blocks for management of back pain and vertebroplasty for compression fractures, so can discuss these procedures with patients about to undergo these procedures.

• Be able to recognize the appearance of common pathological processes such as stroke, edema, herniation, subdural, epidural and subarachnoid hemorrhage on CT

SPECIFIC RECOMMENDATIONS

• Accompany the neuroradiology fellow/resident during the workup and performance of nerve root blocks and vertebroplasties

• Become an active participant in the daily MR and CT reading including pre-reading studies when a workstation is available

ADDITIONAL READING

University Virginia Intro to Head CT module  University Virginia Evaluation of the Cervical Spine  SUNY Downstate brain MRI anatomy

FLUOROSCOPY

GOALS OF ROTATION

• Understand how fluoroscopy is used to image cavities and lumen

• Know differences between and indications for different fluoroscopic tests and what structures they image: Modified swallow, single and double contrast swallow, UGI, small bowel follow through, single, air and double contrast enemas, IVP, VCUG

• See studies performed so that you can explain them to patients: Ba swallow, UGI, enema, VCUG, arthrogram, IVP

• Describe the advantages and limitations of fluoroscopy

• Describe some of the risks of fluoroscopy - radiation, contrast extravasation/aspiration, perforation

• Identify normal KUB anatomy and become more comfortable with the range of normal appearances

• Become familiar with interpretation of common conditions on plain abdominal radiographs: Obstruction, free air, ileus, abnormal calcifications (vascular, gallbladder, renal, bladder), large masses

SPECIFIC RECOMMENDATIONS

• Pre-read KUB studies and then review with radiologist

• Follow at least one patient through a study with the technologist, preferably one of the more complex studies such as an enema.
• Be present at the 8am case discussion each morning. Watch the studies being performed with the resident/attending (unless you are pregnant), in room with lead and the interpretation afterwards. Try to see as wide a variety of studies being performed as possible including pediatric studies.

ADDITIONAL STUDY MATERIAL

- University Virginia GI site (this may be more detailed than you need but good sections)
- Learningradiology.com plain abdominal film interpretation
- Learningradiology.com (various other student modules) UK
- Masterclass Abdominal radiograph tutorial

BREAST IMAGING

GOALS OF ROTATION

• See how mammograms and breast ultrasound are performed
• Be able to briefly describe mammographic procedures to patients
• See how we use different mammographic views and ultrasound for problem solving in diagnostic mammography
• Understand the differences between screening and diagnostic mammography
• Know the effect of screening mammography on survival rates Know the current recommendations for screening mammography and MRI
• Understand the management of screening 'call back' patients
• Understand the meaning of BIRADS 0-6 categories
• Know the indications for referral for diagnostic mammography and how to indicate the abnormality appropriately.
• Know the current indications for breast MRI.
• Understand some of the limitations of breast imaging techniques including the effect of breast density.
• See how ultrasound is used in the diagnostic setting and some of its limitations
• Know what the options are for image guided procedures in the breast.
• Understand how clinical examination and imaging are inter-related and how they affect management especially of palpable breast masses.
• Understand what a radiologist is looking for on a mammogram and what those terms mean:
  o Calcifications, Asymmetric densities, Architectural distortion, Masses.
• See some examples of benign and malignant processes in the breast on mammography and ultrasound
SPECIFIC RECOMMENDATIONS

- Spend a minimum of one diagnostic session in mammography
- See at least one full mammographic series (CC, MLO) being obtained by a technologist
- Follow at least one patient through her diagnostic evaluation including additional mammo views and ultrasound, watching the tech performing the views as well the radiologist interpreting them.
- Perform a clinical breast examination on consenting women with palpable masses prior to the ultrasound
- Look up the BIRADS categories
- Go through CORE Women’s Imaging Case 2 again
- Review Dr. Poplacks lecture and/or this lecture from U.Washington on screening or this one on diagnostic mammography/breast MRI
- For students spending > 1 session in mammography should also aim to:
  - See image guided breast procedures performed, assist in basic patient care procedures where possible
  - See some examples of breast MR studies

ADDITIONAL STUDY MATERIAL

Current ACS guidelines for screening mammography
Breast Cancer Detective
Beth Israel (Lieberman) breast imaging module
Uptodate review of breast cancer screening

