Patella Fractures and Extensor Mechanism Injuries

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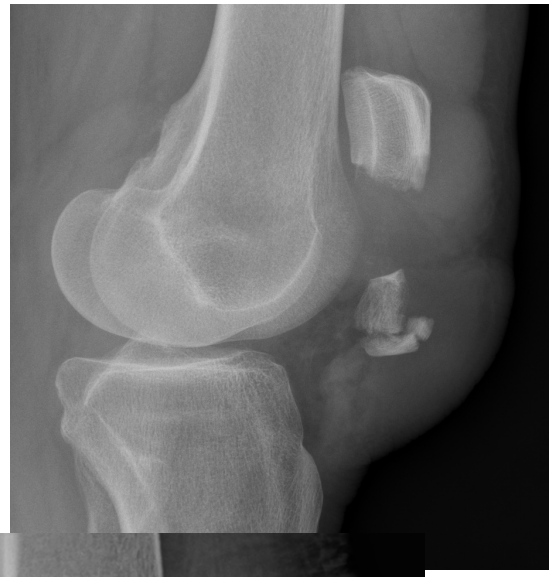
Overview & Objectives

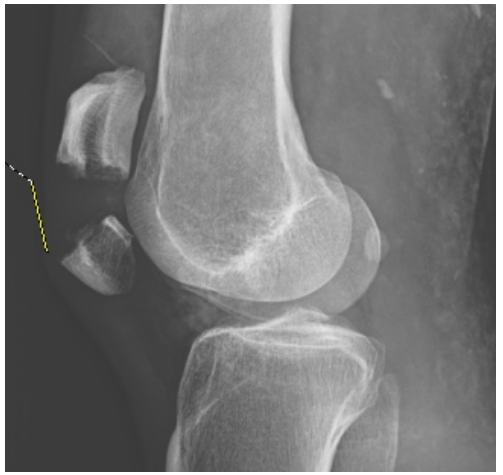
- **Epidemiology & Mechanism of Injury**
- **Anatomy & Biomechanics**
- **Diagnosis & Classification**
- **Non-Operative Treatment**
- **Operative Treatment**
  - **Patella Fractures: Simple & Complex**
  - **Quad/Patella Tendon Injuries**
- **Complications**
- **Summary/Key Points**

Illustrative Cases Throughout This Lecture



Epidemiology & Mechanism of Injury

- **Patella Fractures:**
  - **~1% of all fractures**



- **Mechanism of Injury:**
  - **Direct impact (fall, dashboard)**
  - **Indirect (forceful quadriceps contraction)**
    - **Frequent cause of patella tendon/quad tendon ruptures**
  - **Combined (impact + quad contraction)**

Anatomy – Blood Supply

- **Geniculate arteries**
  (branches of popliteal artery)
  - **Lateral Superior (LS)**
  - **Medial Superior (MS)**
  - **Lateral Inferior (LI)**
  - **Medial Inferior (MI)**
  - **Supreme (S)**
    (branch of SFA)
  - **Anterior Tibial Recurrent (ATR)**
    (branch of anterior tib)
- **Robust blood supply:**
  - **Even in setting of fracture, most fragments retain blood supply**

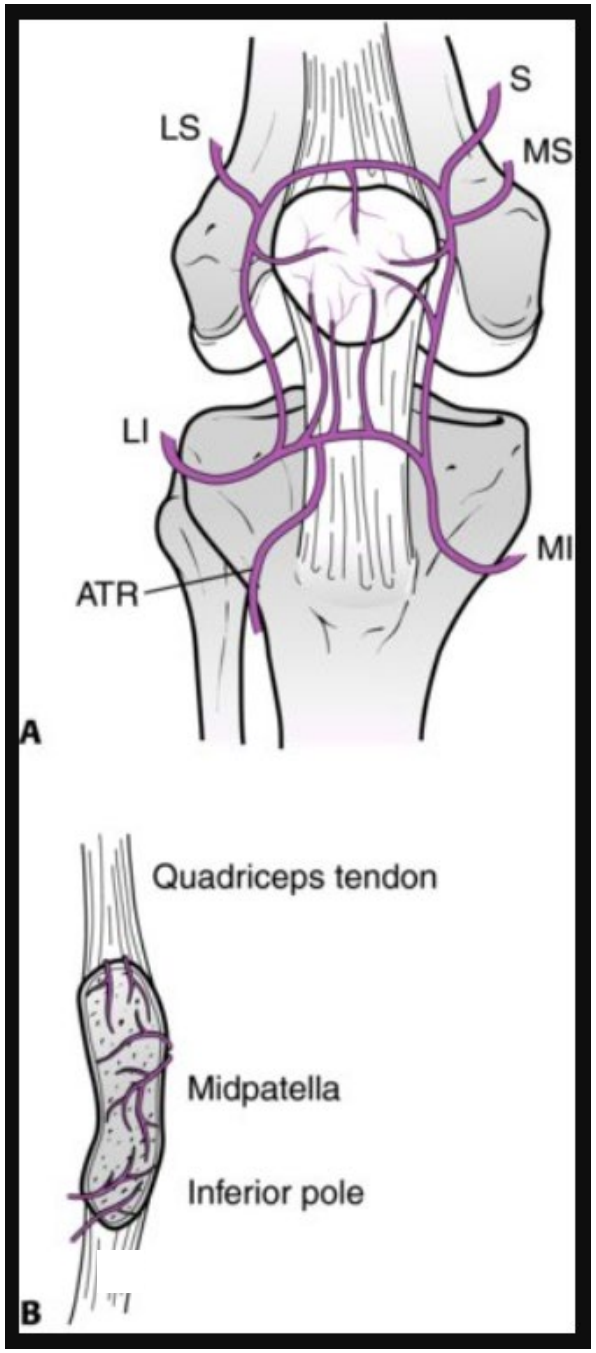
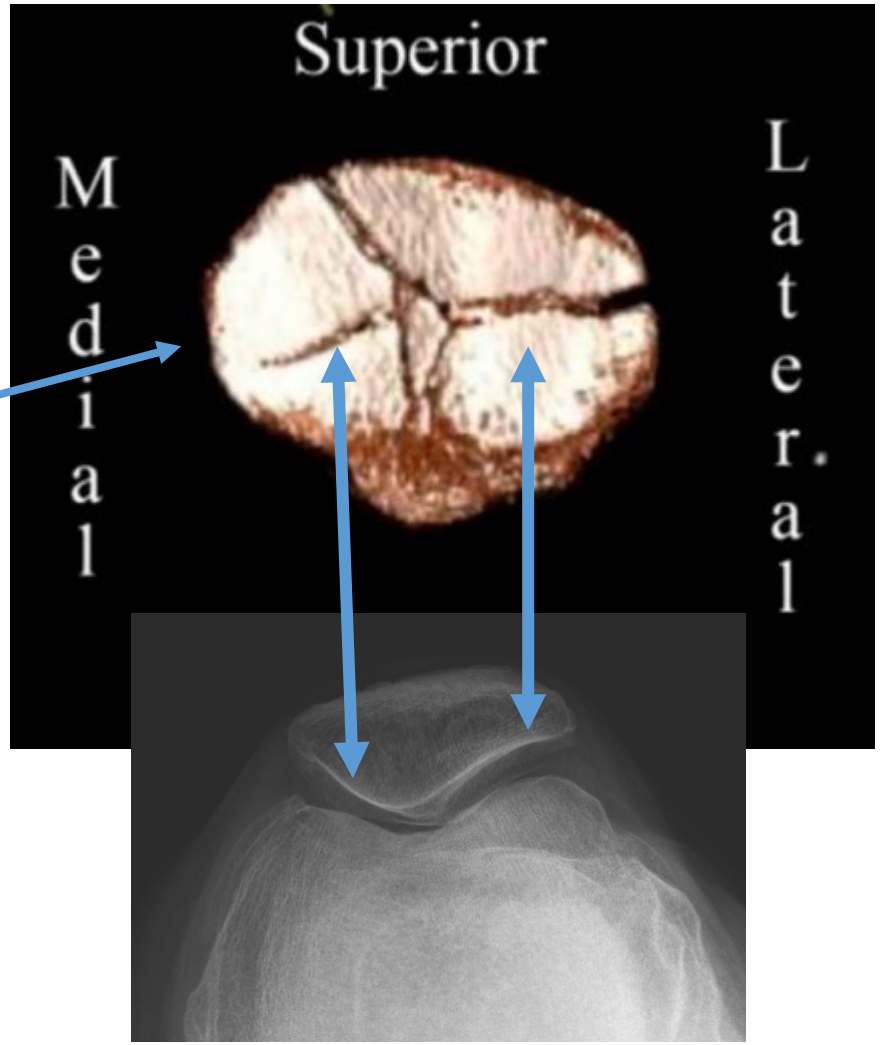


Image Source: Rockwood and Green's Fractures in Adults, 9th Edition, Fig. 59-5.

Anatomy – Articular Facets

Image Source: Misir et al. Fracture Patterns and Comminution Zones in OTA/AO 34C Type Patellar Fractures. *J Orthop Trauma* 2020 May;34(5). E159-e164. Fig. 1.

- **Medial Facet:**
  - **Separated from lateral facet by vertical ridge**
  - **Usually concave, but can be convex**
- **Odd Facet:**
  - **Medial border of the patellar articular surface**
  - **Only contacts femur in flexion >45 degrees**



- **Lateral Facet:**
  - **Largest facet (typically)**
  - **Concave**

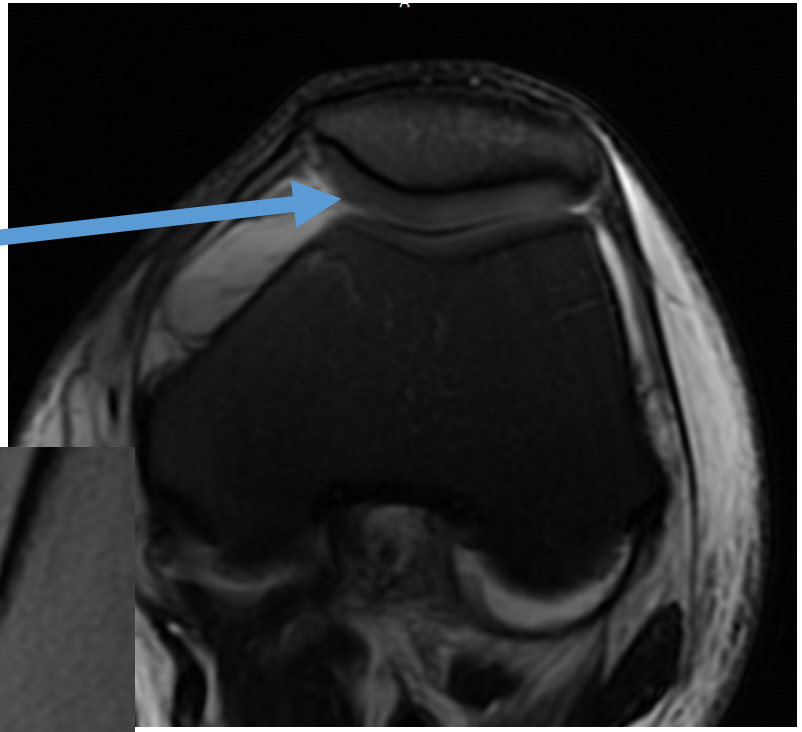
Anatomy – Bipartite Patella

- **Normal anatomic variant**
- **Secondary ossification center fails to fuse to primary ossification center**
- **Often *mistaken* for an acute fracture**
- **Most commonly superolateral**
- **Smooth, well-corticated edges**
- **Bilateral in ~50% of patients**

Image Source: Rockwood and Green's Fractures in Adults, 9th Edition, Fig. 59-2.

Anatomy – Articular Cartilage

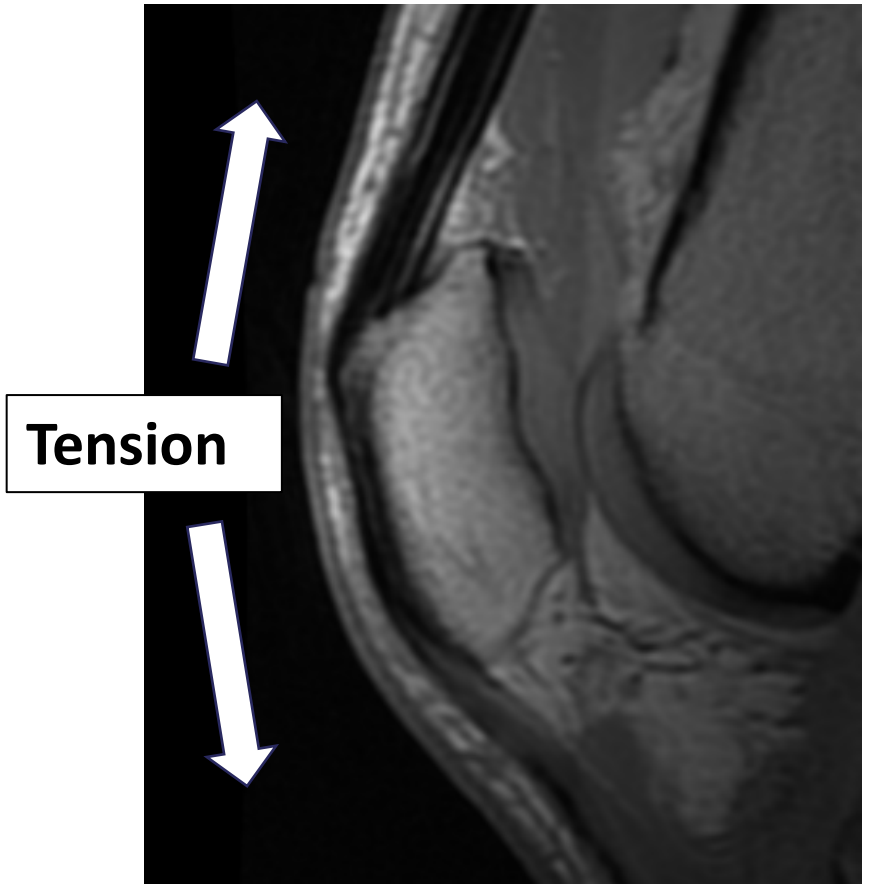
- **Undersurface of Patella:**
  - **Covered with *thick* articular cartilage**
  - **Up to 1cm thick**



- **Distal pole:**
  - **Devoid of cartilage**
  - **As a result, most distal pole fractures are *extra-articular* injuries**

Biomechanics

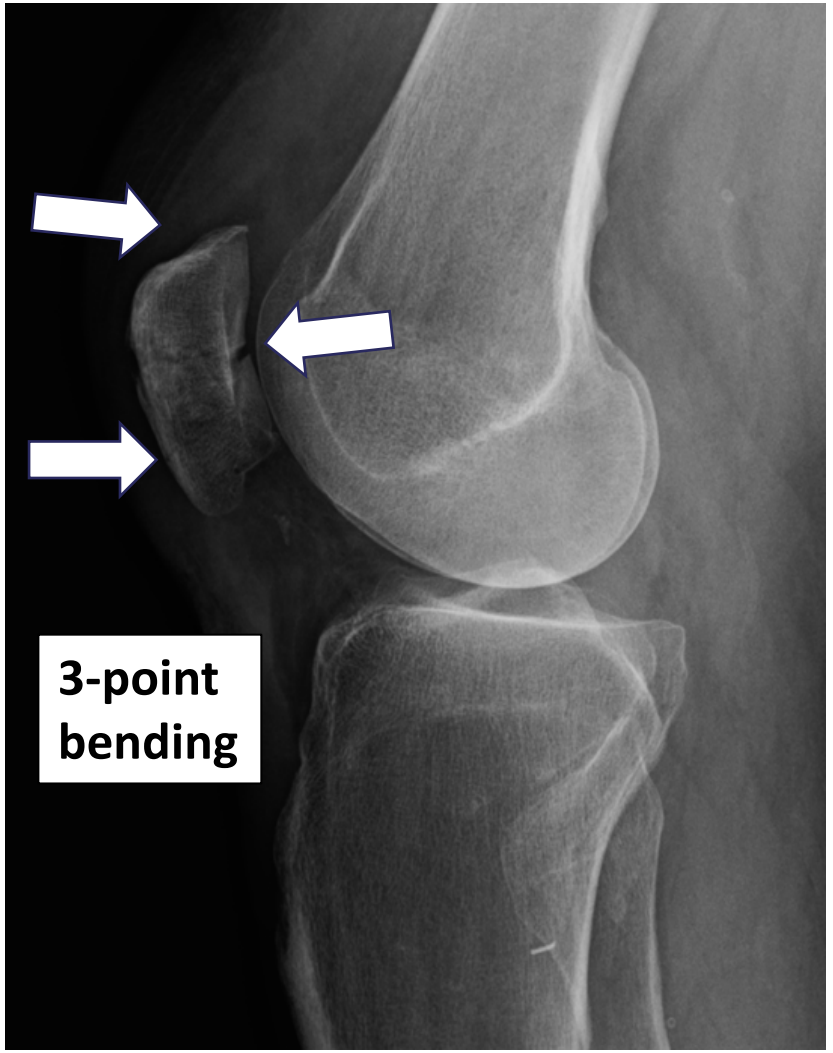
- **Extensor mechanism critical for:**
  - **Maintaining upright posture**
  - **Generating torque for knee extension**
- **Patella serves to *displace* the quad tendon away from knee's center of rotation:**
  - **Increases quad tendon's moment arm**
  - **↑ Mechanical advantage up to 50%**
- **Significant tensile forces generated**
  - **Up to 6,000 N (~8x body weight)**



Biomechanics

- **Patella Experiences 3-Point Bending forces in knee flexion**
  - **Where articular cartilage is thickest**

- **Patello-Femoral Contact Forces:**
  - **Greater than any other joint**
  - **Up to 7x body weight**
  - **Highest during squatting, ascending and descending stairs**

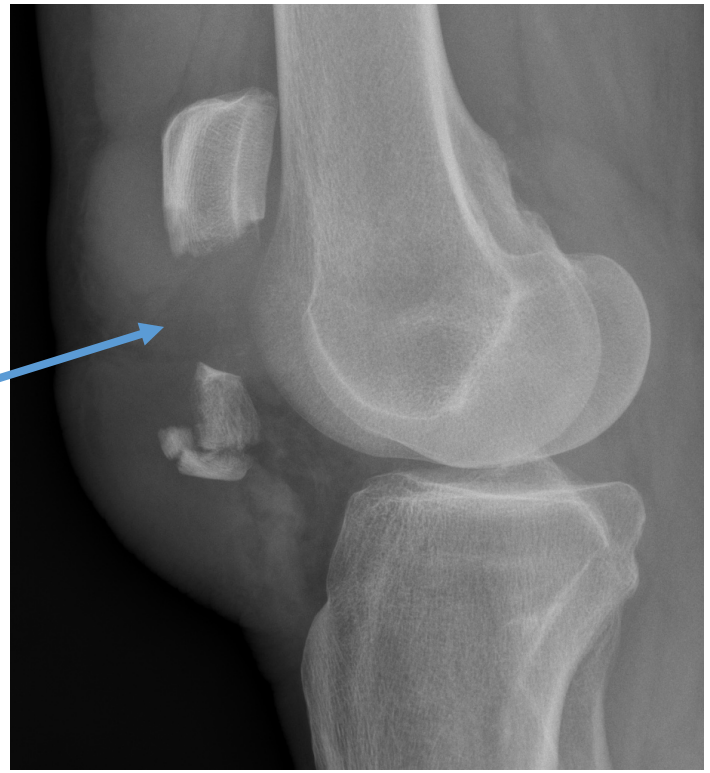


Diagnosis – Physical Exam

- **All Extensor Mechanism Injuries:**
  - **Hemarthrosis/Effusion**
  - **Inability to perform straight leg raise**
    - *** If retinaculum intact, pt may be able to SLR**

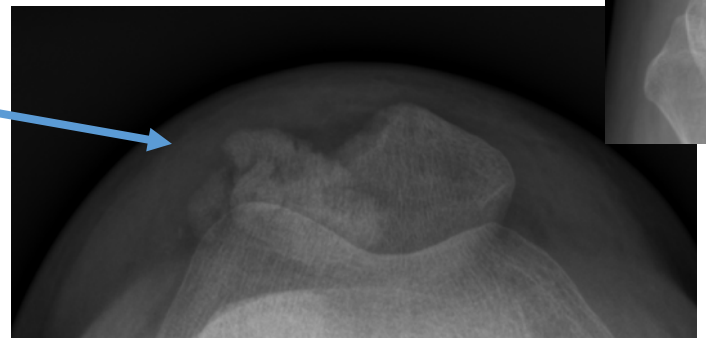
- **Patella fractures:**
  - **Palpable defect between fracture fragments**

- **Quad Tendon/Patella Tendon Injury:**
  - **Palpable defect:**
    - **Proximal to patella (quad tendon injury)**
    - **Distal to patella (patella tendon injury)**



