Periprosthetic Fractures
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Orthopaedic Surgeon
Northeast Nebraska Orthopaedics P C
Norfolk Nebraska
Periprosthetic Fractures

Fractures around Joint Replacements

Mostly Lower Limb

Knee Arthroplasty 700,000/yr.

Hip Arthroplasty 350,000/yr.

Shoulder Arthroplasty ? 60,000/yr.

Elbow Arthroplasty ? 20,000/yr.
Periprosthetic Fractures

Incidence

Increasing due to Increasing Demand and High Demands of Older Patients

Projections 2025
2,000,000 (2 million) Knee Replacements

750,000 Total Hip Replacements
Risk factors

I. Patient related:
- Rheumatoid arthritis
- Neurologic disorders
- Chronic steroid therapy
- Osteopenia/osteoporosis

II. Surgery related:
- In Supracondylar #:
  - Anterior femoral notching weakens the anterior femur at the bone-component interface
- In Tibia #:
  - Varus positioning and malrotation of the tibial component
- In Patella #:
  - Axial extremity deformities or malalignment of the prosthesis,
  - Extensive resections of the patella with thickness <15 mm

Periprosthetic Fractures

Risk Factors

- Mechanical
  - Implant Loosening
  - Osteolysis
  - Femoral Notching (Above TKA)

- Patient Factors
  - Rheumatoid Arthritis
  - Chronic Steroid Use
  - Neurologic Disease/Disorders
  - Osteoporosis/Osteopenia
  - Female Gender
  - Increasing Age
Periprosthetic Fractures

Incidence Hip

Intraoperative Acetabulum
- Cemented 0.2%
- Uncemented 0.4%

During Impaction

Under reaming > 2mm,
- Osteoporosis
- Dysplasia
- Radiation
Periprosthetic Fractures

Incidence Hip

Intraoperative

Primary 0.1-5%

Classification

Osteoporosis, Cementless, Technique, Revision, Minimally Invasive, Revision 3-21%
Periprosthetic Fractures

Risk Factors

DON’T FALL

Remove Loose Rugs
Minimize Stair Use Rail
Stay Home in Bad Weather!!!
Use Common Sense
Periprosthetic Fractures

Risk Factors

DON’T FALL

Remove Loose Rugs
Minimize Stair Use Rail
Stay Home in Bad Weather!!!
Use Common Sense

This Is Ice

SRS 2017
Periprosthetic Fractures

Incidence Knee

Intraoperative ?? Occasional Medial Femoral Condyle Often Tibial Crack after Stem Impaction

Postoperative Distal Femur 0.3-2.5%

Tibial 0.4-1.7%

Patella 0.2-21% Resurfaced

0.05% Non-Resurfaced???
Periprosthetic Fractures

Non Resurfaced Patella in Total Knee Arthroplasty
Smith SR, Stuart P, Pinder I
J Arthroplasty 1989 4 Supp s 81-86
Fragmentation ??? Fracture
<table>
<thead>
<tr>
<th>Fracture Type</th>
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Periprosthetic Fractures

Hip

Is it a Problem?

Incidence

Intraoperative 3.5%?? Very low for Acetabular

Postoperative 0.1%- 3% ???

So Low Why We Talking About This ???

21000 patients Devastating !!!!!!
Periprosthetic Fractures

Incidence Hip Postoperative 0.1-3% For Primary Hip Arthroplasty
Vancouver Classification of Periprosthetic Fracture After Total Hip Arthroplasty

Why?

