

## Patella – Open Reduction and Internal Fixation

### Surgical Indications and Considerations

*Anatomical Considerations:* The patella is a sesamoid bone that is embedded in the quadriceps tendon. Tensile forces are transmitted from the quadriceps to the tibia via the patella. The patella is also subjected to compressive forces at the articulation with the femur. At 45° the patella is under the most force (approximately between 2 and 10 newtons per millimeter squared). During development the patella most often originates from a single ossification center. In approximately 23% of patients two to three separate ossification centers exist. Two percent of the time these centers do not completely merge, the condition is called bipartite patella. Of these individuals approximately 2% develop symptoms secondary to trauma or chronic stress on the patella. Traumatic patellar fractures are identified as transverse, vertical, marginal or osteochondral. Transverse fractures occur horizontally across the patella. Vertical fractures run from the inferior pole to the superior pole. Marginal fractures occur at the perimeter of the patella and most often include small fragments. Osteochondral fractures are cracks or discontinuities of the covering of the patella.

*Pathogenesis:* Fractures of the patella occur in when the force applied to the patella is stronger than the bone that constitutes the patella. This can happen when the patella receives a direct blow or as a result of indirect forces. If the patella is osteoporotic, much less force is required to fracture the patella. The patella can also be fractured during ACL reconstruction surgery when autogenous patellar tendon is used. The patella can be fractured while the proximal bone plug is being removed.

Transverse fractures most often occur with indirect force (for example a forceful quadriceps contraction). Transverse fractures are the most common fracture to result from a traumatic patellar dislocation. Vertical and osteochondral fractures are rare and can occur with either direct or indirect force. Marginal fractures are usually due to a direct force to the side of the patella.

*Epidemiology:* Patellar fractures make up approximately 1% of skeletal injuries. Males are more likely to have bipartite than females, but traumatic patellar fractures do not occur more commonly in men or women. Osteochondral fractures are more common in children than in adults.

### *Diagnosis:*

- History of a direct blow to the patella
- There may be a palpable ridge in the patella if the break is complete
- Persistent patellar tenderness
- Decreased function of the extensor mechanism (inability to extend the knee against resistance)
- Radiographs confirm injury to the bone
- MRI can be helpful to identify or rule out associated ligamentous injuries to the knee

*Nonoperative Versus Operative Management:* Fractures with 2mm or less separation are indicated for nonoperative treatment. This includes 4-6 weeks of immobilization in a splint or cast on the conservative side and as little as 2 weeks of immobilization on the aggressive side. Aggressive nonoperative treatment may include weight bearing as tolerated as early as 1-week post fracture. Surgical repair is typically recommended for all patellar fractures that demonstrate 3mm or more separation of fragments or a step off of 2mm or more. In the case of comminuted fractures or fractures of severely osteoporotic bone a synthetic patellar prosthesis can be used.

*Surgical Procedure:* Surgical techniques include placing two or three wires or canulated screws perpendicular to the fracture line. In addition, wire can be used around the circumference of the patella. New procedures include arthroscopic techniques also using screws perpendicular to the fracture line as well as circumferential wiring. Fixation screws and wiring are not removed post operatively unless there are complications. Small fragments and loose bodies are removed if found.

*Preoperative Rehabilitation:* Goals include gait with the appropriate assistive device, control of swelling/inflammation, maintaining maximum range of motion, strengthening of surrounding stabilizing musculature, and patient education. Physical therapy interventions include gait training, joint mobilizations, strengthening, and modalities.

## POSTOPERATIVE REHABILITATION

### **Phase I:** Weeks 1-4

Goals: Pain and edema control  
 Improvement in muscle contraction  
 PROM: 0°-30°  
 Avoid excessive stress on the extensor mechanism  
 Independent home program

Intervention:

- Cryotherapy
- Electrical stimulation for muscle stimulation (remember to not stress extensor mechanism)
- Patellar mobilization
- PROM: heel slides
- Isometrics: Quadriceps sets at 20°-30°, hamstring sets
- Straight leg raises
- Immobilization for gait with WBAT (begin WBAT around week 4)
- Weight shifting

**Phase II:** Weeks 5-8

Goals: Pain management

Normalize gait pattern

Increase lower extremity strength

PROM: 0°-90°

Intervention:

- Modalities for pain control
- Progress PROM
- AAROM: therapist assisted and stationary bike
- AROM when cleared by physician (6-8weeks)
- Isometrics – continue progress from Phase I
- Open chain hip and ankle strengthening
- Gait training (progress weight bearing)

**Phase III:** Post Week 8

Goals: Self management of symptoms

Increased ambulation distance

Good sitting and standing tolerance

Good patellar stability and tracking

Intervention:

- AROM: 0°-120°
- Progress lower extremity strengthening: closed chain (squats, steps), continue hip and ankle strengthening, focus on stability, proprioception, balance, and extensor strengthening

**Phase I for Aggressive Rehabilitation:** Weeks 1-2

Goals: Pain and edema control

Improvement in muscle contraction

PROM: 0°-30°

Avoid excessive stress on the extensor mechanism

Independent home program

### Intervention Week1:

- Cryotherapy
- Electrical stimulation for muscle stimulation
- Patellar mobilization
- PROM: heel slides in hinged splint set at 0°-30° to be work constantly except for bathing.
- Isometrics: Quadriceps sets at 20°, hamstring sets
- NWB gait with crutches
- Relative immobilization with hinged splint set at 0°-30°
- Open chain hip strengthening: abduction, adduction, extension

### Intervention Week 2:

- Continue interventions from Week 1
- AAROM in hinged splint set at 0°-30°
- Begin WBAT gait with splint and crutches

### **Phase II for Aggressive Rehabilitation:** Weeks 3-4

Goals: Pain management

Increase weight bearing with gait

Increase lower extremity strength

ROM: 0°-90°

Intervention:

- Modalities for pain control
- AAROM: therapist assisted and stationary bike 0°-90°
- AROM: heel slides, short arc quad extension, begin closed chain strengthening
- Isometrics: continue progress from Phase I
- Closed chain hip and ankle strengthening
- Gait training: WBAT with hinged splint and crutches

### **Phase III for Aggressive Rehabilitation:** Weeks 5-6

Goals: Pain management

Normalize gait pattern

Increase lower extremity strength

ROM: 0°-120°

Intervention:

- Modalities for pain control
- Patellar and tibial/femoral mobilization
- AROM
- Closed chain strengthening: wall squats, supine leg press, stationary bike
- Proprioceptive and balance training
- Gait training: FWB with hinged splint

**Phase IV for Aggressive Rehabilitation:** Weeks 7-12

Goals: Self management of symptoms  
 Increased gait distance and speed  
 Good sitting and standing tolerance  
 Good patellar stability and tracking  
 5/5 hip, knee and ankle strength

Intervention:

- AROM: 0°-120°
- Progress lower extremity strengthening: closed chain (squats, steps, increase speed and force), continue hip and ankle strengthening, focus on stability, proprioception, balance, and quadriceps strengthening.

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