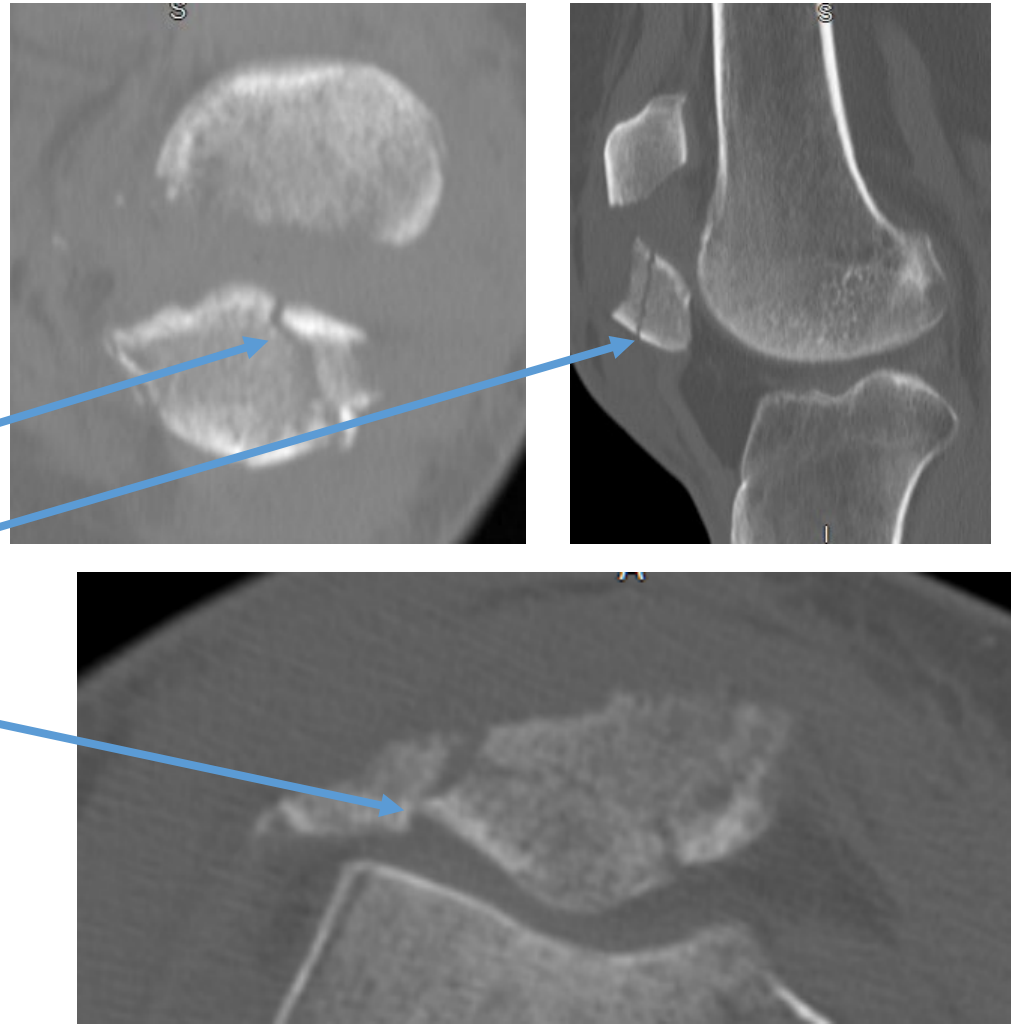
Diagnosis – Patella Fractures

- **X-rays (AP/Lateral)**
  - **Typically sufficient to confirm diagnosis**
  - **Lateral view:**
    - **degree of displacement**
  - **AP view:**
    - **fracture obliquity & degree of comminution**
  - **Sunrise view:**
    - **Additional fracture characteristics**



Diagnosis – Patella Fractures

- **Advanced imaging:**
  - **CT Scan**
    - **In comminuted fractures, helpful for pre-op planning**
    - **Improved understanding of fracture pattern:**
      - **# of fragments**
      - **Fracture orientation**
      - **Articular impaction/step-off**
  - **MRI**
    - **Rarely needed for isolated patella fractures**
    - **Useful if concomitant knee ligament injury suspected**



Diagnosis – Quad/Patellar Tendon Injuries

- **X-ray: Lateral view**
  - **In 90 flexion, superior pole normally rests *posterior* to the anterior femoral line**
  - **With patella tendon injury, patella rests *anterior* to the anterior femoral line**

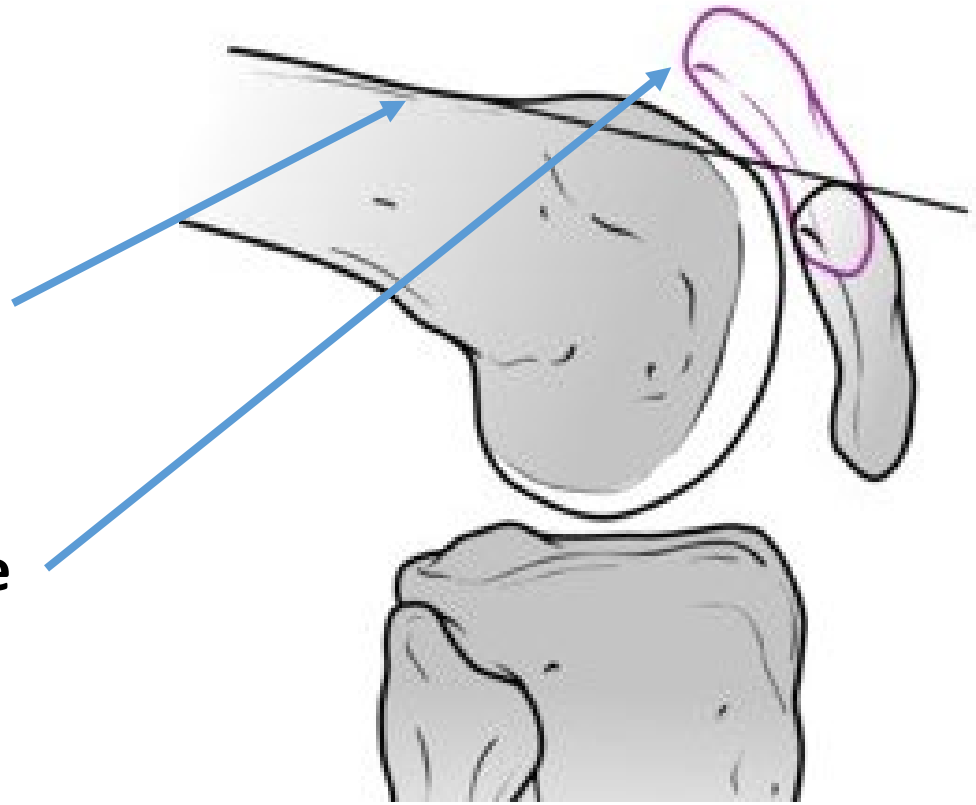


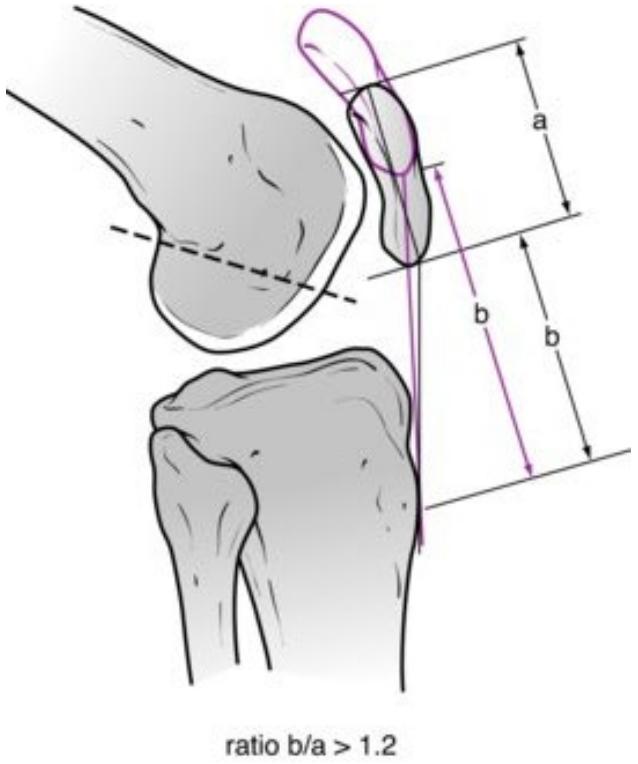
Image Source: Rockwood and Green's Fractures in Adults, 9th Edition, Fig. 59-3.

Diagnosis – Quad/Patellar Tendon Injuries

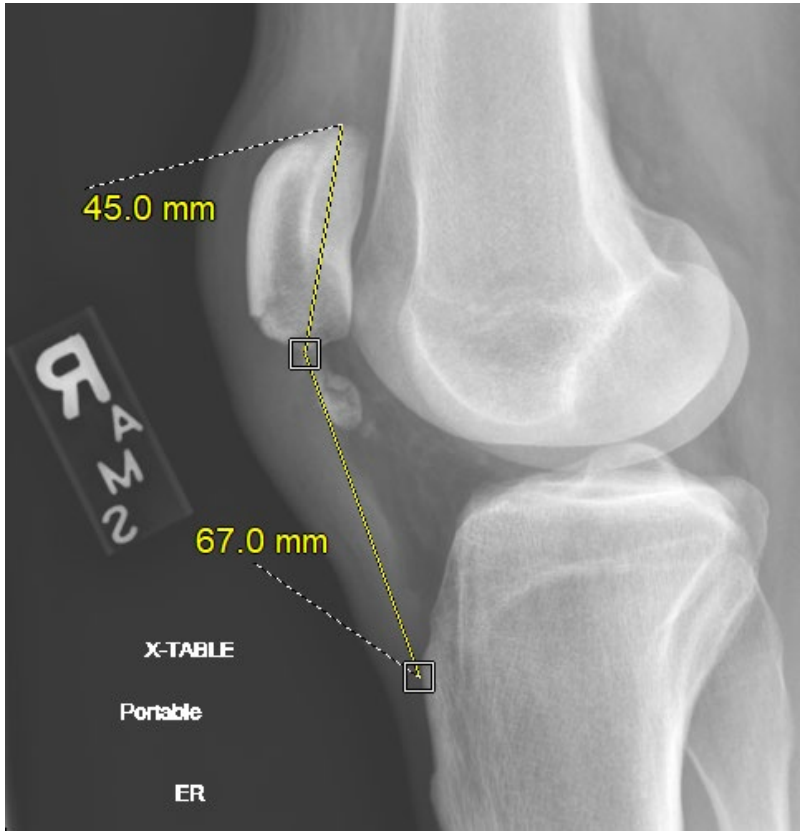
- **X-ray: Lateral view**
  - **Insall-Salvati Ratio:**

$$\frac{\text{Length of patella tendon (b)}}{\text{Length of patella (a)}}$$

  - **>1.2 = patella tendon tear (patella alta)**
  - **< 0.8 = quad tendon tear (patella baja)**



ratio b/a > 1.2



- **Example:**

$$\frac{\text{Patella tendon length = 67mm}}{\text{Patella length = 45mm}}$$

→ **Ratio = 1.49 (patella alta)**

Image Source: Rockwood and Green's Fractures in Adults, 9th Edition, Fig. 59-3.

Diagnosis – Quad/Patellar Tendon Injuries

- **X-ray: AP view**
  - **Normal Patella position:**
    - **Inferior pole within 2cm of the plane formed by distal femoral condyles**
  - **Patella alta:**
    - **Concern for patella tendon injury**
  - **Patella baja**
    - **Concern for quadriceps tendon injury**

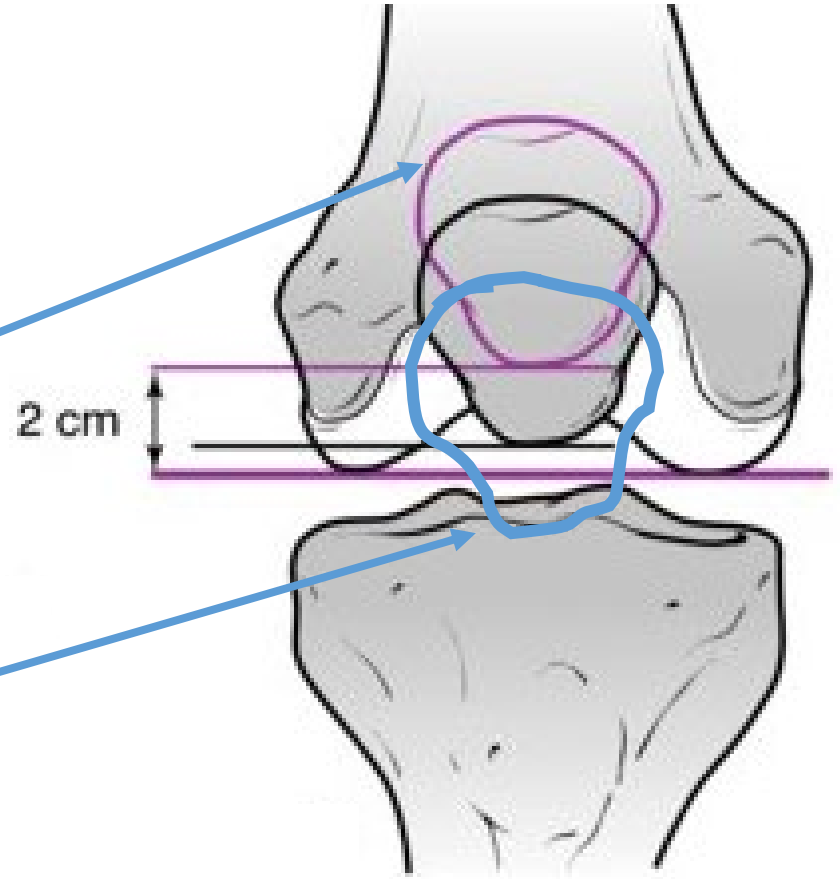


Image Source: Rockwood and Green's Fractures in Adults, 9th Edition, Fig. 59-3.

Diagnosis – Quad/Patellar Tendon Injuries

- **MRI:**
  - **Confirms physical exam and X-ray findings in quad/patella tendon injury**
  - ***Disruption* of quadriceps (or patellar tendon)**
  - ***Laxity* or *redundancy* of the *opposite* side of the extensor mechanism**

Classification

- **Descriptive Classification**
  - **Displaced vs. Undisplaced**
  - **If *displaced*, need to describe…**
    - **Primary Fracture Line (Transverse vs. Vertical)**
    - **Location (midportion vs. superior or inferior pole)**
    - **Degree of comminution**
- **AO/OTA Classification rarely used**

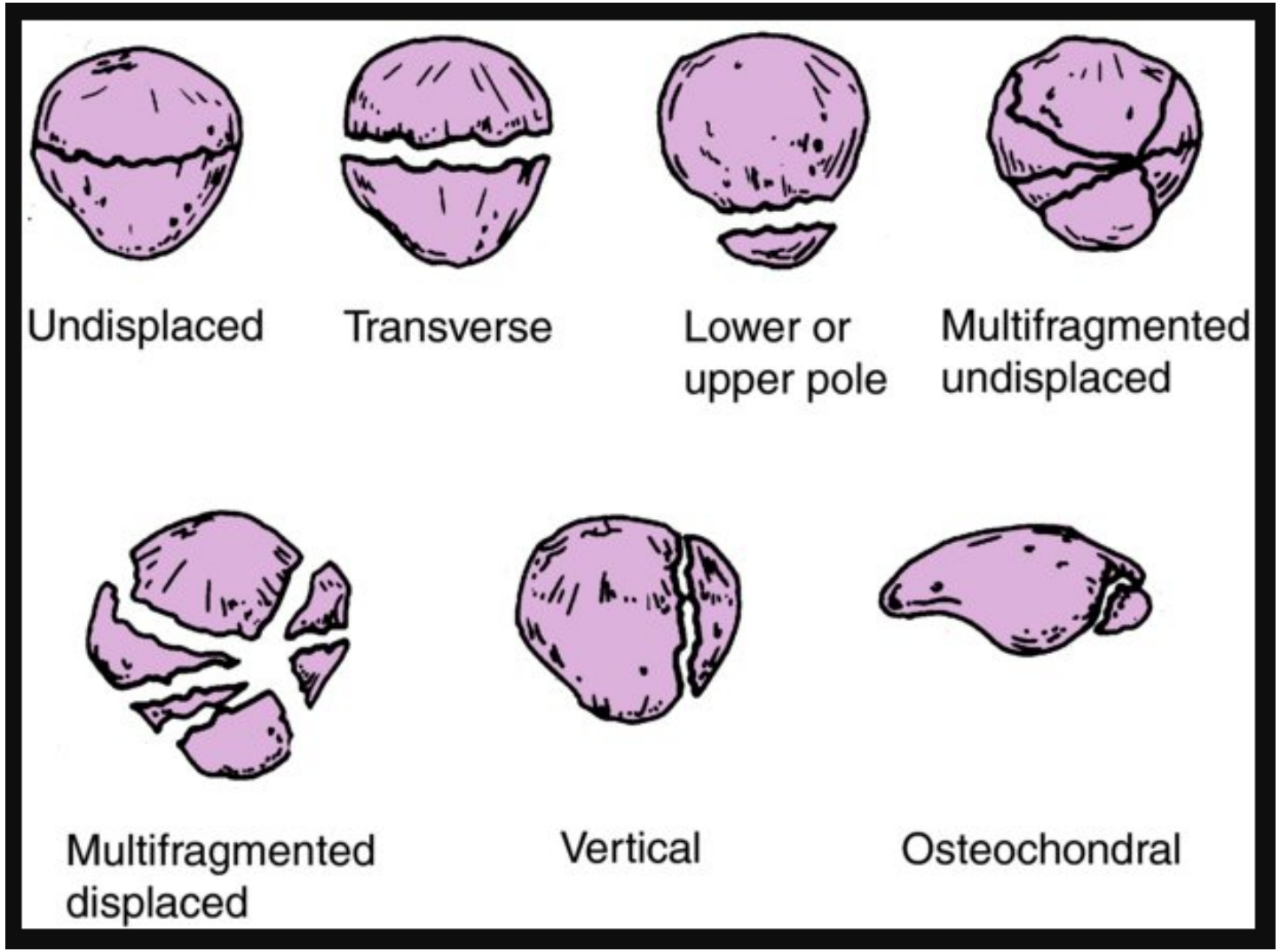


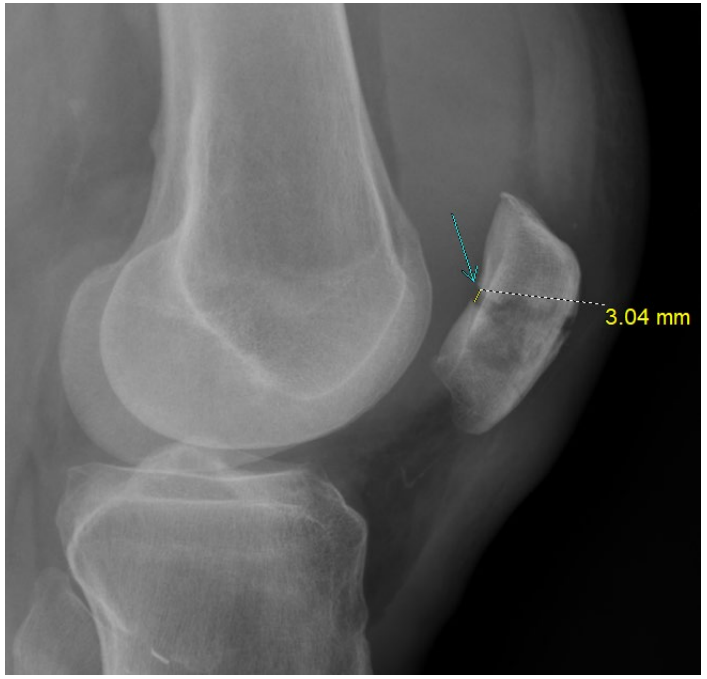
Image Source: Rockwood and Green's Fractures in Adults, 9th Edition, Fig. 59-4.

Non-Operative Treatment

- **Patients medically unfit for surgery**
- **Non-displaced fractures**
- **“Minimally displaced” fractures with intact extensor mechanism**
  - **No clear consensus on “*acceptable*” amount of displacement**
  - **Depends in part on patient’s *activity level***
  - **Pre-existing arthritis:**
    - **Favors *non-operative* treatment**

Non-Operative Treatment

- **63 yo M – Fall from standing – Closed Fx – Intact Extensor Mechanism**



Injury Films showing 3mm articular gap

- WBAT, hinged knee brace
- Locked in full extension

6-week F/U X-rays

- Allowed Active Flexion, Passive Extension 0-60˚
- Progress 10˚ per week

12-week F/U X-rays

- Allowed Unrestricted ROM/strengthening

Non-Operative Treatment – Example # 2

- **80 yo M – Fall from standing – Intact Ext. Mechanism – Bad arthritis**

Injury Films – some articular incongruity

- WBAT, hinged knee brace
- Locked in full extension

2-week F/U

- No interval displacement

6-week F/U X-rays

- Allowed Active Flexion, Passive Extension 0-60˚
- Progress 10˚ per week

12-week F/U X-rays

- Allowed Unrestricted ROM/strengthening

Operative Treatment – Many Options!

