The broken hip bone renewal and repair of microdamage, severe suppression of bone remodeling can lead to microdamage accumulation. It should be noted, however, that microdamage accumulation alone does not explain the decline in bone toughness, as minimal association between changes in microdamage accumulation and bone toughness was found in preclinical studies.

Studies on stress fractures induced in the rat ulna showed that bisphosphonates impair stress-fracture-healing by reducing the volume of bone resorbed and replaced during the remodeling process. Several clinical reports also showed that a periosteal stress reaction and a transverse radiolucent line indicative of stress fracture usually preceded the complete atypical fracture in patients taking bisphosphonates, indicating a possible role for bisphosphonates in impaired stress-fracture-healing.

Reduced Heterogeneity of Organic Matrix and Mineral Properties

Bone maintains its compositional heterogeneity through the continuing process of bone remodeling. Heterogeneity of bone matrix and mineral density is preferable to homogeneity. Computational models of trabecular and cortical bone showed that a heterogeneous tissue distribution reduces local stress and enhances energy dissipation, whereas a homogeneous distribution is associated with greater propensity for crack formation and propagation, thereby increasing the risk of fracture.

By inhibiting the process of bone remodeling, bisphosphonates lead to a less heterogeneous structure with narrowed distributions of mineral and collagen properties. Boskey et al. found that treatment with alendronate for three years increased tissue mineral content and decreased the spatial heterogeneity of mineral properties of iliac crest tissue in healthy postmenopausal women without fractures. In addition, Donnelly et al. used Fourier transform infrared (FTIR) imaging to compare the mineral and collagen properties of corticocancellous bone biopsies from forty patients diagnosed with proximal femoral fractures. The authors found that FTIR-measured parameters in the twenty bisphosphonate-treated patients were similar to those in the twenty patients who had not received bisphosphonate treatment. However, the distributions of collagen maturity and crystal...
Disclosures

- None
Outline

● Definition: What’s a “hip fracture”?
● Why do we fix them?
● How do we fix them?
● How do we choose amongst our tools?
● What are the outcomes?
Definition: What’s a hip fracture?

- **Hip Anatomy**
  - “Ball & Socket” joint
    - Ball: Femoral head
    - Socket: Acetabulum
Definition: What’s a hip fracture?

- Hip fractures
  - Femur
    - Femoral head
    - Femoral neck
    - Intertrochanteric
    - Subtrochanteric
Definition: What’s a hip fracture?

- Femoral Head Fracture
  - Pipkin 1
  - Pipkin 2
  - Pipkin 3
  - Pipkin 4
Definition: What’s a hip fracture?

- Femoral Neck Fracture
  - I: Location
    - Basicervical
    - Transcervical
    - Subcapital
  - II: Displacement
    - Garden 1
    - Garden 2
    - Garden 3
    - Garden 4
  - III: Angulation
    - Pauwel’s 1
    - Pauwel’s 2
    - Pauwel’s 3
Definition: What’s a hip fracture?

- Intertrochanteric Femur Fracture
  - Normal Obliquity
  - Reverse Obliquity
Definition: What’s a hip fracture?

- Subtrochanteric Femur Fracture
  - Russell-Taylor
    - IA
    - IB
    - IIA
    - IIB
Definition: What’s a hip fracture?

- Acetabulum
  - Judet & Letornel
    - Elementary
      - Anterior Column
      - Posterior Column
      - Anterior Wall
      - Posterior Wall
      - Transverse
    - Associated
      - Posterior Column + Posterior Wall
      - Transverse Posterior Wall
      - Anterior Column Posterior Hemitransverse
      - T-shaped
      - Associated Both Column
Definition: What’s a hip fracture

- Large group of diagnoses, each with its own natural history, surgical treatments, and prognoses.
Why do we “fix” hip fractures

- Quantity of life
  - Mortality rate if untreated: ~85% at 1 month
  - Mortality rate if treated: 30% at 1 year
  - Cause of death: Complication of immobilization:
    - Pneumonia
    - Urinary Tract Infections
    - Bed Sores
    - Deconditioning
Why do we “fix” hip fractures

