Radiology
Preface

One of the most difficult and stressful times in the career of any diagnostic radiologist is in the preparation for the oral board exam given by the American Board of Radiology. Oral boards often engender more angst than the written boards because the potential questioning could include any possible question or combination of questions and because the exam requires physical participation.

Radiology: The Oral Boards Primer is designed to provide information that is typical of that found on the oral board examination for diagnostic radiology. Cases are provided to illustrate typical pathology and to provide a visual source for the construction of a differential diagnosis. Once the differential is mentally rendered, the mnemonics may be used as a memory aid and to augment any missing components of the differential that would be considered important. The chapters are organized as close to the oral boards exam format as possible. The cases should be examined, interpreted, and completed in a very rapid fashion, allowing for many cases to be reviewed in a single sitting. The vast majority of the cases contain prototypical representations of pathology allowing this text to be used as a memory aid and as a case reference source for many years after one has taken and passed the oral board examination.

The book can be used both during residency and at the time of review for the oral board examination. Radiology: The Oral Boards Primer will assist greatly in the preparation for this examination and will contribute to the assuredness and confidence that comes from being adequately prepared. As always, a text can only improve through evaluation and evolution, and we welcome your comments.

A CD-ROM edition of the book (ISBN 1-58829-928-7), sold separately, is available for use on the reader’s PC or PDA.

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An Approach to the Oral Boards

The oral boards attempt to cover a large amount of material in a short period of time. It is to your advantage to cover as much material as you can so that if one case does not go well, you have a big denominator to limit the significance of that particular case. As such, it is important to have an organized approach to each case. This not only shows the examiner that you are prepared, but also allows for an intelligent discussion.

THE 5Ds

Data
Detect
Describe
Differential
Diagnose

For each case use this approach.

1. Data
This is a quick description of the study and any pertinent data the examiner gives you: "This is a contrast-enhanced computed tomography scan of the chest in a 42-yr-old African-American female with a 1-yr history of shortness of breath."

2. Detect
After a quick review of the image, show the examiner you have found the pertinent abnormality: "The abnormality is throughout both lungs radiating from the hilar regions along the bronchovascular bundles."

3. Describe
Take a brief moment to describe the abnormality to show the examiner you are focusing on the correct finding. If you have incorrectly detected or described the abnormality, the examiner will redirect you to the correct path: "There is soft tissue opacity that spreads along the bronchovascular bundles from both hila. There is associated lymphadenopathy in both hilar regions and the mediastinum."

4. Differential
Use the mnemonics in this text to give a quick differential diagnosis: My top four considerations for this constellation of findings would include the following:

- Sarcoidosis
- Histoplasmosis or TB
- Amyloidosis
- Metastasis
5. Diagnose

Of the differential diagnoses you have provided, give the examiner your top choice and a reason: "Of these differential diagnoses, my top choice is sarcoidosis. The combination of the patient’s demographic data and the finding of spread along the bronchovascular bundles associated with lymphadenopathy best supports this diagnosis."
Musculoskeletal Radiology

Includes plain film diagnosis in all areas of the musculoskeletal system plus any related special or imaging procedures, including CT, interventional techniques, and MRI.

GENERAL CASE CATEGORIES

1. General including Metabolic
2. Congenital
3. Tumors
4. Arthritis
BASILAR INVAGINATION

PF ROACH

- Paget disease
- Fibrous dysplasia
- Rickets
- Osteogenesis imperfecta, Osteomalacia
- Achondroplasia
- Cleidocranial dysplasia
- Hyperparathyroidism, Hurler syndrome
SUBCHONDRAL CYSTS

COORS

CPPD
Osteoarthritis
Osteonecrosis
Rheumatoid arthritis
Synovial-based tumors
ACETABULAR PROTRUSION

PROTrusion

- Paget disease
- Rheumatoid arthritis
- Osteomalacia
- Trauma
STERNOCLAVICULAR SCLEROSIS

STOP

SAPHO syndrome
Traumatic osteolysis
Osteomyelitis/Osteosarcoma
Pagets

DISTAL CLAVICLE EROSION

SHIRT

Scleroderma
Hyperparathyroidism
Infection
Rheumatoid arthritis
Traumatic osteolysis
SCLEROSIS-GENERALIZED
R.S.M.O.P.M.M.P.F. (Regular sex mnemonic)
- Renal osteodystrophy
- Sickle cell disease
- Myelofibrosis
- Osteopetrosis
- Pyknodysostosis
- Mastocytosis
- Metastasis
- Pagets
- Fluorosis

OSTEONECROSIS
ASEPTIC
- Anemias
- Sickle cell disease/SLE
- ETOH/Exogenous steroids
- Pancreatitis
- Trauma
- Infection
- Caisson’s disease
ACRO-OSTEOLYSIS

PINCH FO

Psoriasis
Infection
Neuropathic
Collagen vascular disease
Hyperparathyroidism
Familial (Hadju Cheney)
Other—polyvinyl alcohol
CHONDRAL CALCIFICATION

HOGWASH

Hyperparathyroidism
Ochronosis
Gout
Wilson’s Disease
Arthritis
Pseudogout
Hemochromatosis
Chapter 1 / Musculoskeletal Radiology

Congenital

ERLYMEYER FLASK

CHONGO

- Craniometaphyseal dysplasia
- Hemoglobinopathies
- Osteopetrosis
- Niemann Pick
- Gaucher’s Disease
- Other

METAPHYSEAL BANDS

DENSE

- LINES
  - Lead poisoning
  - Infantile growth arrest
  - Normal, 3 yr
  - LEukemia treated
  - Syphilis

- LUCENT

NORMAL TENDER LOVING CARE

- Normal (neonates)
- TORCH
- Leukemia
- Chronic illness
GRACILE BONES

NIMROD

- Neurofibromatosis
- Immobilization
- Muscular dystrophy
- Rheumatoid arthritis
- Osteogenesis imperfecta
- Dysplasias
MADELUNG DEFORMITY

HITDOC

Hurler syndrome
Infection
Trauma
Dyschondrosteosis
Osteochondroma
Congenital–Turner’s syndrome

SHORT METACARPALS

BIC PEN

Basal Cell Nevus syndrome
Idiopathic
Chromosomal–Turner’s syndrome
Pseudohypoparathyroidism/PseudoPseudohypoparathyroidism
Tumors

DIAPHYSEAL LESIONS IN GENERAL

CEMENT
- Cysts
- Enchondroma
- Metastasis
- Eosinophilic granuloma (EG)
- Non-ossifying fibroma (NOF)
- TB/infections

CORTICAL LESION

MOFOS
- Metastasis
- Osteomyelitis
- Fibrosarcoma
- Osteoid osteoma
- Stress fracture
ILIAC WING LESIONS
- Fibrous dysplasia
- Unicameral bone cyst
- Chondrosarcoma
- Mets/Myeloma/Plasmacytoma
- Ewings

VERTEBRA PLANA
- IMELT
  - Infection
  - Mets/Myeloma
  - EG
  - Lymphoma/Leukemia
  - Trauma

BONY SEQUESTRUM
- LIFE
  - Lymphoma
  - Infection
  - Fibrosarcoma
  - EG

RIB LESION
- FAME
  - Fibrous dysplasia
  - ABC
  - Metastatic/Myeloma/Lymphoma
  - EG/Enchondroma
EPIPHYSEAL LESIONS

CIGS
- Chondroblastoma
- Infection
- Giant cell tumor/Granuloma (EG)
- Subchondral cyst

FOCAL SCLEROTIC LESION

HOME LIFE
- Healed NOF
- Osteoma
- Metastasis
- Ewing’s sarcoma
- Lymphoma
- Infection/Infarct
- Fibrous dysplasia
- Enchondroma

PERMEATIVE LESIONS

FIRE
- Fibrosarcoma (Desmoid/MFH)
- Infection
- Round cell tumors
- EG
- Mets/Myeloma
SKULL LESION

MEL TORME

Metastasis
EG
Lymphoma
TB
Osteomyelitis
Radiation
Mets
Epidermoid

TIBIAL LESION

FOAM

Fibrous dysplasia
Osteofibrous dysplasia
Adamantinoma
Metastasis

POSTERIOR VERTEBRAL BODY LESION

GO TAPE

Giant cell tumor
Osteoblastoma
TB
ABC
Paget disease
EG
CALCANEAL LESION

**BIG G**
- Bone cyst-unicameral
- Intraosseous lipoma
- Ganglion
- Giant cell tumor

---

FINGER TIP LESION

**GEMS**
- Glomus tumor
- Epidermoid/Enchondroma
- Metastasis (lung almost exclusively)
- Sarcoid

---

SOFT TISSUE CALCIFICATION/OSSIFICATION

**My GHOSTS**
- Myositis ossificans
- Gout
- Hyperparathyroidism
- Ochronosis
- Scleroderma/connective tissue disease
- Tumoral calcinosis
- Sarcoma (synovial cell)
SACRAL LESION

CAN

Chondrosarcoma/Chordoma
ABC/GCT
Neurofibromatosis
And always Mets/Myeloma/Lymphoma

FLUID-FLUID LEVEL

HOT MASS

HemangiOma
Telangiectatic osteosarcoma
Metastasis
ABC/GCT
Synovial cell
Sarcoma
**Arthritis**

**INFLAMMATORY ARTHRITIS**

1. RF+

   *Rheumatoid Arthritis*
   – Symmetric

   *SLE*
   – Subluxation/nonerosive

   *Scleroderma*
   – DIP, PIP erosions
   – Soft tissue Ca²⁺
   – Acroosteolysis

   *Dermatomyositis*
   – Soft tissue Ca²⁺
2. RF–

*Ankylosing Spondylitis*

–SI joint involvement

*Reiters*

–Foot > Hand
–Bony Proliferation

*Psoriasis*

–Erosive
–Bony proliferation
–Asymmetric
–Sausage digit
–Ivory phalanx
–Pencil in cup

*Inflammatory Bowel Disease (IBD)*

–Arthritis with IBD
3. EROSIVE OA

– Dip Joints
CRYSTAL ARTHRITIS

1. DEPOSITION

*Gout*

- Marginal erosions
- Overhanging edges
- Preserved joint space
**CPPD**

- ChondroCa$_2^+$
- Cysts
- 2nd and 3rd MCP
- SLAC
- TFCCa$_2^+$
2. OTHER

*Hemochromatosis*

*Acromegaly*

*Other*

- Ochronosis
  - Disc calcification
- Multicentric reticular histiocytosis
  - Symmetric
  - No osteopenia
- Infection
  - Crosses Joint Space
OH MY GOD LESIONS

VERY BIZARRE LOOKING GENERALIZED LESIONS THAT YOU HAVE NO IDEA WHAT IT IS, THINK OF:

- Paget disease
- Fibrous dysplasia
- Neurofibromatosis
- Charcot joints
Metabolic

OSTEOPENIA

GENERALIZED

Senile osteoporosis
Osteomalacia
Endocrine abnormalities
  – Cushings (too much)
  – Hypogonadism (too little)
Anemia/Myelofibrosis/Gauchers
  – Bone marrow
Congenital
  – Osteogenesis imperfecta
Hyperparathyroidism
FOCAL

Reflex sympathetic dystrophy (complex regional pain syndrome)
Disuse
Transient osteoporosis
Migratory osteoporosis
SPINE

CALCIFICATION OF THE ANNULUS FIBROSIS

Ankylosing spondylitis
– Disks unremarkable
Ochronosis
– Disks calcified
– Abn SI joints

OSTEOPHYTES

DISH
– Disks unremarkable
– Normal SI joints
SYNDESMOPHYTES
  Psoriasis
  Reiters

MARGINAL OSTEOPHYTES
  Spondylosis or degenerative

OSTEOPHYTOSIS
## ARTHRITIS BASICS AND ARTHRITIS BY LOCATION

### ABCDS

- **Alignment**
- **Bone**
- **Cartilage/calcifications**
- **Distribution**
- **Soft tissues**

### Wrist

- 1st CMC, TFC—CPPD
- Radiocarpal joint—osteoarthritis
- CMC—gout (marginal erosions)

### Hand

- **DIP + PIP**
  - Osteoarthritis
    - Osteophytes
    - No erosions
  - Erosive osteoarthritis
    - Osteophytes
    - Erosions
    - Females
  - Psoriasis/Reiters
    - No osteophytes
    - Erosions
- **MCP + PIP**
  - Rheumatoid
    - Erosions
    - No osteophytes
    - Osteopenia
  - Psoriasis/Reiters
    - Erosion
    - Bony proliferation
- **MCP**
  - Inflammatory
    - Erosions
  - CPPD/hemochromatosis
    - Osteophytes

### Foot

- **MTP JOINTS**
  - RA
  - Gout
  - OA
  - Neuropathic
- **MIDDLE/HINDFOOT**
  - RA
  - Osteoarthritis

### Hip

- **BONY PROLIFERATION**
  - OA
    - Superolateral migration
  - Ankylosing spondylitis
    - Axial migration
    - SI joint involvement symmetric
  - Psoriasis/Reiters
    - Axial migration
    - SI joint involvement asymmetric
  - CPPD
    - Chondrocalcinosis
- **NO . PROLIFERATION**
  - RA
    - Acetabular protrusio
    - Osteopenia
**Knee**

**COMPLETE JOINT INVOLVEMENT**

RA
- No bony proliferation
- Osteopenia
- Cyst formation

JRA/hemophilia
- Wide femoral notch
- High density effusion

Psoriasis/Reiter’s
- Asymmetric
- Bony proliferation

**MEDIAL INVOLVEMENT**

Osteoarthritis

**PATELLOFEMORAL INVOLVEMENT**

CPPD

**Shoulder**

**GLENOHUMERAL JOINT**

CPPD
- vs osteoarthritis—not a weight-bearing joint

**ACROMIOCLAVICULAR JOINT**

Rotator cuff tear
- Glenohumeral joint spared

**TOTAL JOINT INVOLVEMENT**

Rheumatoid
- Symmetric

**NORMAL JOINT SPACE**

Hydroxyapatite crystal deposition disease
### NAMES TO KNOW

#### UPPER EXTREMITY

<table>
<thead>
<tr>
<th>Name</th>
<th>Location of Injury</th>
</tr>
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<tbody>
<tr>
<td>Mallet Finger</td>
<td>Dorsal Base DP</td>
</tr>
<tr>
<td>Bennett’s</td>
<td>1st MC base, intraarticular</td>
</tr>
<tr>
<td>Rolando</td>
<td>Communitied</td>
</tr>
<tr>
<td>Gamekeeper</td>
<td>1st PP ulnar</td>
</tr>
<tr>
<td>Boxer’s</td>
<td>5th MC</td>
</tr>
<tr>
<td>Colle’s</td>
<td>Distal radius</td>
</tr>
<tr>
<td>Smith’s</td>
<td>Reverse colles</td>
</tr>
<tr>
<td>Chauffer’s (Hutchinson’s)</td>
<td>Radial styloid</td>
</tr>
<tr>
<td>Barton’s</td>
<td>Dorsal rim</td>
</tr>
<tr>
<td>Rev. Barton’s</td>
<td>Anterior rim</td>
</tr>
<tr>
<td>Nightstick</td>
<td>Ulnar shaft isolated</td>
</tr>
<tr>
<td>Monteggia</td>
<td>Ulna and radial + dislocation (elbow)</td>
</tr>
<tr>
<td>Galleazzi</td>
<td>Ulna and radial + dislocation (wrist)</td>
</tr>
<tr>
<td>Hill Sach’s</td>
<td>Humeral head</td>
</tr>
<tr>
<td>Bankart</td>
<td>Glenoid</td>
</tr>
</tbody>
</table>