ULTRASOUND

GOALS OF ROTATION

- Gain hands-on practice in using ultrasound imaging:
- Be able to find and recognize major intra-abdominal organs
- Gain basic familiarity with how moving the transducer changes the imaging plane
- See how altering scanning parameters such as gain, depth and focal zone affect our images
- See how different transducers are used for different purposes
- Learn the basic ultrasound imaging characteristics of tissues –
  - simple fluid, complex fluid, soft tissue, bone, air, fat
• See how the different types of Doppler ultrasound (m mode, pulsed, color and power) image motion
• Learn the appropriate indications for the common ultrasound examinations
• See some of the limitations of ultrasound –
  o obesity, bowel gas etc
• Learn the classical appearances of common conditions:
  o RUQ: gallstones, acute cholecystitis, biliary obstruction
  o Abdominal aortic aneurysm
  o Renal: renal stones, hydronephrosis
  o Pelvic: Fibroids, endometrial thickening, ovarian cysts, early pregnancy, normal 2nd trimester pregnancy
  o Other: pleural fluid and ascites

SPECIFIC RECOMMENDATIONS

• Students should spend at least 50% of time with technologists watching scans
• Scan patients themselves (not transvaginally), with patient permission after tech leaves room.
• Remainder of time with attending/residents in reading room, helping with clinical workflow where possible.
• After they see an abnormal study: look up brief background on condition/additional images (e.g. http://www.mypacs.net (search under ultrasound), www.ultrasoundcases.info or the Brigham teaching database.

ADDITIONAL STUDY MATERIAL

University of Virginia Emergency Ultrasound  Introduction to obstetrical ultrasound

INTERVENTIONAL RADIOLOGY

GOALS OF ROTATION

• Learn how different imaging modalities are used to guide procedures and begin to understand when each is used: ultrasonography, fluoroscopy, CT, MRI
• Be familiar with the indications and techniques of the following common IR procedures:
  o central vascular access, fluid aspiration and drain placement, angiography, percutaneous nephrostomy, percutaneous transhepatic cholangiography, gastrostomy tube placement, percutaneous angioplasty and stent placement
• Be able to describe to a patient the following procedures (observe any of these which occur the day you are on angio)
- Vascular access, angiography, fluid aspiration and drainage, tube placement in stomach (gastrostomy), kidney (nephrostomy)

- Learn how we work up requests for IR procedures and the factors that go into determining if a procedure is necessary and indicated, safe, and able to be performed.

### SPECIFIC RECOMMENDATIONS

- Introduce yourself to the staff of the day

- Attend the morning conference to discuss the day’s cases. This begins at 7:15 am in the small reading room near angio; anyone in the angio suite can direct you

- If you are spending more than one day in angio, in the afternoon before an IR day:
  - Pick one case that you would like to be involved with from the board (check with the resident, fellow or NP/PA on the service) and participate in/do the patient work-up. Review the relevant patient history, allergies, medications, PMH, Labs and pertinent imaging studies. Understand the indications for the requested procedure and how it is performed. Write the pre-procedure note and have an attending review it and sign it

- Put your initials on the angio board next to the cases you wish to participate in

- Observe and/or participate in several additional IR cases from start to finish: Review the patient history, labs and relevant imaging, learn the indication for the procedure, learn the pre-procedure work up and patient preparation

- Follow the technologist and nurses as they set up the room, bring the patient in, position them and prep and drape the field. Understand the techniques used to perform the procedure.

### ADDITIONAL STUDY MATERIAL

- Vascular anatomy- see "vasculature" section in each learning module DHMC angio survival manual

### NUCLEAR MEDICINE

### GOALS OF ROTATION

- Understand the concept of physiological imaging

- Radioisotopes vs. radiotracers

- Learn some of the common indications for nuclear medicine studies

- See examples of common examinations:
  - PET-CT scans
  - Bone scans
  - Renal scans
  - Hepatobiliary studies
  - Cardiac perfusion scans
- VQ scan
- Thyroid scan

- Know the appearance of common conditions on these studies
  - PET-CT scans: lung cancer, metastatic disease
  - Bone scans: metastases, trauma, degenerative changes
  - Renal scans: obstruction
  - Hepatobiliary studies: acute cholecystitis, CBD obstruction
  - Cardiac perfusion scans (ischemia, infarction)
  - VQ scan: pulmonary emboli
  - Thyroid scan: Grave disease, hot and cold nodules