- Most described techniques are for simple fractures:
  - Transverse
  - Non-comminuted
  - Good bone quality
- Simple Fracture patterns best illustrate key *concepts:*
  - Resisting tensile forces
  - Interfragmentary compression

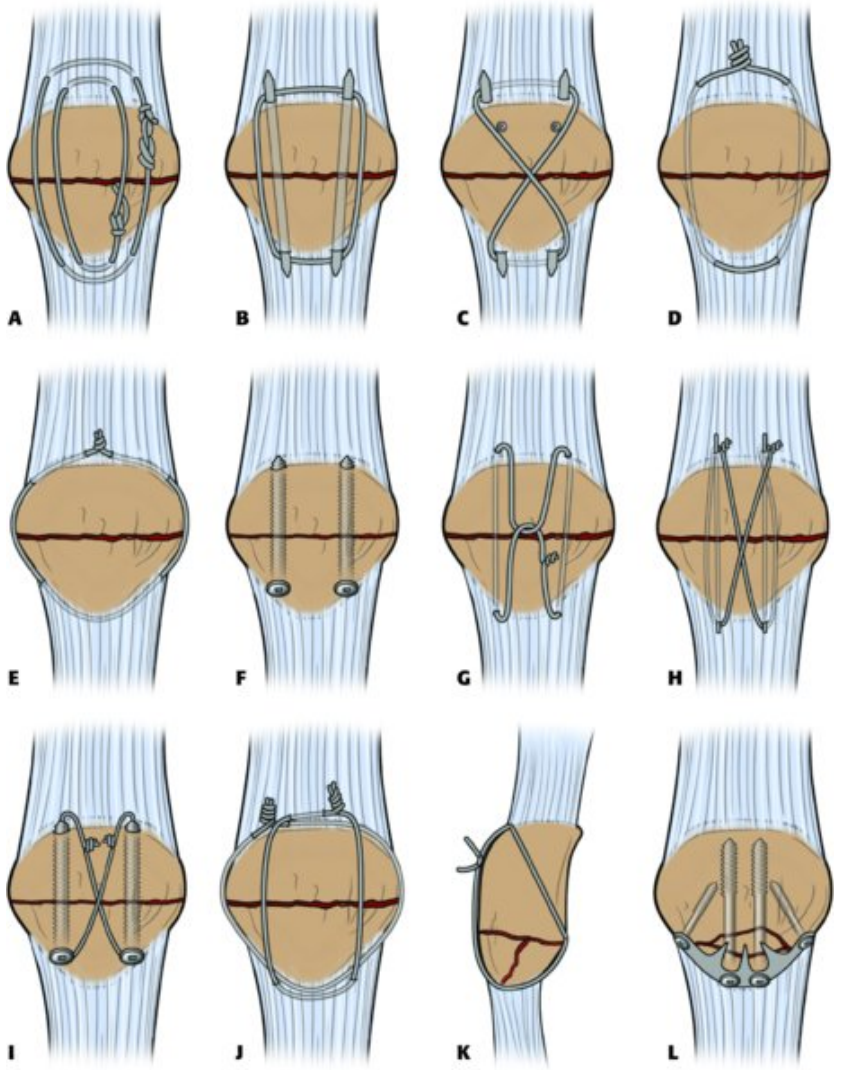
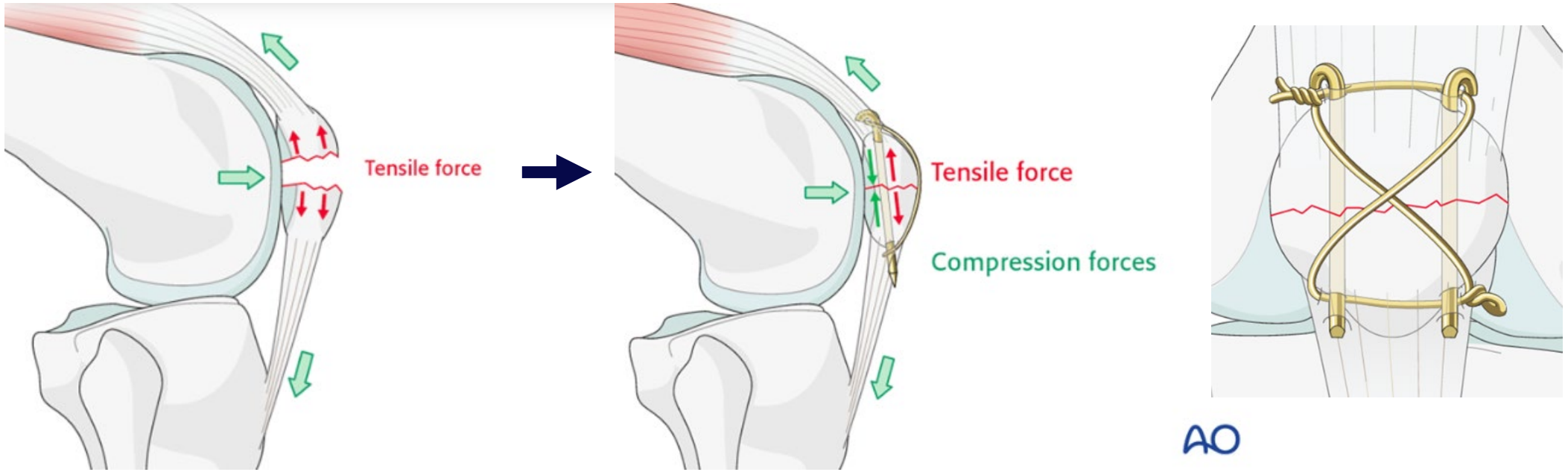


Image Source:
Rockwood and Green's Fractures in Adults, 9th Edition, Fig. 59-6.

Operative Treatment – Transverse Fractures

- Tension Band Wire (TBW) – Concept:
  - Converting *tensile* forces (extensor mechanism) into *compressive* forces (at the fracture site)



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Operative Treatment – Transverse Fractures

- Tension Band Wire (TBW) – Concept:
  - Controversial Theory
    - Several Biomechanical Studies refuting this theory

Injury, Int. J. Care Injured 48 (2017) 1749–1757

Contents lists available at ScienceDirect

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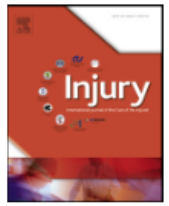

Biomechanical evaluation of the tension band wiring principle. A comparison between two different techniques for transverse patella fracture fixation

Ivan Zderic[a,*], Karl Stoffel[b,c], Christoph Sommer[d], Dankward Höntzsch[e], Boyko Gueorguiev[a]

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Operative Treatment – Transverse Fractures

- Tension Band Wire (TBW) – Concept:
  - Controversial Theory
    - Several Biomechanical Studies refuting this theory

Conclusions: Tension band wiring fulfills from a biomechanical perspective the requirements for sufficient stability of transverse patella fracture fixation. It should, however, rather be considered as a static fixation principle than a dynamic one. Tension band wiring with cannulated screws was found advantageous over Kirschner wires in terms of interfragmentary movements at the posterior fracture site.

fracture fixation

Ivan Zderic[a,*], Karl Stoffel[b,c], Christoph Sommer[d], Dankward Höntzsch[e], Boyko Gueorguiev[a]

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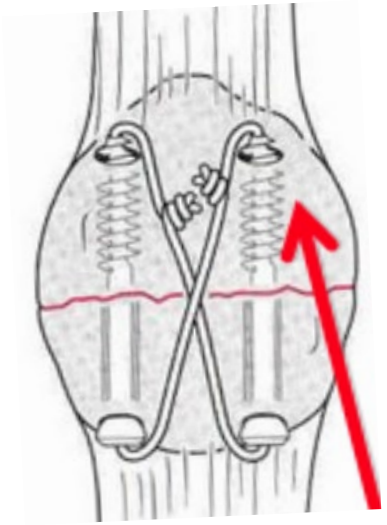
Operative Treatment – Transverse Fractures

- Tension Band Wire (TBW): **Alternative approach:**
  - Achieve compression *intra*-operatively with cannulated screws
  - Utilize SS wire or non-absorbable suture to *augment* fixation
    - Wire/Suture acts in "Neutralization" Mode



Courtesy of OTA archives

Make sure screw tips are buried

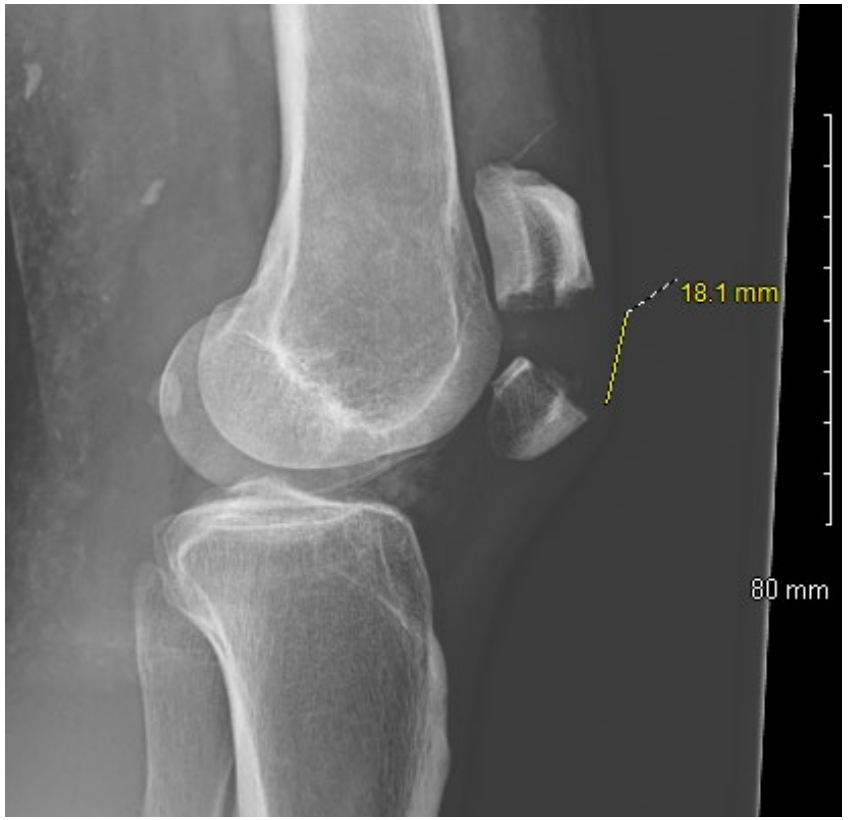
- Wire or suture can be cut by prominent screw tips
- Prominent screws *also* compromise biomechanical stability of screw/TBW constructs (cadaveric study)

  - Increased fracture gapping during cyclic loading

Avery et al. *CORR* 2019

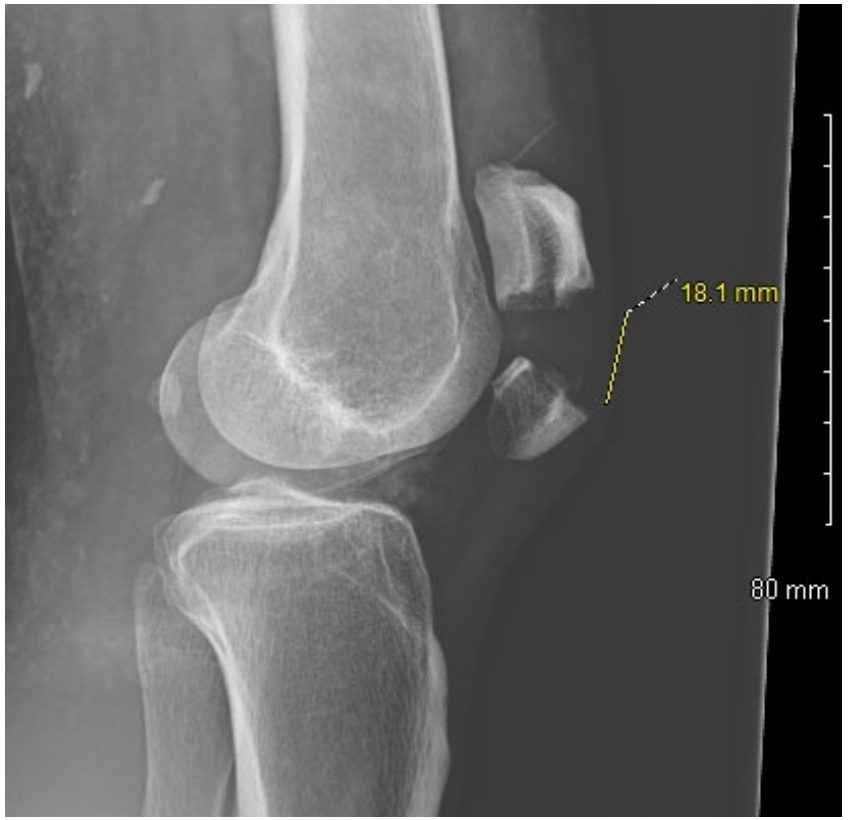
Case Example: 42yo F, fall while running uphill

- Healthy, active, high-intensity athlete

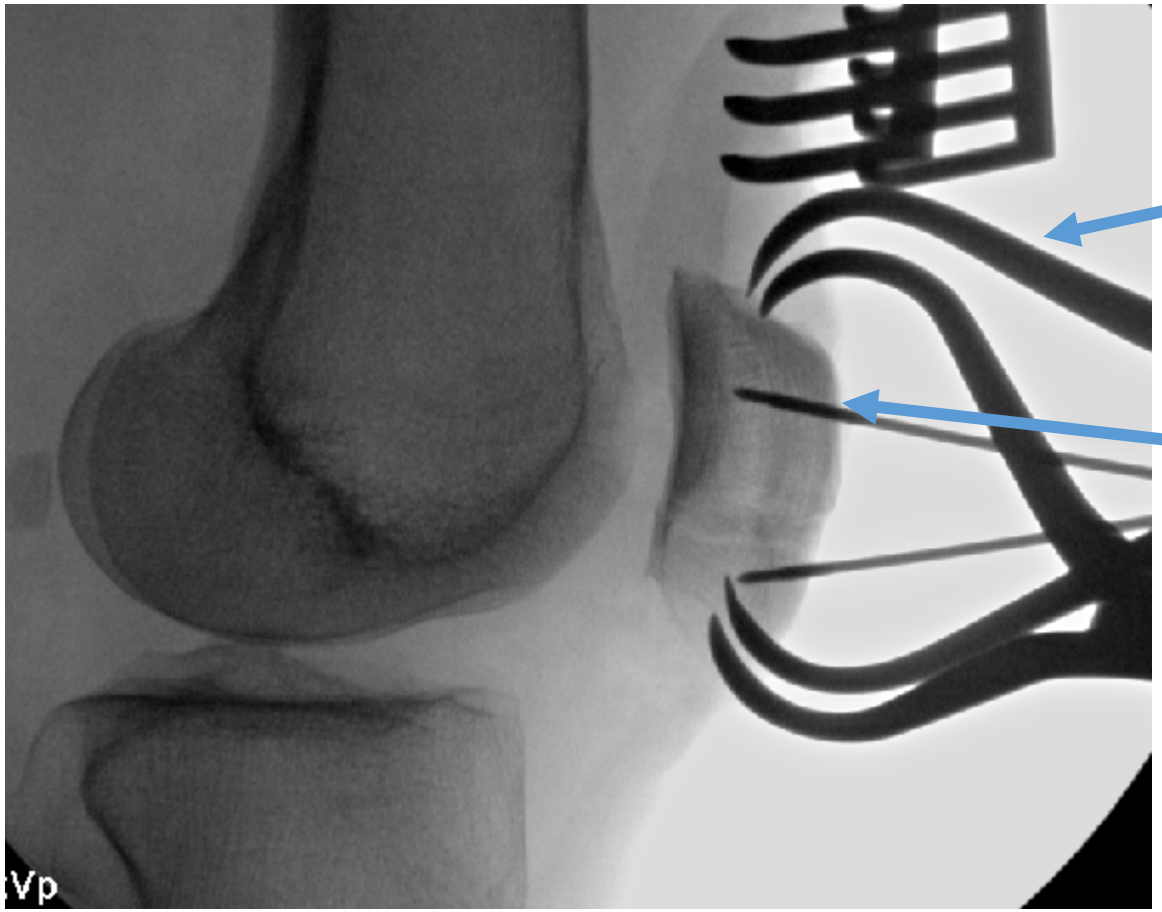


Transverse Patella Fracture

- Pre-operative Plan
  - Reduction Technique(s)
    - examples will be illustrated
  - Implant Choice
    - Traditional TBW?
    - Cannulated screws?
  - “Tension Band” Material
    - 18-gauge wire vs. suture?
  - Soft Tissue Augmentation
    - When is it needed?

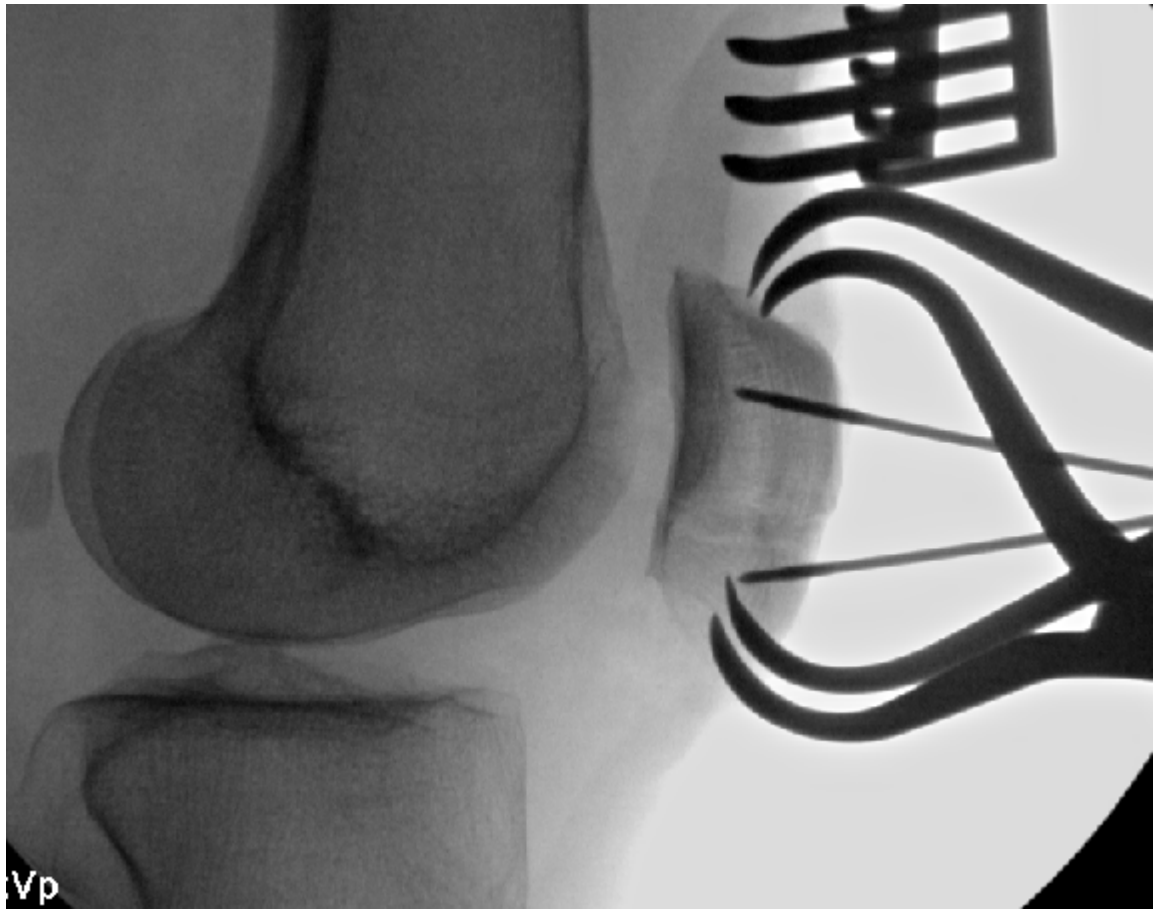


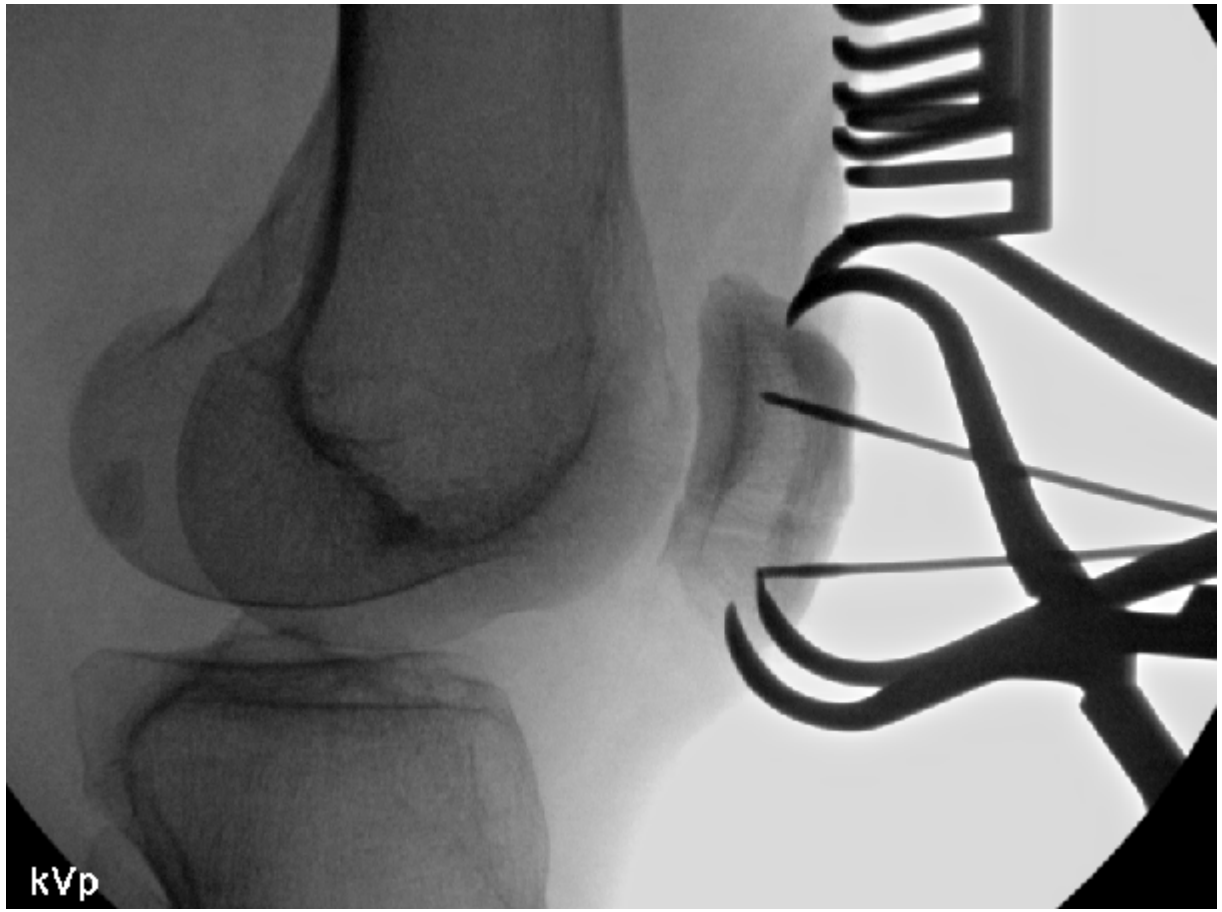
Reduction Techniques



- Large pointed reduction clamps ("Weber clamps")
  - Generating compression
  - Best to use two clamps
- One K-wire in each fragment
  - Use these as "joysticks"
  - Helps fine-tune reduction rotationally *and* in the sagittal plane

