Humeral Nonunions: Issues and Strategies

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Disclosure
Consultant
• Biomet
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Royalties
• Zimmer-Biomet
• Smith & Nephew
• Advanced Orthopedic Systems
• DePuy-Synthes

Humeral Shaft Fractures
• Healed and well-aligned

"UNION"
97%
Humeral Shaft Fractures

- Unhealed or poorly-aligned

"NONUNION"

- 3%

Humeral Shaft Nonunions

- Nonunion is predictable in some Limb
  - Proximal 1/3
  - Transverse
  - Gap
  - Open fracture
  - High-energy
  - Infection

- Host
  - Diabetes
  - Nicotine
  - NSAIDs
  - Thyroid
  - Immune disorders
  - Testosterone
  - Vitamin D
  - Cancer drugs
Humeral Shaft Nonunions

Patients
• Depressed
• Disabled
• Divorced
• Destitute

If you help them they are Darn thankful!

Humeral Shaft Nonunions

Treatment
• Challenging problems
• No cookbook answers
• Thoughtful intervention
• Creative solutions

A number of generalizations exist which will help you provide a customized Rx plan

Humeral Shaft Nonunions

A thoughtful approach....
• Host
• Bone
• Soft tissues
• Alignment
• Infection
Humeral Shaft Nonunions

- General Approach
  - Why is it not healed?
    - Host problems- correctable?
    - Limb problems- correctable?
  - Is it infected?
  - How long will fracture stability be maintained?

Humeral Shaft Nonunions

Host problems: Correctable?

- A long list......
  - Nicotine
  - NSAIDs
  - Thyroid
  - Testosterone
  - Vitamin D
  - Diabetes
  - Hepatitis
  - Immune disorders
  - Cancer drugs

- If so, WE SHOULD CORRECT THEM!?

Humeral Shaft Nonunions

Atrophic (oligo or hypo-trophic)

- Lack of callus (healing)
- “Avascular”
- Failure of healing cascade

- Factors
  - Host
  - Limb

Problem: BIOLOGY!
Humeral Shaft Nonunions

**Atrophic (oligo or hypo-trophic)**
- Lack of callus (healing)
- “Avascular”
- Failure of healing cascade
- Factors
  - Host
  - Limb

Solution: **BIOLOGY!**

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**Humeral Shaft Nonunions**

**Hyper-trophic nonunions**
- Lots of callus
- “Vascular”
- Mechanically unstable
- Factors
  - Rx failure?

**Problem:** **Mechanics!**

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**Humeral Shaft Nonunions**

**Hyper-trophic nonunions**
- Lots of callus
- “Vascular”
- Mechanically unstable
- Factors
  - Rx failure?

Solution: **Mechanical stabilization!**
Infection must be “ruled out”
- History
- Examination
- Sed rate, C-reactive protein
- Nuclear medicine
- MRI (CT)
- Culture
- Pathology

Humeral Shaft Nonunions

If “+” must be “treated”
- Debridement
- IV ABX
- Local ABX
- Wound coverage (Plastics)
- (Suppressive ABX)

Will defer to another talk

Humeral Shaft Nonunions

Fixation
- IM nail
- Plates/ screws
- External fixation

(+)
- Implant life
- Stability
- Familiar

(-)
- Retained implant
- Shoulder pain

Familiarity
- Less dissection
- No retained implant
- Flexibility of usage

Retained implant
- Larger dissection
- Less familiar
- Additional surgeries
A Few Cases

Case 1: History
• 68 yo woman
• BMI 38
• 2 years from fracture
• Nailed 3 mos later
• Shoulder pain 2/10
• Mid arm pain 4/10

Case 1: History
• 58 yo woman
• BMI 38
• 2 years from fracture
• Nailed 3 mos later
• Shoulder pain 2/10
• Mid arm pain 4/10
Case 1: Bone Health?

- Nicotine?
- Medical Hx?
  - Thyroid
  - Hormones
  - Vit D
  - Osteoporosis
  - Prior NU
- Medications?
  - Chemo
  - Psychotropics
  - Seizure
  - Osteoporosis

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  - Seizure
  - Osteoporosis

Case 1: Infection?

- # surgeries
- Infection Hx?
- Persistent drainage?
- Wound problems?
- Given ABX?
- Fevers/chills?
Case 1: Infection?

- # surgeries
- Infection Hx?
- Persistent drainage?
- Wound problems?
- Given ABx?
- Fevers/chills?

Case 1: Tests

- Basic anesthesia labs
- CBC
- C-reactive protein
- Sed rate
- Thyroid
- PTH
- Vit D
- Hormones

Case 1: Pre-op Plan

- Bone metabolism?
- Low probability infection?
- Treat Vit D
- Await labs
- Await labs
- Start surgical planning
Case 1: Pre-op Plan

- Bone metabolism?
- Low probability infection?

Surgical planning

Case 1: Surgery

- Address hardware
- Fixation construct
- “Graft”
- Approach
- Set-up

Debride & Fixation Construct

- Remove nail
- AL approach
- Drill bone ends/ NU
- Deep culture
- Fibular allograft
- Long 4.5mm plate
- Compression applied
- Autograft (Gerdy's)
Anterolateral Approach

Radial Nerve Protection
• Tale of 2 outcomes....

Follow-up

6 months
Case 2

- 48 yo woman
- BMI 37
- Polytrauma
- 9mos from fracture
- Mid arm pain 4/10

Case 2: Bone Health?

- Nicotine?
- Medical Hx?
  - Thyroid
  - Hormones
  - Vit D
  - Osteoporosis
  - Prior NU
- Medications?
  - Chemo
  - Psychotropics
  - Seizure
  - Osteoporosis
- Low Vit D
- Hypothyroid
- Distal femur NU

Case 2: Infection?

- # surgeries
- Infection Hx
- Persistent drainage
- Wound problems
- Given ABX
- Fevers/chills
- Infection: low risk
Case 2: Tests
- Basic anesthesia labs
- CBC
- C-reactive protein
- Sed rate
- Thyroid
- PTH
- Vit D
- Hormones

Low infection risk
Vit D is low
TSH is low

Case 2: Surgery @ 2mos
- Address hardware
- Fixation construct
- No "Graft"?
  - Approach
  - Set-up

Debride & Fixation Construct
- Posterior Approach
- Remove plate
- Examine bone > Cx
- Long 4.5mm plate
- Compression applied
Posterior Approach

- Triceps splitting

Posterior Approach

- Triceps sparing

Locked Plating

- Fixed angle device
- Lots of screws
- Open approach
Case 2: Follow-up

Humeral Shaft Nonunions

Treatment
- Challenging problems
- Thoughtful intervention
- No cookbook
- Type of nonunion
- Bone health
- Infection

Thank You