- Understand some of the limitations of nuclear medicine examinations
- Understand the difference between SPECT vs. PET
- Know some of the important patient preparations for nuclear medicine studies (PET studies, thyroid, cardiac etc)
- Know how common studies are performed to explain them to patients. Know some of the therapeutic uses of nuclear medicine (I-131 therapy)

**SPECIFIC RECOMMENDATIONS**

- Minimum 1/2 day in nuclear medicine
- Spend 30+ minutes watching techs performing exams in department
- The remainder of the time alternating between the attending reading PET-CT and conventional nuclear medicine studies
- Many PET-CT scans are shown in CTOP conference Tues 8 am.

**ADDITIONAL STUDY MATERIAL**

- University Virginia Intro to PET-CT module
- Intro to nuclear medicine ppt
- Harvard teaching files Mallinkrodt teaching files
- Beth Israel nuclear medicine tutorial

**SELF STUDY TIME**
• A variable amount of self-study time is provided in the schedule depending on student learning style and requests, as well as the amount of time taken for interviews or other days out of the schedule.

• It is expected that this time be used to utilize text, web and CD/ROM learning resources and prepare for workshops and presentations as well as doing CORE cases

SUGGESTIONS FOR SELF STUDY RESOURCES

• CORE cases

• Oxford Textbook of Radiology

• PACS elective teaching folders: (all preceded with “Elective-“) Pneumonia, Edema, Lines and Tubes, Atelectasis, Effusions, Pneumothorax, Free air, Obstruction, Fractures

• Lines and Tubes module: Can be downloaded here https://www.mededportal.org/publication/8399

• CXR anatomy and review systems: http://radiologymasterclass.co.uk/tutorials/chest/chest_home_anatomy/chest_anatomy_start.html
  http://www.youtube.com/watch?v=HiNjBdGXFgk

• AXR anatomy and review systems http://radiologymasterclass.co.uk/tutorials/abdo/abdomen_x-ray/anatomy_introduction.html

• Common conditions on abdominal radiographs http://www.learningradiology.com/lectures/gilectures/Plain%20Films%20of%20the%20Abdomen/player.html

• Bone and joint anatomy and review system http://radiologymasterclass.co.uk/tutorials/musculoskeletal/principles/bones_joints_x-ray_start.html

• CT anatomy and interpretation modules http://www.medicined.virginia.edu/courses/rad/CTAbdominalAnatomy/CTAnatomyoftheAbdomen.htm
  http://www.medicined.virginia.edu/courses/rad/CTChestAnatomy/CTAnatomyoftheChest.htm

• MSK trauma modules http://radiologymasterclass.co.uk/tutorials/tutorials.html
  Recognizing and describing fractures from Learning Radiology

• Head CT module University Virginia Intro to Head CT module

• www.learningradiology.com (note, use the ppt links, some of the flash links go to adverts for his book)

• University Virginia radiology tutorials

• BrighamRad teaching cases

• Beth Israel (Lieberman) web-tutorials (see list at bottom page)
- Harvard guide to imaging in pregnant patients
- Dartmouth Anatomy web-course
- Yale cardiothoracic imaging module
- ACR appropriateness criteria

PRIVATE PRACTICE DAY

- Generally intended for students considering radiology as a career, but does not have to be
- See how a general private practice radiologist functions in a community hospital
- One-on-one teaching with the radiologist
- Most students go to Speare Hospital Plymouth (staffed by DHMC rads), but we also have radiologists at Cottage Hospital and Brattleboro.
- Shadowing with radiologist for a day, aid radiologist where possible
LECTURE LIST

