

Topics **Language of Fractures**

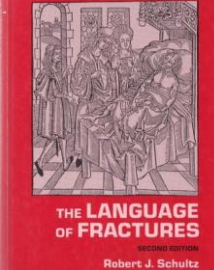
- Intro ① ② ③
- Patterns
- Orientation
- Displaced
- Angulated
- Bone Ends
- Immature
- S-H
- Plastic
- Torus
- Occult
- Stress ④
- Don't Miss

Title:

- Robert Jordan Schultz
- Orthopedic Surgeon
- Out of print since 1990

Ideas in this talk:

- My 20 years of trying to understand fractures




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Why are Fractures Hard?

There are 206 bones!

- **Carpals:** Scaphoid, Lunate, Triquetrum, Pisiform (proximal row) Hamate, Capitate, Trapezoid, Trapezium (distal row)
- **Fingers:** Thumb, Index, Long, Ring, Small (Metacarpals, Phalanges)
- **Tarsals:** Talus, Calcaneus, Navicular, Cuboid, 3 Cuneiforms
- **Arm:** Scapula, Humerus, Radius, Ulna
- **Leg:** Femur, Patella, Tibia, Fibula
- **Pelvis:** Sacrum, Ilium, Ischium, Pubic
- **Spine:** Cervical (7), Thoracic (12), Lumbar (5), [ribs & sternum]
- **Skull:** 1 big bone + Mandible Maxilla, Nasal, Frontal, Parietal, Occipital, Temporal, (Zygomatic, Sphenoid, Ethmoid, Lacrimal)



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Why are Fractures Hard?

There are 206 bones!

They're all different!

- They have different functions.
- Exposed to different mechanical forces.
- They each respond differently to stress/trauma.



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Example: Metatarsals

1st MT:

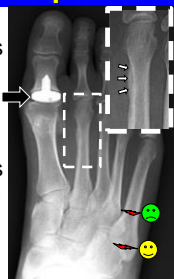
- Fractures ✓ Rare
- Common ✓ OA

2nd MT:

- Fractures ✓ Common
- Stress (Fatigue) "March"

5th MT:

- Fractures ✓ Very Common
- Base 5th MT
- 1) Avulsion Fx ✓ 99% Heal
- 2) Jones Fx ✓ 50% non-union



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Why are Fractures Hard?

There are 206 bones!

They're all different!

- They have different functions.
- Exposed to different mechanical forces.
- They each respond differently to stress/trauma.

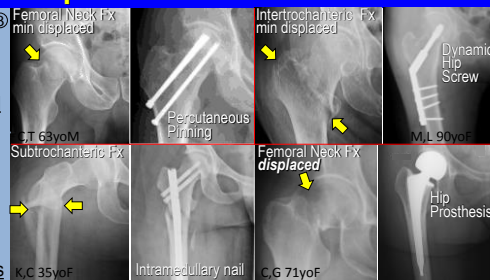
Even where fractures occur within a bone affects the treatment, prognosis



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Example: Proximal Femur Fractures



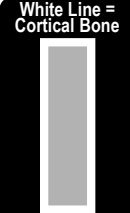
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Language of Fractures Looking at Bones in General

Bone Model

White Line = Cortical Bone



Gray Fill = Trabecular Bone (Cancellus)

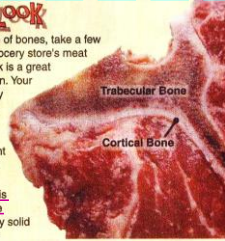
A Closer Look

To check out the inside of bones, take a few extra minutes at the grocery store's meat counter. A T-bone steak is a great example of bone design. Your bones are built the very same way a T-bone is built.

Hold one up and look closely. You'll blend right in. People finger meat packages a lot.

The outside of a bone is called the **cortical bone** (KOR-ti-ka). It's mostly solid with just a few cavities.

Inside the cortical bone is the **trabecular bone** (truh-BEK-u-lar). It's like a fine honeycomb of cavities that contain liquid bone marrow, special bone-rebuilding cells, blood cells, other chemicals and fats.