#### LOWER EXTREMITY

<table>
<thead>
<tr>
<th>Name</th>
<th>Location of Injury</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jones</td>
<td>5th MT base</td>
</tr>
<tr>
<td>Lisfranc</td>
<td>2-5 MT</td>
</tr>
<tr>
<td>Choparts</td>
<td>Talonavicular and calcaneocuboid dislocation</td>
</tr>
<tr>
<td>Maisonneuve</td>
<td>Pronation external rotation injury-proximal fibula</td>
</tr>
<tr>
<td>Tillaux</td>
<td>Anterior tibial tubercle</td>
</tr>
<tr>
<td>Wagstaffe-Lefort</td>
<td>Fibular avulsion</td>
</tr>
</tbody>
</table>

#### SPINE

<table>
<thead>
<tr>
<th>Name</th>
<th>Location of Injury</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jefferson</td>
<td>C1 lateral masses</td>
</tr>
<tr>
<td>Hangman</td>
<td>C2 pars Fx</td>
</tr>
<tr>
<td>Clay Shovelers</td>
<td>Posterior elements</td>
</tr>
<tr>
<td>Lefort I</td>
<td>Through maxilla</td>
</tr>
<tr>
<td>Lefort II</td>
<td>Nasal—inferior orbital rims</td>
</tr>
<tr>
<td>Lefort III</td>
<td>Nasal—orbits</td>
</tr>
</tbody>
</table>
LYMPHANGITIC CARCINOMATOSIS

“CERTAIN Cancers SPread BY PLUGGING THE Lymphatics”

- Cervix
- Colon
- Stomach
- Breast
- Pancreas
- Thyroid
- Larynx
BRONCHIOLITIS OBLITERANS

CRITTERS

COP/BOOP
Rheumatoid
Infectious-Swyer James
Transplant
Toxins
Sarcoid

MULTIPLE NODULES OR MASS >3 CM

DAYS OF THE WEEK: MTWTFSS

Mets/Carcinoma/Lymphoma
TB/granuloma
Wegeners
Rheumatoid nodules/Round pneumonia
Fungal
Sarcoid
Septic pulmonary emboli
COIN LESION <3 CM

CHANGE

- Carcinoma/Congenital
- Hamartoma/Hematoma
- AVM/Abscess
- Neoplasm-mets
- Granuloma
- Esoteric-TB pneumonia
A CT scan should be done to assess:

Ca²⁺ pattern
- Benign: solid, lamellated, central
- Malignant: stippled, any other pattern.
- Density: fat - Hamartoma

Margins:
- Spiculated suggestive of carcinoma

Enhancement
- Four 1-min images >15HU suggestive

Growth

CAVITY

CAVITY
- Carcinoma-SCC
- Abscess-fungal/bacterial/TB
- Vascular-septic emboli
- Inflammatory-rheumatoid nodule
- Trauma-resolving contusion
- Young-bronchogenic cyst
CAVITY (continued)
BRONCHOVASCULAR SPREAD

SKILL

- Sarcoid
- Kaposi
- Infection–PCP/TB
- Lymphoma
- Lymphagitic spread

UNILATERAL HYPERLUCENT LUNG

POEMS

- Poland syndrome/Pneumothorax
- Oligemia/Obstruction (PE)
- Emphysema
- Mastectomy
- Swyer James
ACUTE INTERSTITIAL DISEASE (RETICULAR)

HELP

- Hypersensitivity pneumonitis
- Edema-Inhalation injuries
- Lymphoproliferative
- Pneumonia-atypicals, PCP
CHRONIC INTERSTITIAL DISEASE (RETICULAR)

PAGE CHUCK AT THE CIA RIGHT NOW, THERE’S DRUGS

UPPER LUNG ZONES
- Pneumoconiosis
- Ankylosing spondylitis
- Granulomatous
- Eosinophilic
- Sarcoid/Silicosis

MID LUNG ZONES
- Chronic Hypersensitivity
LOWER LUNG ZONES

Collagen vascular disease
IPF
Asbestos
Rheumatoid
NF
Drug toxicity
ACUTE AIRSPACE DISEASE

HELP LEGALIZE HEMP

**DIFFUSE**
- Hemorrhage
- Edema
- Lymphoproliferative—esoteric
- Pneumonia

**FOCAL**
- Hemorrhage-contusion/PE
- Edema-inhalation (crack)
- MI (RUL)
- Pneumonia
CHRONIC AIRSPACE DISEASE

PEBBLES

- PAP/PCP/Pedema
- Eosinophilic pneumonia
- BAC
- BOOP
- Lymphoma
- Esoteric-Wegener’s/TB
- Sarcoid/Septic pulmonary emboli
GROUND GLASS DIFFUSE OPACITY

SHAKE YOUR HIPS IN BED

Sarcoid
Hypersensitivity—smokers
Infection
Pneumonitis—DIP
Scleroderma/CVD
BOOP
Edema/aspiration
Drug toxicity

CENTRAL OPACITIES EXTENDING FROM THE HILA OUTWARDS

P PPP
PAP
Pulmonary edema
PCP
Pneumonia—atypical/influenza
MIDDLE MEDIASTINAL MASS

HABIT

- Hernia, Hematoma
- Aneurysm
- Bronchogenic cyst/duplication cyst
- Inflammation (sarcoidosis, histoplasmosis, coccidioidomycosis, primary TB in children)
- Tumors—remember the five Ls:
  - Lung, especially oat cell
  - Lymphoma
  - Leukemia
  - Leiomyoma
  - Lymph node hyperplasia
RETICULAR (CXR)/CYSTIC OPACITIES (CT)

ELECT CHIP

EG
LAM
Emphysema
CF
TS
Coccidiomycosis
Hydrocarbon
Infectious
PCP
FINGER IN GLOVE OPACITIES

CACACA

CF
Asthma
Congenital bronchial atresia
ABPA
Cancer
AVM
CRAZY PAVING (CT)

ACUTE
- Edema
- Hemorrhage

CHRONIC
- PAP
- Sarcoïd
- PCP
- Fibrosis
END-STAGE LUNG (CXR)—ARCHITECTURAL DESTRUCTION

TESSA

TB
EG
Sarcoid
Silicosis
ARDS—The sequela of
CA\(^2+\) NODULES

MASH POX

- Metastatic disease
- Alveolar microlithiasis
- Silicosis/siderosis
- Histoplasmosis
- Pox (Varicella)

TREE IN BUD OPACITIES (CT)

MIT

- Mucous plugging: Aspiration/Kartageners
- Inflammatory plugging (PUS): TB/MAI
- Tumor emboli (rare)
NODULES (CT)

DIFFUSE

MISSILE

Mets
Infection
Sarcoid
Silicosis
Lymphoma
EG
PERILYMPHATIC

A SKILL

Amyloid
Sarcoid
Kaposi’s
Infection (PCP)
Lymphoma
Lymphang carcinomatosis
CENTRILOBULAR

HERB HAS GAS

Hypersen pneumonitis
EG
RB-ILD
BAC/BOOP
GVHD
VASculitis
BRONCHIECTASIS

CAPT KANGAROO HAS MOUNIER KUHN

- Cystic fibrosis
- ABPA
- Postinfectious
- TB
- Kartagener’s
- Mounier Kuhn
TRACHEAL NEOPLASMS

*Multiple*

**TRAM**
- Tracheobronchopathia
- Relapsing polychondritis
- Metsastasis

*Single*

**MATCH**
- Mucoepidermoid
- Adenoid cystic
- Tracheal SCC
- Carcinoid
- Hamartoma
Cardiac

CARDIOMYOPATHY

RESTRICTIVE
- Sarcoid
- Hemochromatosis
- Amyloid
- Endocardial fibroelastosis

HYPERTROPHIC
- Obstructive
- Nonobstructive
Dilated

PERICARDIUM
CA\textsuperscript{2+}

- Uremic
- Viral
- TB
- Prior hemorrhage
3

Gastrointestinal Radiology

Includes plain radiograph interpretation, contrast studies of the GI tract and abdominal imaging studies including CT, MRI, and ultrasound, plus interventional techniques related to the esophagus, stomach, small and large intestines, biliary tract, liver, spleen, pancreas, peritoneal cavity, and abdominal wall.

GENERAL

1. The Gastrointestinal Mantra: Always consider the three following categories in the GI tract, almost all cases shown will encompass:
   a. Neoplasm
   b. Infection
   c. Inflammatory

2. In GI, when all else fails, think: TB, CROHN'S, LYMPHOMA, METS. It will save you 90% of the time.
PLAIN FILM

HAVE A SYSTEMATIC APPROACH ON THE BOARDS. It goes quickly so you must do this on all films.

“ABCD”

AIR (MISSING THESE = FAIL)
1. Portal vein
2. Emphysematous cholecystitis
3. Emphysematous pyelonephritis
4. Emphysematous cystitis
5. Retroperitoneal air
6. Free air
7. Pneumatosis
Chapter 3 / Gastrointestinal Radiology

BOWEL

Pattern
Location
Hernia
**Calcium**
- Gallbladder
- Renal
- Appendix
- Bladder
- Aneurysms
DEM BONES

Lytic pedicles will signify RCC on board exams.
ABNORMAL COLLECTION OF BARIUM ANYWHERE

FED UP

Fistula
Extravasation
Diverticulum
Ulcer
Perforation
Esophagus

**MASS**

**CALL the MVP**

- Carcinoma
- Adenoma/Polyp/Papilloma
- Lymphoma
- Leiomyoma
- Metastasis
- Varices
- Papilloma
ULCERATION/STRUCTURE

CAR RIMS

- Caustic or NG/Crohn’s
- Adenocarcinoma
- Reflux
- Radiation
- Infection/inflammatory
- Metastasis
- Skin – Bullous/Pemphigus
ESOPHAGEAL FILLING DEFECTS

Candida
Glycogenic Acanthosis/Acanthosis Nigricans
Leukoplakia
ESOPHAGEAL MOTILITY DISORDER

PRIMARY

Achalasia
Nonspec Esop Motility Dz
Presbyesophagus
DES
SECONDARY

Scleroderma
Diabetes
Infection-Chagas
Esophagitis-reflux/radiation
DIVERTICULI

**High**
PULSION-Zenker’s

**Mid**
TRACTION-TB/Histoplasmosis

**Low**
EPIPHRENIC
Stomach

GASTRITIS
Fold Thickening

GASTRIC ULCERS

Benign
Thin folds
Beyond lumen
Eccentric crater
+ Hampton
N Peristalsis

Malignant
Thick fold
Within lumen
Central crater
− Hampton
Abn Peristalsis
APTHOUS ULCERS

ACHE BABY

ASA/meds
Crohn’s
Herpes
ETOH
Behcet
Amebiasis
Bad AIDS
Yersenia
ANTRAL NARROWING

CTL SPINE (AS IN CTL: CERVICAL/THORACIC/LUMBAR)

- Crohn’s
- TB
- Lymphoma/carcinoma/mets
- Sarcoid
- Prior ulcer/Atrophic gastritis
- Ingestion (caustic)
- Eosinophilic gastroenteritis
- Chronic granulomatous dz childhood (Pediatrics only—for the 72)

FOLD THICKENING

LAMAZE CLASSES

- Lymphoma
- Adenocarcinoma
- Menetriers
- Zollinger Ellison
- Eosinophillic gastritis

GASTRIC MASS

CALL ME

- Carcinoma
- Adenoma/Hyperplastic polyps
- Lymphoma
- Leiomyoma/Lipoma
- MEtastasis
CALL ME (continued)

LINITIS PLASTICA

GRAM STAIN

- Granulomatous infection (TB)/Crohn’s/Lymphoma
- Radiation
- Adenocarcinoma
- Metastasis-breast
BULLSEYE/TARGET LESION

BLACK

Breast metastasis/Melanoma metastasis
Leiomyoma
Adenocarcinoma
Cancer-lymphoma
Kaposi

DOUBLE CHANNEL PYLORUS

ULCER

Ulcer disease
Lymphoma
Crohn’s
Endoscopy induced injury
Radiation
Duodenum

ANTRAL/DUODENAL FILLING DEFECTS

BLED
Brunner’s gland hyperplasia
Lymphoid hyperplasia
Ectopic gastric mucosa
Duodenitis

BULBAR MASS

ABCDE
Ampulla
Brunner’s gland adenoma
Crohn’s
Duodenal adenocarcinoma
Ectopic pancreas
DUODENAL ULCER

PAT

Peptic ulcer
Adenocarcinoma
TB/Crohn’s/Lymphoma

DUODENAL FOLD THICKENING

PAD LOCZS

PAncreatitis
Duodenitis-ETOH/meds
LymphOma
Cystic Fibrosis/Crohn’s
Zollinger Ellison
Sprue/strongyloides
Small Bowel

APPROACH TO SMALL BOWEL

- Focal
  - Mass
    - Specifically terminal ileum
  - Non-Mass
- Diffuse
  - Non-Dilated
    - Fold Thickening
      - Irregular
      - Regular
  - Dilated
    - Regular
    - Aneurysmal
FOCAL PROCESS

ANYWHERE

- Ischemia
- Crohn’s
- Neoplasm
- Radiation

TERMINAL ILEUM (exclude appendix and cecal processes)

- TB
- Crohn’s
- Lymphoma
- Mets
- Infection (specific to the TI)

Your S Smells Totally Awful

- Yersinia
- Shigella
- Salmonella
- TB
- Actinomycosis
DIFFUSE

SMALL BOWEL

Dilated

SOS

Sprue
Obstruction
Scleroderma

OR

Wet Pattern
Sprue
Zollinger Ellison
Lymphoma

Dry Pattern
Obstruction
Scleroderma
Radiation

SMALL BOWEL

Aneurysmal Dilation

MALL
Metastasis
Abscess/Hematoma
Lymphoma
Leiomyosarcoma
SMALL BOWEL FOLDS

Irregular Thickening

MALE COW

MAI
Amyloid
Lymphoma
Eosinophilic Gastroenteritis
Crohn’s
Other-Giardiasis
Whipple
**SMALL BOWEL FOLDS**