May vary slightly some months

<table>
<thead>
<tr>
<th>LECTURE</th>
<th>STAFF/RESIDENT</th>
<th>Backup</th>
</tr>
</thead>
<tbody>
<tr>
<td>CORE 1 Workshop (90 Min)</td>
<td>Lewis</td>
<td>Lewis</td>
</tr>
<tr>
<td>CORE 2 Workshop (90 Min)</td>
<td>Lewis</td>
<td>Lewis</td>
</tr>
<tr>
<td>CORE 3 Workshop (90 Min)</td>
<td>Percario</td>
<td>Lewis</td>
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<tr>
<td>CORE 4 Workshop (90 Min)</td>
<td>Resident</td>
<td>Lewis</td>
</tr>
<tr>
<td>CORE 9 Workshop (60 min)</td>
<td>Palifka</td>
<td>Pastel</td>
</tr>
<tr>
<td>CORE 10 Workshop (60 min)</td>
<td>Pastel</td>
<td>Palifka</td>
</tr>
<tr>
<td>CORE 11 Workshop (60 min)</td>
<td>Sargent</td>
<td>Lewis</td>
</tr>
<tr>
<td>CORE 12 Workshop (60 min)</td>
<td>Sargent</td>
<td>Lewis</td>
</tr>
<tr>
<td>CXR Elements 1 (90 Min)</td>
<td>Lewis</td>
<td>Lewis</td>
</tr>
<tr>
<td>Ultrasound Workshop</td>
<td>Lewis</td>
<td>Resident</td>
</tr>
<tr>
<td>PACS Workstation</td>
<td>Lewis</td>
<td>McNulty</td>
</tr>
<tr>
<td>Introductory talk</td>
<td>Lewis</td>
<td>McNulty</td>
</tr>
<tr>
<td>Diagnosis Please #1 (given on day 1)</td>
<td>Lewis</td>
<td>McNulty</td>
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<tr>
<td>Diagnosis Please #2</td>
<td>Lewis</td>
<td>McNulty</td>
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<tr>
<td>Diagnosis Please #3</td>
<td>McNulty</td>
<td>Lewis</td>
</tr>
<tr>
<td>Image Jeopardy</td>
<td>RESIDENT</td>
<td>Lewis/McNulty</td>
</tr>
<tr>
<td>Imaging Lingo</td>
<td>Austin-Strohbehn</td>
<td>Lewis</td>
</tr>
<tr>
<td>Course Title</td>
<td>Instructor 1</td>
<td>Instructor 2</td>
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<tr>
<td>Esac Conference</td>
<td>Austin-Strohbehn</td>
<td>Lewis/McNulty</td>
</tr>
<tr>
<td>Chest/GI Imaging Algorithms Workshop</td>
<td>Czum</td>
<td>Savellano</td>
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<tr>
<td>MS Imaging Algorithms Workshop</td>
<td>Cheung</td>
<td>Goodwin</td>
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<tr>
<td>IR/GU Imaging Algorithms Workshop</td>
<td>Gemery</td>
<td>Gemery/Forauer</td>
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<tr>
<td>Imaging Algorithms Neuro</td>
<td>Eskey</td>
<td>Pastel</td>
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<tr>
<td>KUB interpretation 101</td>
<td>Chertoff</td>
<td>McNulty</td>
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<tr>
<td>KUB interpretation 202</td>
<td>Chertoff</td>
<td>McNulty</td>
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<tr>
<td>Introduction to Mammography</td>
<td>Rooney</td>
<td>Lewis</td>
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<tr>
<td>Nuclear Medicine Fundamentals</td>
<td>Siegel</td>
<td>Yen/Seltzer</td>
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<tr>
<td>Nuclear Medicine Cases</td>
<td>Yen</td>
<td>Selzer/Siegel</td>
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<tr>
<td>Intro to abdominal U/S</td>
<td>Resident</td>
<td>Resident</td>
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<tr>
<td>Introduction to pelvic U/S</td>
<td>Resident</td>
<td>Diflorio</td>
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<tr>
<td>Abdominal CT Pathology</td>
<td>Resident</td>
<td>Resident</td>
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<tr>
<td>Intro to Chest CT</td>
<td>Black</td>
<td>Savellano</td>
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<tr>
<td>Radiology Risks</td>
<td>RESIDENT</td>
<td>RESIDENT</td>
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<tr>
<td>Basic MS Radiology 1</td>
<td>Cheung</td>
<td>Goodwin</td>
</tr>
<tr>
<td>Basic MS Radiology 2</td>
<td>Goodwin</td>
<td>Cheung</td>
</tr>
<tr>
<td>Intro to Fluoroscopy</td>
<td>RESIDENT</td>
<td>RESIDENT</td>
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<tr>
<td>Trauma Radiology</td>
<td>Guerin</td>
<td>Silas</td>
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<tr>
<td>Intro to Body MR/CT Anatomy</td>
<td>Percarpio</td>
<td>Tsapakos</td>
</tr>
<tr>
<td>Section</td>
<td>Author(s)</td>
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<tr>
<td>Intro to interventional radiology</td>
<td>Hoffer McNulty</td>
<td></td>
</tr>
<tr>
<td>Imaging Indications</td>
<td>Yen Savellano</td>
<td></td>
</tr>
<tr>
<td>Cool Cases</td>
<td>Austin-Strohbehn</td>
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<tr>
<td></td>
<td>various</td>
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</tbody>
</table>
During your elective, you should try to see at least one of each of the following tests/procedures performed either by a physician or a tech (not just see the images). The reason for seeing procedures performed is that you will then have a much better understanding of what information that test/procedure can give us, as well as the indications and contraindications.