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Language of Fractures Looking at Bones in General

Terminology

Intro ① ② ③

Patterns

Orientation

Displaced

Angulated

Bone Ends

Immature

S-H


Plastic

Torus

Occult

Stress ④

Don't Miss



Radiographic Views

- AP (Anterior → Posterior)
 - Most frontal radiographs
 - PA (Posterior → Anterior)
 - Hands, wrists
 - Chest (Standard non-portable)
- Lateral view
 - From the side (R→L, L→R)

Patient sides

- Medial: Towards the middle
- Lateral: Towards the side
- Anterior: Front (Volar)
- Posterior: Back (Dorsal)

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Language of Fractures Looking at Bones in General

Simple vs Comminuted

Intro ① ② ③

Patterns

Orientation

Displaced

Angulated

Bone Ends

Immature

S-H

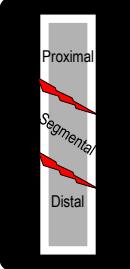

Plastic

Torus

Occult

Stress ④

Don't Miss

Simple Fx:

- >2 fragments
 - Proximal fragment
 - [L] proximus: "nearest"
 - Near body attachment
 - Distal fragment
 - [L] distare: "distant"
 - away from attachment

Comminuted:

- >2 fragments
- Segmental fragment

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Language of Fractures Looking at Bones in General

Simple vs Comminuted

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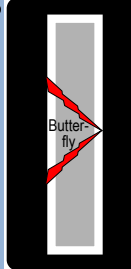

Plastic

Torus

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- >2 fragments
 - Proximal fragment
 - [L] proximus: "nearest"
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 - Distal fragment
 - [L] distare: "distant"
 - away from attachment

Comminuted:

- >2 fragments
- Segmental fragment
- Butterfly fragment

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Language of Fractures Looking at Bones in General

Simple vs Comminuted

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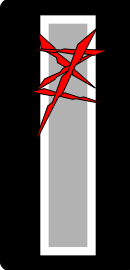

Plastic

Torus

Occult

Stress ④

Don't Miss

Simple Fx:

- >2 fragments
 - Proximal fragment
 - [L] proximus: "nearest"
 - Near body attachment
 - Distal fragment
 - [L] distare: "distant"
 - away from attachment

Comminuted:

- >2 fragments
- Segmental fragment
- Butterfly fragment
- Severely comminuted

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Language of Fractures Looking at Bones in General

Fracture Orientation

Intro ① ② ③

Patterns

Orientation

Displaced

Angulated

Bone Ends

Immature

S-H

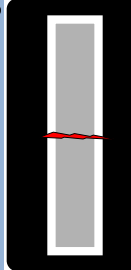


Plastic

Torus

Occult

Stress ④

Don't Miss

Transverse ↔
 ↳ Horizontal

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Language of Fractures Looking at Bones in General

Fracture Orientation

Intro ① ② ③
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 Torus
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 Stress ④
 Don't Miss

Transverse ↔
 ➤ Horizontal
 ➤ Avulsion
 ✓ End of bone

Longitudinal ↕
 ➤ Vertical
 ➤ Compression

Oblique ↗
 ➤ Diagonal
 ➤ Most common

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Language of Fractures Looking at Bones in General

Fracture Orientation

Intro ① ② ③
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 Torus
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 Stress ④
 Don't Miss

Spiral Fracture
 ➤ Twisting injury
 ➤ Resembles:
 ✓ Oblique fracture
 ✓ Butterfly frag.
 ➤ Need multiple views to see the spiral

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Language of Fractures Looking at Bones in General

Fracture Orientation

Intro ① ② ③
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 ➤ Resembles:
 ✓ Oblique fracture
 ✓ Butterfly frag.
 ➤ Need multiple views to see the spiral

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Language of Fractures Looking at Bones in General

Fracture Orientation

Intro ① ② ③
 Patterns
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Spiral Fracture
 ➤ Twisting injury
 ➤ Resembles:
 ✓ Oblique fracture
 ✓ Butterfly frag.
 ➤ Need multiple views to see the spiral

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Language of Fractures Looking at Bones in General

Fracture Orientation

Intro ① ② ③
 Patterns
 Orientation
 Displaced
 Angulated
 Bone Ends
 Immature
 S-H
 Plastic
 Torus
 Occult
 Stress ④
 Don't Miss

Spiral Fracture
 ➤ Twisting injury
 ➤ Resembles:
 ✓ Oblique fracture
 ✓ Butterfly frag.
 ➤ Need multiple views to see the spiral

Toddlers Fx
 ➤ Distal Tibia
 ➤ < 5 years old

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Language of Fractures Looking at Bones in General

Displacement

Intro ① ② ③
 Patterns
 Orientation
 Displaced
 Angulated
 Bone Ends
 Immature
 S-H
 Plastic
 Torus
 Occult
 Stress ④
 Don't Miss

RULE:
 We describe displacement of **distal** fragment relative to **proximal** fragment

“There is an oblique fracture of the distal tibia, with lateral displacement of the distal fracture fragment 1/2-shaft width.”