- Quality of life
  - O
  - O
  - B
  - W
  - B
  - A
  - T
How do we fix hip fractures

Internal Fixation

Arthroplasty
Goals of Treatment:
- Reduce the fracture
  - Restore patient's own anatomy
- Stable Fixation
  - Place an internal implant that will maintain the reduction
  - Allow immediate WBAT
- Limit soft tissue injury
  - Maintain the blood supply to the bone
  - Keep surrounding tissues healthy and functional
- Fracture healing
Internal Fixation
Internal Fixation
Arthroplasty

- **Goals of Treatment:**
  - Remove the fractured bone
    - Restore patient’s biomechanics, not their native anatomy
  - Stable implant
    - Implant geometry
      - Allows immediate stability within bone
    - Implant surface
      - Allows eventually bone ingrowth to implant
    - Both required for WBAT
  - Limit soft tissue injury
    - Maintain the blood supply to the bone
    - Keep surrounding tissues healthy and functional
  - Implant that lasts life span of patient
How do we choose amongst our tools?

1) Potential for fracture healing

2) Which procedure will allow for the weight bearing needs of the patient
How do we chose amongst our tools?

1) Potential for fracture healing

2) Which procedure will allow for the weight bearing needs of the patient

Scenario 1: 22yo M MCA, p/w R Pipkin II femoral head fracture and associated hip dislocation
How do we chose amongst our tools?

- 1) Potential for fracture healing
- 2) Which procedure will allow for the weight bearing needs of the patient

Scenario 1: 89yo M GLF, p/w R Pipkin II femoral head fracture and associated hip dislocation
How do we chose amongst our tools?

- 1) Potential for fracture healing
- 2) Which procedure will allow for the weight bearing needs of the patient

Scenario 1: 22yo M MCA, p/w R intertrochanteric hip fracture

✔ ✔
How do we choose amongst our tools?

- 1) Potential for fracture healing
- 2) Which procedure will allow for the weight bearing needs of the patient

Scenario 1: 89yo M GLF, p/w R intertrochanteric hip fracture
How do we chose amongst our tools?

- 1) Potential for fracture healing
- 2) Which procedure will allow for the weight bearing needs of the patient

Scenario 1: 65yo M GLF, p/w R Garden IV femoral neck fracture fracture

✔ ✔
How do we choose amongst our tools?

- 1) Potential for fracture healing
- 2) Which procedure will allow for the weight bearing needs of the patient

Scenario 1: 89yo M GLF, p/w R Garden IV femoral neck fracture fracture
How do we choose amongst our tools?

1) Potential for fracture healing

2) Which procedure will allow for the weight bearing needs of the patient

Scenario 1: 22yo M MCA, p/w L Associated both column acetabular fracture
How do we choose amongst our tools?

- 1) Potential for fracture healing
- 2) Which procedure will allow for the weight bearing needs of the patient

Scenario 1: 79yo M GLF, p/w L Associated both column acetabular fracture
What are the outcomes?

- Complications:
  - Heterotopic Ossification  
    • 5-50%
  - Avascular Necrosis  
    • 1-25%
  - Sciatic nerve palsy  
    • 1-25%
  - Post trauma arthritis  
    • 1-75%
  - Non-union  
    • 2-30%
  - Dislocation  
    • 0-10%
  - Infection:  
    • 3-5%
Summary

- **Definition:** What’s a “hip fracture”?
  - Large group of diagnoses, each with its own natural history, surgical treatments, and prognoses.

- **Why do we fix them?**
  - Quantity of life
  - Quality of life

- **How do we fix them?**
  - Internal Fixation
  - Arthroplasty

- **How do we choose amongst our tools?**
  - Healing potential of the fracture
  - Weight bearing needs of the patient

- **What are the outcomes?**
  - If complications can be avoided, outcomes are clearly better on an individual and societal level than non-operative treatment.
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Thank You