*Regular Thickened “Picket Fence”*

**HEMORRHAGE**
- HSP
- Anticoagulation

**EDEMA**
- CHF
- Hypoproteinemia

**OTHER**
- Lymphoma
- Lymphagectasia
- Radiation

---

**SMALL BOWEL**

* Ribbon Bowel

**A CUTE GIRL**
- Amyloid
- Cryptosporidiosis
- GVHD
- Ischemia/Infection
- Radiation
- Lymphoma
SMALL BOWEL

Masses

LACK
- Leiomyoma
- Adenocarcinoma
- Carcinoid
- Kaposi

SMALL BOWEL

Nodules

MACE KILLS
- Mastocytosis/Macroglobunemia
- Amyloid
- Crohn’s
- Eosinophillic enteritis
- Kaposi
Colon

POLYPS

SINGLE

Hamartomatous
Adenoma-tubular/tubulovillous/villous
Hyperplastic
Lymphoma
Inflammatory-UC/Crohn’s
MULTIPLE/POLYPOSIS

1. Hamartomas
   Peutz-Jaeger: (MUCOCUTANEOUS)

2. Hyperplastic
   Juvenile Polyposis (Children are HYPER)
Cronkhite Canada:  
(CHECK STOMACH FOR POLYPS)
3. Adenomatous FiGhT

Familial Polyposis
Gardner’s
Turcot
SPICULATED SEROSA

SEARS Credit Card

- Serosal mets
- Endometriosis
- Abscess/Adhesion
- Radiation
- Swallowed foreign body
- Crohn’s
- Carcinoid

PNEUMATOSIS

CHIPS

- COPD
- Ischemia
- Pneumatosis cystoides intestinalis
- Scleroderma/Steroids

SACCULATIONS

MISC

- Mets
- Ischemia
- Scleroderma
- Crohn’s
BALD COLON

I Use Radioactive Laxatives

Ischemia
Ulcerative colitis
Radiation
Laxatives
Scleroderma

GENERALIZED COLITIS

I’NR

Infectious-E. coli/CMV
Inflammatory-Pseudom, Crohn’s/UC
Ischemic -A. fib etc.
Neoplastic-lymphoma
Radiation

FOCAL COLITIS

CECUM-

ABC

Amebiasis
Blastomycosis
CMV

RIGHT COLON-

Typhlitis, salmonella, shigella, TB, Diverticular bleed

TRANSVERSE-

Pseudomembranous/CMV/E. coli
Pancreatitis/Stomach

LEFT COLON-

Diverticulitis/CA
Ischemia at flexure
RCC
APPENDIX

INC

Infection
Neoplasm
  – Cystadenocarcinoma
  – Mucocele
Carcinoid

RECTUM

CLOGGED

Chlamydia
Lymphogranulomatous venerum
Gonococcus
Liver

**IN GENERAL:**

1. Fatty or not? Always a favorite question

2. Cirrhotic or not? Makes one think of HCC every time

3. Portal vein—open or not? Consider HCC
<table>
<thead>
<tr>
<th>DIFFUSE</th>
<th>FOCAL</th>
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<tbody>
<tr>
<td><strong>Neoplasm</strong></td>
<td><strong>Neoplasm</strong></td>
</tr>
<tr>
<td>• HCC</td>
<td>“Liver Cell”</td>
</tr>
<tr>
<td>• Cholangiocarcinoma</td>
<td>• Benign</td>
</tr>
<tr>
<td>• Lymphoma</td>
<td>– Adenoma</td>
</tr>
<tr>
<td></td>
<td>• Malignant</td>
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<tr>
<td></td>
<td>– FNH</td>
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<tr>
<td></td>
<td>– HCC</td>
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<tr>
<td></td>
<td>– Fibrolamellar</td>
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<tr>
<td></td>
<td>– Metastasis</td>
</tr>
<tr>
<td>“Bile Cell”</td>
<td><strong>“Bile Cell”</strong></td>
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<tr>
<td></td>
<td>• Benign</td>
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<tr>
<td></td>
<td>– Cystadenoma</td>
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<td></td>
<td>• Malignant</td>
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<tr>
<td></td>
<td>– Cystadenocarcinoma</td>
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<tr>
<td>“Mesenchymal”</td>
<td><strong>“Mesenchymal”</strong></td>
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<td></td>
<td>– Hemangioma</td>
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<tr>
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<tr>
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<td><strong>Inflammatory</strong></td>
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<td>• Cirrhosis</td>
<td><strong>Other</strong></td>
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<td>• Glycogen storage</td>
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<td></td>
<td>• Hemochromatosis</td>
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<td>• Fatty</td>
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<td><strong>Vascular</strong></td>
<td><strong>Vascular</strong></td>
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<tr>
<td>• Pre-Sinusoidal</td>
<td></td>
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<tr>
<td></td>
<td>– Schistosomiasis</td>
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<tr>
<td></td>
<td>– Cirrhosis</td>
</tr>
<tr>
<td>• Post Sinusoidal</td>
<td></td>
</tr>
<tr>
<td></td>
<td>– Budd Chiari</td>
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<tr>
<td></td>
<td>– CHF</td>
</tr>
</tbody>
</table>
IMAGES

Diffuse Neoplasm
HCC

Focal Neoplasm
“Liver cell”

Focal Neoplasm
“Bile cell”

Focal Neoplasm
“Mesenchymal”
Diffuse
Infectious

Focal
Infectious

Diffuse
Inflammatory

Diffuse
Other

Diffuse
Vascular
BILE DUCT DILITATION

High
HIV
PSC
Cholangiocarcinoma

Confluence
Metastatic lymph nodes
Klatskin
HCC
GB

Low
GB
Mirizzi
Post-instrumentation stricture
HCC

Ampulla
Panc CA
Stone

Cholangiocarcinoma

**BILE DUCT WALL THICKENING**

**PAC-SAC**

- Pancreatitis
- Ascending cholangitis
- Cholangiocarcinoma
- Sclerosing cholangitis
- AIDS cholangiopathy
- Choledocholithiasis
Pancreas

**MASS**

**NEOPLASM**

**Gland**

**AISLE**

- Adenocarcinoma
- Islet
- Solid and papillary epithelial neoplasm
- Lymphoma
- MEts

**Duct**

- Macrocystic
- Microcystic
- IPMT (intraductal papillary mucinous tumor of the pancreas)
Duct (continued)

INFLAMMATORY

PANCREATITIS

Focal

OTHER

Abscess
Pseudocyst
Real Cyst-VHL, PCKD

Choledochal cyst
Spleen

**CYSTIC LESION**

**MATE**
- Metastasis
- Abscess
- Traumatic Cyst/Congenital Cyst
- Echinococcal

**SOLID LESION**
- Granulomatous disease
- Metastasis: melanoma
- Hemangioma/sarcoma
- Infarct
Peritoneal Masses

PEPPERCORN MELT

- Peritoneal Carcinomatosis
- Mesothelioma
- Lymphoma
- TB
4

Genitourinary Radiology

NEPHROCALCINOSIS

Cortical

COAGS

Cortical necrosis
Oxalosis
Alports
Glomerulonephritis
Sickle cell disease

From: Radiology: The Oral Boards Primer
By: A. Mehta and D. P. Beall © Humana Press Inc., Totowa, NJ

105
**Medullary**

**MARCH**

- Medullary Sponge Kidney
- Alkali
- RTA
- Cushing’s syndrome
- HPTH
PAPILLARY NECROSIS

NSAID

NSAID
Sickle cell
Analgesic
Infection TB/Pyelo
Diabetes
NSAID (continued)
BLADDER WALL CALCIFICATION

STIR

- Schisto
- Tb/TCC
- Interstitial
- or eosinophillic cystitis
- Radiation

URETERAL STRicture

MISTER

- Mets
- Inflammation (stone)
- Schisto
- Tb/TCC/Trauma
- Endometriosis
- Radiation
URETERAL DEVIATION
TAP YOUR FRIEND ON THE SHOULDER

Lateral

TAP

- Tumor (retroperitoneal)
- Aneurysm/adenopathy
- Peritonealization of ureters/post op

Medial

FRIEND

- Fibroid
- RPF
- Idiopathic
- Enlarged prostate
- Node dissection
- Diverticulum
RENAL MASS (CATEGORIZE BY ENTITY OR SHAPE)

BY ENTITY

Tumor

**Cystic**
- Cystic RCC
- MLCN
- Mets

**Solid**
- Parenchymal—RCC
- Mesenchymal—AML
- Collecting System—TCC

**Other**
- Mets
- Lymphoma
Infection
Abscess
Pyelonephritis
XGP focal or diffuse

Vascular
AVM
Hematoma
BY SHAPE

**Bean-shaped (entire kidney)**
- Metastasis
- Diffuse RCC or TCC
- Lymphoma
- Infarction

**Ball-shaped (single mass)**
- RCC
- TCC
- Metastasis
- Infection
WHEN DO YOU BIOPSY?

*When it changes management*

- Metastatic disease
- Lymphoma (medical vs sx treatment)
  - Single kidney
- Abscess
INFUNDIBULAR NARROWING

- Inflammatory
- Infection
- Instrumentation
- TCC

— Stone
— TB — “Phantom calyx”
— Trauma
— “Oncocalyx”
URETERAL DILATATION
PRESSURE OVERLOAD
  Obstruction

VOLUME OVERLOAD
  Reflux
  Diuresis

INTRINSIC ABNORMALITY
  Eagle Barrett
  1° Megaureter
DELAYED NEPHROGRAM

PRERENAL

- Hypotension
- RAS

RENAL

- Glomerulonephritis
- ATN
- Papillary necrosis

POSTRENAL

- Crystals/proteins
- Obstruction—ureteral or venous

STRIATED NEPHROGRAM

MOP

- Medullary sponge
- Obstruction—vascular or ureteral (stone)
- Pyelonephritis
RIM SIGN

RAM

Renal vein thrombosis
ATN
Main renal artery thrombus/avulsion
UNILATERAL SMALL KIDNEY

Renal artery stenosis
Reflux nephropathy
Nephritis (chronic)
Congenital
**RENAL AND URETERAL STONES**

*(Radio-opaque + / Radiolucent –)*

<table>
<thead>
<tr>
<th></th>
<th>Plain film</th>
<th>CT</th>
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<tbody>
<tr>
<td>Calcium oxalate</td>
<td>+</td>
<td>+</td>
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<tr>
<td>SMUX</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Struvite</td>
<td>–</td>
<td>+</td>
</tr>
<tr>
<td>Matrix</td>
<td>–</td>
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<tr>
<td>Uric acid</td>
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<tr>
<td>Xanthine</td>
<td>–</td>
<td></td>
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<tr>
<td>Indinavir</td>
<td>–</td>
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</table>
# RENAL TRANSPLANT

<table>
<thead>
<tr>
<th>ATN</th>
<th>Normal</th>
<th>Decreased &lt;24 h</th>
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<tbody>
<tr>
<td>Rejection</td>
<td>Decreased</td>
<td>Decreased</td>
</tr>
<tr>
<td>Cyclosporine</td>
<td>Normal</td>
<td>Decreased &gt;24 h</td>
</tr>
</tbody>
</table>

**Flow**

**FCN**
URETERAL FILLING DEFECTS

**Single**

5CS
- Calcium (stones)
- Cancer (TCC)
- Clots (blood)
- Candida (fungus ball)
- Crazy papilla (papillary necrosis)

**Multiple**

SLUMM
- Stones
- Leukoplakia
- Ureteritis cystica
- Malakoplakia
- Metastasis—Melanoma
PEAR-SHAPED BLADDER

LAUNCH

Lipomatosis
Adenopathy/lymphoma
Urinoma
Neurofibromatosis
Caval obstruction (collaterals)
Hematoma (trauma)
Adrenal

MASS

CORTICAL
Adenoma
Carcinoma
Metastasis

MEDULLARY
Pheochromocytoma (5 Ps)
- pain
- pallor
- palpitations
- perspiration
- panic

CYSTS
True — congenital
Pseudo — posthemorrhagic
Infectious — echinococcal
Retroperitoneum

NORMAL TO HEMORRHAGE

- Neural (schwanomma, NF)
- Ormond’s disease (idiopathic RPF)
- RP Fibrosis (secondary—drug/tumor)
- Metastasis from genital system
- Adenopathy—infectious
- Lymphoma
- Hemorrhage
URETHRAL STRICTURE

I

Infection
Gonorrhea
TB
Schistosomiasis
Iatrogenic
Injury—posttraumatic
Uterus

HSG
Can be shown essentially two types of cases with abnormalities:
Uterus or Fallopian tube

Uterine Cavity
Bicornuate vs Septate
Chapter 4 / Genitourinary Radiology

Didelphys

DES
Asherman’s Syndrome
Adenomyosis
**Fallopian Tube**

- Salpingitis Isthmica Nodosa
- TB
- Obstruction
Prostate

CYSTS

*Midline*

**“U” CYST**
- Utricle

Urethra (connected)

- Urethral polyp association
- Undescended testicle association

**“S” CYST**
- Mullerian
- Sperm containing
- Stone forming
- Superior extending (above prostate)
**Paramedian**

- BPH
- Ejaculatory duct cyst

**Lateral**

- Seminal vesicle cyst (renal agenesis association)

**Infection**

**Neoplasm**

- Peripheral zone (prostate carcinoma)
Head and Neck Radiology

Includes plain film diagnosis of the skull, sinuses, mastoids, spine & head & neck structures and all other imaging and special procedures related to the central nervous system head & neck. This includes angiography, myelography, interventional techniques, CT, and MRI.
Sinuses

NASOPHARYNGEAL MASS

AISLE

- Antrochoanal polyp
- Inverted papilloma (destroys bone)
- Lethal midline granuloma
- Squamous cell carcinoma (destroys bone)
- Esthesioneuroblastoma (destroys bone)

SINUS MASS

AFIP

- Antrochoanal polyp
- Atelectatic sinus
- Fungal sinusitis
- Inverted papilloma
- Polyposis
Head & Neck Spaces

PTERYOPALATINE FOSSA

- Juvenile angiofibroma
- Schwanomma
- Perineural spread from V2 (palate—mouth)—adenoid-cystic, melanoma, lymphoma
**ORAL CAVITY/OROPHARYNX**

- Dermoid
- Ranula
- Hemangioma
- SCC
- Minor salivary

**MASTICATOR SPACE**

- **Bone**—Odontogenic abscess
- **LN**—Lymphoma
- **Muscle**—Sarcoma
- **Nerve**—V3 Schwan/NF
- **Mucosa**—SCC