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Language of Fractures Looking at Bones in General

Displacement

Intro ① ② ③

Patterns

Orientation

● Displaced

○ Angulated

Bone Ends

Immature

S-H

Plastic

Torus

Occult

Stress ④

Don't Miss

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RULE:

We describe displacement of distal fragment relative to proximal fragment

“There is an transverse fracture of the distal tibia, with lateral displacement of the distal fracture fragment by 1-shaft width.”

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Jump to next slide

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Language of Fractures Looking at Bones in General

Displacement: Check all Views

Intro ① ② ③

Patterns

Orientation

● Displaced

○ Angulated

Bone Ends

Immature

S-H

Plastic

Torus

Occult

Stress ④

Don't Miss

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“Posterior (dorsal) displacement 2-shafts”

“Minimally displaced on AP view”

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Language of Fractures Looking at Bones in General

Open (Compound) Fracture

Intro ① ② ③

Patterns

Orientation

● Displaced

○ Angulated

Bone Ends

Immature

S-H

Plastic

Torus

Occult

Stress ④

Don't Miss

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Fractured end of the bone is poking through the skin.

- Common with Tibia Fxs
 - ✓ Very little skin covers tibia
- Sterile bone is exposed to the non-sterile air...
- Bone is now infected
 - ✓ “Osteomyelitis”
- Requires:
 - ✓ Surgical washout
 - ✓ IV antibiotics (6 weeks)

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Language of Fractures Looking at Bones in General

Displacement... exceptions

Clavicle

Intro ① ② ③

Patterns

Orientation

● Displaced

○ Angulated

Bone Ends

Immature

S-H

Plastic

Torus

Occult

Stress ④

Don't Miss

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➢ Proximal fragment relative to distal

➢ Neck muscles pull the proximal fragment up

“Superior displacement proximal clavicle fragment 1/2-shaft width”

“Superior displacement proximal clavicle fragment 2-shaft widths”

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Language of Fractures Looking at Bones in General

Displacement... exceptions

Clavicle

Intro ① ② ③

Patterns

Orientation

● Displaced

○ Angulated

Bone Ends

Immature

S-H

Plastic

Torus

Occult

Stress ④

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➢ Proximal fragment relative to distal

➢ Neck muscles pull the proximal fragment up

“Superior displacement proximal clavicle fragment >2-shaft widths, with a segmental fragment”

Healing

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Language of Fractures Looking at Bones in General

Displacement... exceptions

Clavicle

Intro ① ② ③

Patterns

Orientation

● Displaced

○ Angulated

Bone Ends

Immature

S-H

Plastic

Torus

Occult

Stress ④

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➢ Proximal fragment relative to distal

➢ Neck muscles pull the proximal fragment up

“Superior displacement proximal clavicle fragment >2-shaft widths, with a segmental fragment”

Required internal fixation

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Language of Fractures Looking at Bones in General

Displacement... exceptions

Intro ① ② ③
 Patterns
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 Angulated
 Bone Ends
 Immature
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 Plastic
 Torus
 Occult
 Stress ④
 Don't Miss

Spine – Spondylolisthesis

- Displacement of the upper vertebral body relative to lower vertebral body
- “Anterior slippage of L5 on S1”
- “Spondylolisthesis of L5 on S1”
- “Anterolisthesis of L5 on S1”

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Language of Fractures Looking at Bones in General

Impaction

Intro ① ② ③
 Patterns
 Orientation
 Displaced
 Angulated
 Bone Ends
 Immature
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 Plastic
 Torus
 Occult
 Stress ④
 Don't Miss

Fragments are driven into each other.
 Foreshortened
 Telescoped in

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Language of Fractures Looking at Bones in General

Override

Intro ① ② ③
 Patterns
 Orientation
 Displaced
 Angulated
 Bone Ends
 Immature
 S-H
 Plastic
 Torus
 Occult
 Stress ④
 Don't Miss