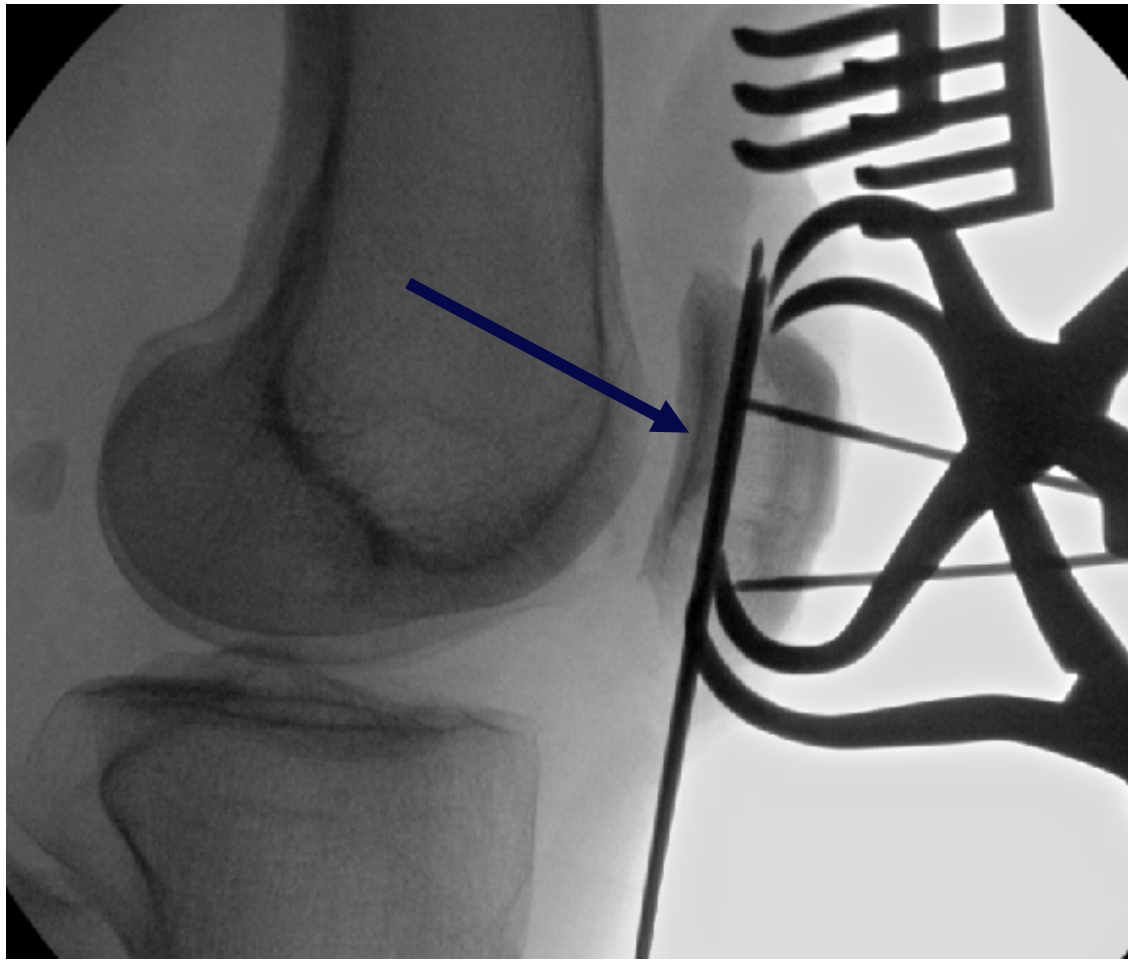
Reduction Techniques – Rotational Views





Key Point: Multiple lateral views (int/ext rotation) are **critical** to assess accurate articular reduction

Implant Placement



- Place K-wires as posterior as possible
  - Closer to articular surface
  - Biomechanically superior
  - If using traditional TWB:
    - Provides a more *balanced* tension band construct
  - If using cannulated screws:
    - Improved *compression* of articular surface

Implant Choice:

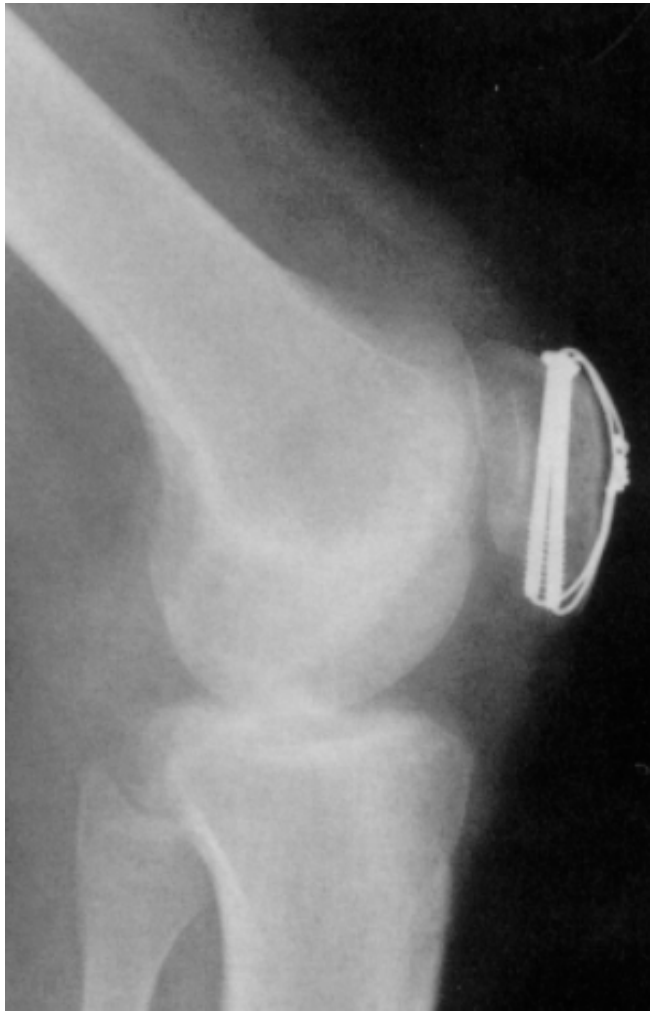
Image Source: Smith ST et al. Early Complications in the Operative Treatment of Patellar Fractures, *J Orthop Trauma.* 1997 Apr;11(3):183-7. Fig. 1D.

Traditional TBW

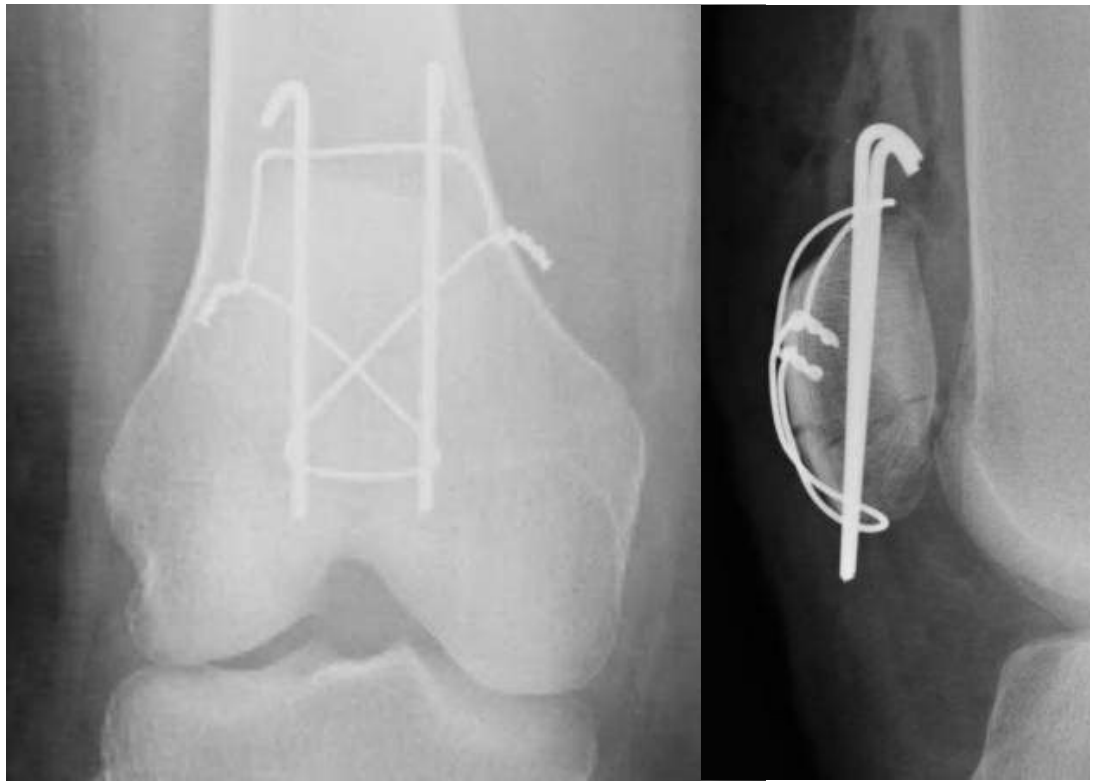
vs.

Cannulated Screws?

Either is fine for *simple* fractures



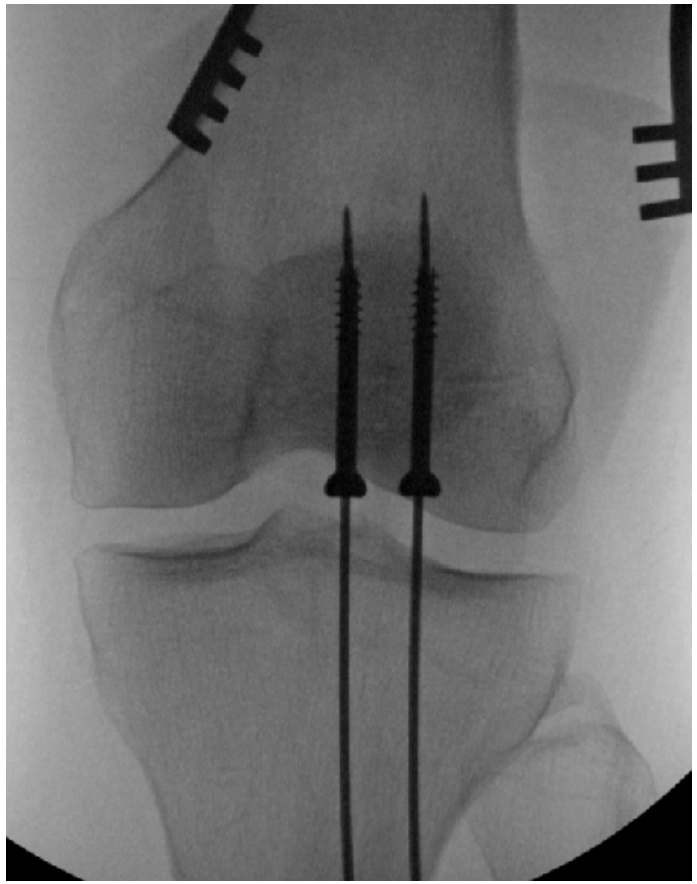
Implant Choice:



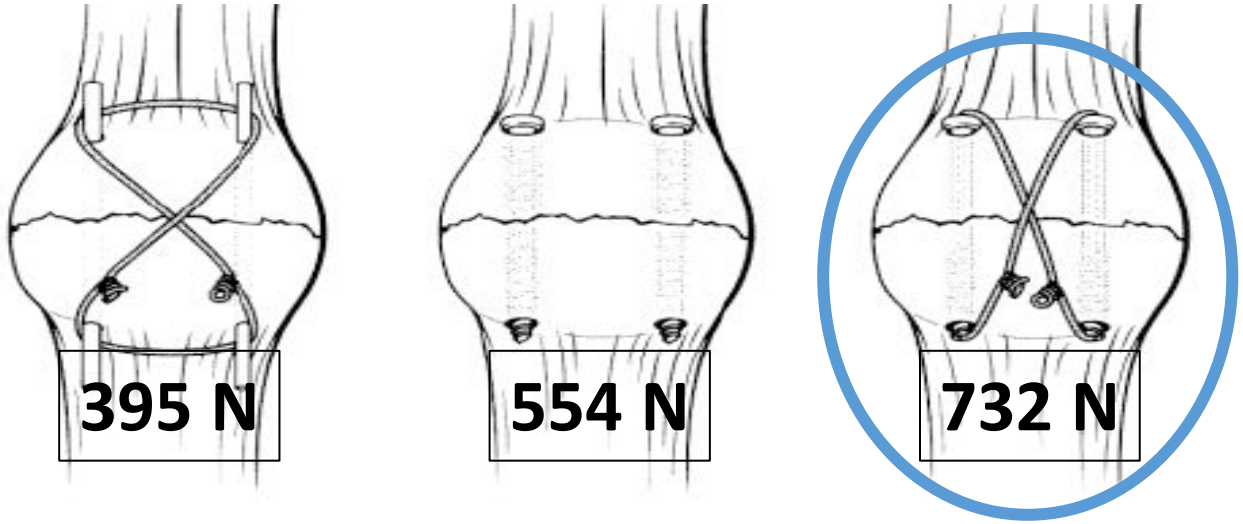
- Traditional Tension Band Wire
  - Advantages:
    - Low-cost
    - Simple, time-tested
  - Disadvantages:
    - Does not *generate* compression at Fx site
    - Hardware prominence VERY common
    - Implant removal in **up to 38% of cases**

Gosal et al. Injury, 2001

Implant Choice:



- Cannulated Screws
  - Advantages:
    - *Generates compression* at Fx site
    - Higher load to failure than:
      - TWB construct with K-wires
      - Screw fixation alone



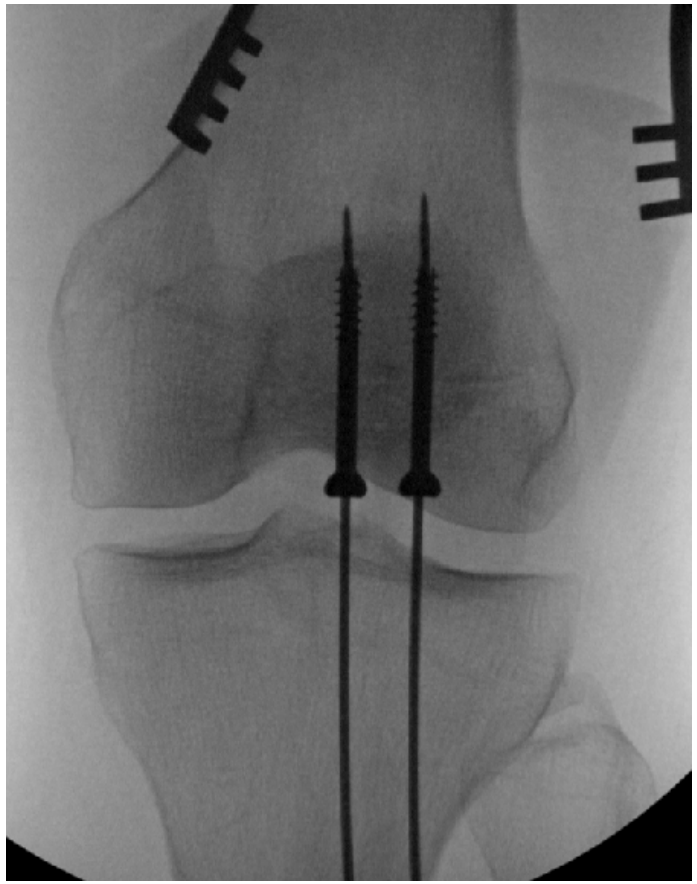
OTA Video Library Link

Image Source: Carpenter JE, et al. Biomechanical evaluation of current patella fracture fixation techniques. *J Orthop Trauma* 1997;11(July(5)):351–60 . Fig. 1.

Video

OTA Video Library Link:
https://otaonline.org/video-library/45036/procedures-and-techniques/multimedia/16731413/orif-patella-fracture-with-tension-band-construct

Implant Choice:



- Cannulated Screws
  - Disadvantages:
    - Higher cost
    - Challenge: passing wire/suture through screw
    - No standard screw size recommendation:
      - 4.5 mm
      - 4.0 mm
      - 3.5 mm
      - Pros/Cons of each size
    - Key advantage of 4.5 mm screws:
      - Ability to use commonly available suture passer
        - Easier than Keith Needles

Implant Choice:

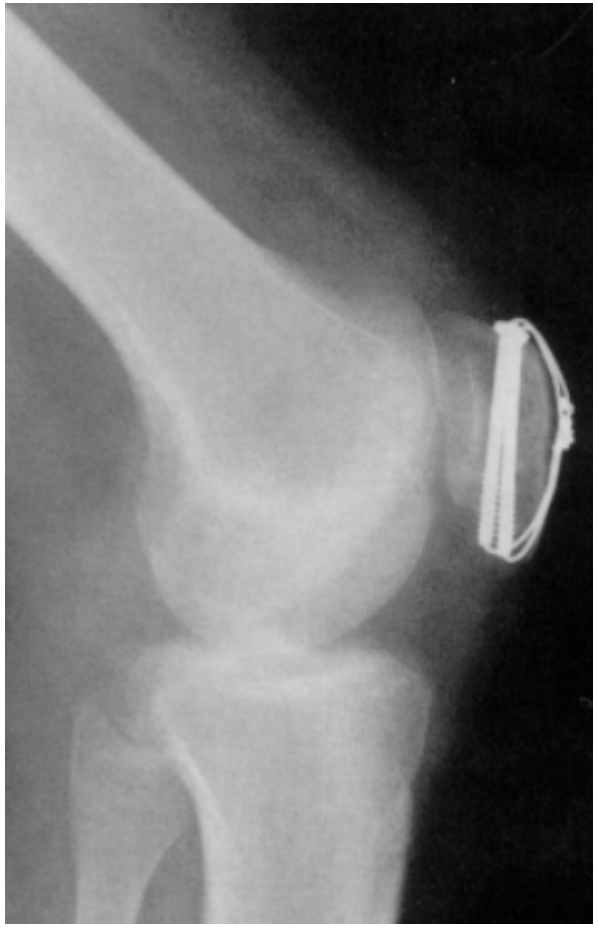


Image Source: Smith et al. *JOT* 1997. Fig 1D.

- Cannulated Screws
  - Disadvantages:
    - Dependent on bone quality
    - Hardware prominence may be similar if SS wire is used for the tension band
      - Wire knots still present

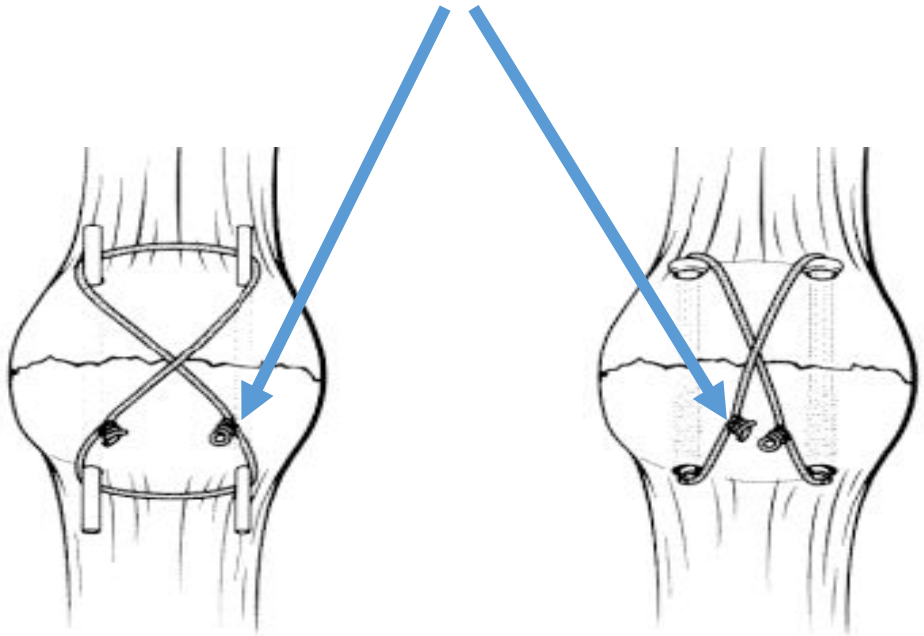


Image Source: Carpenter et al. *JOT* 1997. Fig. 1.