**PAROTID SPACE/PRE STYLOID PARAPHARYNGEAL SPACE**

**PLEASE WATCH OUT for HEMANGIOMAS**

**Benign:**

- Pleomorphic adenoma
- Warthins
- Oncocytoma
- Hemangioma

**Malignant:**

- Minor salivary gland tumors
CAROTID SPACE

V—Carotid body tumor
N—Schwannoma/NF

LN—Mets

M—SCC
PHARYNX

Laryngocoele

CYSTIC NECK MASS

Second brachial cleft (fat)
Thyroglossal duct (medial)
Cystic hygroma (everywhere)
Laryngocoele (pharynx)
Abscess (retropharyngeal space)
Necrotic nodes
Other

PULSATILE TINNITUS
Glomus tumor
Dehiscent jugular vein (bulb)

Aberrant cartoid AVM
Orbit

LACRIMAL GLAND

MELDS

- Metastasis
- Epithelial tumor—pleomorphic adenoma/carcinoma
- Lymphoma
- Dermoid
- Sjögrens/Sarcoid
EXTRACONAL

LIMP + RHABDO

Lymphoma
Infection
Mets
Pseudotumor
Rhabdomyosarcoma
INTRACONAL

LIMP + HEMANGIOMA

Lymphoma
Infection
Mets
Pseudotumor
Hemangioma
EXTRAOCULAR MUSCLES

LIMP + GRAVES
- Lymphoma
- Infection
- Metastasis
- Pseudotumor
- Graves

OPTIC NERVE

LIMP + GMN
- Lymphoma
- Infection
- Metastasis
- Pseudotumor
- Glioma
- Meningioma
- Neuritis
LEUKOCORIA

Retinoblastoma
PHPV
Coats
RLF (retrolental fibroplasia)
Phthisis bulbi

GLOBE

Mets
Melanoma
Drusen
Angle of Mandible

ANTERIOR MASS

- Submandibular gland mass
- Sublingual gland mass
- Larynx
- Parotid

POSTERIOR MASS (LOOK AT CAROTID)

*Splayed*

- Carotid body tumor
**Chapter 5 / Head and Neck Radiology**

**Lateral**

- Brachial cleft cyst
- Papillary thyroid CA
- Cystic schwannoma
- Cystic hygroma
- Lymphoma/Node

**Posterior**

- Node or Nerve

**Medial**

- Nerve only
Neck

TUMOR

Glottic
Supraglottic (FAT)
Subglottic
MIDLINE OR SOMEWHAT OFF MIDLINE

**Cyst**
Thyroglossal duct cyst

**Bone**
Chondrosarcoma
Submucosal

Laryngocele
Temporal Bone

WHITE MASS

*Cholesteatoma*

a. Tegmen tympani ? intact  
b. Lat wall semicircular canal ? intact  
c. Facial nerve—  
   Location? Bone? Relationships?

*Cholesterol Granuloma*

RED MASS

*Glomus Jugulare*

Erodes pars vascularis  
—do angio to determine vs hemangioma

*Glomus Tympanicum*

Jugular bulb ok  
—no angio

*Aberrant Carotid*

Peristant stapedial artery

*Jugular Bulb Anomalies*

**WORKUP**  
CT separates aberrant carotid/GJ/GT  
MR for flow void assessment and extent
OTHER

MONDINI

Inner ear
Segmentation cochlear problem
Interscalar septum
Lateral semicircular canal (central post absent)
Vestibular aqueduct—bigger than posterior semicircular canal
PETROUS EXPANSION

Cholesterol cyst/granuloma T1 BRIGHT
Epidermoid/cholesteoma T1 DARK
Mucocele
Thyroid

SUBACUTE

Post-viral
Hypothyroid
Fever, chills, pain

HASHIMOTO’S

Early—Hyperthyroid

Late—Hypothyroid

GRAVES

Goiter
Thyrotoxicosis
Increased uptake—gland hot
Skull Base

BY LOCATION

*Midline*

- Craniopharyngioma
- Chordoma
**Paramedian**

- Carotid aneurysm
- Chondrosarcoma

**Lateral (GW of sphenoid)**

- Meningioma
- Metastasis
- Dermoid
- Glomus
- Epidermoid
- **Cholesterol cyst**
Always Include
Mets
Myeloma
Lymphoma

LACRIMAL
Epithelial—Pleomorphic adenoma, Adenoid cystic, Mucoepidermoid
Lymphoid—Lymphoma, Sjogren, Benign lymphoid hyperplasia
Vascular and Interventional

Includes the diagnosis of all abnormalities and anomalies of the arteries, veins, and lymphatics. It includes all vascular and nonvascular imaging-directed interventional procedures. All modalities and techniques used in diagnostic and interventional procedures are also included.
GENERAL APPROACHES

1. Technique
   a. Which vessel injected
   b. Phase of injection
      i. Arterial—early/mid/late
      ii. Venous—early/mid/late

2. Anatomy
   a. Which vessels are opacified?
   b. Are the expected vessels based on the injection filled?
   c. Are any vessels missing?
   d. Are there vessels that should not be filling?
   e. Anatomy—too small/too large/filling defects/cutoff
   f. Are there vessels that are filling early?

TECHNIQUE SPECIFICS

VASCULAR

<table>
<thead>
<tr>
<th>Injection and Filming Rates</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pulmonary artery</td>
</tr>
<tr>
<td>Thoracic aorta</td>
</tr>
<tr>
<td>Abdominal aorta</td>
</tr>
<tr>
<td>Pelvic aorta/bifurcation</td>
</tr>
<tr>
<td>Iliac artery</td>
</tr>
<tr>
<td>Celiac artery/SMA</td>
</tr>
<tr>
<td>Inferior mesenteric artery</td>
</tr>
<tr>
<td>Renal artery</td>
</tr>
<tr>
<td>Carotid artery</td>
</tr>
<tr>
<td>Subclavian artery</td>
</tr>
<tr>
<td>IVC</td>
</tr>
</tbody>
</table>

ANGIOPLASTY

CHOOSE

1. Diameter (usually 10% larger than the vessel)
   a. Aorta               20 mm
   b. Common iliac        8 mm
   c. External iliac      7 mm
   d. SFA                 6 mm
   e. Popliteal           5 mm
   f. Tibial              3 mm
   g. Dorsalis pedis      2 mm
   h. Renal/celiac/SMA   6 mm
Chapter 6 / Vascular and Interventional

2. Length
   a. Most successful for SHORT, CONCENTRIC, NON-CALCIFIED

3. French size (for pressure measurement, sheath should be 2 FR > catheter)
4. Shaft length of balloon
5. Burst pressure of balloon
6. Gradients
   a. Significant = >10 mmHg at rest, >20 mmHg after challenge
      or >10% of systolic BP

EMBOLIZATION

EMBOLIC AGENTS

Liquid
- ETOH
- Glue

Particulate
- Gelfoam slurry
- Ivalon/PVA
- Clot
- Embolization spheres

Devices
- Coils
- Balloons

THROMBOLYSIS

AGENTS

tPA (Alteplase) (arterial): Infuse at 0.5–1 mg/h. Typically place 10 mg of tPA in
1000 cc of NS and infuse at 50 cc/h (0.5 mg/h). The mean time to lysis is about 20 h. The average total
dose is 10–20 mg. The total dose to the patient should not exceed 40 mg.

tPA (venous): Same infusion rate as arterial.
tPA (Alteplase) (line lysis): Place 2 mg of tPA in 2 cc of NS and dwell in the
lumen for 2 h then aspirate.
RPA (Retaplase): Same as Alteplase but much more published
experience with Alteplase.
Streptokinase: Do not use due to anaphylactic reaction possibility.
Urokinase: 100,000 U/h divided between infusion catheters.
This agent, however, is no longer being manufactured.
Heparin: 1000 U/h for target PTT for 60–80 s
Contraindications

ABSOLUTE
Active internal bleeding
Irreversible limb ischemia
Recent stroke
Brain tumor
Left heart thrombus

RELATIVE
History of GI bleeding
Major surgery within 10 d
Diabetic hemorrhagic retinopathy
Coagulopathy
Embolus of cardiac source

UTLIZED MEDICATIONS

VASODILATORS
Nitroglycerin—100 µg doses
Priscoline—25 mg doses
Papaverine—25 mg doses

VASOCONSTRICTORS
Vasopressin—0.1–0.4 µg

ANALGESICS/AMNESICS
Morphine—1 mg bolus, 1 mg maintenance
Versed (midazolam)—1 mg bolus, 1 mg maintenance
Fentanyl 50 µg bolus, 50 µg maintenance

ANTAGANOSITS
Naloxone (opioid antagonist) 1 mg IV
Flumanezil (benzodiazapene antagonist) 0.2 mg IV

COMMONLY TESTED PROCEDURES

Vascular Intervention
VENA CAVA FILTER
1. Access femoral vein
2. Place pigtail catheter at iliac confluence and perform IVC gram to determine size of IVC and renal vein location
3. Exchange for wire and IVC filter sheath
4. Deploy filter
5. Re-perform IVC gram
TIPS

1. Right internal jugular vein approach with US guidance
2. Place small catheter into hepatic veins and perform venogram after obtaining wedge pressures
3. Using direct puncture, create a connection between the right hepatic vein and right portal vein and place a wire into the portal system
4. Dilate the tract with balloon angioplasty and deploy metallic stent
5. Determine post-procedure gradients and consider coiling varices

Nonvascular Intervention

Biliary Drainage

1. Antibiotics
2. Right lateral midaxillary approach (RIGHT SYSTEM) or subxyphoid approach (LEFT SYSTEM)
3. Chiba needle or one stick system with slow injection and retraction of needle under fluoroscopy. Repeat until bile ducts visualized
4. Exchange for guidewire and plastic catheter with passage into duodenum
5. Dilate skin and place drain
6. Confirm position by fluoroscopy

Cholecystostomy

1. US guidance to determine pathway that is transhepatic to minimize bile leak
2. Use small spinal needle to access GB and in tandem insert 8 FR catheter
3. Aspirate for bile for culture and sensitivity
4. Left in until surgery or at least 3 wk to form tract

Percutaneous Gastrostomy

1. If ascites: Do paracentesis first
2. Indication dictates type of tube: feeding—GJ tube, drainage—G tube
3. Using US guidance, determine left edge of liver and spleen
4. Cup of barium from night before to outline colon through NG tube
5. Insufflate stomach
6. Gastropexy with T-tacks and retract the stomach to the abdominal wall in the high gastric body
7. Place needle between the 4 T-tacks with placement of a stiff wire into the stomach
8. Dilate skin and place peel-away sheath.
9. Place tube

Abscess Drainage

1. Two methods: TROCAR vs SELDINGER
2. Localize abscess under CT or US guidance.
3. TROCAR:
   a. Access abscess with small spinal needle and aspirate pus for microbiology
   b. Adjacent to spinal needle, in tandem, place catheter
4. SELDINGER:
   a. Use one stick needle and place into abscess
   b. Place wire through sheath
   c. Dilate tract
   d. Place drainage catheter
   e. Aspirate abscess for microbiology

PERCUTANEOUS NEPHROSTOMY
1. In the prone position, locate the kidney under US guidance.
2. Place a small spinal or equivalent needle in the upper pole calyx
3. Infuse a small amount of dilute contrast
4. Using a second one stick system, access the middle pole calyx under fluoroscopic guidance
5. Place wire into collecting system
6. Dilate skin
7. Place PCN tube
GENERAL VASCULAR DIFFERENTIAL DIAGNOSIS

AV TIMER

Atherosclerosis
Vasculitis
  a. Large vessel: GIANT/TAKAYASU
  b. Medium vessel: BERGER/BEHCET
  c. Small vessel: CTD–SCLERODERMA LUPUS
Trauma (Dissection)
Infection
Metabolic (Diabetes) or Meds (Ergots)
External (Tumor)
Radiation
TUMOR DESCRIPTORS

NAP IN BED

- Neovascularity
- AV shunting
- Puddling
- Blush
- Encasement
- Displacement of normal vessels

SMALL AORTA

- Williams Syndrome
- Takayasu (<40), giant cell arteritis (>40)
- Small aorta syndrome (female) (smoker)
- Dissection
- Neurofibromatosis
POPLITEAL ENTITIES

*Intrinsic*

- Thrombus (popliteal aneurysm)
- Embolus
- Trauma
**Extrinsic**

Popliteal entrapment syndrome

Cystic adventitial disease (MRI Dx)

External tumor
RENAI

Aneurysms

Polyarteritis nodosa
Lupus
Scleroderma
Wegeners
HIV
Drug-induced

Artery

Atherosclerosis
FMD (renal, ICA, iliac, viscerals)
NF
Arteritis
Radiation
Dissection
AORTIC ROOT

Aneurysm

Connective tissue disease (involves the root)
Atherosclerosis (look at the rest of the aorta)
Trauma
Vasculitis
Mycotic
Syphillis (Luetic)
HEMOPTYSIS

**Bronchial**
- Check spinal artery in field
- Cystic fibrosis
- Bronchiectasis
- TB
- Aspergillus

**Pulmonary Artery**
- Pulmonary embolus
- Infarction
MESENTERIC ISCHEMIA

ARTERIAL

Acute

Occlusive
Thrombus
GO TO SURGERY

Nonocclusive
Low flow
TRY PAPAVERINE CHALLENGE

Chronic

VENOUS
Thrombotic

2/3 vessels occluded (Celiac, SMA, IMA)
Atherosclerosis
Surgery to resect dead bowel

ENDPOINTS

Ischemia to bleeding
Decompensates—peritoneal signs
Improve and wean
Heparin drip with thrombolysis
### GI BLEEDING

**UGI (Proximal To Ligament of Treitz)**

<table>
<thead>
<tr>
<th>Arterial</th>
<th>Venous</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gastritis</td>
<td>Varices</td>
</tr>
<tr>
<td>Peptic Ulcer</td>
<td>Mallory Tear</td>
</tr>
<tr>
<td>Pseudoaneurysm</td>
<td></td>
</tr>
</tbody>
</table>

- **VASOPRESSIN**
  - 0.2 u x 20 min
  - Maximum 0.8 u/min
  - Recheck at 24 h

- **EMBOLIZE**
  - Gelfoam
  - Coils

**LGI**

<table>
<thead>
<tr>
<th>SB</th>
<th>LB</th>
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</thead>
<tbody>
<tr>
<td>Leiomyoma</td>
<td>Diverticulosis</td>
</tr>
<tr>
<td>AVM</td>
<td>Angiodysplasia</td>
</tr>
<tr>
<td>Ulcer</td>
<td>Cancer</td>
</tr>
<tr>
<td></td>
<td>Polyps</td>
</tr>
</tbody>
</table>

- **VASOPRESSIN**
  - Except AVM (surgery)
  - EMBO VS SURGERY
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UPPER EXTREMITY

Atherosclerosis
Thoracic outlet syndrome
Vasculitis—Raynaud’s or Buerger’s
AVM
Trauma