Have a Classification System

Aid To Management
Vancouver Classification of Periprosthetic Fracture After Total Hip Arthroplasty

A  Trochanteric

Greater Trochanter (G)

Minimal Displaced
Treat Conservative
Vancouver Classification of Periprosthetic Fracture After Total Hip Arthroplasty

A  Trochanteric

Greater Trochanter (G)

Minimal Displaced
Treat Conservative
Vancouver Classification of Periprosthetic Fracture After Total Hip Arthroplasty

A Trochanteric
Displaced Abductors
Compromised Treat Operatively with Various Cables, Clamps, Fixation Devices

Greater Trochanter (G)
Vancouver Classification of Periprosthetic Fracture After Total Hip Arthroplasty

A. Trochanteric

Displaced Abductors
Compromised Treat
Operatively
with Various
Cables, Clamps,
Fixation
Devices

Greater Trochanter (G)
Vancouver Classification of Periprosthetic Fracture After Total Hip Arthroplasty

A  Trochanteric  Greater Trochanter (G)

Displaced Abductors
Compromised Treat
Operatively with Various Cables, Clamps, Fixation Devices
Vancouver Classification of Periprosthetic Fracture After Total Hip Arthroplasty

B  About Stem Tip  Stable Stem (1)

Stem Well  Fixed

Conservative
Vancouver Classification of Periprosthetic Fracture After Total Hip Arthroplasty

B  About Stem Tip  Stable Stem (1)

Fixation to Restore
Bone Integrity
Cables
Vancouver Classification of Periprosthetic Fracture After Total Hip Arthroplasty

B  About Stem Tip  Stable Stem (1)

Fixation to Restore
Bone Integrity
Plates with Combination
Cables And Screws
Vancouver Classification of Periprosthetic Fracture After Total Hip Arthroplasty

B  About Stem Tip
Loose Stem (2)

Replace Stem
Always Longer
With Distal Fixation

In this Case Fully Coated Ingrowth Stem
Vancouver Classification of Periprosthetic Fracture After Total Hip Arthroplasty

B About Stem Tip

Replace Stem
Always Longer
With Distal Fixation
+/- Bone Graft
Allograft

In this Case Fully Coated Ingrowth Stem

Poor Bone Stock(3)
Vancouver Classification of Periprosthetic Fracture After Total Hip Arthroplasty

B  About Stem Tip  Poor Bone Stock(3)

Replace Stem
Always Longer
With Distal Fixation
+- Bone Graft
Allograft

In this Case Conical Fluted Stem
B  About Stem Tip  Poor Bone Stock (3)

Replace Stem
Always Longer
With Distal Fixation
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In this Case Conical Fluted Stem
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Vancouver Classification of Periprosthetic Fracture After Total Hip Arthroplasty

C  Below Stem Tip

Fixation to Restore Bone Integrity
Plates with Combination Cables And Screws

Avoid Stress Riser
Vancouver Classification of Periprosthetic Fracture After Total Hip Arthroplasty

C Below Stem Tip

Fixation to Restore Bone Integrity Plates with Combination Cables And Screws

Avoid Stress Riser
Vancouver Classification of Periprosthetic Fracture After Total Hip Arthroplasty

C  Below Stem Tip

Avoid Stress Riser
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Vancouver Classification of Periprosthetic Fracture After Total Hip Arthroplasty

Earlier Designs had Taper Stress Fractures
This Happened when No Proximal Support
Solution More Sizes with Ingrowth Surface
Vancouver Classification of Periprosthetic Fracture After Total Hip Arthroplasty

Female 80’s
Already has a Revision Stem
Revised Acetabulum and Incorporated Allografts
Vancouver Classification of Periprosthetic Fracture After Total Hip Arthroplasty

Low Impact Fall
Vancouver Classification of Periprosthetic Fracture After Total Hip Arthroplasty

Going To Be Good?

2 One Cortical Screws Above/Proximal
Vancouver Classification of Periprosthetic Fracture After Total Hip Arthroplasty

Going!!!
Vancouver Classification of Periprosthetic Fracture After Total Hip Arthroplasty

Gone!!!

