The Hand is “Handy”

Hand is very accessible
- One place on the body it is socially acceptable to touch
  - Shaking hands...
  - Holding hands...

History
Indications
Terminology
Hand/Wrist
Radial/Ulnar
Fingers
Radiographs
Fractures
Mallet @ @
Boxer’s
Gamekeeper
Bennett
WOW ©

Upper Extremity Trauma
Hand & Fingers

Hand Imaging: Since Day 1

1st radiograph:
- Röntgen’s wife’s hand
  - December 22, 1895
- Röntgen: “X-rays”
- Exposure time: 15 minutes
- Exposure time today’s hand radiographs: 5 milliseconds
  (5/1,000th of a second)

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1898: What the “in” crowd did

Tsar Nicholas & Alexandra Winter Palace St. Petersburg Invited Dr. H.H. Horne to make these “photographs” of their hands X-ray apparatus overloaded the palace’s electrical system

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1896 Edison brings X-rays to Public

Edison’s Lab
1896 National Electrical Exposition, NY X-ray tube in box

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Hand & Fingers
Upper Extremity Trauma

The Hand

Indications: Hand Imaging

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Trauma

- Falls (wrist)
- Bites...
- Infection
- Humans
- Animals
- Cats (Tooth chip)

Indications: Hand Imaging

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Hand & Fingers

Indications: Hand Imaging

US Consumer Product Safety Commission, each year snow blowers cause:
- 6,000 ER visits
- 600 finger amps

Arthritis

- Certainly image whichever joint is painful...
- ...but also image the hands
- The most common characteristics:
  - Distribution
  - Erosions
  - Osteophytes
- For the most common arthropathies:
  - OA
  - RA
  - EOA
  - Gout
  - CPPD
  - PA
- are well reflected in the hands

NO!
Arthritis in Hands

Upper Extremity Trauma

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Arthritis in Hands

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The Hand

**Indications: Hand Imaging**

- Mass
  - Usually evaluated with MRI...or US
  - But should start with radiographs
  - Mass size
  - Helps to plan scan

- Schwannoma (Nerve sheath tumor)

**Indications: Hand Imaging**

- Pain?
  - Carpal tunnel syndrome
  - We expect radiographs to be negative
  - Looking for unexpected surprises

- Calcification in Carpal Tunnel

**Hand** vs **Wrist**

- Hand radiographs include:
  - Distal Radius & Ulna
  - All 8 carpals
  - All 5 metacarpals
  - All 14 phalanges
  - Joints
    - Distal Radio-Ulna Joint (DRUJ)
    - Ulnar-Carpal Joint
    - Carpino-Carpal Joint
    - Metacarpal-Carpal Joints
    - Inter-Phalangeal (IP, PIPs, DIPs)

- Wrist radiographs:
  - X-ray beam centered @ 3rd MC head
  - X-ray beam centered @ capitate

**Hand vs Wrist: X-ray Beam**

- 8 years earlier

**Hand vs Wrist**

- “Hand” vs “Wrist”

- Wrist images include:
  - Distal Radius & Ulna
  - All 8 carpals
  - Just metacarpal bases
  - Joints
    - Distal Radio-Ulna Joint (DRUJ)
    - Radio-Carpal Joint
    - Mid-Carpal Joint
    - Carpino-Carpal Joints

**“Hand” vs “Wrist”**

- “Hand” images include:
  - Distal Radius & Ulna
  - All 8 carpals
  - All 5 metacarpals
  - All 14 phalanges
  - Joints
    - Distal Radio-Ulna Joint (DRUJ)
    - Ulnar-Carpal Joint
    - Carpino-Carpal Joint
    - Metacarpal-Carpal Joints
    - Inter-Phalangeal (IP, PIPs, DIPs)

- Gruelich & Pyle

- Images courtesy of Bradley Markfeld, MD

**Indications: Hand Imaging**

- Bone Age
  - At birth many bones unossified
  - Epiphyses (ends of bones)
  - Radius/Ulna, MCs, Phalanges
  - With aging, these bones ossify
  - At specific ages
  - Hand radiographs to compare patient’s skeletal (bone) age to their chronological age.
  - Left hand
Upper Extremity Trauma
The Hand

Hand vs Wrist: X-ray Beam

Medial vs Lateral?
For most body parts, we use the terms “medial” and “lateral”

Medial: Towards the middle
Lateral: Towards the side

But for the hands/wrists, these terms are ambiguous

Is the thumb medial or lateral?

When hand is palm up “supinated” (holding soup) thumb is lateral
When hand is palm down “pronated” thumb is medial

Muffler Men
Created in 1960s by International Fiberglass Co., Venice CA, 23 feet tall

Is the thumb medial or lateral?

Is the thumb medial or lateral?

Is the thumb medial or lateral?

Is the thumb medial or lateral?

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The Hand

**Upper Extremity Trauma**
Hand & Fingers

**Not medial/lateral... radial/ulnar instead**

- History
- Indications
- Terminology
- Hand/Wrist
- Radial/Ulnar
- Fingers
- Radiographs
- Fractures
- Mallet
- Boxer’s
- Gamekeeper
- Bennett
- WOW

**Radial side**

**Ulnar side**

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**Upper Extremity Trauma**
Hand & Fingers

**Which Finger Hurts?**

- History
- Indications
- Terminology
- Hand/Wrist
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- WOW

**Too many arrows is not helpful!**

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**Upper Extremity Trauma**
Hand & Fingers

**Which is the 1st Finger?**

- History
- Indications
- Terminology
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- Bennett
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- Index Finger?
- Thumb?
- Long Finger?