LOWER EXTREMITY

Viable

<table>
<thead>
<tr>
<th>ANGIOGRAPHY</th>
<th>Threatened</th>
<th>Irreversible</th>
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</thead>
<tbody>
<tr>
<td>Embolus</td>
<td>Thrombus</td>
<td></td>
</tr>
<tr>
<td>Menisci</td>
<td>Occlusive</td>
<td>Bypass</td>
</tr>
<tr>
<td>Multiple</td>
<td>Collaterals</td>
<td></td>
</tr>
<tr>
<td>Heparin</td>
<td>Thrombolysis</td>
<td></td>
</tr>
<tr>
<td>Coumadin</td>
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</table>

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Nuclear Medicine

Includes radiopharmaceuticals, dynamic and static nuclear imaging of pathophysiological processes, and quality control of nuclear imaging instruments.
Lung Imaging

V/Q SCAN

Clinical
HIGH probability: 80% chance PE
LOW probability: 80% chance of no PE

VENTILATION
1. 20 mCi Xe-133
   80 keV
   Gas
   T1/2 = 5 d
2. 4-5mCi Tc-99m-DTPA
   140 keV
   Aerosol
   T1/2 = 6 h
   Initial phase 30 s — Ventilation
   Equilibrium phase 3 min — Lung volumes
   Washout phase 3 min — Exclude obstructive disease

PERFUSION
4 mCi Tc-99m-MAA (10-40 µ)
1 million particles
T1/2 = 6 h
**Defect Size**
Small <25%
Moderate 25–75%
Large >75%

**High Probability**
2 large/mismatched defects or the arithmetic equivalent in moderate or large defects

**Intermediate Probability**
1 large/2 moderate mismatched perfusion defects or the arithmetic equivalent in large and moderate defects
Low Probability

>3 small defects

Very Low Probability

Nonsegmental defects (i.e., cardiomegaly, prominent hila, enlarged aorta), >2 matched defects
V/Q MISMATCH

**DDX**

1. Primary vascular disease (vasculitis)
2. Radiation therapy
3. PE/previous embolus
4. Lymph nodes/Hilar carcinoma/
sarcoma/lymphoma
LIVER UPTAKE

Early: Fatty liver
Late: Right heart failure
Endocrine

THYROID

Approach
1. Palpable or nonpalpable nodule → nodule evaluation study
2. Clinical: Hyperthyroid? → radioactive iodine uptake study

1. RADIOACTIVE IODINE UPTAKE STUDY

I-123
200-300 uCi
24-h uptake
N10-30%

2. THYROID SCAN
   FUNCTIONAL

   Hyperthyroid
   1. Graves/Hashimoto’s thyrotoxicosis
      Diffuse increased uptake

   2. Subacute thyroiditis
      Diffuse decreased uptake
3. Toxic/Multinodular (Plummer)
   Nodule uptake

4. Painless, Postpartum

_Hypothyroid_
Hashimoto’s
Surgery
Radiation

_Nodule Evaluation_

<table>
<thead>
<tr>
<th>I-123</th>
<th>Tc-99m</th>
</tr>
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<tbody>
<tr>
<td>159 keV</td>
<td>140 keV</td>
</tr>
<tr>
<td>100–200 µCi orally</td>
<td>5–10 mCi</td>
</tr>
<tr>
<td>Pinhole collimator</td>
<td>Pinhole or straight bore</td>
</tr>
<tr>
<td>Co-57 String or spot marker</td>
<td></td>
</tr>
<tr>
<td>T1/2 = 9 mo</td>
<td></td>
</tr>
</tbody>
</table>
SCAN PATTERNS

1. Normal-Diffuse Symmetric

2. Nodule

COLD

CATCH PALM
- Cancer
- Adenoma
- Thyroiditis
- Colloid Cyst
- Hematoma
- Parathyroid
- Abscess
- Lymph node/lymphoma
- Metastasis

HOT

Functioning adenoma
Malignancy <1% (rule out discordant)
Multiple
-less likely malignant
METASTATIC DISEASE

I-131
Oral
364 keV
5–10 mCi-diagnosis
10 mCi-Grave’s disease
100 mCi-Thyroid bed ablation
>200 mCi-Pulmonary fibrosis results
Normal uptake heart, stomach, bladder, stomach
PARATHYROID SCAN

25 mCi Tc-99m Sestamibi
DUAL WITH Tc-99m (uptake in heart is a clue)
Uptake only in abnormal glands (>35–50 g)
Parathyroid adenoma-single site

Parathyroid hyperplasia-multiple sites
Cardiac Imaging

1. VIABILITY
   - THALLIUM
   - PET

2. ISCHEMIA
   - GATED
   - PLANAR
3. VENTRICULAR FUNCTION

- FIRST PASS
- MUGA
CARDIAC PERFUSION

PROTOCOLS

1. Thallium-201
   - Rest
     - 4 mCi
     - T1/2 = 3 d
     - 70 keV (Hg X-rays)
   - 15 min post-injection imaging
   - Exercise
     - 20 mCi Tc-99m-MIBI
     - 45 min post-injection/exercise imaging to allow clearance of liver

2. Alternates
   - 2 Step MIBI 8 Mci/24 Mci doses
   - Tc-99m Teboroxime

PHYSIOLOGY

LAD Territory
- Ant 2/3
- Apex
- Septum

RCA Territory
- Inferior wall
- Inferior apex
- Inferior 1/3 septum

L. Circumflex
- Inferolateral wall
- Inferior wall ( marginals )
Inflammatory Imaging

IN-111 WBC SCAN

500 uCi
172, 247 keV
Medium Energy Collimator
Image at 24 h or 6 h/24 h
T1/2 = 3 d

Indications
1. Fever of unknown origin
2. Infection
3. IBD F/U
GA-67 SCAN

5 mCi
90, 190, 290, 390 keV
Medium Energy Collimator
Image 24 h, 48 h
T1/2 = 3 d

Indications

LISA

Lymphoma
Infection (Lung)(MAI)
Sarcoid
Abscess

INFECTION/INFLAMMATORY DDX

1. Lung-sarcoid
2. Lung-Pneumonitis
3. Abscess/Cellulitis/Osteomyelitis
TUMOR DDX
1. Lymphoma
2. HCC
3. Sarcoma
4. Melanoma
5. Testicular Carcinoma
   NB: No Uptake in KAPOSI
Neurological Imaging

BRAIN SCANNING

Tc99m HMPAO
Tc-99m ECD
20 mCi
140 keV
T1/2 = 6 h

Indications
1. Stroke–defect
2. Dementia
3. Epilepsy
4. Brain death
5. Tumor
   Tl-201 (will see Orbit uptake)
   a) Lymphoma (+) vs Toxo (–)
   b) Tumor (uptake) vs Necrosis (no uptake)
CSF

In-111 DTPA
500 uCi
174/247 keV

Indications

1. Dementia–NPH-immed/4 h/24/48 h
   - Early filling with reflux into ventricles abnormal (no normal reflux into ventricles)
   - Delayed clearance

2. CSF LEAK
3. CSF SHUNT

![Image of CSF shunt injection sites and imaging results]

- **Inj Site**: Injection site
- **RT Lat Immed**: Right lateral immediate
- **Ant Abd Immed**: Anterior abdominal immediate
- **RT Lat 20MIN**: Right lateral 20 minutes
- **Ant Abd 20MIN**: Anterior abdominal 20 minutes
Gastrointestinal Imaging

GALLBLADDER/LIVER

Tc-99M DISIDA
Tc-99m MEBROFENIN
5 mCi
NPO after midnight
Q5 min x 60 min, then Q1min/frame
All purpose collimator
T1/2 = 6 h

Evaluation
1. Does the patient have a gallbladder?
2. Prompt hepatic uptake? Peak uptake? Distribution?
3. Appropriate blood pool washout?
4. Prompt excretion into intra and extra hepatic ducts?
POTENTIAL SCENARIOS

1. **Bile Duct Obstruction**

   Normal state:
   - Uptake in liver: 5-10 min
   - CBD: 10 min
   - GB: 60 min
   - Intestinal: 60 min

   Any delay beyond this is indicative of obstruction

2. **Acute Cholecystitis**

   Augment study by giving:
   - Morphine 0.04 mg/kg
   - Sincalide 1–2 µg slow i.v. 30 min
   - Delay 4–6 h

3. **Biliary Atresia**
4. **Biliary Leak**

Cystic duct remnant
Choledochocoele
Bowel

5. **GB Ejection Fraction**

Sincalide 0.02 µg/kg
a. Dyskenesia
b. Normal = >30% at 30 min
LIVER/SPLEEN

Tc-99m Sulfur colloid
4 mCi
20 min after injection
All purpose
Planar images

GI BLEEDING

Tc-99m Sulfur colloid 8 mCi
Tc-99m Pertechnate labeled RBC 20 mCi
Q1 min/1 h
Requires active bleeding
GASTRIC EMPTYING

Tc-99m Sulfur colloid 0.5 mCi
Neuroendocrine Imaging

**I-123/I-131 MIBG SCAN**

- 5 mCi (I 123)
- 0.5-1mCi (I131)
- 24-h imaging
- 159/364 keV
- Low count images due to dose
- Normal uptake in bladder,
  - thyroid (if not blocked),
  - heart, stomach, liver, spleen
- No bone uptake
- Abnormal uptake in other regions
I-111 PENTRETOBRIDE/OCTREOTRIDE SCAN

Uptake in liver, spleen, and both kidneys
Whole body images obtained
5 mCi
24-h imaging
172/247 keV
Primarily used for carcinoid and endocrine tumors
Renal Imaging

RENAL SCAN

Tc-99m MAG 3: 5 mCi
Tc-99m DTPA: 15 mCi
Tc-99m DMSA: 5 mCi

**Indications**

<table>
<thead>
<tr>
<th>Nontransplant</th>
<th>Transplant</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Obstruction</td>
<td>Viability</td>
</tr>
<tr>
<td>2. Function</td>
<td></td>
</tr>
<tr>
<td>3. Hypertension</td>
<td></td>
</tr>
</tbody>
</table>

**Evaluation**

1. FLOW-Peak kidney uptake at 6 s equal to aortic uptake
2. FUNCTION
   a. Uptake
   b. Distribution
   c. Excretion (Prompt?)
   d. Symmetry
   e. Gradual washout
   f. Tracer in bladder

Lasix administration should cause 50% drop after 10 min

RADIONUCLIDE VCUG SCAN

Tc-99m DTPA: 10 mCi
Reflux:
   Grade I: Ureter
   Grade II: Collecting system
   Grade III: Severe
Musculoskeletal Imaging

SINGLE-PHASE BONE SCAN

Tc-99m-MDP: 10 mCi
3-h delay to allow soft tissue washout

HOT FOCI-INCREASE UPTAKE

- Metastatic disease
- Tumor
- Trauma
  - Insufficiency
  - Pathological
  - Trauma
- Pagets
- Arthritis
- Osteomyelitis
COLD FOCI: DECREASED UPTAKE

Myeloma

Renal cell/thyroid metastasis

Bone cysts
Infarcts/AVN
Hardware
Abscess
Artifact
SUPERSCAN

Metastatic disease
HPTH
Osteomalacia severe

LIVER UPTAKE

Metastatic
Previous radionuclide administration
Aluminum contamination
Amyloidosis
THREE-PHASE BONE SCAN

Indications

1. Reflex sympathetic dystrophy
   (flow at 2 mo normal, blood pool at 6 mo normal).
2. Infection
3. Neuropathic joint
Other

SENTINEL NODES SCAN

100 µCi filtered Tc-99m Sulfur colloid
Intradermal injections × 4
0.1 cc/injection
Flow images at 10 s/frame × 10 min
Co-57 transmission images are combined
IMAGE ALL BEDS: Chest, Abdo, etc...
2–5 nodes typical
PET

10 mCi F-18 FDG
T1/2 = 110 min
511 keV annihilation photons
Image at 1 h
Attenuation correction
8

Ultrasound

Includes ultrasound imaging and Doppler ultrasound of the head and neck, thorax, abdomen, pelvis, extremities, breast, scrotum, and the vascular system as well as ultrasound evaluation of the fetus pregnant uterus.
Note: Ultrasound is a different section than the other categories in that it is based on a modality rather than a subspecialty. Therefore, the cases are based on ultrasound findings rather than subspecialty entities. The following differentials are based on that principal.

**ULTRASOUND FINDINGS**

**ECHOGENIC**

Fat
Calcium—shadowing

Blood
RING DOWN OR COMET-TAIL

Cholesterol in the Rokitansky-Aschoff sinuses of gallbladder
Metal
Gastrointestinal Ultrasound

LIVER

SOLITARY LIVER MASS

- Hepatocellular carcinoma—Cirrhosis
- Adenoma—Woman on oral contraceptive
- Focal nodular hyperplasia—Central scar
- Cholangiocarcinoma—accompanying biliary ductal dilatation
- Pyogenic abscess—Complex cystic
- Focal sparing of fatty liver—Gallbladder fossa, portal bifurcation

MULTIFOCAL LIVER LESIONS

- Metastases
- Microabscesses—Candida
- Other abscesses—Pyogenic, Amebic (complex cystic)

HYPERECHOIC LIVER LESIONS

- Hemangioma—MRI for confirmation
- Focal fat—next to falciform ligament in anterior aspect of segment 4, portal bifurcation
- Metastases—Mucinous such as colon or ovarian
- Any other primary liver tumor
MULTIPLE CALCIFIED HEPATIC MASSES

- Stones
- Histoplasmosis
- PCP

COMPLEX CYSTIC MASS

- Infection
- Abscess—pyogenic or amebic
- Echinococcus
- Tumor
- Cystic metastases—ovarian
- Biliary cystadenoma
- Hemorrhagic mass—e.g., adenoma (solitary)
- Necrotic metastases—sarcoma
- Trauma
- Hematoma (solitary)
- Biloma (solitary)
MULTIPLE SIMPLE CYSTS

Cysts
Carolí’s

DIFFUSE INHOMOGENEOUS LIVER ECHOTEXTURE

Cirrhosis—ascites, surface nodularity
Metastases
Fatty infiltration—loss of portal triad hyperechogenicity
Lymphoma
Kaposi in immunocompromised
GALLBLADDER

SMALL INTRALUMINAL GALLBLADDER LESIONS

Stones—shadow, mobile

Cholesterol polyps—No shadow, not mobile

Cholesterol crystals—ring-down, not dependent
GALLBLADDER MASSES

Polyp—<1 cm
Tumefactive sludge—mobile
Focal adenomyomatosis
Chronic cholecystitis
Gallbladder carcinoma
Metastases—melanoma
GALLBLADDER WALL THICKENING (MANY CAUSES)

Biliary—cholecystitis, adenomyomatosis, AIDS cholangitis
Edema—hypoproteinemia (cirrhosis, nephrotic syndrome), congestive heart failure
Hepatitis
SHADOWING IN THE GALLBLADDER FOSSA