Poor Bone Stock
Proximal Fixation?
Augment With Cables
Vancouver Classification of Periprosthetic Fracture After Total Hip Arthroplasty

Fracture
Non-union
Vancouver Classification of Periprosthetic Fracture After Total Hip Arthroplasty

19 /20 Hole Plate

Cables Held onto Plates
Vancouver Classification of Periprosthetic Fracture After Total Hip Arthroplasty

19 /20 Hole Plate

Cables Held onto Plates
Vancouver Classification of Periprosthetic Fracture After Total Hip Arthroplasty

19 /20 Hole Plate

Cables Held onto Plates
Vancouver Classification of Periprosthetic Fracture After Total Hip Arthroplasty

19 /20 Hole Plate

Cables Held onto Plates

Allograft
Vancouver Classification of Periprosthetic Fracture After Total Hip Arthroplasty

Female 80’s
Low Impact Fall

Uncemented Hemiarthroplasty
Vancouver Classification of Periprosthetic Fracture
After Total Hip Arthroplasty

Female 80’s
Low Impact Fall

Uncemented Hemiarthroplasty

Fracture Propagation
Vancouver Classification of Periprosthetic Fracture After Total Hip Arthroplasty

Conversion to Total Hip

Trochanteric Bolted Claw

Fully Ingrown Body

Conical Ingrowth Stem

Multiple Cables to Stop Crack Propagation
Vancouver Classification of Periprosthetic Fracture After Total Hip Arthroplasty

Female 80’s
Low Impact Fall

Uncemented Hemiarthroplasty

Recognized Fracture
Inadequate Fixation
Vancouver Classification of Periprosthetic Fracture After Total Hip Arthroplasty

Conversion to Total Hip
Trochanteric Bolted Claw
Fully Ingrown Body
Conical Ingrowth Stem
Vancouver Classification of Periprosthetic Fracture After Total Hip Arthroplasty

Female 70’s
2 Previous THA
1st Compass in Nebraska
Used For Radical Bone Loss
Vancouver Classification of Periprosthetic Fracture After Total Hip Arthroplasty

Used Hip or Knee Massive Bone Loss And Tumor
Periprosthetic Fractures

Risk Factors
- Mechanical
  - Implant Loosening
  - Osteolysis
  - Femoral Notching (Above TKA)

Not Any Different Than Hip

Patient Factors
- Rheumatoid Arthritis
- Chronic Steriod Use
- Neurologic Disease/Disorders
- Osteoporosis Ostoepenia
- Female Gender
- Increasing Age

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Classification of Periprosthetic Fracture After Total Knee Arthroplasty

Femur 0.3-2.5%

Type 1
Proximal to the Component

Type 2
At the Level of the Component

Type 3
Within the Component
Classification of Periprosthetic Fracture After Total Knee Arthroplasty

Femur 0.3-2.5%

Type 1
Proximal to the Component

Retrograde Intramedullary Nail Introduced Through the Knee

SRS 2017
Classification of Periprosthetic Fracture After Total Knee Arthroplasty

Femur 0.3-2.5%

Type 1
Proximal to the Component
Retrograde Intramedullary Nail Introduced Through the Knee
If Stabilized Needs An Open Box Or Has a Stem Needs ORIF
Classfication of Periprosthetic Fracture After Total Knee Arthroplasty

ORIF Long Locking Plate Cables

7 Cortices Above Proximal to Fracture
Classification of Periprosthetic Fracture After Total Knee Arthroplasty

7 Cortices Above /Proximal to Fracture

Need at Least 6
Classification of Periprosthetic Fracture After Total Knee Arthroplasty

Femur 0.3-2.5%

Type 1
Proximal to the Component

ORIF Locking Supracondylar Plate
Classification of Periprosthetic Fracture After Total Knee Arthroplasty

Femur 0.3-2.5%

Type 2
At the Level of the Component
Classification of Periprosthetic Fracture After Total Knee Arthroplasty

Femur 0.3-2.5%

Type 2
At the Level of the Component
Classification of Periprosthetic Fracture After Total Knee Arthroplasty

Femur 0.3-2.5%

Type 2
At the Level of the Component

ORIF Locking Condylar Plate or Retrograde Nail
??Space for 2 Screws
Classification of Periprosthetic Fracture After Total Knee Arthroplasty