Implant Choice:

- If using cannulated screws…
- What to use for the tension band?
  - Suture vs. SS wire?

Injury 51 (2020) 473–477

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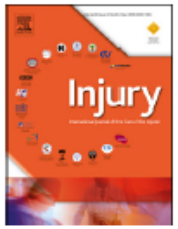


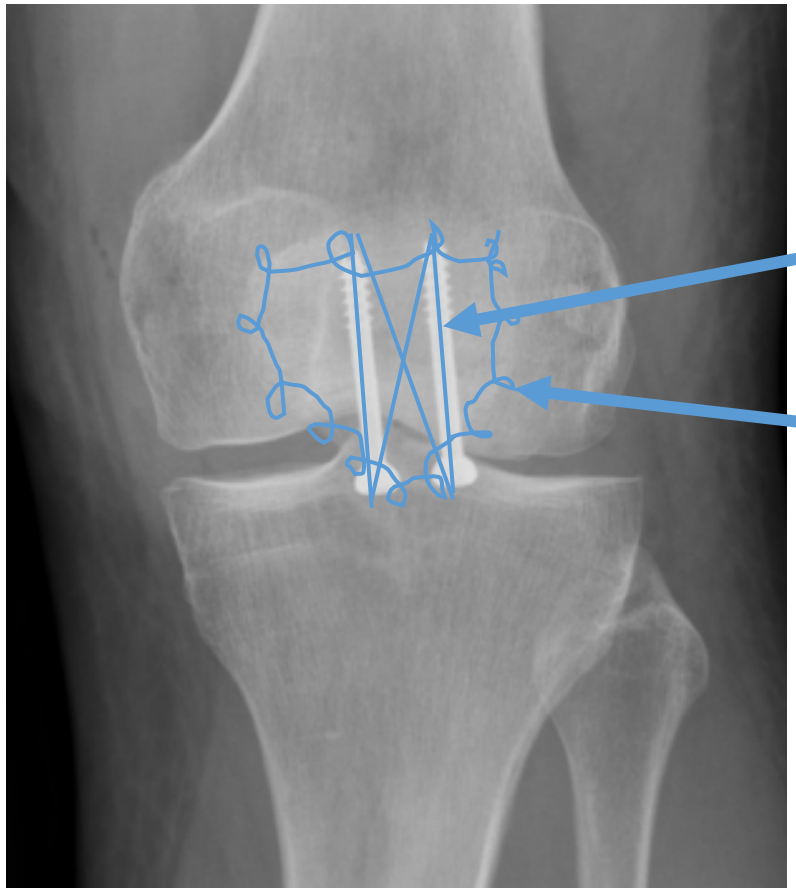
Patella fractures treated with cannulated lag screws and fiberwire® have a high union rate and low rate of implant removal ☆

Gennadiy Busel[a,*], Brett Barrick[b], Darryl Auston[c], Kyle Achor[d], David Watson[d], Ben Maxson[d], Anthony Infante[d], Roy Sanders[d], Hassan R. Mir[d]

[a] Health Partners, Minneapolis, MN, United States of America
[b] Saint Francis Health System, Tulsa, OK, United States of America
[c] OrthoONE North Suburban Medical Center, Thornton, CO, United States of America
[d] Florida Orthopaedic Institute, Tampa, FL, United States of America

Busel et al. *Injury*, 2020

Implant Choice:

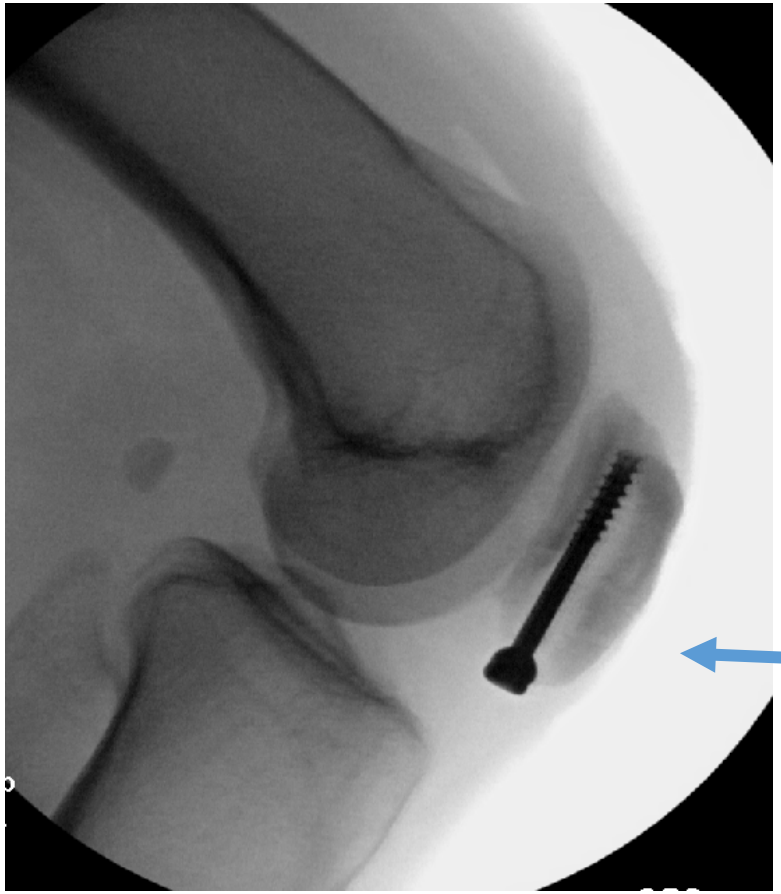


- If using suture for the tension-band
  - Heavy, non-absorbable
- Figure-of-Eight passed through cannulated screws
- Supplemental Cerclage
  - Running, Locking

- Case series of 50 patients
  - 96% rate of union
  - 8% rate of hardware removal

Busel et al. *Injury*, 2020

Post-Op Rehabilitation



Lateral Fluoro View:

Anti-gravity flexion

- No clear consensus
  - Often locked in extension ‘til wound heals
- When ROM is allowed…
  - Begin w/ *active* flexion/*passive* extension
  - Progressive range (hinged brace useful)
    - Start with a defined ROM limit
    - May use intra-operative fluoroscopic *stress view to determine safe ROM range* for rehab
    - Can progress each week

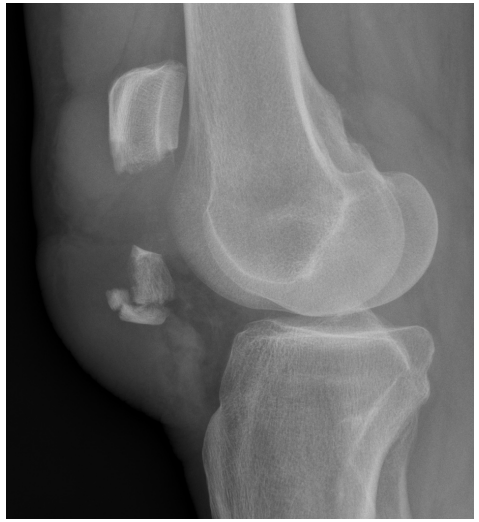
Post-Op Rehabilitation

Lateral Fluoro View:

Anti-gravity flexion

- Post-Op Rehab **example**…
  - Begin *active* flexion/*passive* extension
  - Start 0-60 degrees at 6 wks post-op
  - Progress 10 degrees/wk from 6-12 wks
  - Active extension/strengthening at 12 wks

Complex Patella Fractures – Operative Treatment



- Big Picture:
  - If possible…

    try to convert *comminuted* fractures into *simple* fractures
  - If not possible…

    consider *alternative* fixation strategies

OTA Video Library Link

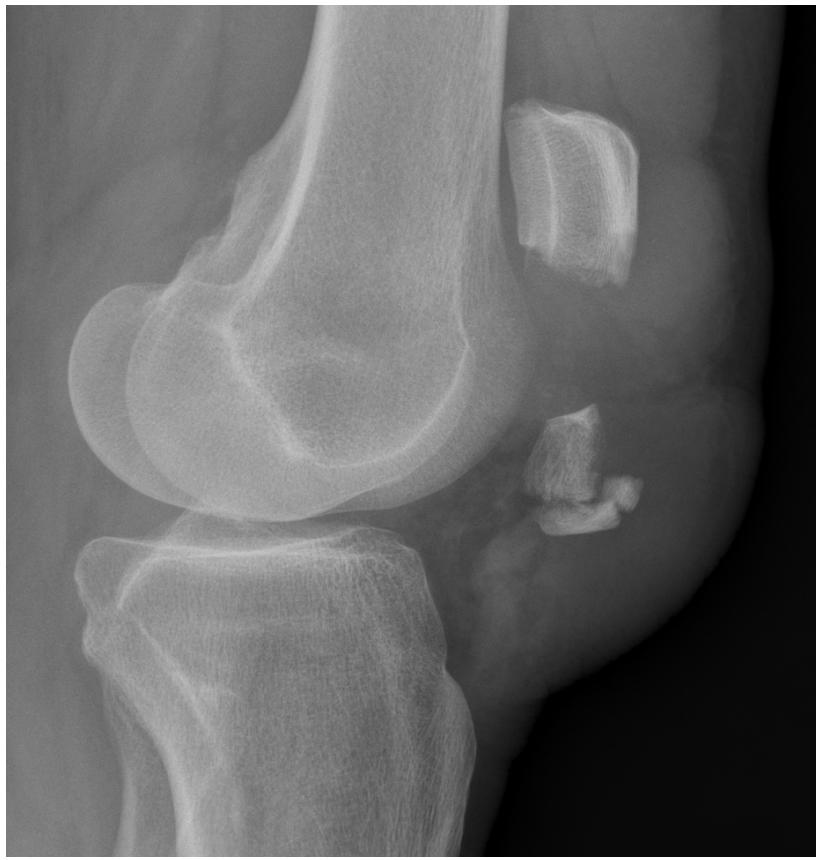
Video

OTA Video Library Link:

- https://otaonline.org/video-library/45037/annual-meeting-and-conferences/multimedia/16845974/comminuted-patella-fractures

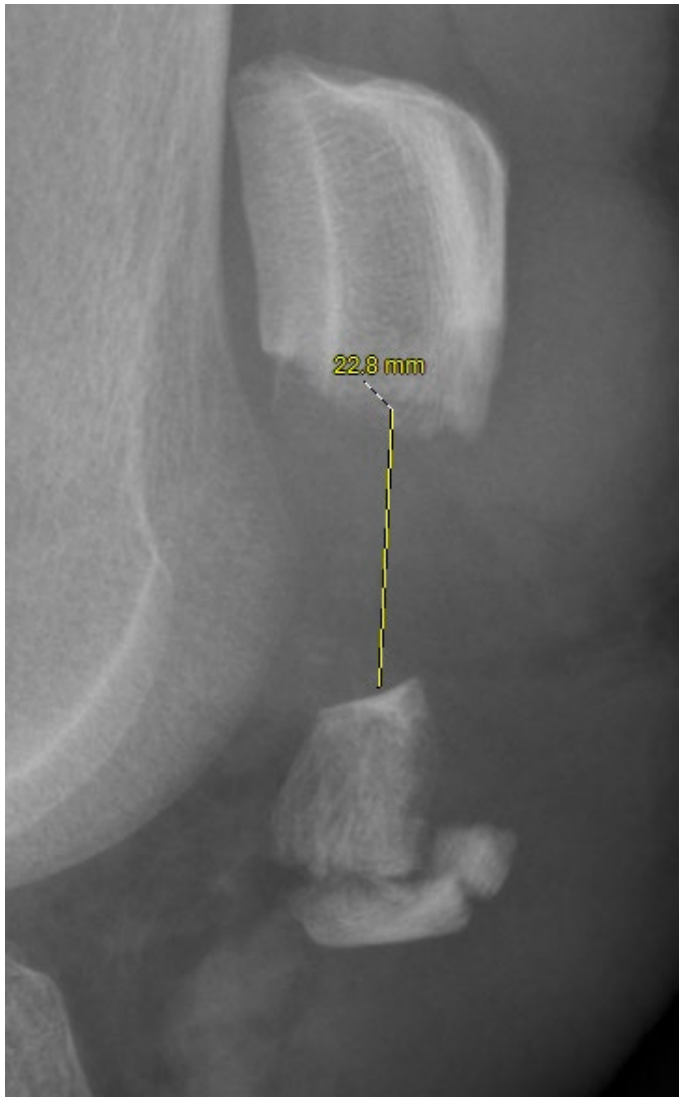
Complex Case Example

- 57 yo F, fall from standing
- Baseline ambulatory status: normal (independent)

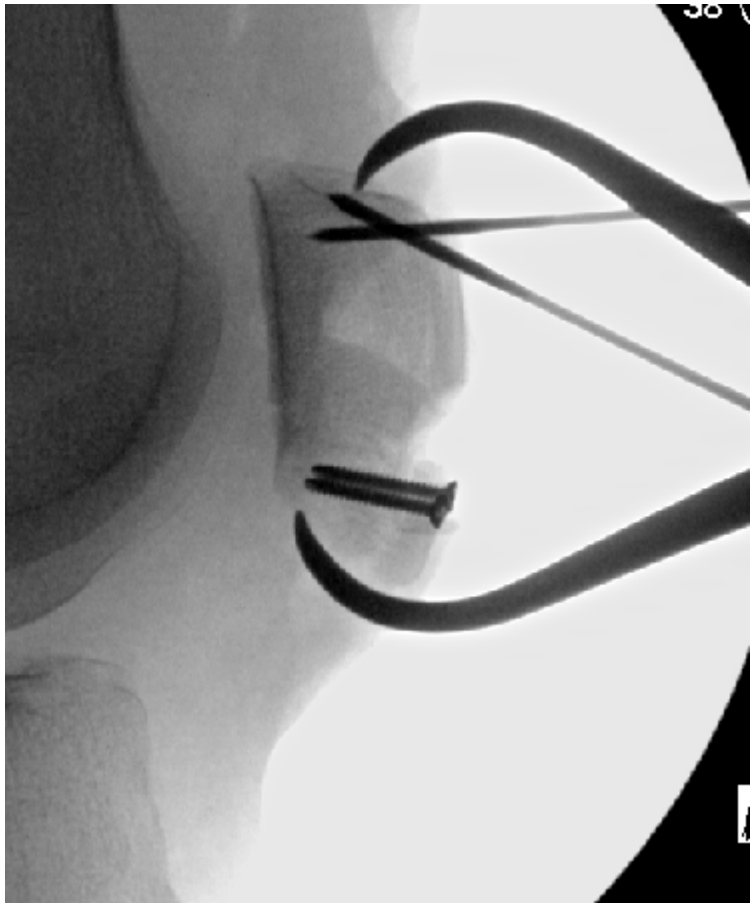


Comminuted Inferior Pole Fractures

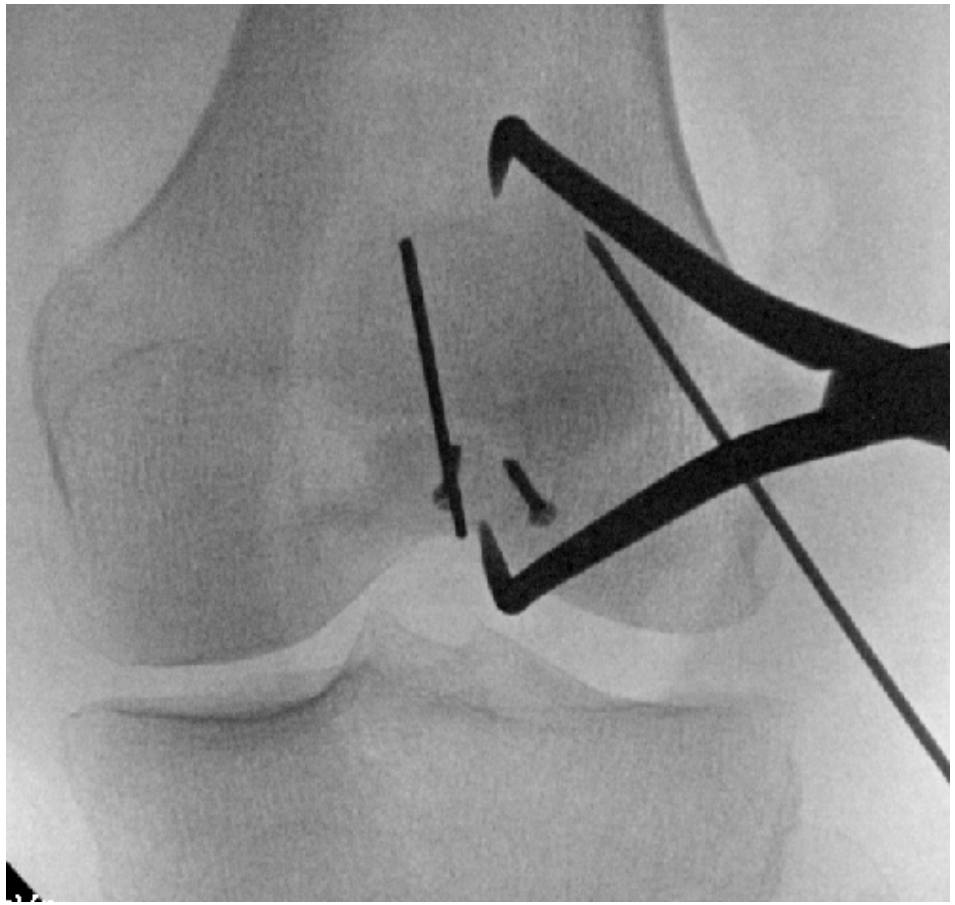
- Treatment options:
  - Non-operative?
  - Partial patellectomy?
  - ORIF?
    - Reduction Technique(s)?
    - Implant Options?
    - “Tension Band” Material?
    - Soft Tissue Augmentation?



Comminuted Inferior Pole Fractures

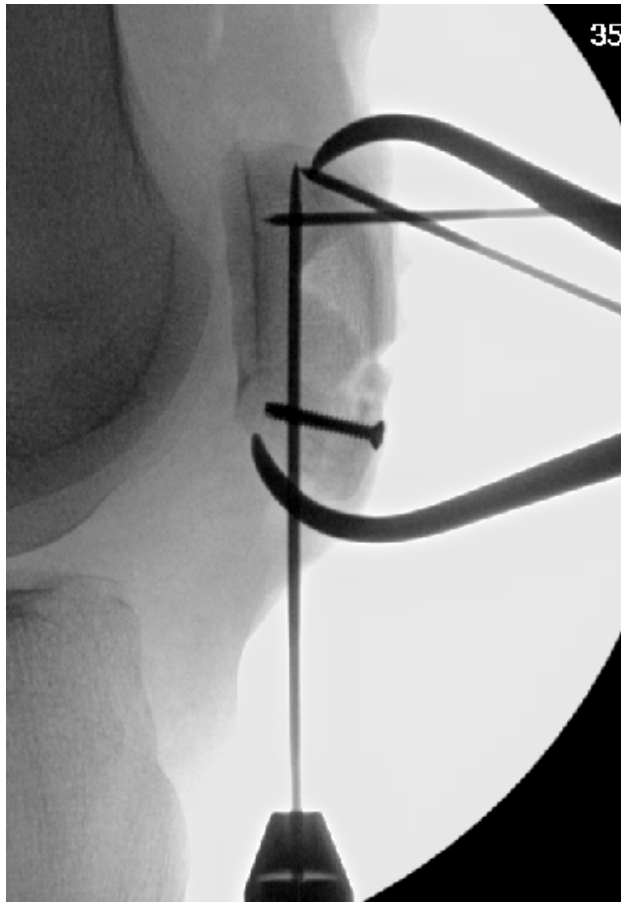


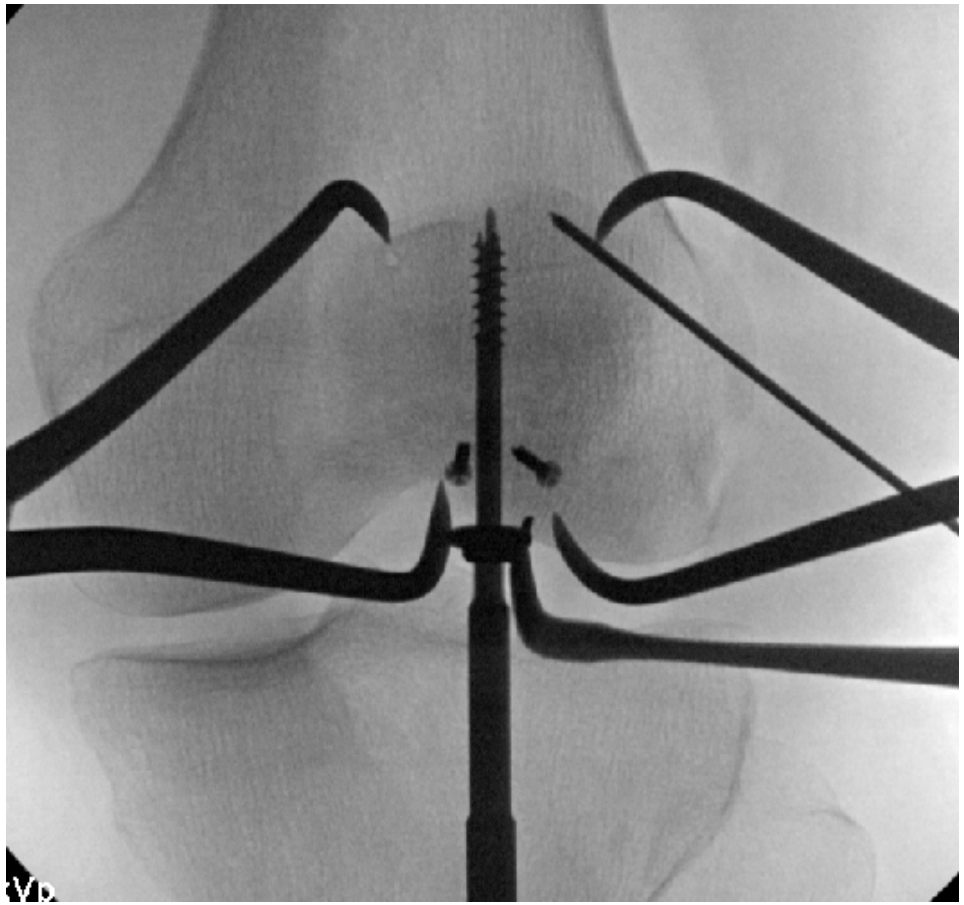
Reconstructing the inferior pole: preserves articular congruity



Next Step: How to secure *reconstructed* inferior pole to *intact* superior pole?