WES of stones
Porcelain gallbladder—must be removed because of increase risk of carcinoma
Emphysematous cholecystitis
BILIARY DUCTS

CYSTIC STRUCTURE IN REGION OF CBD

Choledochal cyst
Duodenal duplication
Mesenteric cyst
Pancreatic pseudocyst
BILIARY DUCTAL WALL THICKENING

Cholangitis
  Sclerosing—also see strictures
  AIDS cholangiopathy—looks exactly like sclerosing cholangitis
  Oriental cholangiohepatitis—stones
  Ascending
Cholangiocarcinoma
Pancreatitis

INTRAHEPATIC BILIARY DUCTAL DILATATION

Stone
Benign stricture—chronic pancreatitis
Pancreatic head mass
Klatskin tumor
PANCREAS

SOLID PANCREATIC MASS

- Adenocarcinoma
- Focal pancreatitis—calcifications
- Lymphoma
- Metastasis
- Islet cell tumor
- Peripancreatic lymph node

CYSTIC PANCREATIC MASS

- Pseudocyst
- Macrocystic = mucinous cystadenoma/ carcinoma (middle-aged women)
- Microcystic = serous cystadenoma (middle-aged women)
- Solid and papillary epithelial neoplasm (young women)
- IPMT—dilated side branches, 85% malignant
- Aneurysm or pseudoaneurysm (pancreatitis)
CYST ADJACENT TO MEDIAL ASPECT OF SPLEEN

- Pancreatic pseudocyst
- Renal cyst
SPLEEN

CYSTIC SPLENIC MASS

- Pseudocyst—acquired from prior trauma or infarct; most common
- Epidermoid cyst—congenital
- Lymphangioma
- Hematoma
- Abscess
**SOLID SPLENIC MASS**

- Hemangioma—hyperechoic
- Lymphoma—may be multiple
- Infarct—wedge shaped
- Abscess—Candida gives multiple microabscesses
- Sarcoidosis—multiple

**SPLENOMEGALY**

- Portal hypertension
- Splenic vein thrombosis
- Leukemia/lymphoma
- Mononucleosis
- Glycogen storage disease
- Myelofibrosis
THYROID

THYROID MASS

CATCH

- Carcinoma—microcalcifications
- Adenoma
- Thyroiditis
- Colloid Cyst
- Hyperplasia (Parathyroid gland)
Genitourinary Ultrasound

KIDNEY

HYDRONEPHROSIS

- Obstruction
- Reflux
- Active diuresis
- Congenital megacalyces

RI > 0.7

- Acute tubular necrosis
- Renal vein thrombosis
- Obstruction
- Complication in transplanted kidney = rejection, perinephric collection, cyclosporin toxicity
MEDULLARY NEPHROCALCINOSIS

Renal tubular acidosis
Medullary sponge kidney
Hyperparathyroidism

CORTICAL NEPHROCALCINOSIS

Chronic glomerulonephritis
Healed pyelonephritis
XGP
TB
PAPILLARY NECROSIS

NSAID

- NSAID
- Sickle cell
- Analgesics
- Infection (TB)
- Diabetes
CYSTIC STRUCTURES ADJACENT TO RENAL HILUM

Hydronephrosis
Peripelvic cysts
Papillary necrosis
Dilated renal vein

BILATERAL MULTIPLE RENAL CYSTS

Acquired cystic disease of dialysis—small kidneys, increased risk of RCC
ADPKD—enlarged kidneys, liver cysts, berry aneurysms
Von-Hippel Lindau—pancreatic cysts, increased risk of RCC, CNS hemangioblastomas, pheos
Tuberous sclerosis in kids—AMLs, cortical tubers, giant cell astrocytomas, periventricular nodules, cardiac rhabdomyomas, pulmonary LAM
Chapter 8 / Ultrasound

HYPERECHOIC RENAL MASS

Stone (shadow)
AML
RCC
Lobar nephronia

ECHOGENIC KIDNEYS

GLAD

Glomerulonephritis
Lupus
AIDS
Diabetes
SOLID RENAL MASS

Tumor
RCC
Lymphoma or mets—multiple
AML—hyperechoic
Oncocytoma—central scar

Lobar nephronia
Hypertrophic column of Bertin—extend into renal sinus
Focal parenchymal hypertrophy in atrophic kidney

COMPLEX CYSTIC RENAL MASS

Tumor—RCC, multilocular cystic nephroma
Hemorrhage into cyst
Abscess—fever
Hematoma—biopsy, trauma
Hemorrhage into mass—e.g., AML
ENLARGED KIDNEY WITH LOSS OF CORTICO-MEDULLARY ARCHITECTURE

- Infection
- Renal vein thrombosis
- Rejection, ATN, or cyclosporin toxicity in renal Tx
- Lymphoma
SHADOWING FOCI ADJACENT TO RENAL HILUM

Stone
Renal artery calcification
ECHOGENIC MATERIAL IN COLLECTING SYSTEM

Stone
Clot
TCC
Pus
Fungus ball
FLUID COLLECTION AROUND TRANSPLANTED KIDNEY

Hematoma
Lymphocele
Urinoma—usually originate from ureteric implantation site into bladder
Abscess
BLADDER

THICKENED BLADDER WALL

- Bladder outlet obstruction
- Posterior urethral valves
- Prostatic hypertrophy
- Neurogenic bladder
TESTIS + PROSTATE

INTRATESTICULAR MASS

Tumor—Palpable
  Primary malignant—seminoma, germ cell tumor
  Primary benign—Leydig and Sertoli cell
  Metastasis—lymphoma
Infection—Nonpalpable
  Focal orchitis
  Abscess
  Hematoma
DIFFUSELY ENLARGED HYPOECHOIC TESTIS

- Torsion—decreased flow
- Orchitis
- Tumor—lymphoma, seminoma

HYPERECHOIC FOCI

- Testicular microlithiasis
- Microcalcifications in undescended testis
- Kleinfelter’s Syndrome
- Sarcoid
EPIDIDYMAL MASS

- Focal epididymitis
- Sperm cell granuloma—post-vasectomy
- Benign adenomatoid tumor

HYPOECHOIC PROSTATIC NODULE

- Malignant-Ca
- Benign—prostatitis, BPH, infarct
Obstetrical Ultrasound

UTERUS

EXTRAUTERINE MASS WITH $\beta$HCG = ectopic
COMPLEX INTRAUTERINE MASS WITH + βHCG

Molar pregnancy
Failed pregnancy with retained products of conception
Decidual reaction of ectopic
GESTATION

EMPTY GESTATIONAL SAC IN FIRST TRIMESTER

- Normal IUP <5 wk
- Ectopic with pseudogestational sac
- Failed pregnancy—blighted ovum; missed abortion
- 1000 u/5.0 wk—GS
- >1000 u/5.5 wk—GS + YS
- 10,000+ u/6.0 wk—GS + YS + EMBRYO

OLIGOHYDRAMNIOS

- GU anomalies—e.g., renal agenesis; obstruction
- Spontaneous rupture of membranes—third trimester
- Fetal demise >5 d
POLYHYDRAMNIOS

Idiopathic
Maternal diabetes
CNS or GI anomalies that inhibit swallowing
Hydrops
IUGR

Placental insufficiency—hypothesis, diabetes
Smoking, drug abuse
Chromosomal anomalies
HYDROPS

Immune (rare now with RhoGam)
Cardiovascular—arrhythmia, anatomic anomalies
Chromosomal anomalies—karyotype
TORCH infections—titers
Anemias—umbilical cord sampling
High output failure—sacrococcygeal teratoma; chorioangioma
Twin-to-twin transfusion syndrome

CNS + FACE

FLUID-FILLED SKULL

Hydrocephalus (mantle of cortex)
Hydranencephaly (irregular hyperechoic areas of tissue)
THICKENED NUCHAL FOLD

First 11–14 wk 3 MM (IN–IN)
Second 15–20 wk 6 MM (OUT–OUT)
Trisomy 21
Turners
CYSTIC STRUCTURE ADJACENT TO SKULL

Cystic hygroma
Encephalocele or myelomenigocele—calvarial defect; signs of open neural tube defect
Teratoma
CYSTIC HYGROMA

Chromosomes—Turner’s, Trisomy 21
Lymphangiectasia
Hydrops
AGENESIS OF THE CORPUS CALLOSUM/SEPTUM PELLUCIDUM

Intrahemispheric cyst
- Colpocephaly
- Absent cavum
Dandy Walker
Chiari
Trisomy 13, 18
VENTRICULOMEGALY

TORCH
Chromosomal—Trisomy 21
Intracranial bleed
Dandy-Walker, Chiari
Aqueductal stenosis

CYSTIC STRUCTURE IN POSTERIOR FOSSA

Normal before 8 wk
Dandy-Walker malformation or variant
Mega cisterna magna
Arachnoid cyst
INTRACRANIAL CYSTIC STRUCTURE

Arachnoid cyst
Porencephalic cyst
HYPOTELORISM

- Holoprosencephaly
- Trisomy 13
- Maternal phenylketonuria

HYPERTELORISM

- Frontal encephalocele
- Cleft lip sequence
- Apert syndrome
CLEFT LIP AND PALATE

Chromosomal—trisomy 13
Teratogen—fetal alcohol
Holoprosencephaly
MASS POSTERIOR TO THE SACRAL SPINE

Sacroccygeal teratoma
Myelomeningocele (spinal dysraphism with banana and lemon signs)
PRESACRAL SOFT TISSUE MASS

Sacroccygeal teratoma
Anterior myelomeningocele
Chordoma
CHEST

CYSTIC MASS IN THE CHEST

CCAM I or II
Diaphragmatic hernia
Bronchopulmonary foregut malformation,
  e.g., bronchogenic cyst, esophageal duplication
Teratoma
SOLID MASS IN THE CHEST

- Pulmonary sequestration
- CCAM III
- Morgagni diaphragmatic hernia (liver herniation)
PLEURAL EFFUSION

Hydrops—bilateral
Chylous—unilateral
ABDOMEN

ANTERIOR ABDOMINAL WALL DEFECT

Normal prior to 12 wk
Omphalocele—covered by membrane; associated with structural and chromosomal anomalies
Gastroschisis—free-floating bowel; no associated anomalies
Bladder or cloacal extrophy = omphalocele, imperforate anus, myelomeningocele
Amniotic bands
Pentalogy of Cantrell—ecotopia cordis; omphalocele
Limb–body wall complex—neural tube defect, limb anomalies, short straight umbilical cord
Beckwith-Wiedemann = omphalocele, macroglossia, visceromegaly
CALCIFICATIONS IN ABDOMEN

- Meconium peritonitis
- TORCH
- Calcified teratoma
- Echogenic bowel (no shadowing)
MECONIUM PERITONITIS—CALCIFICATIONS; CALCIFIED PSEUDOCYST

Normal
Distal obstruction
— atresia, volvulus, polyhydramnios
Cystic fibrosis—meconium ileus
ABSENT STOMACH BUBBLE

- Esophageal
- Diaphragmatic hernia
- CNS anomaly causing absence of swallowing
- Oligohydramnios

DOUBLE BUBBLE

- Duodenal atresia—Trisomy 21
- Annular pancreas
- Malrotation with midgut volvulus
- Choledochal cyst
CYSTIC STRUCTURE IN ABDOMEN AND PELVIS WITH NORMAL STOMACH BUBBLE

Renal cysts, hydroureter, urinoma
Bladder
Bowel duplication
Ovarian cyst
Mesenteric cyst
Urachal cyst
Teratoma
LIVER

CALCIFICATIONS IN LIVER

Incidental
TORCH—esp. CMV or Toxoplasmosis
BOWEL

ECHOGENIC BOWEL: FOLLOW-UP IMAGING RECOMMENDED

- Cystic fibrosis
- Chromosomal—Trisomy 21
- CMV
- Intragut bleed

FETAL ASCITES

FLUIDS:
- Blood—hemoperitoneum
- Urine—collecting system
- Bowel—meconium peritonitis
- General—hydrops
- Serous fluid—ruptured ovarian cyst
KIDNEYS

RENAL CYSTIC STRUCTURES

Multicystic dysplastic kidney
Severe hydronephrosis

ECHOCGENIC KIDNEYS

Small—obstructive renal dysplasia
Large—APCKD, Meckel-Gruber
DILATED COLLECTING SYSTEMS AND BLADDER

- Bilateral hydronephrosis
- Posterior urethral valves
- Reflux
- Bilateral UPJ or UVJ

Obstruction, e.g., posterior urethral valves
Prune belly
Megacystitis microcolon hypoperistalsis intestinalis—polyhydramnios and intestinal obstruction
LIMBS

ABSENT RADIAL RAY

VATER
Trisomy 18
Fanconi’s anemia
Holt-Oram syndrome—cardiac anomalies
Amniotic bands

POLYDACTYLY

Familial
Trisomy 13
Meckel Gruber—encephalocele, polycystic kidneys
SHORT LIMBS

Trisomy 21
Dwarfs—thanataphoric dwarf, achondrogenesis
Amniotic bands—asymmetric shortening
CLUBFOOT

Idiopathic
Oligohydramnios
Trisomy 18
Amniotic bands
PLACENTA + CORD

TWO-VEssel CORD

Renal anomalies
Cardiac anomalies
Trisomies 13 & 18

PLACENTA AT MARGIN OF INTERNAL CERVICAL OS

Marginal previa
Full bladder
Normal until 36 wk
Chapter 8 / Ultrasound

**RETROPLACENTAL COLLECTION**

- Placental abruption
- Vascular complex
- Uterine contraction
- Fibroid

![Image of retroplacental collection with ultrasound scan]

**PLACENTAL MASS**

- Chorangioma
- Uterine contraction—NO FLOW
- Fibroid—NO FLOW
- Mole
- Hydrops
- Infection
- Abruption

![Images of placental mass with ultrasound scans]
HETEROGENEOUS MASS CONTIGUOUS WITH PLACENTA; FETUS PRESENT

Partial mole
Partial hydropic placenta
Loculated placental abruption
Chorioangioma
UTERUS + OVARIAS + OTHER

MYOMETRIAL MASS DURING PREGNANCY

- Uterine contraction
- Fibroid
- Cornual ectopic pregnancy
- Extrauterine mass—adnexal, ovaries, bowel
MULTICYSTIC ENLARGED OVARY = THECA LUTEAN CYSTS

- Gestational trophoblastic disease
- Twins
- Rh incompatibility

TWO SACS IN FIRST TRIMESTER

- Twins (vanishing twin)
- Subchorionic hematoma
- Implantation bleed
- Necrotic fibroid
MEMBRANE ACROSS GESTATIONAL SAC DURING SECOND AND THIRD TRIMESTER