<table>
<thead>
<tr>
<th>Test/Procedure</th>
<th>Check</th>
</tr>
</thead>
<tbody>
<tr>
<td>Barium enema</td>
<td></td>
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<tr>
<td>Upper GI study</td>
<td></td>
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<tr>
<td>IVP</td>
<td></td>
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<tr>
<td>Chest Xray-PA and Lateral</td>
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<tr>
<td>Chest Xray-portable</td>
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<tr>
<td>KUB</td>
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<tr>
<td>Ankle or wrist series</td>
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<tr>
<td>Ultrasound of abdomen</td>
<td></td>
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<tr>
<td>Transvaginal ultrasound of pelvis</td>
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<tr>
<td>Fetal ultrasound</td>
<td></td>
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<tr>
<td>CT scan of abdomen/chest</td>
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<tr>
<td>CT scan of head</td>
<td></td>
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<tr>
<td>MRI scan</td>
<td></td>
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<tr>
<td>Bone scan or other similar nucs study</td>
<td></td>
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<tr>
<td>Stress MIBI scan</td>
<td></td>
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<tr>
<td>Aortic/lower extremity angiogram</td>
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<tr>
<td>Cerebral angiogram</td>
<td></td>
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<tr>
<td>Chest drain placement</td>
<td></td>
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<tr>
<td>Central/PICC/Tesio line placement</td>
<td></td>
</tr>
<tr>
<td>Plan elective time</td>
<td>Day 1. Notify coordinator if you wish private practice day</td>
</tr>
<tr>
<td>--------------------</td>
<td>----------------------------------------------------------</td>
</tr>
<tr>
<td>Imaging algorithms</td>
<td>Review before workshops</td>
</tr>
<tr>
<td>Case of the day</td>
<td>Go to the SurveyMonkey links for the week by Thursday</td>
</tr>
<tr>
<td>Cool cases</td>
<td>Each student brings one or more cases (A#)</td>
</tr>
<tr>
<td>Diagnosis please 2 &amp; 3</td>
<td>Email answers (email or doc) to Lewis (#2) and McNulty (#3) by day of session</td>
</tr>
<tr>
<td>Imaging lingo</td>
<td>Bring terms that confuse you</td>
</tr>
<tr>
<td>CT densities video</td>
<td>Review in first week</td>
</tr>
<tr>
<td>Search patterns video</td>
<td>Review (after CXR anatomy session)</td>
</tr>
<tr>
<td>CORE cases</td>
<td>Complete all before end of elective and <strong>before</strong> CORE workshops (1-4, 9-12)</td>
</tr>
<tr>
<td>Sonosim modules</td>
<td>75% score on required modules</td>
</tr>
<tr>
<td>Evaluations on survey monkey</td>
<td>Submit before I will submit your grade</td>
</tr>
<tr>
<td>Procedural check list</td>
<td>Watch procedures listed in list in manual by end of elective</td>
</tr>
<tr>
<td>On call</td>
<td>1 evening with resident</td>
</tr>
<tr>
<td>Practice exam</td>
<td>Do before the final day if you wish</td>
</tr>
<tr>
<td>Return books</td>
<td>To Robert by last day</td>
</tr>
<tr>
<td>Exam</td>
<td>113 Q exam last day, Mean score 84% SD 6</td>
</tr>
</tbody>
</table>
Diagnosis Please Links

These are also on Canvas

Diagnosis Please 1 (these cases are usually done on Day 1 intro session)

Diagnosis Please 2

Diagnosis Please 3

Setting Up Your PACS Login

To fulfill HIPAA regulations, each of you must have your own PACS login. This will be given to you by Robert at the start of the rotation.