Femur 0.3-2.5%

Type 2
At the Level of the Component

ORIF Locking Condylar Plate or Retrograde Nail
??Space for 2 Screws
Classification of Periprosthetic Fracture After Total Knee Arthroplasty

Femur 0.3-2.5%

Type 3 Within the Component

Prosthesis Intact
ORIF or Retrograde Nail
If Sufficient Bone

Prosthesis Loose Exchange to Prosthesis with Long Stem
Or Hinged Knee Replacement
Classification of Periprosthetic Fracture After Total Knee Arthroplasty

Femur 0.3-2.5%

Type 3
Within the Component

Prosthesis Intact
ORIF or
Retrograde Nail
If Sufficient Bone
Classification of Periprosthetic Fracture After Total Knee Arthroplasty

Femur 0.3-2.5%

Type 3
Within the Component

Prosthesis Loose Exchange
to Long Stem or Hinge Knee
Classification of Periprosthetic Fracture After Total Knee Arthroplasty

Femur 0.3-2.5%
Type 3
Within the Component

Prosthesis Loose Exchange to Long Stem or Hinge Knee
Classification of Periprosthetic Fracture After Total Knee Arthroplasty

Periprosthetic Type 2/3 Revised to Long Stem

Non-Union
Classification of Periprosthetic Fracture After Total Knee Arthroplasty

Periprosthetic Type 2/3 Revised to Long Stem

Non-Union
Classification of Periprosthetic Fracture After Total Knee Arthroplasty

Periprosthetic Type 2/3 Revised to Long Stem

Non-Union

Bone Scan Positive
Classification of Periprosthetic Fracture After Total Knee Arthroplasty

Revised to Distal Femur Replacement Hinged Knee
Classification of Periprosthetic Fracture After Total Knee Arthroplasty
Classification of Periprosthetic Fracture After Total Knee Arthroplasty

Female 68 year old
2 years After Full Weight Bearing
Acute Onset Pain
Female 68 year old
2 years After Full Weight Bearing
Acute Onset Pain

Stress Fracture
Non-Union
Classification of Periprosthetic Fracture After Total Knee Arthroplasty

Revised to Retrograde Nail
Option Distal Femoral Replacement
Classification of Periprosthetic Fracture After Total Knee Arthroplasty

Revised to Retrograde Nail

Option Distal Femoral Replacement
Classification of Periprosthetic Fracture After Total Knee Arthroplasty

Female 68 year old
2 years After Full Weight Bearing
Acute Onset Pain

Stress Fracture
Non-Union
Classification of Periprosthetic Fracture After Total Knee Arthroplasty

- Tibia 0.4-1.7%
- Plateau
- Stem of Tibial Stem
- Tibial Shaft
- Tibial Tubercle
Classification of Periprosthetic Fracture After Total Knee Arthroplasty

Tibia 0.4-1.7%

1. Plateau

11. Stem of Tibial Stem

111. Tibial Shaft

1IV. Tibial Tubercle
Classification of Periprosthetic Fracture After Total Knee Arthroplasty

Tibia 0.4-1.7%

1. Plateau

Usually Component Loose

Revision
Classification of Periprosthetic Fracture After Total Knee Arthroplasty

Tibia

Common Crack During Stem Preparation

Easily Covered with a Transverse Screw
Classification of Periprosthetic Fracture After Total Knee Arthroplasty

Tibial Tubercle

Type 4
Classification of Periprosthetic Fracture After Total Knee Arthroplasty

Type 2

Plate or Long Stem

Often Associated With Osteolysis
Classification of Periprosthetic Fracture After Total Knee Arthroplasty

Type 2

Often Associated With Osteolysis

Revision
Classification of Periprosthetic Fractures of the Patella in TKA

Fig. 3. Treatment algorithm of periprosthetic patellar fractures (modified after [58]).
Classification of Periprosthetic Fractures of the Patella in TKA

- Extensor Mechanism Intact
- Extensor Mechanism Disrupted
- Patella Button Intact
- Patella Button Loose
- Patella Fracture
Treatment of Periprosthetic Fractures of the Patella in TKA