Twins
Amniotic sheet
Circumvallate placenta
OLIGOHYDRAMNIOS

DRIPS
Demise
Renal
IUGR
PROM
PoStdates

POLYHYDRAMNIOS

TARDI
Twins
Anomalies (fetal): esophageal atresia, duodenal/proximal small bowel obstruction, omphalocele, non-immune hydrops, anencephaly, hydranencephaly, holoprosen cephaly, myelomeningocele, ventriculomegaly, agenesis of CC, encephalocele, microcephaly, diaphragmatic hernia, CCAM, tracheal atresia, extralobar sequestration, trisomy (13,18,21)
Rh incompatibility
Idiopathic (60%)—associated with macrosomia
CHROMOSOMAL ABNORMALITY SYNDROMES

TRISOMY 13

CNS—holoprosencephaly, facial clefts
GI/GU—omphalocele, renal cystic dysplasia
MSK—polydactyly
TRISOMY 18

CNS—microcephaly, choroid plexus cysts, micrognathia, brachycephaly
GI/GU—omphalocele, diaphragmatic hernia
MSK—club foot, absent radial ray, clenched hands
Other—early symmetric IUGR, cord cyst
TRISOMY 21

CNS—nuchal fold thickening, cystic hygroma
Cardiac—endocardial cushion defect, echogenic intracardiac focus
GI/GU—duodenal atresia, echogenic bowel, renal pelviectasis
MSK—short femur and humerus, widened iliac angle, clinodactyly fifth finger
MECKEL GRUBER

Cystic kidneys = ARPCKD
Encephalocele
Polydactyly
TURNER’S

Cystic hygroma
Nuchal fold thickening
Coarctation of aorta
TRIPLOIDY

Asymmetric IUGR (large head, small body)
Molar placenta
GYNECOLOGICAL ULTRASOUND

_Uterus_

**INTRAUTERINE COLLECTION**
- Retained products of conception—premenopausal
- Pseudogestational sac—+βHCG
- Cervical stenosis—postmenopausal
- Cervical carcinoma—postmenopausal
- Endometrial carcinoma—postmenopausal
GAS IN THE ENDOMETRIAL CAVITY

- Endometritis with pyometria
- Normal up to 4 wk postpartum
MULTIPLE SMALL HYPOECHOIC MASSES IN THE MYOMETRIUM

Adenomyosis
Multiple fibroids
EXTRAUTERINE COMPLEX CYSTIC MASS—DDX DEPENDS ON HISTORY, AGE, ASYMPTOMATIC, PAIN, FEVER, TRAUMA

- Hemorrhagic cyst—resolve when rescan in 6 wk
- Endometrioma
- Teratoma
- Ovarian carcinoma—more likely in postmenopausal
- Ovarian torsion—pain
- Tubo-ovarian abscess
- Bowel abscess—appendicitis, diverticulitis
- Hematoma—posttraumatic
EXTRAUTERINE SOLID MASS

- Pedunculated fibroid
- Endometrioma and hemorrhagic cyst
- Teratoma
- Ovarian torsion—pain
- Fibrothecoma—ovarian
- Dysgerminoma—ovarian
- Ovarian metastasis, e.g., Krukenberg’s tumor
OVARY

OVARIAN MASS

CHEETAH

Cyst
Hemorrhagic
Endometrioma
Epidermoid/Dermoid
Torsion
Abscess
VERY LARGE CYSTIC MASS WITH THIN SEPARATIONS

Ovarian neoplasm either benign (young) or malignant (old)
Loculated ascites—previous surgery or hemoperitoneum
Lymphangioma—previous surgery
MULTICYSTIC ENLARGED OVARY

- Ovarian neoplasms—cystadenoma or cystadenocarcinoma
- Ovarian torsion (pain)
- Theca lutean cyst—+$\beta$HCG (bilateral)
- Ovarian hyperstimulation—on Clomid (bilateral)

CALCIFIED PELVIC MASS

- Fibroid
- Dermoid
- Ovarian neoplasm
ACUTE LOWER ABDOMEN

Torsion
Hemorrhage into ovarian cyst or endometrioma
Abscess—tuboovarian or bowel
Red degeneration of fibroid (during pregnancy)
Appendicitis
ASCITES WITH INTRAPERITONEAL IMPLANTS

- Ovarian carcinoma
- Colon, pancreatic or stomach carcinoma
- TB
PEDIATRIC ULTRASOUND

CHILD WITH SOLID PELVIC MASS

Lymphoma
Malignant germ cell tumor—dysgerminoma
Sarcoma—bladder or vagina
Neuroblastoma
MEDULLARY NEPHROCALCINOSIS

Lasix
Renal tubular acidosis
Tamm Horsfall proteins—rapidly resolve

PELVIC FLUID COLLECTION IN PREMENSES GIRL

Hematometra—cevical dysgenesis, vaginal agenesis
Hematocolpos—imperforate hymen, transverse vaginal septum
DOPPLER ULTRASOUND

DISCUSSIONS SHOULD INCLUDE:

1. Pulse (velocity)
2. Color (direction)
3. Power (flow)

VARIABLES INCLUDE:

1. Doppler gain
2. Doppler scale
3. Wall filters
4. Color gain
5. Color scale
6. Color priority
Pediatrics

Includes imaging procedures for the diagnosis of diseases in infants and children, such as plain film radiography, contrast medium studies, ultrasound, nuclear radiology, computed tomography, digital radiography, angiography, interventional techniques, magnetic resonance imaging, and congenital heart disease.

Chest

**APPROACH TO THE PEDIATRIC CHEST XRAY**

Look at the HEART Size

| Enlarged with CHF | Normal |

This is a CARDIAC CASE

Think of source:
1. Intracardiac Problem – See CV section
2. Extracardiac Problem - AVM (Get a Head US (vein of galen) or a liver US (hemangiendothelioma)

This is a PULMONARY CASE

Look at position of the Mediastinum

| NO SHIFT | SHIFT |

NEWBORN
- >30 D BPD

PREMIE

TERM

- HMD (No Effusion)
- Pneumonia (Effusion)
- TTN (NO ETT)
- EDEMA
- MECONIUM
- HYPOPLASIA (WHITE OUT)
- PNEUMONIA

- CLE
- CCAM
- CDH
- Tension PTX
- Pulmonary Agenesis

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EDEMA

EITHER:
1. CLE

2. BPD

3. CAM

4. CDH
TENSION PTX

PULMONARY AGENESIS/HYPOPLASIA WHITE OUT

HMD (LLV NO EFF)

TTN (NO ETT)

PNEUMONIA (EFFUSION)
EDEMA (OBST)

MECONIUM

BELL-SHAPED THORAX

Lung Hypoplasia
Abn Muscle/Bone—Dysplasia, Syndrome (JEUNE)
Nervous System—Tri 21, Paralysis

UPPER AIRWAY

Hemangioma
Tracheitis (membranous croup)
Chapter 9 / Pediatrics

Retropharyngeal abscess

Epiglotitis

Croup
PULMONARY MASS

RAP’N FOREGUT

Round pneumonia
Abscess
Pseudotumor
Neoplasm (RARE) hamartoma, blastoma
Foregut malformations

BRONCHOPULMONARY FOREGUT MALFORMATIONS

Congenital lobar emphysema
CCAM
Sequestration
Bronchogenic cyst
CHEST WALL MASS

RENAL Mets

- Rhabdomyosacroma
- Ewings
- Neuroblastoma
- Askin tumor/PNET
- Lymphoma Mets
GI/GU

STOMACH

- HPS
- Spasm
- Antral web

DUODENUM

- Annular pancreas
- Hematoma
- Preportal Duodenum
- Duodenal Stenosis
Chapter 9 / Pediatrics

DOUBLE BUBBLE

- Duodenum
- Annular pancreas
- Volvulus
- Ladds bands

SMALL BOWEL OBSTRUCTION

AA II MM

- Adhesion
Appendicitis

Inguinal Hernia

Intussusception

Malortation with volvulus
MICROCOLON

EVALUATE LEVEL OF DISEASE FROM LEVEL OF OBSTRUCTION:

RECTUM → SIGMOID → LEFT COLON → RIGHT COLON → TERMINAL ILEUM

Microcolon secondary to proximal atresia

Meckels/misc

Hirschprungs (rectum)

Meconium plug/Small left colon syndrome (left colon)

Colonic atresia (entire colon)
Ileal Atresia (entire colon)
Meconium ileus
Jejunal atresia
MgSO4
Infant of a diabetic mother
HYDRONEPHROSIS

UPJ

Reflux

Posterior urethral valves

Ectopic ureterocele
Prune belly

Primary megaureter
MCDK
RENEWAL CYSTIC DISEASE

MCDK
Juvenile nephronophthisis
APCKD
ARPCKD
Glomerulocystic disease
Obstructive lesions
NUCS CAN DIFFERENTIATE FCN/Non FCN

RENEWAL MASS

Wilms—(chest mets) (>1 yr)

Rhabdoid—(brain mets) (1 yr)

Clear cell sarcoma—(bone mets) (1 yr)
Mesoblastic nephroma

Multilocular cystic nephroma
RCC (>3 yr)
Renal medullary carcinoma (sickle cell disease)
Pyelonephritis
BILATERAL RENAL MASSES

Nephroblastomatosis

Pyelonephritis

Lymphoma/mets

Infarcts
Cysts
BILATERAL ENLARGED KIDNEYS

Bilateral hydronephrosis

Glomerulonephritis
ARPCKD

ADPKD

Bilateral renal vein thrombosis

Nephroblastomatosis
Beckwith Weidemann
ADRENAL MASS

NAP

Neuroblastoma

Adrenal hemorrhage/Adrenal cortical carcinoma

Pheochromocytoma
BLADDER MASS

FUR

Fibroepithelial polyp
Ureterocele

Rhabdomyosarcoma
ABDOMINAL CALCIFICATION

L-M-N

Liver
Meconium peritonitis
Neuroblastoma

LIVER MASS

NEWBORN

Infantile hemangioma (solid)

Hepatoblastoma (solid)
Embryonal cell sarcoma (mixed)

1 YR

Mesenchymal hamartoma (cystic)
>3 YR

Hepatocellular carcinoma (variable)

CYSTIC ABDOMINAL MASS

ECHO™

Enteric duplication
Choledochal cyst/mesenteric cyst
Hydrocolpos

Ovarian cyst
Teratoma
Meconium pseudocyst
Musculoskeletal

MULTIPLE FRACTURES

SHOT

- Scurvy
- Hypophosphatasia
- OI
- Trauma

DIFFUSE PERIOSTEAL REACTION

SCALPR

- Scurvy/infection
- Caffey
- Accidental trauma
- Leukemia
- PGE2
- Rickets
ATLANTOAXIAL WIDENING
Downs
JRA
Morquio
Trauma

PLATYSPONDYLY
MODIC
Morquio
Osteogenesis imperfecta
Dwarf (thanatophoric)
Cushing’s syndrome
POST VB SCALLOPING

SALMON

Spinal cord tumor
Achondroplasia
Mucopolysaccharidosis
Osteogenesis imperfecta
Neurofibromatosis

SKULL

1. SCAPHOCEPHALY = DOLICOCEPHALY

Premature closure of sagittal suture (long skull)
2. BRACHYCEPHALY = TURRICEPHALY
   Premature closure of coronal/lambdoid sutures (short tall skull)

3. PLAGIOCEPHALY
   Unilateral early fusion of coronal/lambdoidal suture (lopsided skull)

4. TRIGONOCEPHALY
   Premature closure of metopic suture (forward pointing skull)
5. OXYCEPHALY

Premature closure of coronal, sagittal, lambdoid sutures

6. CLOVERLEAF SKULL = KLEEBLATTSCHEDEL

Intrauterine premature closure of sagittal, coronal, lambdoid sutures

TIBIAL BOWING

FONAR

Fibrous dysplasia
Osteogenesis imperfecta
Neurofibromatosis
Achrondroplasia
Rickets
SACRAL MASS

KIDS WITH SACRAL MASSES RANT

Rectal duplication cyst
Anterior meningocele
Neuroblastoma
Teratoma

KNEE

POSSIBLE CASES:

Trauma
JRA
Hemophilia
TB/infection
Trevor’s disease
HIP

POSSIBLE CASES

Septic effusion
Toxic synovitis

Congenital dysplasia hip (neonate/infant)

Legg Calve Perthes (school age)

Slipped capital femoral epiphysis (adolescent)
FRAGMENTED EPIPHYSIS

TWILL

Trauma
Warfarin
Infection
Legg Calve Perthes
Leg dysplasia

RADIAL RAY

TAR
Holt Oram
Fanconi’s anemia
Poland
POLYDACTYLY

Familial
Trisomy 13
Lawrence-Moon-Bardet-Biedel

ABUSE
VIEWS:
   AP/LAT Axial skeleton: skull, spine, sternum
   AP: Appendicular skeleton

HIGH SPECIFICITY
   Spinous process
   Sternum
   Scapula
   Post Rib

INTERMEDIATE SPECIFICITY
   Multiple fractures in various stages of healing
   Hand/wrist injury
   C-Spine

LOW SPECIFICITY
   Midshaft fractures
   Nonspiral fractures
10

BREAST

1. PARENCHYMAL PATTERN ASSESSMENT

1. The breast is almost entirely fat.
2. There are scattered fibroglandular densities.
3. The breast tissue is heterogeneously dense, which may lower sensitivity of mammography.
4. The breast tissue is extremely dense, which could obscure a lesion on mammography.

2. MASSES ASSESSMENT

ROLIA AND COMIS

- Round
- Oval
- Lobulated
- Irregular
- Architectural distortion
- Circumscribed
- Obscured
- Microlobulated
- Indistinct
- Spiculated

3. WORKUP NONPALP MASS

1. MAG VIEWS
2. RO (Round or Oval) 75% well circumscribed, not new, not bigger, not palpable — 6 mo follow-up PB
3. Others:
   - US — CYST
   - Simple — STOP
   - Complex — ASPIRATE

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4. **LI** (lobulated or irregular) BX
5. A, Architect distortion
   —PRIOR SX? Yes—could be CA, scar, radial scar, overlap

If palp—same except US if negative mammo
Dec to bx if both negative—up to clinician

**TRABECULAR THICKENING**

Inflammatory carcinoma
Mastitis
Radiation
Lymphadema/CHF

*Punch BX*

**ARCHITECTURAL DISTORTION**

Carcinoma
Radial scar
Post Sx
Fat necrosis
Abscess

*HX SURGERY*
CIRCUMSCRIBED MASS

- Cyst
- Fibroadenoma
- Cancer
- Other—phylloid/met/hematoma

MULTIPLE MASSES

- Cysts
- Fibroadenomas
- Mets—melanoma/lymphoma/lung
  - No HX malig 1 yr follow-up
  - Hx malig

US

- solid
- cyst

Bx 1 yr f/u
FAT CONTAINING LESION

- Hamartoma
- Galactocele
- Lipoma
- Oil cyst

DEVELOPING DENSITY

- Carcinoma
- HRT
- Lymphoma
- Hematoma
CALCIFICATIONS

1. Identify
2. 90° VIEW to R/O MILK of calcium
3. BENIGN—STOP
   a. Vascular
   b. Popcorn
   c. Large Rods
   d. Lucent center
   e. Eggshell
   f. Suture
   g. Dystrophic
4. MALIGNANT—BX
5. Cluster round probably benign—6 mo follow-up

INDETERMINATE CALCS

DCIS
Fibrocytic change, Sclerosing adenosis
Fat necrosis
SPECIAL

TUBULAR DENSITY/DUCT
Nipple D/C → Serous/Bloody → US/Galactogram
Asymptomatic → STOP

INTRAMAMMARY LYMPH NODE
Lateral outer → Mag view fatty hilum → STOP

ASYMMETRIC BREAST TISSUE
1. No calc.
2. No mass.
3. No central density.
4. No distorted architecture.
FOCAL ASYMMETRIC DENSITY

? LOBULAR CARCINOMA

A. SIMILAR SHAPE ON TWO VIEWS.

B. CANNOT BE DESCRIBED WITH “ROLIA” AND “COMIS” (see p. 305)
   1. No borders, convex outward.
   2. No conspicuity of a true mass, changes on two views.
   3. Variable density.