Similar to impaction
 Foreshortened
 Fragments overlap

Override

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Language of Fractures Looking at Bones in General

Override

Intro ① ② ③
 Patterns
 Orientation
 Displaced
 Angulated
 Bone Ends
 Immature
 S-H
 Plastic
 Torus
 Occult
 Stress ④
 Don't Miss

Posterior Displaced
 Override

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Language of Fractures Looking at Bones in General

Override

Intro ① ② ③
 Patterns
 Orientation
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 Angulated
 Bone Ends
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 S-H
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 Torus
 Occult
 Stress ④
 Don't Miss

“Superior displacement proximal clavicle 1-shaft width”

Override

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Language of Fractures Looking at Bones in General

Distraction

Intro ① ② ③
 Patterns
 Orientation
 Displaced
 Angulated
 Bone Ends
 Immature
 S-H
 Plastic
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Fragments pulled apart
 Doesn't usually occur as the result of direct trauma
 Trauma tends impact/override
 Patella fractures tend to distract
 Distraction can occur when reducing fractures under traction

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Language of Fractures Looking at Bones in General

Diastasis: Joint Widening

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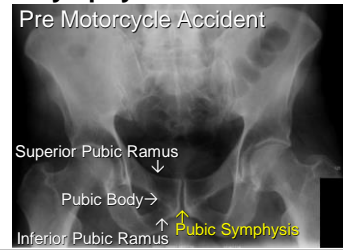
- Space between scaphoid & lunate should not be wider than the spaces between carpal bones.
- Not always due to trauma
- Scapholunate diastasis + Chondrocalcinosis = **CPPD** aka "Pseudo-Gout"

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Language of Fractures Looking at Bones in General

Diastasis: Joint Widening

- Intro ① ② ③
- Patterns
- Orientation
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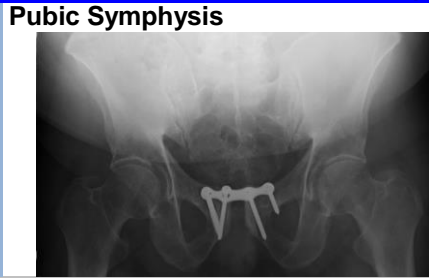


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Language of Fractures Looking at Bones in General

Diastasis: Joint Widening

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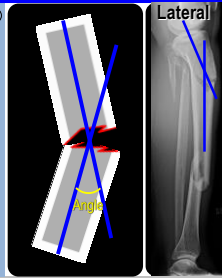


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Language of Fractures Looking at Bones in General

Angulation

- Intro ① ② ③
- Patterns
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- Don't Miss



Need to specify what is angulated relative to what.

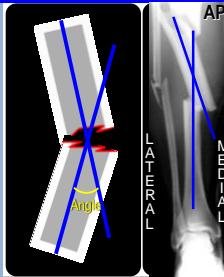
- "Segmental tibia fractures, none of the fragments are very displaced"
- "Dorsal angulation of the distal fracture fragments" or
- "Vertex anterior angulation"

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Language of Fractures Looking at Bones in General

Angulation

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- Don't Miss



Need to specify what is angulated relative to what.

- "Lateral angulation of the distal fracture fragment" or
- "Vertex medial angulation" or
- "Valgus angulation"

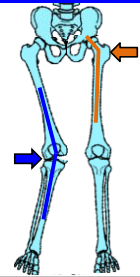
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Language of Fractures Looking at Bones in General

Angulation: Valgus vs Varus

- Intro ① ② ③
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- VALGUS:**
- Vertex deviated **MEDIAL**
- ✓ Knee deviated medially (knock-kneed) = "**Genu Valga**"
- ✓ Angle femoral neck/shaft (normally 120°) is deviated medially = "**Coxa Valga**"
- Vertex deviated towards **GENITALS**



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Language of Fractures Looking at Bones in General

Hallux Valgus

Intro ① ② ③
Patterns
Orientation
Displaced
Angulated
● Bone Ends
Immature
S-H
Plastic
Torus
Occult
Stress ④
Don't Miss

VALGUS

"Bunion"

- 1st MTP (Metatarsal-phalangeal joint)
 - ✓ "Hallux"
- Joint deviates **medially**
 - ✓ "Valgus"
- Very common in women
 - ✓ Due to tight pointy shoes