Your PACS login will allow you to view current patient studies on the PACS workstations and also look at the student teaching files and other teaching files on the workstations.

Unfortunately the current set up of the workstations in the department mean that you will have to set up the PACS login on every new computer that you use (sorry, not my idea...)

You will not be able to annotate permanently or sign off on any studies from your login.

Initial Login and Setting Up

1. Double click the PACS icon located on the desktop to launch and log in (on first login username and password will be the same and you will be prompted to change your password)

2. Click “NO” on the pop-up that follows the login

3. Then press “OK”
4. Click on “Prefs” (top right hand corner).

5. Click on “Viewer” and select “Use Imagecast PACS Diagnostic Viewer on this Workstation”

6. Press “Save”, then “OK” on the pop-up. Then click Close (next to “Save”), “OK” on the pop-up then click “LOG OFF”.

7. Log back into PACS and the Viewer is now loaded.

Steps 1-6 will need to be set up on all workstations the first time you use them. The following changes will only need to be done one time.

PUTTING SHORT CUTS ONTO YOUR HOMEPAGE

The bottom left hand quarter of the home page can contain short cuts to personal or public folders. To add the student teaching file short cuts to access them easily:

**Note:**

- Folders are saved collections of cases (static) e.g. ‘Elective – chest pneumonia’
- Filters are dynamically changing and usually unread cases e.g. ‘ED today’, ‘North Body’
Repeat for any other folders/filters you wish to access (e.g. filters for NORTH CT all, NORTH CR all)

TO VIEW STUDIES
TO VIEW AN INDIVIDUAL PATIENT’S STUDY

Either:

1. Click Lookup and put in the patient’s name or MRN
2. Double Click on a patient in the relevant worklist

VIEWING THE TEACHING FILE FOLDERS

Either

- Click on the folder or filter on the home page
- Click on Exams to bring you to folder list, then click on folder/filter on left tab

TO VIEW THE STUDIES IN A TEACHING FILE OR OTHER FOLDER OR FILTER
For each case history below, devise imaging algorithms that take account of the described patient characteristics. Then consider confounding patient and test variables e.g. body habitus, allergies, test availability, comparison studies, cost etc. Consider what you would do with either a positive or negative result for each test and what preparation may be required for each test (e.g. fasting).

The dates of the individual workshops will be on the schedule.

Please focus on the imaging rather than the clinical evaluation. Additional help may be found in the ACR appropriateness criteria at: http://www.acr.org/s_acr/sec.asp?CID=1847&DID=16052

**CHEST/GI**

**CASE 1**

55 y/o male high powered executive with a heavy smoking history, developed severe chest pain radiating to his back while driving to work. His blood pressure is 190/105 mm Hg and his heart rate is 115. What imaging procedure would you order?

**CASE 2**

24-y/o single male comes to the Emergency Center with progressive cough and fever of 101. His chest film shows "an interstitial abnormality", possibly viral pneumonia or pulmonary changes. What are your concerns?

**CASE 3**

J75 y/o male suffered the acute onset of abdominal pain and lower back pain thirty minutes ago, which has not abated. On examination, you find a pulsatile, midline abdominal mass. His blood pressure is 140/90 and his pulse is 105. Which imaging procedure would you order?

**CASE 4**

28-y/o mother of three was noted to have a small mass in left breast mass during her annual physical examination. Would you consider performing an imaging procedure? Which one?

**CASE 5**

Obese 44 y/o mother of three with RUQ, a fever of 101. Normal LFTs.. What are your concerns? What study would you order?

**CASE 6**
59 y/o Brazilian banker, has just arrived in Hanover to start a six-week management course at Tuck. While watching Dartmouth play football, he tripped and fell against a railing, injuring his right chest. In the ED right rib x-rays show a fracture of the anterior right 9th rib and an 8mm nodule in the LUL. What should you do next?

CASE 7

40 y/o was visiting a farm where he got kicked in the abdomen/low chest by a donkey. Twenty minutes ago he fainted and was rushed to the ED. He is anxious, pale, and clammy with a heart rate of 120. He has LUQ pain and you clinically suspect left lower rib fractures. What imaging study is indicated?