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**Upper Extremity Trauma**
Hand & Fingers

**Finger Numbering = Confusion**

- History
- Indications
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- Thumb
- Index finger

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**Upper Extremity Trauma**
Hand & Fingers

**Finger Numbering = Confusion**

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- Fingers have names (not numbers)
  - "Thumb"
  - "Index"
  - "Long" ("Middle")
  - "Ring"
  - "Small"

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**Upper Extremity Trauma**
Hand & Fingers

**Radiographs: Need 3 Views**

- History
- Indications
- Terminology
- Hand/Wrist
- Radial/Ulnar
- Fingers
- Radiographs
- Fractures
- Mallet
- Boxer’s
- Gamekeeper
- Bennett
- WOW

- PA
- Obl view
- Lat view

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Upper Extremity Trauma
The Hand

**Hand: Oblique View**
- Important 2nd view of the metacarpals
- Yields additional views of:
  - Phalanges
  - Carpals bones

**Radiographs: Finger**
- If interested in only one finger, should order radiographs of just that finger.
  - Costs less than hand
  - 1-view finger = 2-view finger = 3-view finger = $106*
  - $36 less than 3-view hand
  - Bend other fingers out of the way
  - Center x-ray beam over that finger

**Mallet Finger**
- aka “Baseball Finger”
- Tear extensor tendon
- Avulsion fracture dorsal base distal phalanx

**Why not get all 3 views?**
- Do < 3 hand views save radiation?
  - Not really
    - Chest PA & Lateral radiographs = 0.06 mSv
    - 1 week of background radiation
    - 3-view Hand radiographs < 0.01 mSv
    - < 1 day of background radiation

- Do < 3 hand views save money?
  - Not much
    - 1-view hand = 2-view hand = $113*
    - $36 less than 3-view hand
    - 3-view hand = $142 (only $29 more than 2-views)

*UWMF Technical + Professional charges

**Radiographs: Finger**
- Can use non-radiopaque object (tongue blade) to extend the finger

**Finger Model (Lateral View)**
- Extensor Digitorum
- Flexor Digitorum

**Mallet Finger**
- Treated with splint to hold DIP straight
  - 3 weeks in splint
  - 8 weeks

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Upper Extremity Trauma
The Hand

Upper Extremity Trauma

"Mallet Finger"

Mallet?
- Google “Mallet”...

Pry bar finger”?

Finger Model (Lateral View)

Extensor Digitorum Profundus (deep) → DIP
Flexor Digitorum Superficialis ("surface") → PIP

Swan Neck Deformity

DIP flexion + PIP hyper-extension = Swan Neck

Boutonnière Deformity

DIP flexion + PIP hyper-extension = Boutonnière

Boutonnière Deformity

The Three Graces (1638)
Paul Rubens (1577–1640)
Model: Hélène Fourment, wife, 23yo
- RA?
  - In Hélène?
  - In Rubens himself?

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The Hand

"Boxer's Fracture"
Combination of:
- College Student
- Alcohol
- Fracture 5th MC neck

Best view to measure angulation

"Boxer’s Fracture"
Combination of:
- College Student
- Alcohol
- Fracture 5th MC neck

Best view to see MC fractures

"Boxer's Fracture"
Combination of:
- College Student
- Alcohol
- Fracture 5th MC neck

Best view to measure angulation

"Gamekeeper’s Thumb"
C.S. Campbell, Bridge of Earn, Scotland


Examined 24 gamekeepers
20 (83%) laxity of the thumb
- Metacarpo-phalangeal joint
- Ulnar side

Injure Thumb MCP UCL
- Acute trauma/fall
- “Skier’s Thumb”
- Falling while holding the ski pole
- Tear UCL
- Avulsion fracture ulnar side of the base of the thumb proximal phalanx

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Upper Extremity Trauma
The Hand

What to Order When (WOW)
Always start with radiographs!

Hand 3-views (PA, Lateral, Oblique)
> When need to see all of the bones and joints
  > Arthritis
  > For metacarpal fractures
  > Boxer Fracture

Finger
> When interested in just one finger
  > Mallet, Swan Neck, Boutonniere
  > Gamekeeper’s fracture

Radiographs
Fractures
Mallet ©
Boxer’s
Gamekeeper
Bennett

Foreign bodies (FB)?
> Radiographs: radiopaque FB
  > Metal
  > Glass
  > All glass is radiopaque

Non-Radiopaque foreign bodies?
> Wood splinters
> Sea urchin spines
> Can’t be seen with radiographs or CT
> May be able to see with MR
> ALL can be seen with Ultrasound!

Masses, Infections, Synovitis
> ALWAYS START WITH RADIOGRAPHS!
> MR is the next imaging study of choice
  > Usually with IV contrast
  > Contrast is particularly helpful for synovitis (RA)
  > Normal synovium does not enhance
  > Vascularized pannus greatly enhances
> These MR studies should be ordered by the
specialist who will be treating the condition
  > Rheumatologist
  > Hand Surgeon

Questions?
Raise your hand...

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