Hallux Varus

VARUS

LJ 76yoF

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Language of Fractures Looking at Bones in General

Ends of Bones

Intro ① ② ③
Patterns
Orientation
Displaced
Angulated
● Bone Ends
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Torus
Occult
Stress ④
Don't Miss

Humeral Head

Medial Femoral Condyle

Lesser ↑ ↑
Greater Tuberosity

Medial Epicondyle

Joints: Articular Surfaces

Spherical articular surface: **"Head"**

Knuckle-shaped surface: **"Condyle"**

Tendon Insertions

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Language of Fractures Looking at Bones in General

Extra vs Intra-Articular Fractures

Intro ① ② ③
Patterns
Orientation
Displaced
Angulated
● Bone Ends
Immature
S-H
Plastic
Torus
Occult
Stress ④
Don't Miss

Intra-articular fractures

- Involve articular cartilage
- Extend into joints
 - ✓ Risk of developing 2° OA
- Reduction must be *anatomic*

Extra-articular fractures

- Don't involve joints
- Reduction can be *relatively* anatomic
- Bones will remodel
 - ✓ Particularly with weight-bearing

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Language of Fractures Looking at Bones in General

Immature Bone

Intro ① ② ③
Patterns
Orientation
Displaced
Angulated
● Bone Ends
Immature
S-H
Plastic
Torus
Occult
Stress ④
Don't Miss

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Language of Fractures Looking at Bones in General

Parts of the Immature Bone

Intro ① ② ③
Patterns
Orientation
Displaced
Angulated
● Bone Ends
Immature
S-H
Plastic
Torus
Occult
Stress ④
Don't Miss

Epiphysis

Physis

Metaphysis

Diaphysis

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Language of Fractures Looking at Bones in General

Salter-Harris Fractures

Intro ① ② ③
Patterns
Orientation
Displaced
Angulated
● Bone Ends
Immature
S-H
Plastic
Torus
Occult
Stress ④
Don't Miss

All involve the Physis

- If fracture doesn't involve the physis **not Salter-Harris**
- If the patient is skeletally mature (physis fused) **not Salter-Harris**
- Physis fractures risk of premature growth plate fusion
- Could lead to a leg length discrepancy

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Language of Fractures Looking at Bones in General

Salter-Harris Fractures

“Types I – V”
As the # goes up, fractures get worse

Journal Bone & Joint Surgery 1963 v 45-A p.587-662

Injuries Involving the Epiphyseal Plate
BY ROBERT B. SALTER, M.D., F.R.C.S.(C)*, AND W. ROBERT HARRIS, M.D., F.R.C.S.(C)†, TORONTO, ONTARIO, CANADA

An Instructional Course Lecture, The American Academy of Orthopaedic Surgeons

Injuries involving the epiphyseal plate present special problems in diagnosis and management. The dread complication of serious disturbance of growth is usually predictable and, in certain circumstances, can be prevented. Thus, knowledge of the prognosis for a given injury to the epiphyseal plate in a particular child is of considerable importance to the surgeon, who has the dual responsibility of treating the child and advising the parents. The purpose of this presentation is to discuss epiphyseal-plate injuries from both the clinical and the experimental points of view.

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Language of Fractures Looking at Bones in General

Salter-Harris: Type I

Physis Only

- Can be quite subtle
- Especially when non-displaced
- Comparison with normal contralateral side helps

Physis Only

- Can be quite subtle
- Especially when non-displaced
- Comparison with normal contralateral side helps

Soft Tissue Swelling Painful Side
S-H I
Horizontal Lucency Fracture? Unfused Physis?

Normal Side NO Soft Tissue Swelling
NO Horizontal Lucency Physis is Fusing!

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Language of Fractures Looking at Bones in General

Salter-Harris: Type I

Physis Only

- Can be quite subtle
- Even when slightly displaced
- Need Multiple Views!

Physis Only

- Can be quite subtle
- Even when slightly displaced
- Need Multiple Views!