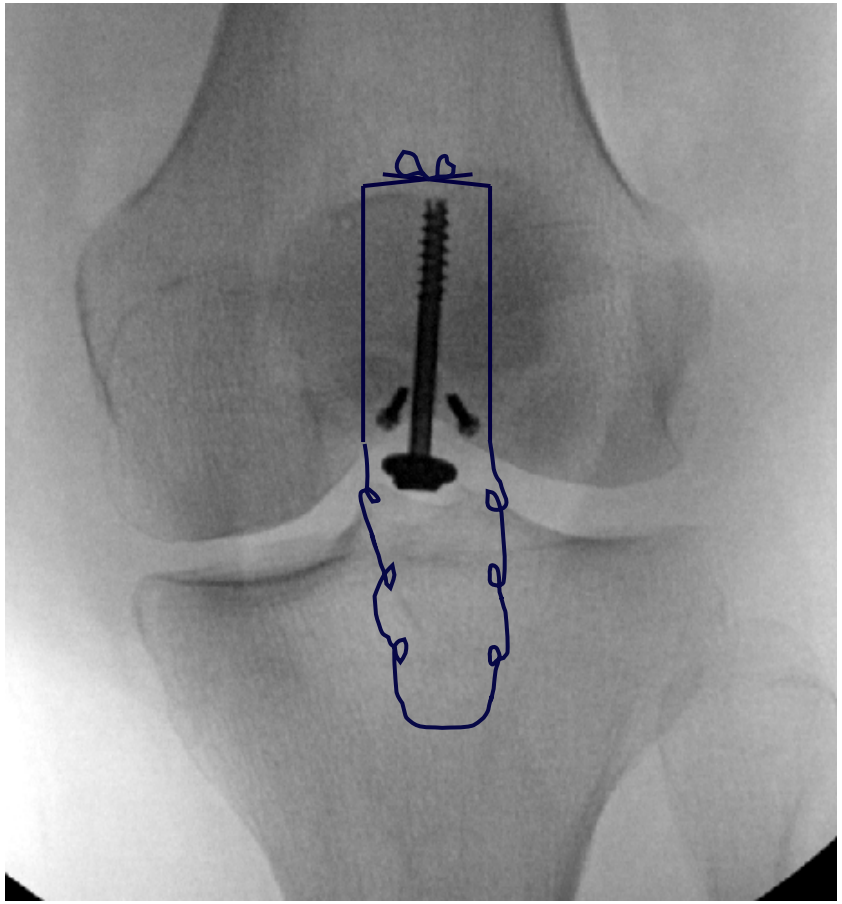
Comminuted Inferior Pole Fractures





- Bony healing:
  - More reliable than soft tissue healing
  - Use this to your advantage if possible
- Limited real estate
  - Maximize bony stability, but…
  - Augment w/ soft tissue repair techniques

Comminuted Inferior Pole Fractures

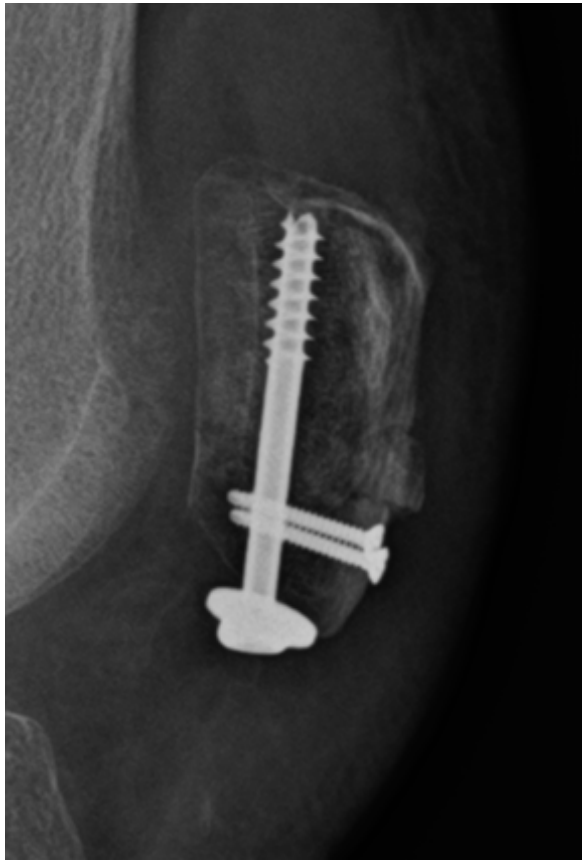


- Incorporate patella tendon into repair
  - Running, locking stitch
  - Sutures passed through bony tunnels
  - Tied over bony bridge (superior patella)

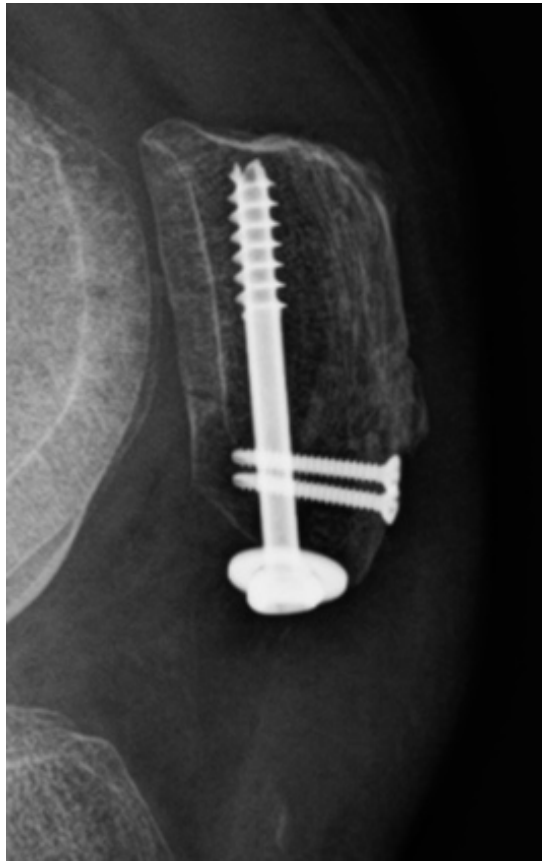
Follow-Up:

6 wks

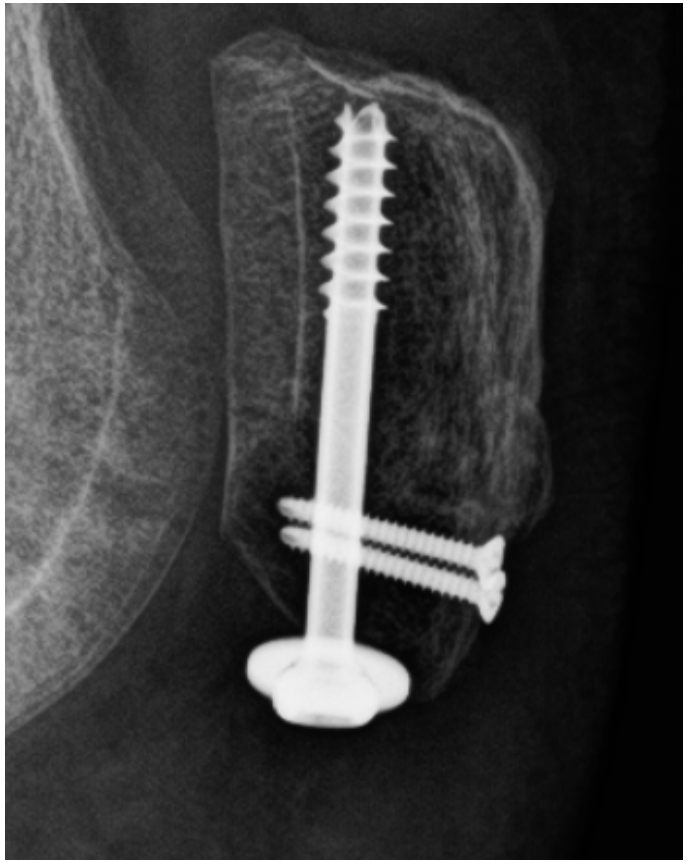
3 mo



5 mo



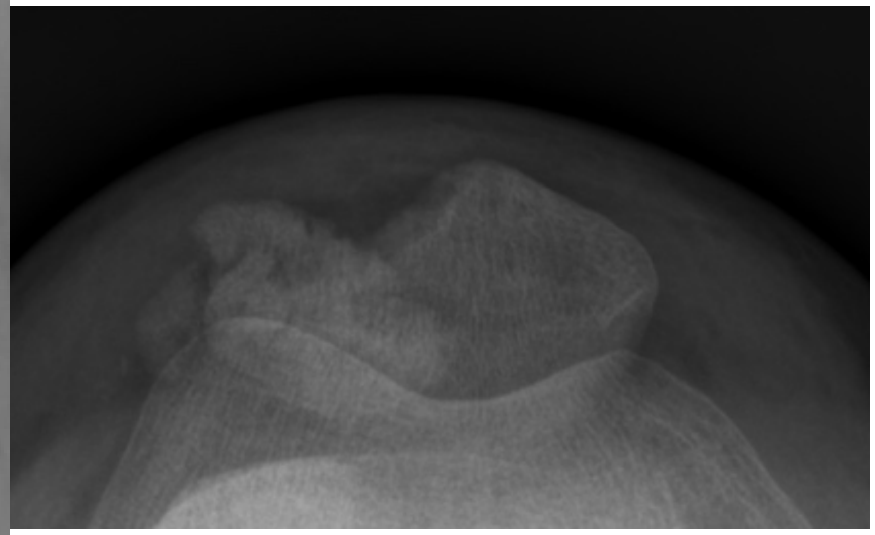
7 mo



- ROM: 0-130˚
- No pain
- Back to baseline function

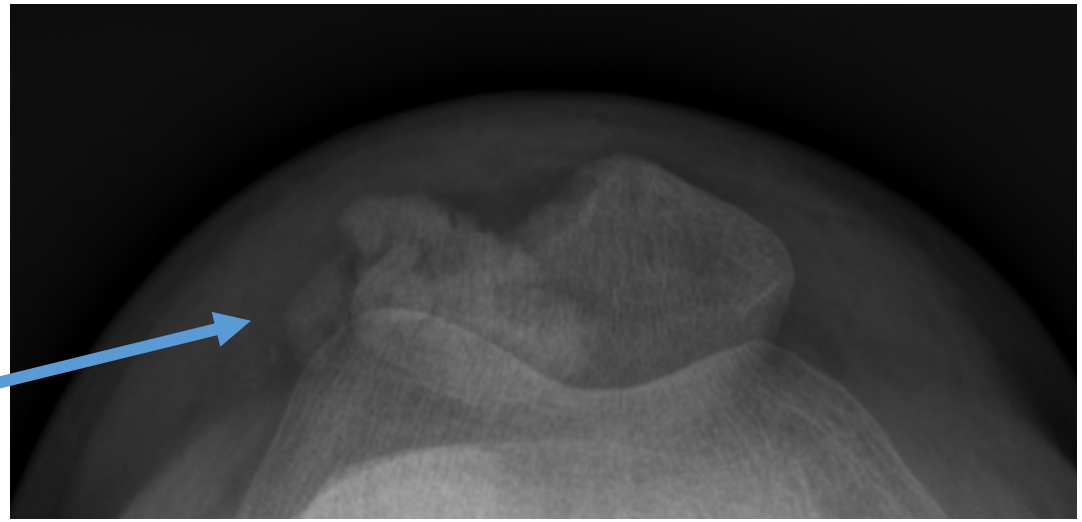
Complex Case:

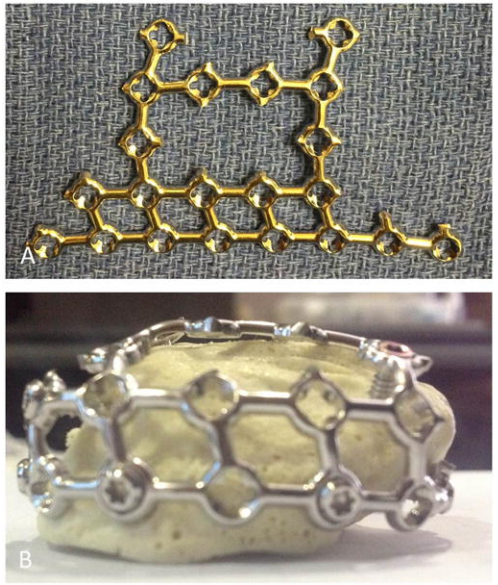
- 35 yo M, fall while running down a hill
- Otherwise healthy

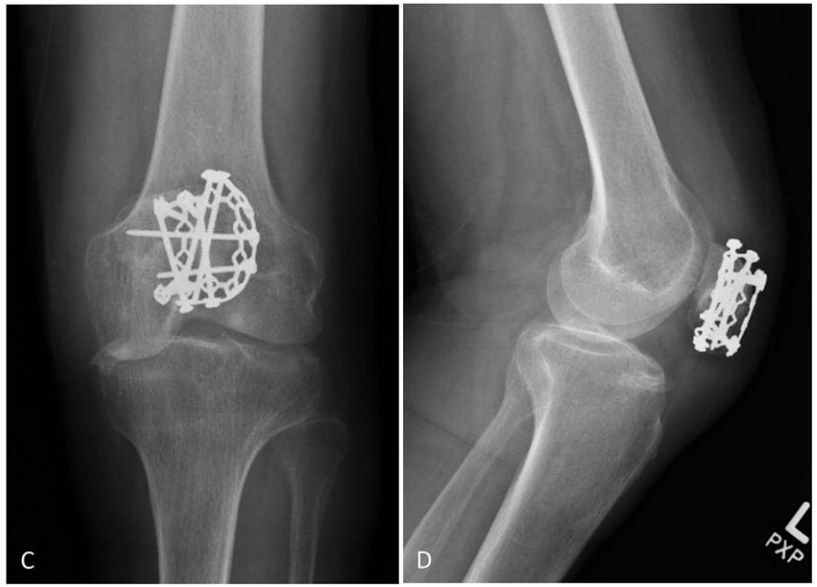


Mesh Plates

- **Comminuted Fracture Patterns**
- **Containment of Small Fracture Fragments**
- **Customizable**
- **“Fragment-Specific” Fixation**





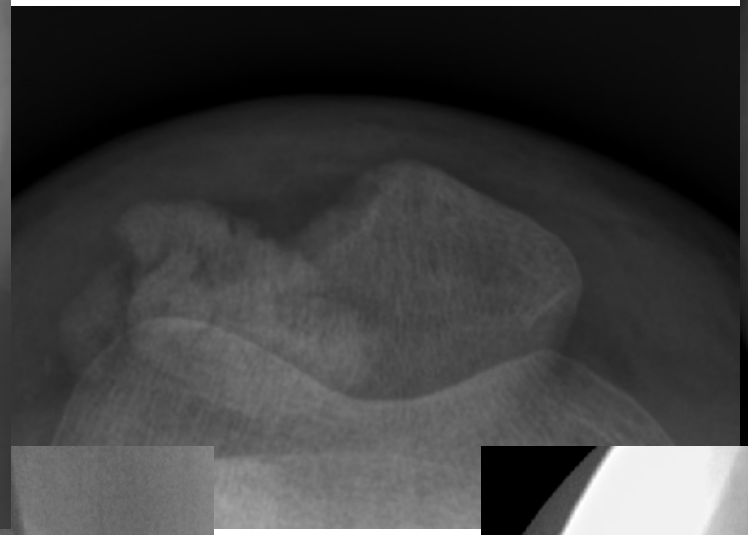


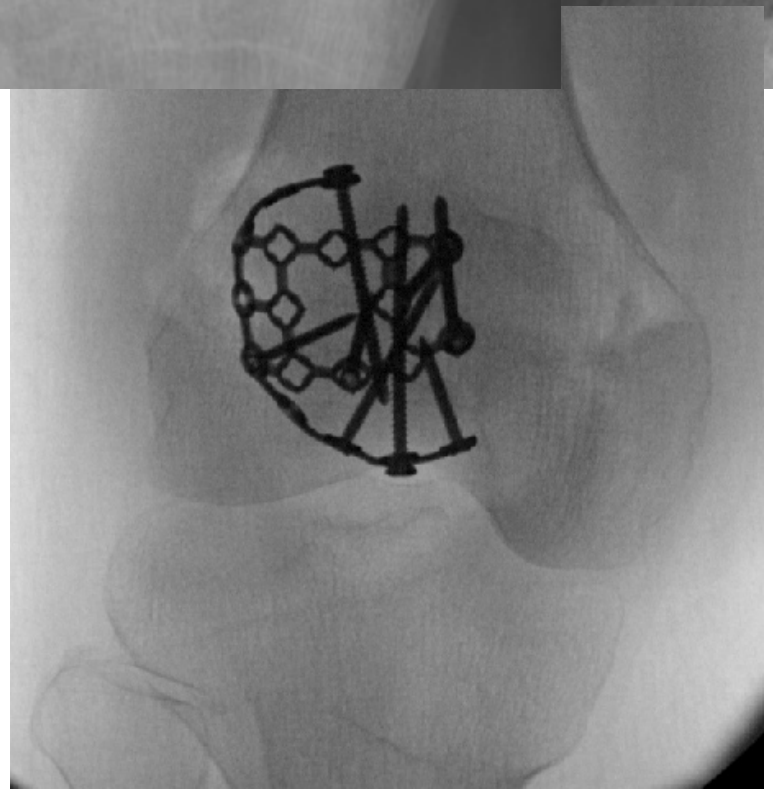
[OTA Video Library Link]

Image Source: Lorich DG, et al. Superior outcomes after operative fixation of patella fractures using a novel plating technique: a prospective cohort study. *J Orthop Trauma.* 2017 May;31(5):241-7. Fig. 1A-D.

