Lecture 4

Imaging of Neoplasm
Neoplasm

- Benign tumors
  - New growth
  - May not be ‘malignant’ but can cause detrimental changes
  - Seldom fatal
  - All tissue types/ organs may be affected

Neoplasm

- Malignant tumors
  - Cancer
  - May be destructive or fatal
  - All tissue types/ organs may be affected
General Signs

- Tumor mass
  - Polypoid lesions
  - Irregular infiltration
  - Constriction
  - With necrotic ulceration, cavitation
  - Obstruction
- Relationship to surrounding tissue
  - Infiltration
  - Displacement = “mass effect”

Lung Neoplasm

Primary Tumor

- Direct sign:
  - Solitary mass
  - Unilateral Hilar mass
- Indirect signs:
  - Atelectasis
  - Slowly resolving pneumonia
  - Pleural effusion
  - Abscess
Lung Neoplasm

Primary Tumor

- Adenopathy:
  - Widened mediastinum
  - SVC syndrome
  - Tracheal compression
  - Nerve paralysis (recurrent laryngeal, phrenic nerves)

Lung Neoplasm

Secondary Tumor

- Metastatic Tumor
  - Multiple potential sources
  - Typically present as multiple varying size nodule in the lung
Bronchogenic Carcinoma

- Large right peri-hilar mass
- Remaining lungs are clear
- Fullness to the right hilum

Bronchogenic Carcinoma

- Mass posterior to the hilum
- Enlarged hilum on the lateral, large lymph node
Solitary Pulmonary Nodule

- Benign
  - Sharp, well defined outline
  - Cortical “expansion”
  - Narrow ‘zone of transition’
  - Preserved cortical or trabecular pattern

Bone Tumor
Bone Tumor

- Malignant
  - Irregular outline
  - Broad 'zone of transition'
  - Break through the cortex
  - Periosteal elevation
  - Soft tissue mass (may be infiltrative)
  - Metastasis

Periosteal Reaction

- Smooth/solid
Periosteal Reaction

- Lamellated/onion skin appearance

Periosteal Reaction

- Sunburst
- Hair on End
Simple Bone Cyst

- Benign intraosseous neoplasm humerus
- Radiolucent area with septations
- Narrow zone of transition

Osteogenic Sarcoma

- Destructive lesion in the distal femur (arrowheads)
- Permeative – ‘broad zone of transition’
- Extends into the medial soft tissues
- Zone of periosteal reaction along proximal femur (arrows)
**Astrocytoma**
- MRI
- Parietal lesion
- White representing surrounding edema on T2 images
- Contrast enhancement on T1+C

**Brain Tumor**
- Metastasis
  - Lung
  - Breast
  - GI Tract
- Signs on CT or MRI
  - Mass
  - Edema
  - Solid or ring shaped enhancement
Breast Cancer

- Most common cancer in women
- Early detection → potential cure
- Early detection:
  - Routine self-breast exams
  - History
  - Physical examinations
  - Mammography
  - Needle biopsy
  - Periodic screening

Normal Mammogram
Breast Cancer

• Direct or primary signs
  – Unilateral asymmetric mass
  – Irregular shape and density
  – Invasive growth pattern

Breast Cancer

• Indirect or secondary signs
  – Calcifications
    • Micro calcifications
    • Irregular clusters
  – Skin thickening, retraction
Breast Cancer

- Mass, calcifications
- Magnification view shows irregular calcifications (arrow)

Breast Cancer, The Future

- Computer aided detection
- Breast MRI
  - Evaluate for blood flow kinetics
  - Increased blood flow and washout in breast tumors
  - Evaluate for other sites of neoplasm
- PET
  - Staging of breast neoplasm
  - Re-staging during and after radiation or chemo therapy
Breast MRI

PET Scanning Breast Carcinoma
Trauma

- Skeletal trauma
- Non-skeletal trauma

X-rays Signs of Bone Fx

- Fracture line:
  - Usually appears as a lucent line
  - Occasionally appears as a dense line due to overlap of fragments
- Interruption of bony trabeculae, may have bony shape or volume change
- Bulging or buckling of the cortex
- Soft tissue swelling
- May have joint effusion
Fracture Evaluation