AP View Mortise View Lateral View

Looks like normal tibial growth plate Looks like normal tibial growth plate

S-H I
Tibial Epiphysis Displaced Dorsally

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Language of Fractures Looking at Bones in General

Salter-Harris: Type II

Physis + Metaphysis

- Doesn't extend into the joint
- Most common type of S-H

Physis + Metaphysis

- Doesn't extend into the joint
- Most common type of S-H

PA View Lateral

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Language of Fractures Looking at Bones in General

Salter-Harris: Type II

Physis + Metaphysis

- Doesn't extend into the joint
- Most common type of S-H

Physis + Metaphysis

- Doesn't extend into the joint
- Most common type of S-H

AP View Lateral View

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Language of Fractures Looking at Bones in General

Salter-Harris: Type III

Physis + Epiphysis

- Extends into joint
- Potentially more serious

Physis + Epiphysis

- Extends into joint
- Potentially more serious

HJ 16yoM WJ 14yoM

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Language of Fractures Looking at Bones in General

Salter-Harris: Type III

Physis + Epiphysis

- Extends into joint
- Potentially more serious
 - >2mm articular step-off → surgery
 - ✓CT very helpful assess alignment

Mortise View Coronal CT

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Language of Fractures Looking at Bones in General

Salter-Harris: Type IV

+ Epiphysis + Metaphysis

- Distal Tibia="Triplane Fracture"
- ✓Usually evaluated with CT

AP View Lateral View

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Language of Fractures Looking at Bones in General

Salter-Harris: Type IV

+ Epiphysis + Metaphysis

- Distal Tibia="Triplane Fracture"
- ✓Usually evaluated with CT

Coronal CT Sagittal CT

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Language of Fractures Looking at Bones in General

Salter-Harris: Type V

Crush Injury

- Rare
- High rate of premature fusion

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Language of Fractures Looking at Bones in General

Bowing (Plastic) Fractures

Adult bones are brittle

- Tend to break

Child bones are soft

- They can bend
- ✓Bowing ("plastic") deformation
- ✓Typically will remodel with time

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Language of Fractures Looking at Bones in General

Bowing (Plastic) Fractures

Under Anesthesia @1 month @2 months

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Language of Fractures Looking at Bones in General

Greenstick Fracture

Intro ① ② ③
Patterns
Orientation
Displaced
Angulated
Bone Ends
Immature
S-H
Plastic
Torus
Occult
Stress ④
Don't Miss

Adult bones are brittle
 ➤ Tend to break like a dry stick

Child bones are soft
 ➤ Can break like a green stick
 ✓ Only through one cortex
 ✓ Incomplete Fx

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L,A 5yoF Jump to last slide viewed Jump to next slide Slide 55 of 76

Language of Fractures Looking at Bones in General

Torus (Buckle) Fracture

Intro ① ② ③
Patterns
Orientation
Displaced
Angulated
Bone Ends
Immature
S-H
Plastic
Torus
Occult
Stress ④
Don't Miss

Plastic-type fracture
 ➤ Commonly in radius of children who fall on hand

➤ **Metaphysis-Diaphysis junction**
 ➤ Outward cortical buckling

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Language of Fractures Looking at Bones in General

Torus (Buckle) Fracture

Intro ① ② ③
Patterns
Orientation
Displaced
Angulated
Bone Ends
Immature
S-H
Plastic
Torus
Occult
Stress ④
Don't Miss

Plastic-type fracture
 ➤ Commonly in radius of children who fall on hand

➤ **Metaphysis-Diaphysis junction**
 ➤ Dorsal cortical buckling

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Language of Fractures Looking at Bones in General

Radiographically Occult Fractures

Intro ① ② ③
Patterns
Orientation
Displaced
Angulated
Bone Ends
Immature
S-H
Plastic
Torus
Occult
Stress ④
Don't Miss

Not detected on radiographs

- Places with many overlapping structures
 - ✓ Cervical Spine
 - ✓ CT is good for these fractures
- Fractures too non-displaced to see
 - ✓ Femoral neck, scaphoid
 - ✓ CT is *not* good for these fractures
 - ❖ Non-displaced on radiographs is non-displaced on CT
 - ✓ MR is good for these fractures
- Fractures with no cortical disruption
 - ✓ Stress fractures
 - ✓ MR is good for these fractures

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Language of Fractures Looking at Bones in General

Stress Fractures

Intro ① ② ③
Patterns
Orientation
Displaced
Angulated
Bone Ends
Immature
S-H
Plastic
Torus
Occult
Stress ④
Don't Miss