CASE 8

65 y/o life long smoker of 2 PPD presents with a cough and fever. He also complains of a weight loss of 15 lbs over the last 6 months. A chest x-ray is read as LLL pneumonia. What are your thoughts? Is any further imaging required? If so, what and when?
CASE 1

Kathryn., a 75 year old grandmother of 10, fell on an icy sidewalk last week and injured her right hip. X-rays taken at that time were reported as normal. However, her right hip pain persists, and despite a week of bed rest, she has been unable to bear weight on the injured hip. Her husband brings her to your clinic for reassessment. What do you do?

CASE 2

Lionel, N a 48 year old overweight doctor, comes to your ED complaining of acute low back pain after moving his refrigerator. Other than muscle spasm and diminished range of lower back motion, his physical examination is normal.

CASE 3

Paul S., a 16 year old Lebanon High School student, is brought to the ED following injuring in a soccer game complaining of pain in his left knee and unable to weight bear.

CASE 4

Roger A., a 22-year old graduate student at Dartmouth had a high speed snowmobile accident while drunk, estimated to be traveling at 50 mph. He has fractured his pelvis in multiple areas fracture and has a comminuted right femur fracture. His right leg is severely and increasingly swollen. His blood pressure is 90/50. What will you do?
CASE 1

Harry R. underwent a left colectomy for carcinoma of the colon three years ago. There was no evidence of metastatic disease at that time. On a routine follow-up visit, his liver function tests are now abnormal. The SGOT is elevated to 72 and the SGPT to 80. What diagnosis are you considering and what imaging procedures would you recommend, if any?

CASE 2

Gerald B., Dentist and father of two, complains of a "lump" in the right scrotum, which he discovered while showering yesterday. Physical examination confirms a mass in the right testicle. Would you recommend an imaging procedure?

CASE 3

Ellen Q, a 32 year old policewoman, is happily married and two months’ pregnant. Tonight she was awakened by the sudden onset of severe, colicky, left flank pain, which radiates to the groin. Physical examination reveals left costovertebral angle and flank tenderness. Urinalysis shows microscopic hematuria.

CASE 4

Roger A., a 22-year old graduate student at Dartmouth had a high speed snowmobile accident while drunk, estimated to be traveling at 50 mph. He has fractured his pelvis in multiple areas and has a comminuted right femur fracture. His right leg is severely and increasingly swollen. His blood pressure is 90/50. His portable AP chest film showed a widened and hazy mediastinum. What is your major concern? What will you do?

CASE 5

Middle aged female presents to the ED with complaint she “has not felt right” and is found to have an elevated creatinine.

CASE 6

Mrs. F has noted she has been a bit more yellow than usual and a little itchy but now has developed a fever.
CASE 7

Elizabeth F., a 52 yr old housewife has a distant history of left breast cancer 8 years ago. She also has a 20 pack year history of smoking. She now presents with a cough, fever and shortness of breath and a chest x-ray shows a large pleural effusion which appears loculated and a 2cm Left lower lobe mass. What diagnostic procedures should you consider? If the patient is symptomatic from the pleural effusion, what image guided therapies can be performed?

CASE 8

A 72 year old homeless man is admitted with his third episode of hematemesis. He gives a history of drinking heavily for 30 years. What diagnostic and therapeutic procedures would you consider? What clinical factors need to be considered?
CASE 1

A 59 year old man is brought to the hospital by ambulance at 9 am. This morning at 7 am on waking he was normal. Then at 8 am his wife noticed that he wasn't using his right arm and leg and that his speech was garbled. She immediately called the ambulance. He has marked right arm, face and leg weakness and is aphasic. What imaging test would you obtain first and why? What are the treatment options?

What if it is determined that he was last normal at midnight? What if he was last normal at 4 am?

CASE 2

A 57 year old psychiatrist with 6 months of tinnitus. What are the key clinical characteristics of tinnitus that will affect management? What is the clinical and imaging workup of tinnitus?

CASE 3

A 20 year old student is brought to the hospital after being thrown from her vehicle during a car crash. She is conscious, has visible deformity of her left lower extremity and complains of neck pain. How will you evaluate the neck pain?

CASE 4

A 44 year old man comes to the hospital when he experiences the sudden onset of a terrible headache. He is alert and oriented. What is the initial imaging study of choice? Outline the possible pathways of diagnosis and treatment for the most likely causes.