Video

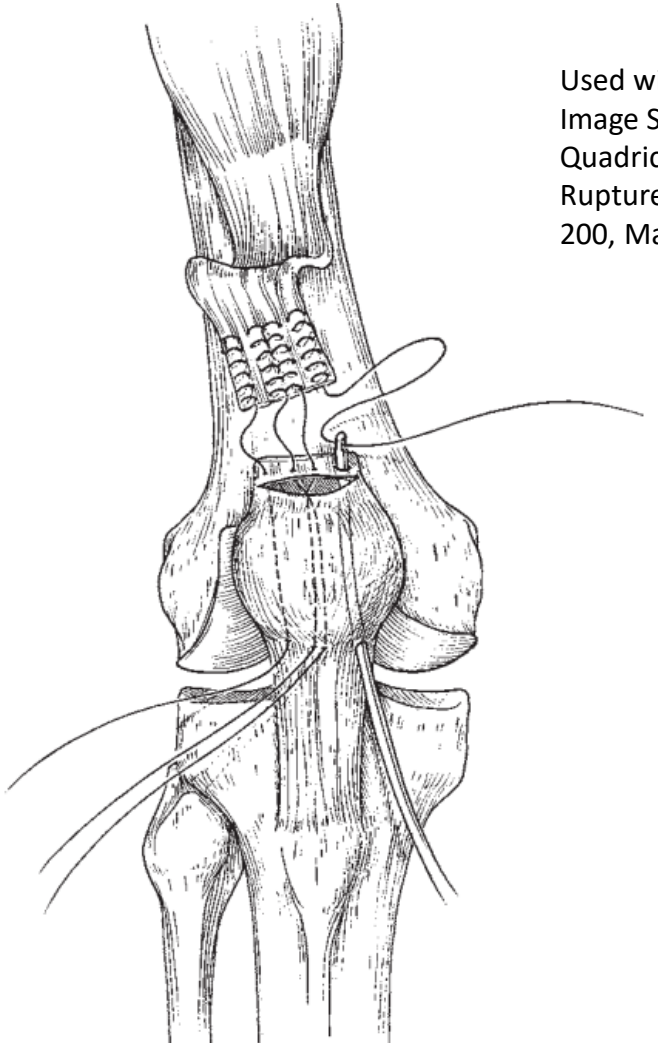
OTA Video Library Link:
https://otaonline.org/video-library/45036/procedures-and-techniques/multimedia/16731407/low-profile-mesh-plating-for-patella-fractures





Quadriceps & Patella Tendon Repair

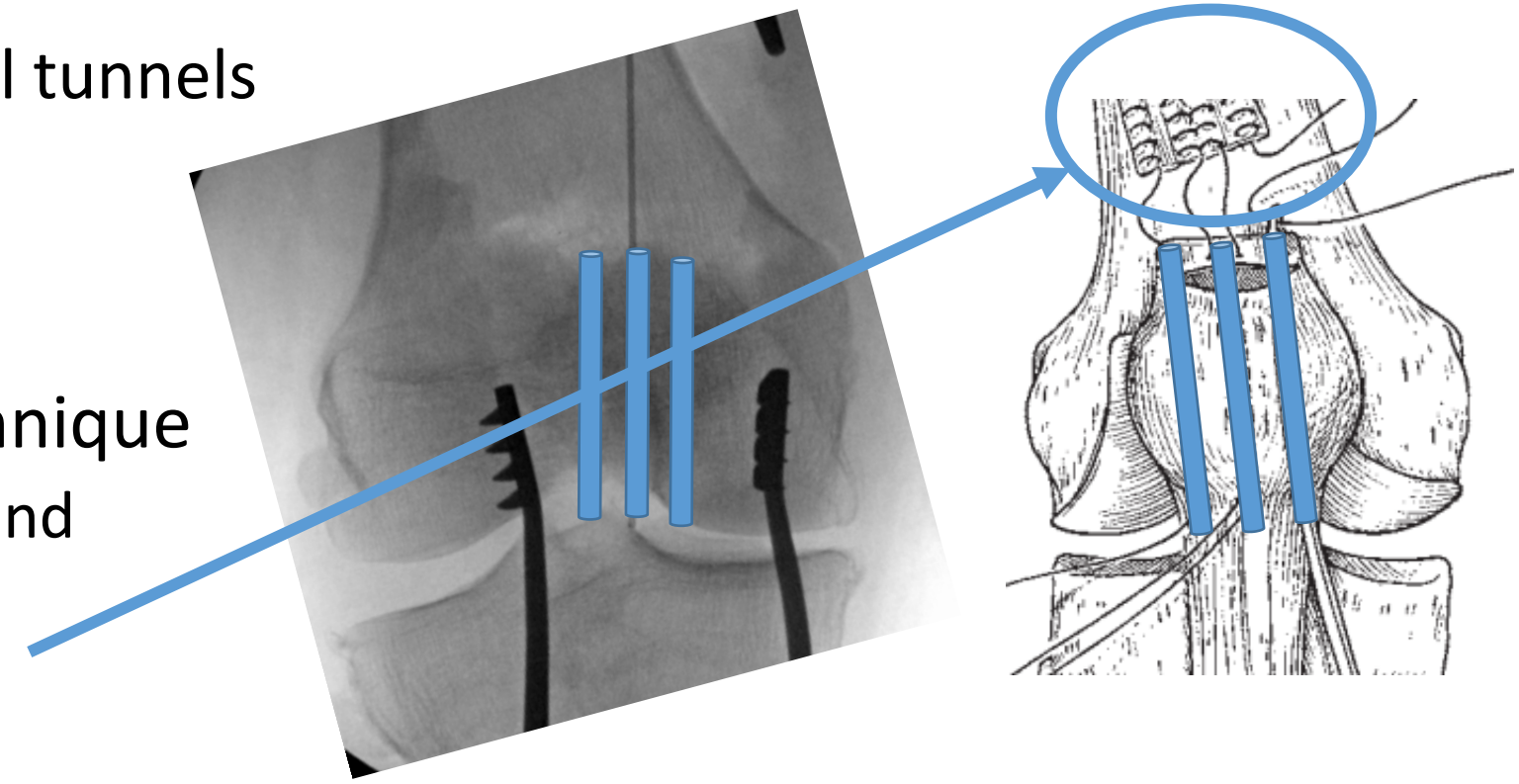
- Similar Operative Technique for both
  - Approach:
    - Midline anterior incision
    - Elevate full thickness flaps
  - Identify medial & lateral extent of retinacular tears
    - Repair during closure
  - Debride tendon stump
  - Prepare bony surface
    - Burr or curettes
    - Stimulates tendon-to-bone healing



Used with permission. Image Source: Ilan DI, et al. Quadriceps Tendon Rupture. *JAAOS*. 11(3):192-200, May-June 2003. Fig. 3.

Quadriceps & Patella Tendon Repair

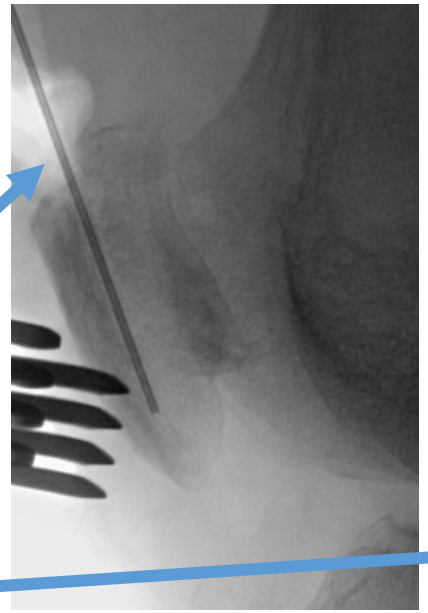
- Drill bone tunnels
  - 3 (or more) parallel tunnels
  - Suture:
    - Heavy (#2 or #5)
    - Non-absorbable
- Running locking technique
  - Enter tendon from end
  - Up & back medially
    - Up & back laterally
    - 4 strands total



Used with permission.
Image Source: Ilan et al. *JAAOS* 2003. Fig. 3.

Quadriceps & Patella Tendon Tears

- Pass sutures through bone tunnels
  - Keith needle
  - Suture passer
- Tie sutures down over bony bridge b/w holes
  - 3 holes = 2 knots
  - Augment if needed
    - Cerclage through tibial tubercle
    - Circumferential purse-string suture



Used with permission. Image Source: Ilan et al. *JAAOS* 2003. Fig. 3.

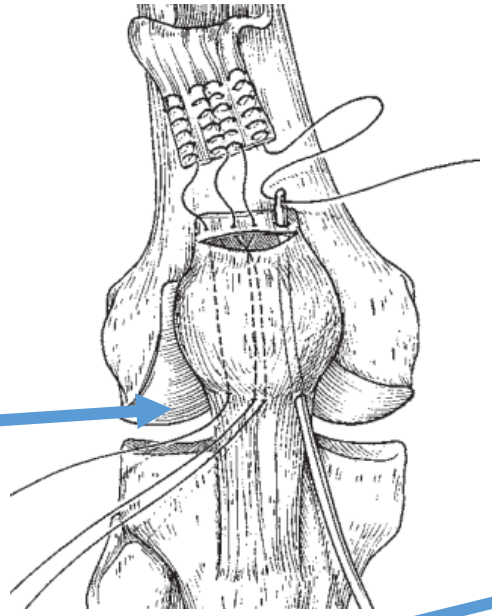
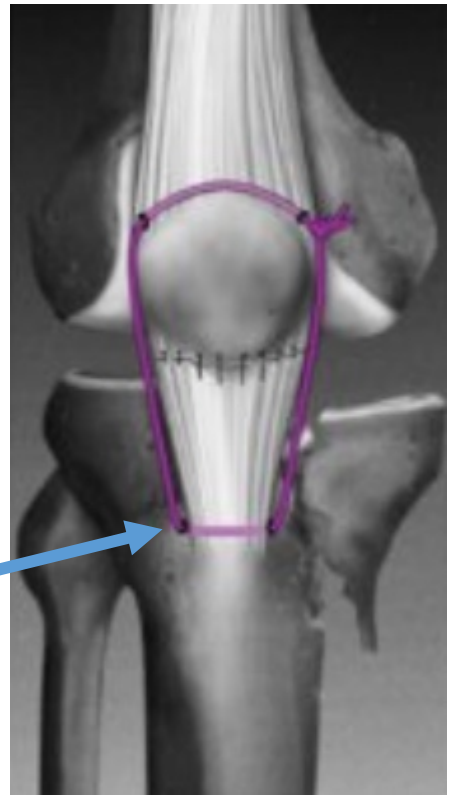


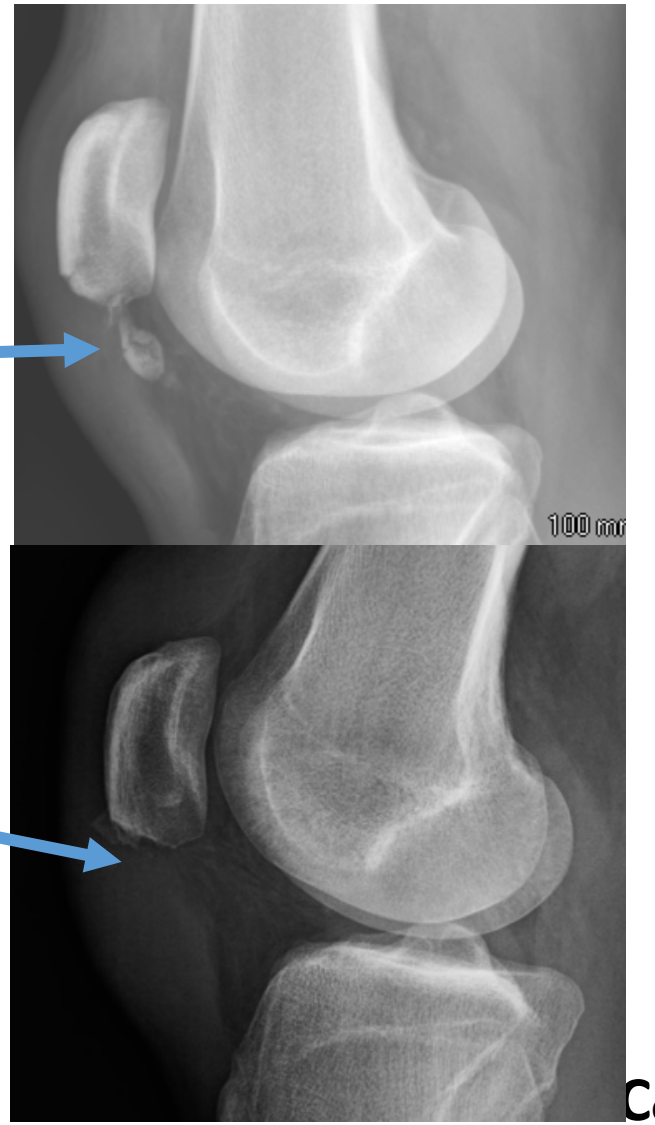
Image Source: Rockwood and Green's Fractures in Adults, 9th Edition, Fig. 59-9.



Special Considerations: Patella Tendon Injuries

- Tiny inferior pole fractures:
  - Usually non-articular
  - Often too small to fix
- Preferred Treatment:
  - Fragment excision with patella tendon advancement

    (essentially converting this to a patella tendon repair)



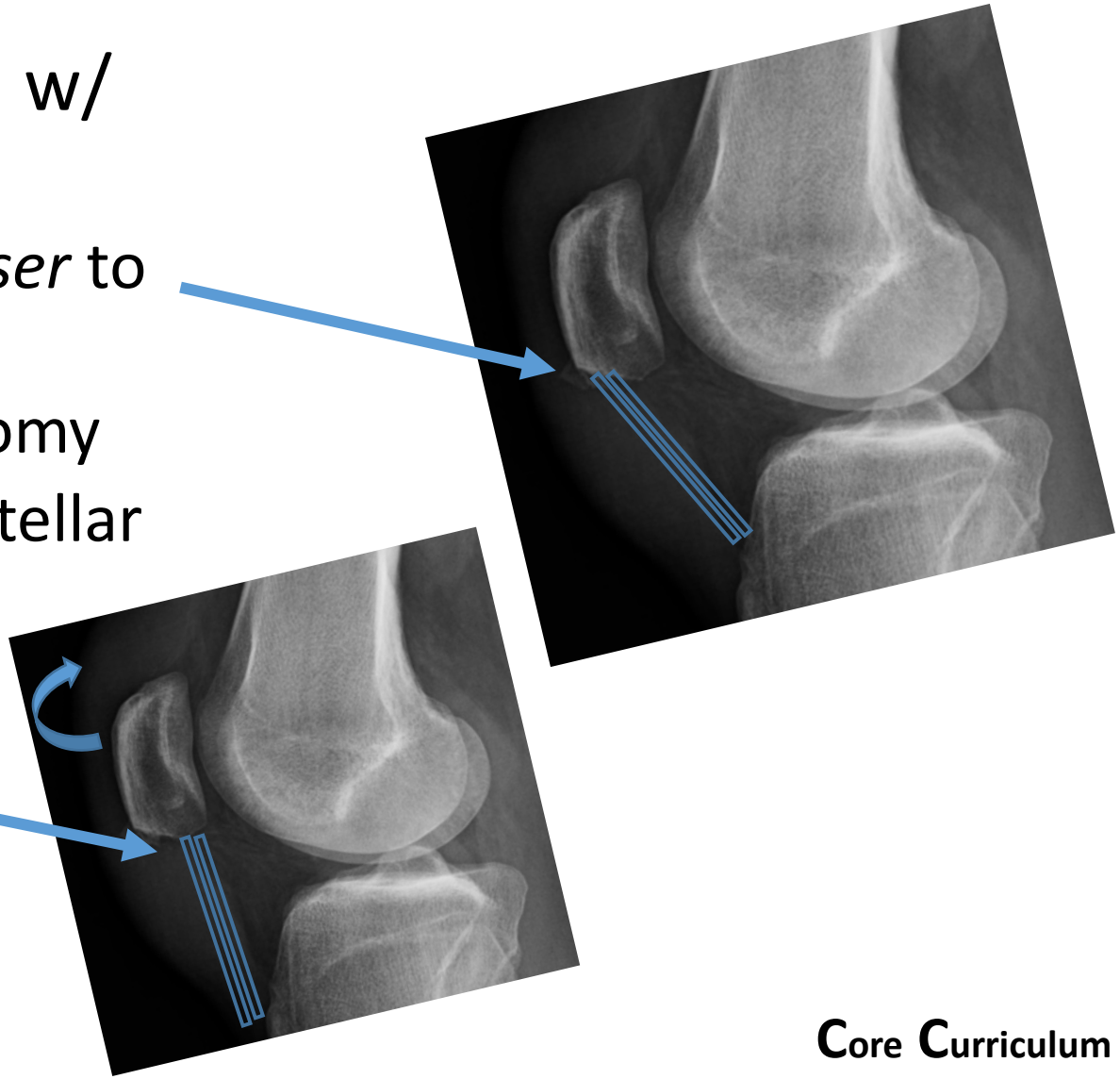
OTA Video Library Link

Video

Video Link:
https://otaonline.org/video-library/45036/procedures-and-techniques/multimedia/16731411/suture-repair-of-pole-patella-fracture

Special Considerations: Patella Tendon Injuries

- Inferior pole fragment excision w/ patella tendon advancement:
  - Make sure to attach tendon *closer* to anterior cortex
  - Better reproduces normal anatomy
  - Posterior attachment causes patellar rotation/maltracking



Quadriceps & Patella Tendon Tears

- Summary:
  - Prepare tendon & bone
  - Parallel drill tunnels
  - Heavy non-absorbable suture
  - Running-locking suture
  - Sutures through drill tunnels
  - Tie over bony bridge
  - Retinacular repair
  - Augment if needed using cerclage/purse-string
  - Alternative: suture anchors

Used with permission. Image Source: Ilan et al. *JAAOS* 2003. Fig. 3.

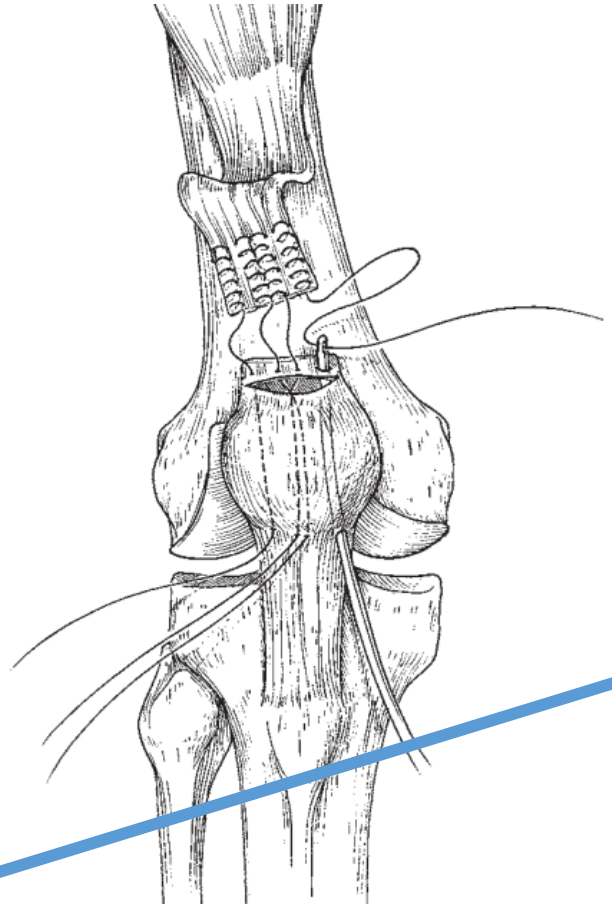
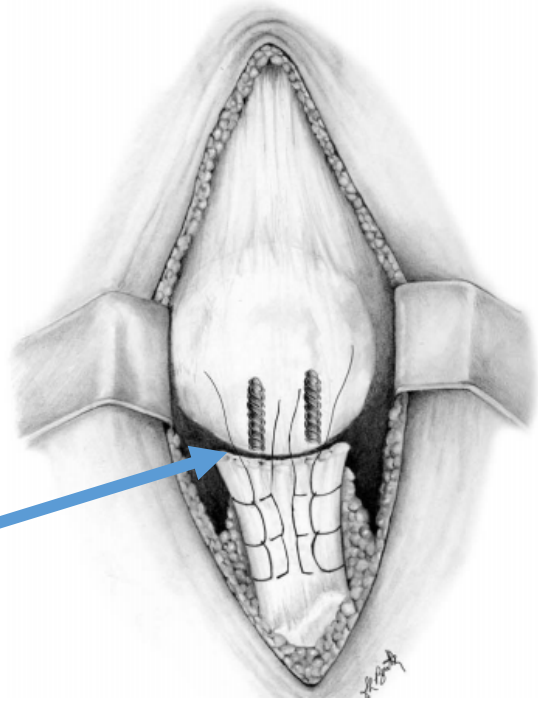
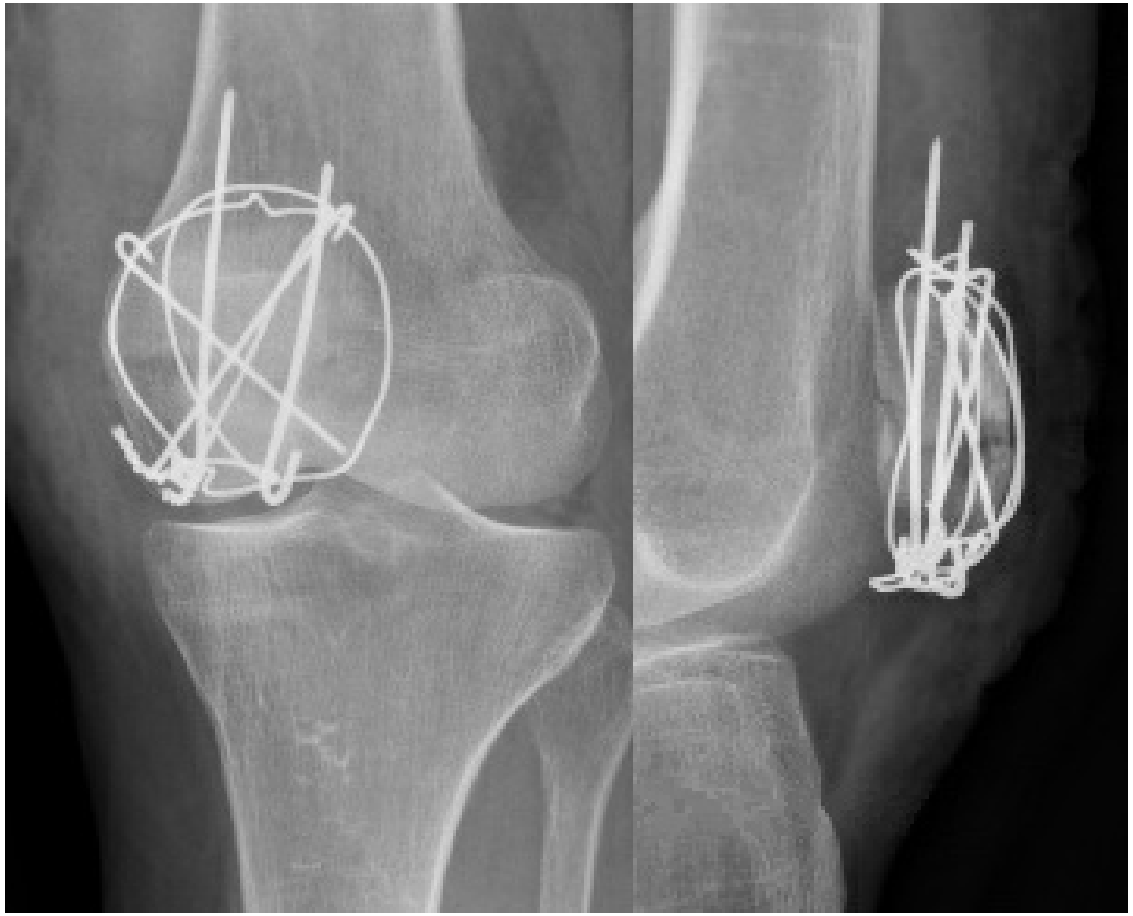


Image Source: Gaines RJ et al. Patellar Tendon Repair with Suture Anchors Using a Combined Suture Technique of a Krackow-Bunnell Weave. *J Orthop Trauma*. 2009 Jan;23(1):68-71. Fig. 3A.