- Extensor Mechanism Intact
- Patella Button Loose
  - Remove Loose Button
  - Replace if >9mm. Patella Bone
- If Removed Stair Climbing Out of Chair Weaker
Treatment of Periprosthetic Fractures of the Patella in TKA

Extensor Mechanism Intact

Patella Button Loose
Remove Loose Button
Replace if >9mm. Patella Bone
If Removed Stair Climbing Out of Chair Weaker
Treatment of Periprosthetic Fractures of the Patella in TKA

- Extensor Mechanism Intact or Stretched
- Patella Button Loose
  - Remove Loose Button
  - Replace if >9mm. Patella Bone
  - If Removed Stair Climbing Out of Chair Weaker
Classification of Periprosthetic Fractures of the Patella in TKA

- Extensor Mechanism Intact
- Patella Fracture
- Patella Button Intact????
- Probably Never
Classification of Periprosthetic Fractures of the Patella in TKA

- Extensor Mechanism Disrupted
- Patella Button Intact

Repair Extensor Mechanism
Commonly Quadriceps
Patella Tendon Devastating

I Prefer to Exchange Patella
Suture Button (Predrilled)
Classification of Periprosthetic Fractures of the Patella in TKA

- Extensor Mechanism Intact
- Extensor Mechanism Disrupted
- Patella Button Intact
- Patella Button Loose
- Patella Fracture
Classification of Periprosthetic Fractures of the Patella in TKA

- Extensor Mechanism Disrupted
- Patella Button Loose

Repair Extensor Mechanism

Patella

>9mm. Replace

<9mm. Non Replaced

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Classification of Periprosthetic Fractures of the Patella in TKA

- Extensor Mechanism Intact
- Patella Fracture

- Repair Extensor Mechanism
- Don’t Repair Excise
- or Repair Tendon to Bone
- Quadriceps to Bone or
- Patella Tendon to Bone
- Patella is Loose so Remove

SRS 2017
Classification of Periprosthetic Fractures of the Patella in TKA

- Extensor Mechanism Intact
- Patella Fracture
  - Repair Extensor Mechanism
  - Don’t Repair
  - Excise
  - or Repair Tendon to Bone
  - Quadriceps to Bone or
  - Patella Tendon to Bone or
  - Complete Patellectomy
Classification of Periprosthetic Fractures of the Patella in TKA

Knee Arthrodesis

Function Terrible

Salvage Surgery
Classification of Periprosthetic Fractures of the Patella in TKA

- Extensor Mechanism Disrupted
- Patella Button Loose

Repair Extensor Mechanism

Suture Button if >9mm Patella Thickness

Otherwise Leave Non Resurfaced Patella

SRS 2017
Knee Complications

Quads Tendon Tear
Rehab Slow!
Protect with T-Rom Brace
No Flexion until wound healing
The flexion Lock Brace
at Flexion Range Obtained
DC Brace only when Quads
Control And Flexion>100 degrees
Female 70’s Not Walked
15yrs Fall
Supracondylar Fracture
Knee Complications

Patella Tendon Tear Fall!!!!!

SRS 2016
Knee Complications

Patella Tendon Tear


Results
Still had Significant Extensor Lag
Excellent Functional Result Full Extension
Patella Tendon Tear Tibia Patella Tendon Patella Distal Quadriceps Allograft
Patella Tendon Tear
Patella Tendon Tear
Again I’ll End With The Really Scary!!!!
Thank You

Northeast Nebraska Orthopaedics Staff
FRHS Surgical Staff and Anaesthesia
FRHS Pre-Op Staff and Joint Teaching Staff
FRHS Ortho/Surgery Staff
FRHS PT/OT
NE Nebraska NH and PT Facilities
Thank You

Northeast Nebraska Orthopaedics Staff
FRHS Surgical Staff and Anesthesia
FRHS Pre-Op Staff and Joint Teaching Staff
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NE Nebraska NH and PT Facilities
Periprosthetic Fractures