Fatigue Fractures

- **Abnormal** forces on **normal** bones
 - ✓ Athletes; People who increase activities (Military)
 - ✓ Change in habits (Different shoes)
- Occur in lower extremities
 - ✓ Femur, Tibia, 2nd Metatarsal, Navicular

Insufficiency Fractures

- **Normal** forces on **abnormal** bones
 - ✓ Osteoporosis; Osteomalacia
- **OCCUR IN FEMORAL NECK**
- Occur in Spine; Sacrum

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Language of Fractures Looking at Bones in General

Fatigue Fractures

Intro ① ② ③
Patterns
Orientation
Displaced
Angulated
Bone Ends
Immature
S-H
Plastic
Torus
Occult
Stress ④
Don't Miss

➤ Result of chronic repetitive micro-fractures
 ➤ Will progress if repetitive stress continues

Radiographs...

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Language of Fractures Looking at Bones in General

2nd MT Fatigue Fractures

Intro ① ② ③
 Patterns
 Orientation
 Displaced
 Angulated
 Bone Ends
 Immature
 S-H
 Plastic
 Torus
 Occult
 Stress ④
 Don't Miss

Small Periosteal Reaction

G,J 19yoF

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Language of Fractures Looking at Bones in General

2nd MT Fatigue Fractures

Intro ① ② ③
 Patterns
 Orientation
 Displaced
 Angulated
 Bone Ends
 Immature
 S-H
 Plastic
 Torus
 Occult
 Stress ④
 Don't Miss

Small Periosteal Reaction

K,D 40yoF

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Language of Fractures Looking at Bones in General

2nd MT Fatigue Fractures

Intro ① ② ③
 Patterns
 Orientation
 Displaced
 Angulated
 Bone Ends
 Immature
 S-H
 Plastic
 Torus
 Occult
 Stress ④
 Don't Miss

Incomplete Fracture

H,S 50yoF

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Language of Fractures Looking at Bones in General

2nd MT Fatigue Fractures

Intro ① ② ③
 Patterns
 Orientation
 Displaced
 Angulated
 Bone Ends
 Immature
 S-H
 Plastic
 Torus
 Occult
 Stress ④
 Don't Miss

Complete Fracture

K,D 58yoF

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Language of Fractures Looking at Bones in General

Tibial Fatigue Fractures

Intro ① ② ③
 Patterns
 Orientation
 Displaced
 Angulated
 Bone Ends
 Immature
 S-H
 Plastic
 Torus
 Occult
 Stress ④
 Don't Miss

Common site for Fatigue Fractures in athletes

Radiographically may see:

- Nothing
- most usual finding
- ✓ Periosteal Reaction

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Language of Fractures Looking at Bones in General

Tibial Fatigue Fractures

Intro ① ② ③
 Patterns
 Orientation
 Displaced
 Angulated
 Bone Ends
 Immature
 S-H
 Plastic
 Torus
 Occult
 Stress ④
 Don't Miss

Common site for Fatigue Fractures in athletes

Radiographically may see:

- Nothing
- most usual finding
- ✓ Periosteal Reaction
- ✓ Trabecular Sclerosis

D,G 16yoM

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Language of Fractures Looking at Bones in General

Tibial Fatigue Fractures

Intro ① ② ③
Patterns
Orientation
Displaced
Angulated
Bone Ends
Immature
S-H
Plastic
Torus
Occult
Stress ④
Don't Miss

➤ **Common site for Fatigue Fractures in athletes**

➤ **Radiographically may see:**

- ❖ Nothing
- ❖ most usual finding
- ✓ Periosteal Reaction
- ✓ Trabecular Sclerosis
- ✓ **Cortical Lucency**
- ✓ **"Dreaded Black Line"**

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Language of Fractures Looking at Bones in General

Fatigue Fracture: Management

Intro ① ② ③
Patterns
Orientation
Displaced
Angulated
Bone Ends
Immature
S-H
Plastic
Torus
Occult
Stress ④
Don't Miss

➤ **Diagnosis primarily by History/Exam**

- Patient tells of new or repetitive activities
- Pain worse with activity; relieved with rest
- Focally tender

➤ **Get Radiographs**

- May confirm diagnosis (periosteal reaction)
- Make sure not already a complete fracture
- May find something else (arthritis, foreign body,...)