Complications - Common

- Hardware prominence/pain
  - VERY common (up to 60%)
  - Often require reoperation for hardware removal
  - Implant-dependent:
    - Highest rates with traditional Tension Band Wire construct (using 18G stainless steel wire)
    - Lower rate (8%) with cannulated screws + suture tension band



Busel et al. *Injury*, 2020

Complications – Less Common

- Extensor mechanism weakness
  - Common, but often very minor
    - 2-4cm loss of terminal extension
  - Extreme: total patellectomy:
    - 49% loss of quadriceps strength
- Knee stiffness
  - Typically can be prevented by early ROM
  - If unable to reach 90˚ of flexion by ~8wks, consider intervention:
    - Closed manipulation under anesthesia
    - +/- arthroscopic lysis of adhesions
    - Quadriceps-plasty in extreme cases.

Complications - Uncommon

- Infection/wound complications
  - <5% in most series
  - Up to 11% in open fractures
- Non-union
  - < 1% in most series
  - Up to 7% in open fractures
- Post-traumatic patello-femoral arthritis
  - Higher with partial patellectomy than with ORIF

Complications - Uncommon

- In rare cases, total patellectomy may be required:
  - Highly comminuted fractures
  - Severe infection or tumor
  - Failed internal fixation
  - Post-traumatic arthritis
- VMO advancement technique
  - Improved strength & functional outcomes vs. std patellectomy

Complications - Uncommon

- Re-fracture
- Re-rupture
- Loss of reduction/failure of fixation
  - Reported range of 0-20% in literature
  - Risk Factors:
    - Severe comminution
    - Osteopenia/Osteoporosis
    - Inadequate fixation
    - Overly aggressive physical therapy
    - Patient non-compliance
  - **Illustrative case next…**

88 yo F – s/p patella ORIF 6 wks ago

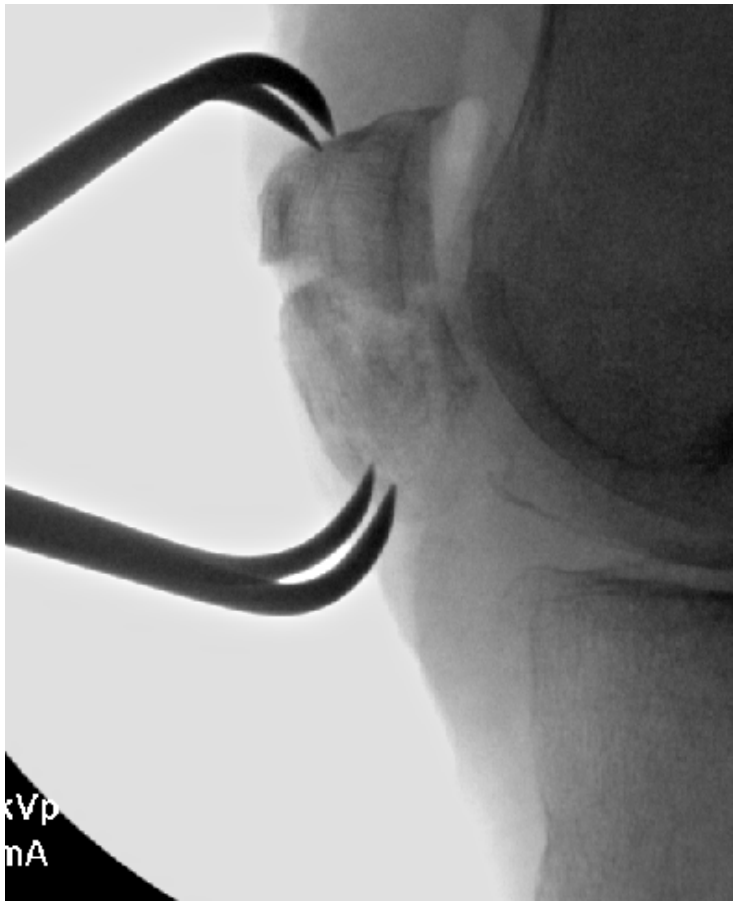
Injury Films (from outside hospital)

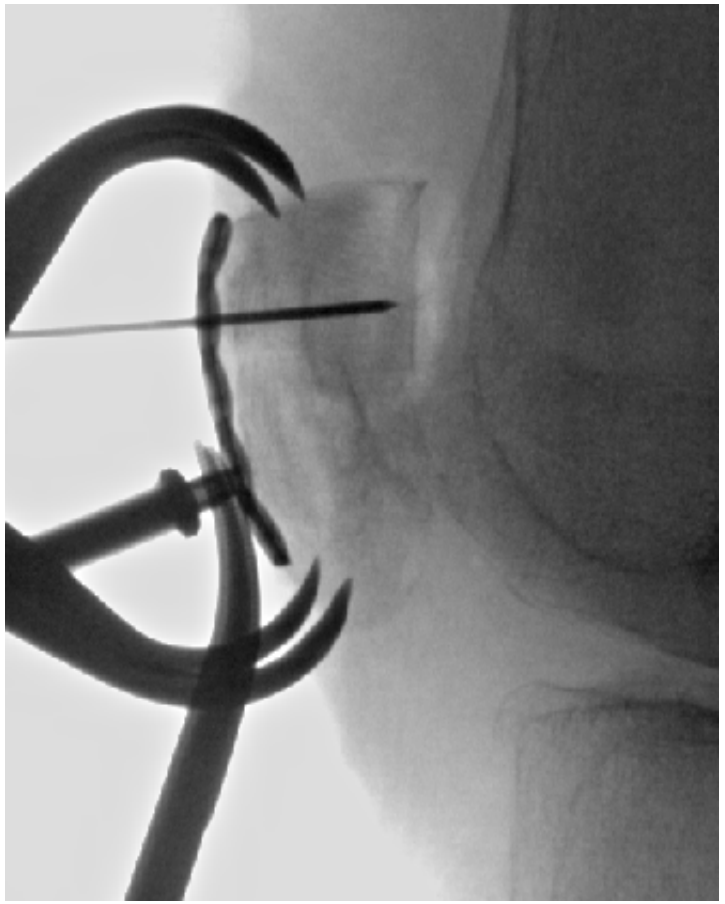
On today's X-rays, the inferior pole fracture is healing well

88 yo F, 6 wks s/p failed patella ORIF

- Treatment Plan?
  - Fracture Reduction
    - (Nonunion preparation)
  - Implant Options?
    - How to generate compression?
  - Soft Tissue Augmentation?
    - How? What materials?
  - Bone Grafting?
    - If so, what type?

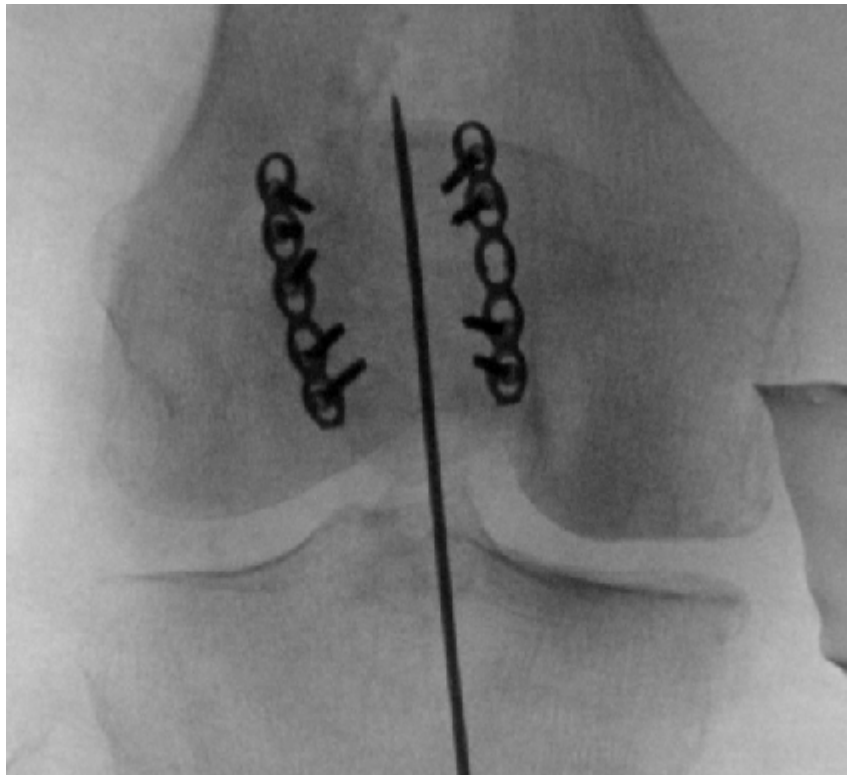
Fluoro Images

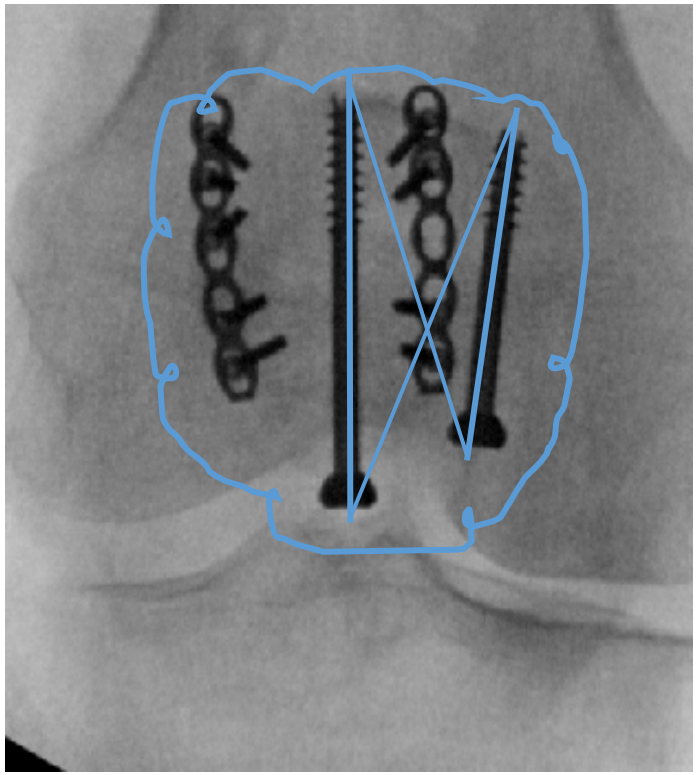


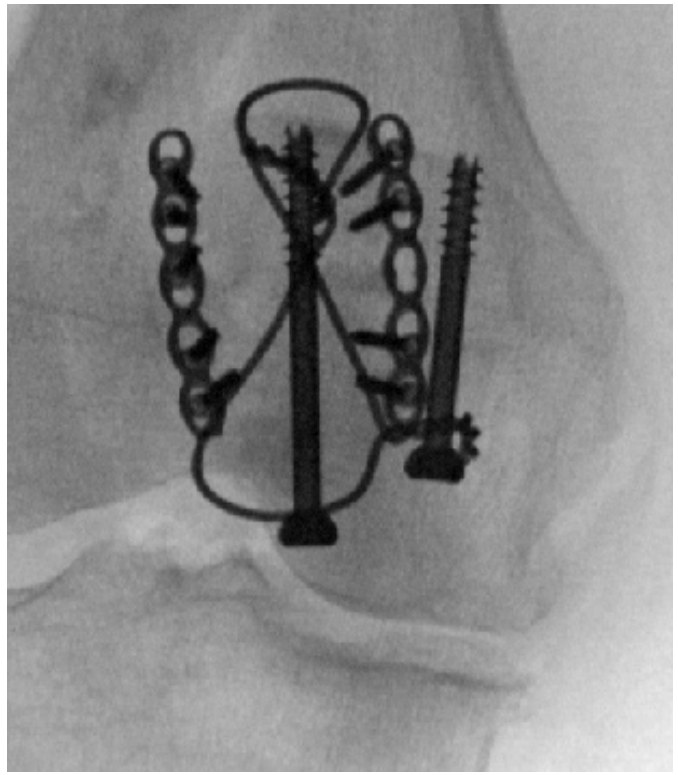


Key Point: With clamps compressing *posteriorly*, plates can compress *anteriorly*

Fluoro Images

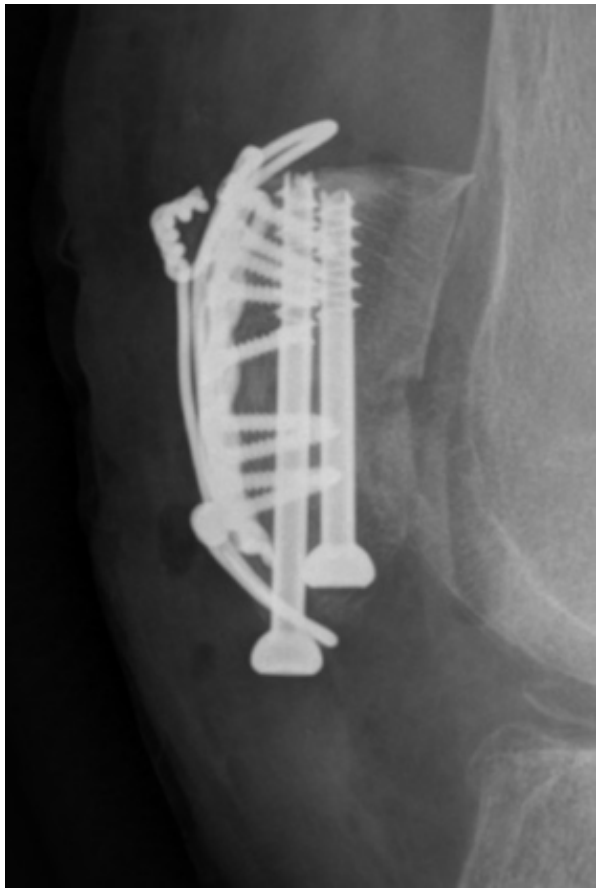






Key Point: Revision fixation with poor bone quality: augment as much as possible!

Post-Op Images



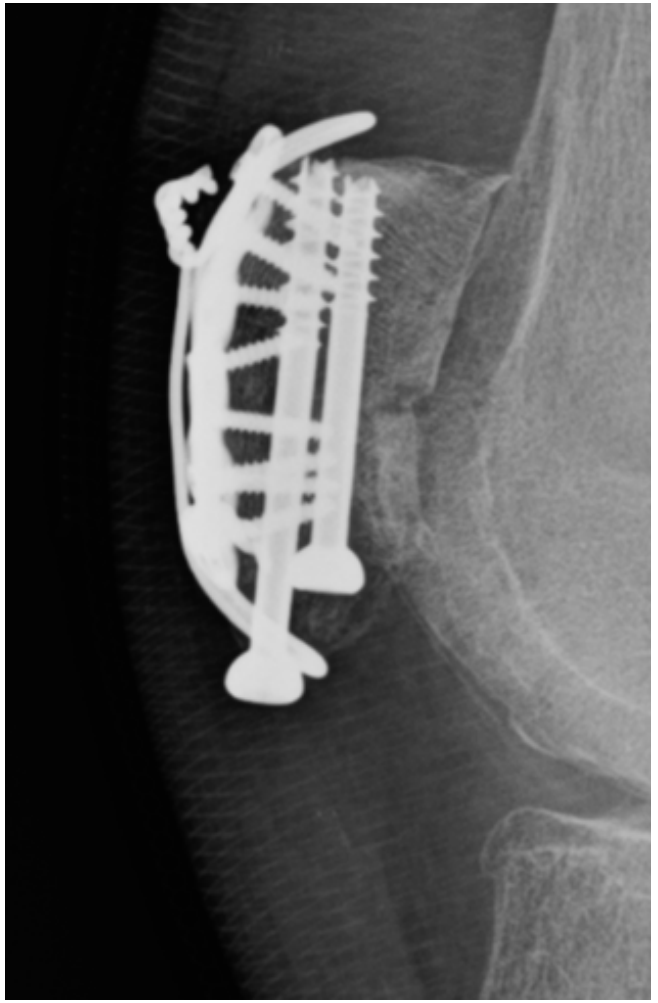
Rehab Protocol:

- Post-op WB status?
- Brace? What kind?
- ROM? If so, what range?

Follow-up: 2 & 6 wks

- 2 wks:
  - Sutures out
  - X-rays (to ensure no unexpected early failure of fixation)

- 6 wks:
  - Fracture healing
  - Started active flexion/ passive extension

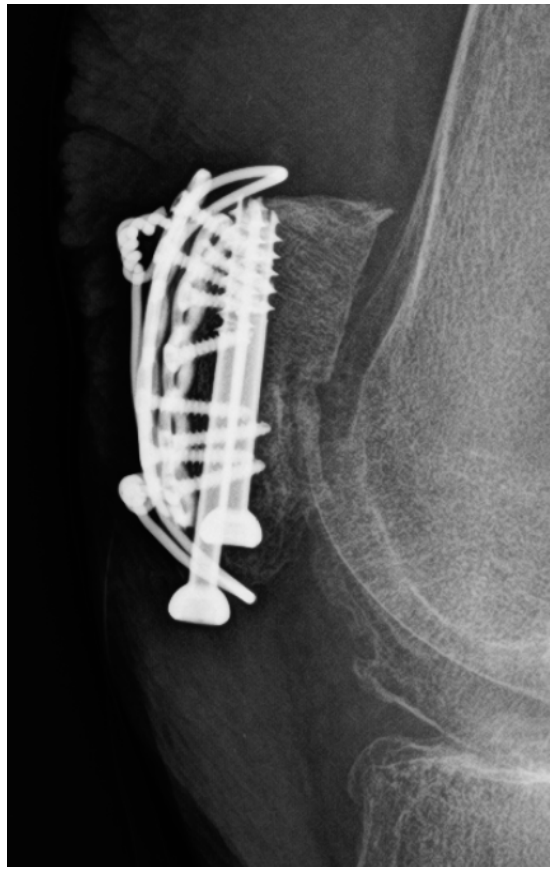


Follow-Up:

- ROM:
  - 3 mo: 0-94˚
  - 6 mo: 0-110˚
  - Back to baseline function

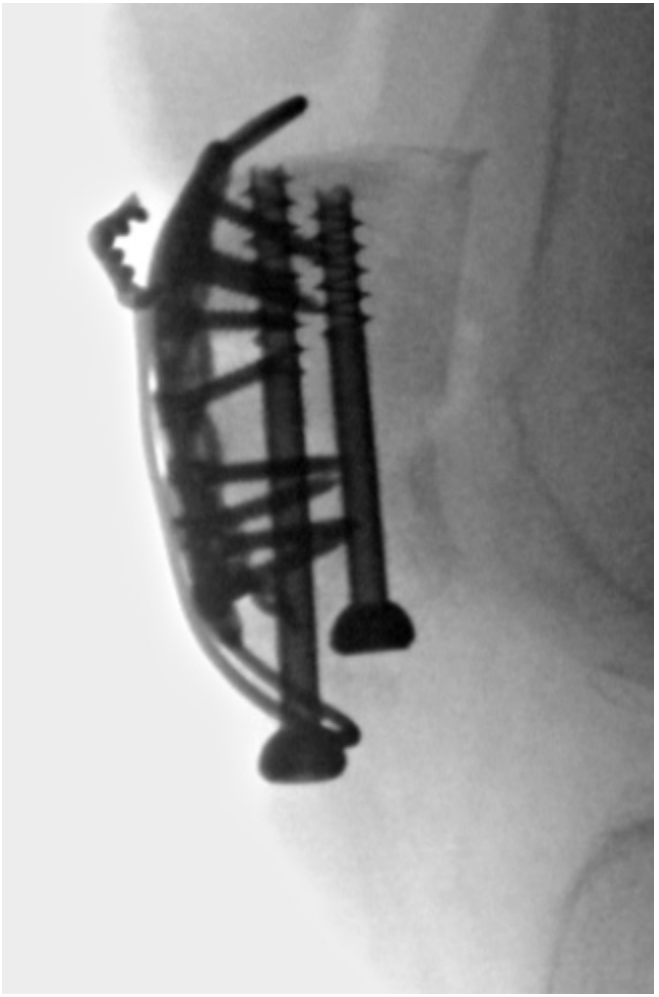
3 months

6 months



Failed Fixation: Take Home Points

- Construct *stability* is the priority
  - Revision, poor bone quality
- Generating compression:
  - Anterior plates (alternative: mesh plate)
  - Screws
- Soft Tissue Augmentation
  - Figure-of-eight: suture + tension-band wire
  - Purse-string suture
- Rehab Protocol:
  - Conservative in setting of revision



Overview & Objectives

- ✓Epidemiology & Mechanism of Injury
- ✓Anatomy & Biomechanics
- ✓Diagnosis & Classification
- ✓Non-Operative Treatment
- ✓Operative Treatment
  - ✓Patella Fractures: Simple & Complex
  - ✓Quad/Patella Tendon Injuries
- ✓Complications
- ✓Summary/Key Points

Summary – Patella/Extensor Mechanism Injuries

- ***Most*** **require operative treatment**
- **Significant *tensile* forces – must be overcome by fixation construct**
- **Simple transverse fractures – surgeon preference**
  - **traditional TWB or cannulated screws can provide reliable outcomes**
- **Complex fractures – maximize bony stability, augment w/ soft tissue**
- **Quadriceps & Patella Tendon Injuries – drill tunnels/suture repair**
- **Revision fixation – Generate compression, combine fixation methods**
  - **Augment w/ soft tissues & use conservative rehab protocol**
- **Complications – Symptomatic hardware most common (up to 60%)**
  - **Implant-dependent**

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