• X-ray films should be taken in at least 2 projections usually AP and lateral view
• X-ray films should be large enough to include one end of joint and adjacent soft tissue

Fracture Evaluation

• In a child, the healthy opposite side occasionally is examined for comparison
• For special questions, some special studies
  – Oblique view
  – Stress film
  – Flexion and extension views
  – Delayed films
**Lower Leg Fracture**

- Frontal view
- Oblique fracture tibia
- Angulation convex lateral at fracture
- Slight medial displacement distal fragment
- Comminuted fracture of fibula
- Lateral displacement
- Angulation convex lateral at fracture

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**Lower Leg Fracture**

**Lateral View**

- Posterior displacement of tibia fracture
- Slight angulation convex anteriorly at the fracture site
- Inadequate films with fibular fracture not included
Scaphoid Fracture

• Sclerosis of proximal portion
• Avascular necrosis of the proximal portion *
• Blood supply distal to proximal

Tibial Stress Fracture

• Femur, tibia, metatarsals common locations
• Bone scan and MRI useful
• Plain film negative many cases
• Linear fracture with some callus in this case
Soft Tissue Signs Associated With Fractures

- Localized swelling and edema
- Obliteration of muscle-fat interface
- Displacement of fat pads

Normal Anterior Fat Pad
Humeral Fracture with Fat Pad

- Undisplaced ulnar fracture (olecranon process)
- Posterior Fat Pad
- Anterior Fat Pad

Pathologic Fracture

- Fracture of proximal humerus
- Through pre-existing bone tumor (*)
- Early healing with callus noted on the study (arrowhead)
Healing of Fracture

- Focal hematoma around the fracture end
- Formation of granulation tissue
- Bone callus (spindle-shape new bone formation)
- Gradually diminished fracture line and swelling soft tissue 2-4 weeks
- Remodeling of bone 2-3 years

Delayed and Non Union of Fractures

- Causes
  - Infection
  - Distraction of fragment
  - Poor blood supply
  - Improper fixation
  - Interposition of soft tissues between fragments
- X-Ray signs
  - Widening of fracture line
  - No callus formation
  - Smooth and sclerotic changes of fragment ends
Non-Union Fracture

- Sclerosis of fragment ends
- Lack of callus
- Widened fracture line

Non Union Fracture

- Fusiform healing
- Persistent fracture line
- Later repaired with an intramedullary rod
Evaluation of Non-Skeletal Trauma
Edema, Hemorrhage, Hematoma

- Plain X-ray
- CT
- MRI
- Angiography
- Ultrasound

Chest Trauma

- Pulmonary contusion lower left lobe
- Alveolar hemorrhage and edema
- Indistinguishable from other causes of consolidation
Chest Trauma

- Lateral view same patient
- Density over lower spine representing pulmonary contusion

Foreign Body

- Child
- Pre-op
- Recent fall
Liver Laceration

- Linear low attenuation area in right lobe (arrows)
- Crescent of low attenuation beneath the liver capsule (arrowheads)

Epidural Hematoma

- High density area
- Lens shaped
- Right parietal
- Confined to sutures
Subdural Hematoma

- Balanced (upper image) and T2 image
- Band like high signal along right lateral brain surface
- Crescentic shape
- Represents methemoglobin resulting from subdural bleed
- Compare to epidural

Subdural – Epidural Compared
Parenchymal Bleed

- Intraparenchymal hematoma
- No enhancement
- Deep left parietal white matter
- Oval high attenuation (blood)
- Surrounding low attenuation (edema)
- Mild mass effect

Subdural – Epidural – Parenchymal Compared
Achilles Rupture

- T2 image
- Focal high signal in tendon (white)
- Irregular appearance to tendon
- Tendon normally low signal (black)

Muscle Tear

- Coronal section of the thigh
- High signal on Fat suppressed images
- Fluid-Hematoma in adductor muscle group
- Compare to right thigh
**Widened Mediastinum**

- Deceleration injury
- Widened superior mediastinum
- Must exclude positional factors (supine patient, AP film)
- CT can identify blood
- Angiogram to separate aortic injury from other vessel injuries

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**Aortic Tear**

- Arch aortogram
- Arrow indicates area of aortic tear