C. MAG-ISLAND OF NORMAL BREAST TISSUE WILL RESOLVE
   If does not resolve.

D. ULTRASOUND

   ABN       NORMAL
   ↓         ↓
   BX       consider HORMONE TX, If yes STOP for 3 mo. Repeat if no FOLLOW or BX (new/increasing).
ULTRASOUND

1. Skin
2. Superficial Fascia—Superf and Deep
   a. Fat b/w the skin and superfic
   b. Coopers b/w two layers
3. Mammary Gland
4. Retromammary Space (post to deep layer of the superficial fascia)
5. Pec Major/minor
6. Rib

CYSTS

SIMPLE

1. Completely anechoic
2. Smooth walls
3. Sharp ant and post borders
4. Post-acoustic enhancement

COMPLEX

1. Abscess
2. Debris
3. Intracystic tumor (papilloma, papillary carcinoma)
4. Fat necrosis
MASSES

THRU TRANSMIT

1. Fibroadenoma
2. Medullary carcinoma
3. Papillary carcinoma
4. Metastatic lymphoma
MALIGNANT MASS

1. Spiculation
2. Taller than wide
3. Angular margins
4. Hypoechoic to fat
5. Shadow
6. Duct extension
7. Microlobulation
BENIGN MASS

1. No malignant features
2. Intense, uniform echog
3. Ellipsoid plus capsule
4. Three or fewer gentle lobulations

INDETERMINATE
Stereotactic Biopsies

CONTRAINDICATIONS

1. Breast doesn’t compress
2. Cant get to lesion
3. Radial Scar/Arch distortion
4. Patient cannot lie prone
Neuroradiology

Includes plain film diagnosis of the skull, sinuses, mastoids, spine and head, and neck structures, and all other imaging and special procedures related to the central nervous system and head and neck including angiography, myelography, interventional techniques, and magnetic resonance imaging.

IN GENERAL, EVERY CASE WILL FALL INTO:

1. Tumor
2. Infarct (arterial or venous)
3. Infection
4. Vascular
5. Congenital
6. Inflammatory

EVERY CASE TO PREVENT FAILING THE SECTION:

1. IS IT VASCULAR?
2. IS THERE HERNIATION?
White Matter

Demyelinating

Cortical

Late Video

- Lymphoma
- ADEM
- Trauma
- Elderly-nonspecific periventricular
- Vasculitis
- Infections HIV/Herpes/PML
- Demyelinating
- Eclampsia
- Other—Radiation Tx
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Brainstem

Central Pontine Myelinolysis
DYSMYELINATING

LACK OF Proper Myelination

Leigh (Leigh’s PUTATO chips)
— Putamen, periventricular, subcortical
Adrenoleukodystrophy—Posterior
Alexander—Big head, Frontal
Canavan—Big Head, Subcortical
Krabbe—Thalami
Pelizaeus Merzbacher—Diffuse
Metachromic Leuko—Cerebellar+BG
ATROPHY

CORTICAL

- Senile dementia Alzheimer’s type
- Ischemic/Vascular
- Picks

BASAL GANGLIA/OTHER

- Parkinson’s

MULTIPLE MASSES

MAILMAN

- Metastasis
- Angiomas—Vascular malformations
- Infarction/infection
- Lymphoma
- Multiple sclerosis
- Abscesses
- NF spots (remember the esoteric diagnoses)
EXTRA AXIAL MASS

MAD SALE

Mengioma
Abscess
Dural metastasis—prostate/breast

Sarcoidosis
Abscess/AVM
Lymphoma
Epidermoid/dermoid
INTRA-AXIAL

Supratentorial

CHILD

TAPE

Teratoma
Astrocytoma
PNET
Ependymoma

ADULT

WHITE MATTER

OLD MAN

Oligodendroglioma
Lymphoma
Dermoid
Metastasis
Astrocytoma
Neuronal tumors
INFECTION
CORTICAL

TIGER TIM

Trauma
Infarct
Gangliogioma/glioma
Encephalitis
Radiation
Tubers
Infection—toxoplasmosis
Metastasis
Infratentorial

CHILD

*Cerebellum*

- Medulloblastoma—(precontrast hyperintense)
- Ependymoma—(Ca²⁺)(cystic)
- JPA
- Mets
- Choroid plexus papilloma

*Brainstem*

- Brainstem glioma+tectal glioma
ADULT

Cerebellum

Mets
Hemangioblastoma
Astrocytoma
Choroid plexus C/P
Lymphoma

Brainstem

Tumor
Metastasis
Brainstem Glioma

Infection
Tb
Abscess

Inflammatory/Vascular
Cavernoma/AVM
Infarct

Demyelinating
TEMPORAL LOBE

- Tumor: Ganglioglioma
- Infection: Herpes
- Vascular: Transverse sinus thrombosis/infarct

CALCIFIED TUMORS

OLD ELEPHANTS AGE GRACEFULLY AND LIKE PEANUTS

- Oligo
- Ependymoma
- Astrocytoma
- GBM
- PNET
SELLAR

PC OR MAC?

Pituitary adenoma/apoplexy
Craniopharyngioma
Mets/meningioma
Abscess/Aneurysm
Cysts—Rathke’s cleft
SUPRASELLAR

SATCHMOE

Sarcoid
Aneurysm
Teratoma/germinoma
Craniopharyngioma
Hamartoma of the tuber cinereum
Meningioma/mets
Optic glioma
EG

PARASELLAR MASS

MCAT

Meningioma/metastasis
Cavernous carotid fistula
Aneurysm
Trigeminal Schwannoma/Tolosa-Hunt
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INFUNDIBULAR MASS

MEET GIRLS

- Metastasis
- Eosinophilic granuloma
- Germinoma/germ cell tumors
- Infection/inflammation (hypophysitis)
- DuRal—(think of dural-based conditions)
- Lymphoma
- Sarcoid
PINEAL MASS

MAD PIG

Meningioma/metastasis
Arachnoid cyst/Aneurysm/AVM
Dermoid/teratoma
Pineal parenchymal tumor
Pineal cyst
Germ cell tumor/Glioma
CP ANGLE

SLOW GAME

- Schwannoma: V and VII
- Lymphoma/lipoma
- Glomus tumor
- Aneurysm
- Meningioma/Metastasis
- Epidermoid/Ependymoma
Ventricular Disorders

VENTRICULITIS

Infection—CMV/HIV/TB

Tumor—Carcinoma/metastasis/lymphoma
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MASS

Adult

EMC²

Ependymoma/Gliomas
Mets/Meningioma
Choroid plexus tumors
Central neurocytoma/Cystercercosis
Child

PETA (save animals)

- PNET
- Ependymoma
- Teratoma
- Astrocytoma
HYDROCEPHALUS

Communicating

NPH (wet, wobbly, wacky)
Meningitis
Post subarachnoid hemorrhage
Post surgery
Noncommunicating

3rd ventricular mass
Aqueductal tumors/stenosis
4th ventricular mass
INFARCTS/STROKE

1. Large vessel—MCA/ACA/PCA

2. Watershed

3. Small vessel disease—Lacunes. HTN
4. Microvascular—Leukariosis

5. Posterior fossa (may need to be decompressed)

**ARTERIAL CAUSES**

- Thrombosis/atherosclerosis
  - Check Circle of Willis/branch points
- Dissection—Check neck vessels
- Low flow—Check history
- Emboli—Drug history
- Vasculitis
VENOUS CAUSES

SHIPPED

- Sickle cell
- Hypercoaguable
- Infarct
- Infection
- Pregnancy
- Pill (oral contraceptives)
- Endogenous—Factor V Leiden
- Dehydration
INTRAPARENCHYMAL HEMATOMA

Young

DATA

Drug abuse—Cocaine
Aneurysm
Tumor—Underlying
AVM/Vascular malformations
Old

HAT

HTN—putamen/thalamus/pons/cerebellum
Amyloid/Anticoagulation
Tumor—primary or metastasis
RING-ENHANCING LESION

MAGIC DR

*Immunocompromised*
- Toxoplasmosis vs lymphoma

*Immunocompetent*
- Mets
- Abscess
- Glioma
- Infarct
- Contusion
- Demyelinating (MS)
- Radiation Necrosis
CROSSING LESIONS OF THE CORPUS CALLOSUM

Lymphoma
GBM
MS
ADEM/PML
Trauma
Metastases
LEPTOMENINGEAL ENHANCEMENT

Carcinomatosis—breast/lung/melanoma
Infection—viral or bacterial meningitis/TB
Inflammatory—sarcoid
Consider subarachnoid hemorrhage
Spontaneous intracranial hypotension
DURAL ENHANCEMENT

- Postoperative
- Spontaneous intracranial hypotension
- Metastatic disease—breast/prostate
- Sarcoidosis
CONGENITAL

Children Complete Myelination at 2 yr of Age

Disorders of Neural Tube Closure

Cephalocele

Corpus Callosal anomaly—Agenesis

Dandy Walker malformation
Chiari II
Migrational disease
Idiopathic Lipomas

Cysts—Aicardi’s syndrome
Hydranencephaly
Porencephaly—toxoplasmosis

Dyke Davidoff Mason—unilateral atrophy

**DISORDERS OF NEURONAL MIGRATION**
Lissencephaly
Nonlissencephalic cortical dysplasia
*ASSOCIATED WITH CMV—affinity for germinal matrix

Heterotopia
Schizencephaly

Unilateral megalencephaly

**DISORDERS OF DIVERTICULATION**

Holoprosencephaly

Septo-optic dysplasia

Absence of SP — *LOOK FOR SEPTO-OPTIC AND SCHIZENCEPHALY*
Cystic Posterior Fossa

DW Complex

DW Variant
MCM
Arachnoid Cyst
Cerebral Angiography

Angiograms shown in the Neuro section will be looking for specific diagnoses based on the region in which they are shown. These are:

ANGIOGRAPHIC DDX

AORTIC ARCH

*Vessel Irregularity*

Atherosclerosis

Vasculitis

Trauma
EXTERNAL CAROTID ARTERY

Tumor

Meningioma
Juvenile Angio

Chemodectoma
CERVICAL CCA/ICA/VERT

Vessel Irregularity

Atherosclerosis

FMD
Dissection
Trauma

Neoplasm

Paraganglioma
AVM—Dural-based

PETROUS INTERNAL CAROTID ARTERY

Trauma
Aneurysm
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**INTRACRANIAL ICA**

Aneurysm
CCF
Occlusion

**CIRCLE OF WILLIS**

Aneurysm

AVM
Stenosis
Tumor
  Meningioma
  Hemangioblastoma
INTRACRANIAL

VASCULAR MALFORMATIONS

AVM—parenchymal/dural/cryptic

Venous angioma (deep venous anomaly)/cavernoma
Cavernous Angioma
Capillary Telangiectasia
## VASCULITIS

<table>
<thead>
<tr>
<th>Infectious</th>
<th>Noninfectious</th>
<th>Atypical</th>
<th>Nondrug</th>
</tr>
</thead>
<tbody>
<tr>
<td>TB</td>
<td>Cocaine</td>
<td>Drug ergots</td>
<td>Sarcoid</td>
</tr>
<tr>
<td>Syphilis</td>
<td>Amphetamine</td>
<td></td>
<td>Wegener's PAN</td>
</tr>
</tbody>
</table>
CHILDREN/INFANTS

Moya Moya
NF
Sickle
Radiation
Idiopathic
Vein of Galen malformation
CSF SEEDING

PAGE ME

- Papillomas—choroid plexus/carcinoma
- Astrocytomas—GBM
- Germinoma
- Ependymoma
- Medulloblastoma
BASAL GANGLIA CA\(^{2+}\) HYPERDENSE ON CT/HYPOINTENSE ON T1

**BIRTH**

- Birth Anoxia
- Infection—HIV
- Radiation
- Toxin—Carbon Monoxide/Lead/TPN
- Hypoparathyroidism/Hypophosphatasia

---

BASAL GANGLIA DISEASES HYPODENSE ON CT/HYPERINTENSE ON T2

**LINT**

- Lymphoma
- Infarction—hypoxia/hypotension
- Neurodegenerative—Wilson’s
- Toxins—Carbon Monoxide/Cyanide/Chloroethane
DIFFUSE CEREBRAL EDEMA

HIGH PRESSURE

Hypertensive crisis
Pseudotumor
Reye’s syndrome
Encephalitis
Sagittal SinUS thRombosis
Eclampsia

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SPECTROSCOPY

Normal Spectrum

Rules of Thumb

1. Low grade tumor and demyelination can look identical.
2. Very high choline levels usually indicates tumor.
3. Infarct shows elevated lactate and decreased other values.
4. Increased lactate in the CSF can be seen in NPH.
5. Decreased NAA indicates neuronal loss
   (including neuronal loss seen in tumor).
Spine

INTRADURAL INTRAMEDULLARY

AHEM, MIGHT I help you?

Astrocytoma
Hemangioblastoma
Ependymoma
Mets
MS
Infection/myelitis
Granulomatous – sarcoid
Hemorrhage
Trauma

INTRADURAL EXTRAMEDULLARY

DAMN VASCULAR HEMATOMA

Dural mets
AVM/arachnoid cyst
Meningioma
NF/Schwanomma
Vascular
Hematoma
EXTRADURAL EXTRAMEDULLARY

SMALL HEAD

- Synovial cyst
- Mets/Meningioma/Schwanomma
- AVM
- Lymphoma
- Leukemia
- Hematoma
- Epidural Abscess
- Adenopathy
- Disk
  - Bulge
  - Herniation—Extrusion/Protrusion
  - Free Fragment
ARACHNOIDITIS

Failed back syndrome
Subarachnoid hemorrhage
Infection
Pantopaque