➤ **Treat (even if radiographs are negative)**

- Stop/change activity; hard soled shoe

➤ **DON'T NEED TO ORDER MRI**

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Language of Fractures Looking at Bones in General

MRI for Stress Fractures

Intro ① ② ③
Patterns
Orientation
Displaced
Angulated
Bone Ends
Immature
S-H
Plastic
Torus
Occult
Stress ④
Don't Miss

➤ **MR is Sensitive & Specific for fracture**

- Sees marrow edema, periosteal reactions
- (Bone scans: sensitive but not specific)

➤ **When should you consider MR?**

- Fatigue fractures in patients reluctant to stop
 - ✓ College athletes
 - ✓ Ironmen; Marathoners
- Patients not responding to conservative treatment
- Insufficiency fractures in osteoporotic pts
 - ✓ Spine/sacral fractures may require prolonged rest
 - ✓ Hip fractures require surgery

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Language of Fractures Looking at Bones in General

MR staging Tibia Fatigue Fractures

Intro ① ② ③
Patterns
Orientation
Displaced
Angulated
Bone Ends
Immature
S-H
Plastic
Torus
Occult
Stress ④
Don't Miss

- **1) Periosteal reaction only**
 - "Shin Splints"
- **2) Marrow edema: Most sensitive sequence**
 - T2 with fat suppression (or IR, STIR)
- **3) Marrow edema: Most specific sequence**
 - T1
- **4) Line through Cortex**

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Language of Fractures Looking at Bones in General

2 Fractures Not to Miss

Intro ① ② ③
Patterns
Orientation
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Bone Ends
Immature
S-H
Plastic
Torus
Occult
Stress ④
Don't Miss

➤ **1) Femoral Neck Fracture**

- Common in osteoporotic patients
- Need to detect non-displaced
 - ✓ Can treat with percutaneous pinning
- If fracture becomes displaced...
 - ✓ Need to treat with hip replacement
- But non-displaced fractures are hard to see on radiographs
 - ✓ Particularly in osteoporosis
- **MRI does not miss fractures!**
 - ✓ Get MR if radiographs are negative & you are concerned for occult hip Fx

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Language of Fractures Looking at Bones in General

2 Fractures Not to Miss

Intro ① ② ③
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Immature
S-H
Plastic
Torus
Occult
Stress ④
Don't Miss

➤ **2) Scaphoid Fracture**

- High rate of non-union, avascular necrosis
 - ✓ Non-displaced fractures require splint/cast
 - ✓ Displaced fractures require surgical screw
- But non-displaced fractures are hard to see
- Diagnosis is made primarily by exam
 - ✓ **Snuffbox Tenderness = Presumed Scaphoid Fx**
- Treat with splint/cast for 2 weeks
 - ✓ Even if radiographs are read as negative
- Reexamine after 2 weeks
 - ✓ Repeat radiographs if still has snuffbox tenderness
- **MRI does not miss fractures!**
 - ✓ Used for persistent pain; UW athletes

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Language of Fractures Looking at Bones in General

Don't Miss Scaphoid Fractures!

Intro ① ② ③
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Occult
Stress ④
Don't Miss

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Language of Fractures Looking at Bones in General

Old Radiology Saying...

Intro ① ② ③
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Plastic
Torus
Occult
Stress ④
Don't Miss

“The hardest fracture to find... is the second fracture”

“Satisfaction of the Search”

- You feel good when you find one fracture... so you stop looking for other fractures
- This is why it is important to understand
 - ✓ Mechanisms of injury
 - ✓ Patterns of fractures
- This is why it's important to have a **Radiologist** formally interpret all studies!

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Language of Fractures Looking at Bones in General

Schreibman's Sayings...

Intro ① ② ③
Patterns
Orientation
Displaced
Angulated
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Immature
S-H
Plastic
Torus
Occult
Stress ④
Don't Miss

“Trauma is not evenly distributed within the population”

- Patients who come in with new fractures have had fractures in the past
 - ✓ People who drive recklessly... do so repeatedly
 - ✓ People who get into fights... do so repeatedly
 - ✓ Students who get drunk on Friday night and punch walls... do so repeatedly
- It can be hard to tell old from new fractures
- This is why it's important to have a **Radiologist** formally interpret all studies!
- Sometimes we suggest additional studies

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Language of Fractures Looking at Bones in General

Any Questions?

Intro ① ② ③
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Torus
Occult
Stress ④
Don't Miss

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