Periprosthetic Hip Fractures

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Objectives

• Define periprosthetic and peri-implant fractures

• Accurately classify periprosthetic fractures at the hip

• Describe treatment strategies for periprosthetic and peri-implant fractures
Definitions

• Periprosthetic fracture
  • A fracture about a prosthesis (e.g. arthroplasty stem)

• Peri-implant fracture
  • A fracture adjacent to a surgical implant (e.g. plate, medullary nail)
Periprosthetic Fractures of the “Hip”

• Proximal Femoral Periprosthetic
  • Interprosthetic

• Acetabular Periprosthetic

• Proximal Femoral Peri-Implant
Periprosthetic Fractures of the Proximal Femur

• Occur around hip arthroplasty stems and/or cement mantles

• Incidence varies, 0.1-18%\(^1\)

• Etiology - bimodal distribution:
  • Elderly: Low energy MOI (fall from standing height)
  • Young: High-energy trauma (sport, MVC, etc; <10% reported cases\(^2\))
Periprosthetic Fractures of the Proximal Femur

• Risk factors:
  • Demographics:
    • Increased age, female sex, osteoporosis, inflammatory arthropathy, altered bony morphology
  • Surgical:
    • Press-fit stem – 1.2-5.4% incidence\(^3\)
    • Anterior approach – 2.5-10% incidence\(^4\)
    • Long-stem implants
    • Impaction grafting\(^{1,3}\)
Periprosthetic Fractures of the Proximal Femur

• 30-day mortality around 3% in multiple series

• Mortality higher when revision performed for fracture than for other reasons
Classification

• Early systems classify by anatomic region

• AAOS, 1990
  • Does not consider implant stability

• Kelley, 1994
  • Considers stem stability

• Poor utility
Classification

• Vancouver Classification

• Intraoperative vs postoperative

• Suggests treatment strategy

• Improved postop outcomes after adoption

Vancouver Classification

• A – trochanteric
  • G, greater
  • L, lesser

• B – involving stem
  • 1, Well-fixed prosthesis
  • 2, Loose prosthesis
  • 3, Loose prosthesis, poor bone stock

• C – well below stem

Intraoperative Fractures

• Incidence approx 1% primary THA, 7.8% revision THA

• Uncemented > Cemented stems
  • 2-7x increased rate of fx compared to cemented stems

• Risk factors:
  • Stem morphology
  • Bone morphology
  • Approach
  • Female sex
  • Increased age
  • H/o prior hip surgery or revision THA
Intraoperative Fractures

- Vancouver Classification for Intraoperative Femur Fractures\(^1\)

<table>
<thead>
<tr>
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### Author's preferred treatment options

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| Unrecognized fractures  |                |
| Cortical strut          | Protected weight bearing or lateral plate |
| Lateral plate           |                |
Vancouver Classification – Postoperative

Initial Evaluation

History

- PMH – critical to assess pt functionality
- Premorbid hip function
  - Pain, instability, weakness
  - Mid-thigh pain, start-up pain, progressive limb shortening – stem loosening
- RED FLAGS FOR INFECTION
  - History of wound-healing complications or delayed wound healing
  - Any hx of postop antibiotic therapy
  - Pain
  - Fever
  - Draining sinus

Physical

- May be limited by pain
- Note location of prior incision
- Leg length discrepancy
- Skin/soft tissue condition
- Neuromotor exam
Radiographic Workup

• XR
  • Standard AP/lat of affected hip and full femur
  • Low AP pelvis
    • Implant positioning
    • Polyethylene wear, osteolysis
  • PRIOR XR

• CT/MRI
  • Rarely indicated
Treatment Principles

• Nonoperative management is uncommon
  • Stable patterns
  • Poor surgical candidates

• Be prepared for several possible scenarios
  • Familiarized with extensile approaches, osteotomies
  • Ensure multiple implant options are available in-house
Treatment Principles

• Obtain intraoperative tissue cultures, even if preoperative risk of infection was low

• Postop early mobility is goal, but may require protected WB 6-12 wks until radiographic evidence of healing
Preop Planning

• Obtain index op report
  • Implant system used, any intraoperative abnormalities, etc

• Obtain postop, pre-morbid XR
  • Look for evidence of subsidence, malpositioning, etc

• Template
  • Consider including multiple systems or bail-out options

• Speak to the rep
  • Ensure all necessary equipment and systems are available in-house
Timing

- Increased mortality with surgical delay beyond 72 hours

- Work expeditiously to ensure the optimal
  - Surgeon
  - Implant availability
  - Team
Postop

• GOAL – WBAT for all fractures
  • May not be possible due to fixation, bone quality, implants etc
  • Alternative strategies – dual plating, nail/plate etc emerging

• Additional protocols (abduction, posterior hip) per surgeon preference

• Scant evidence in periprosthetic ”hip” fractures
Vancouver A

- $A_L$
  - observation for true LT
  - Cerclage + revision for large medial fragment

- $A_G$
  - observation if small
  - Internal fixation for large fragments
Example: AG

- Displaced trochanteric fragment reduced and fixed with claw plate
Example: $A_L$
Example: $A_L$

- Cerclage of fracture
- Prosthesis revision
- Plate spanning entire femur
Vancouver C

- Fix the fracture
- Don’t create new problems
  - Overlap implants
- No stress risers
- Plate the whole bone!!
Example: Vancouver C-analogous fracture
Vancouver B

Vancouver B1

• Don’t forget basic osteosynthesis principles

• Choose absolute or relative stability and create it

• Don’t disturb biology whenever possible

• Test stem intraoperatively and be prepared to revise
Vancouver B

REVISION

ARTHROPLASTY

(± INTERNAL FIXATION)

Vancouver B2/3

- Bypass fractures by at least 2 cortical diameters
  - Biomechanical data from canine models without fixation

- Don’t forget basic osteosynthesis principles

- Create a durable, stable construct
Fixation Mechanics

• Cerclage useful for re-creating tube or when fixation cannot be placed

• Be judicious

• Screws are biomechanically superior to cables
  • Need some BI cortical screws
  • Numerous proprietary options exist to facilitate this
Allograft Struts

• Should be reserved for when there is bone loss

• Inferior to internal fixation with plates/screws for simple patterns

• Increases infection risk and time to union in meta-analyses\(^1\)
Periprosthetic Acetabular Fractures

- Historical intraoperative fracture rate low (0.3% in Mayo series)
  - Rate up to 8.4% based on CT scans

- Postoperative fracture rate very low (0.07% in Mayo series)
Classification

• Peterson and Lewallen (1996)

• Type I: Component position unchanged, no pain with hip motion

• Type II: Radiographic loosening or significant hip pain
Treatment

• Stable cup
  • Intraop – augment with screws
  • Postop – limited weightbearing

• Unstable cup
  • Revision of cup +/- ORIF of acetabular fracture
Example: Stable Cup
Example: Unstable Cup
- Prosthesis revised

- ORIF of posterior column

- Flanged cup with fixation into anterior and posterior columns
Peri-Implant Fractures

• Treatment algorithm determined by 2 questions:
  • How is the fracture optimally treated?
  • Is the initial fracture healed?

• Prioritize optimal treatment of new fracture
  • Especially when prior fracture is healed

• If prior fracture not healed, adjust accordingly
  • Two fractures, two treatments
6 weeks, still w c/o pain 9/10
Re-admit
Summary

• Periprosthetic and peri-implant fractures are unique

• Periprosthetic fractures at the hip can be reliably classified

• Revision arthroplasty is necessary if the prosthesis is unstable