



## **Standard of Care: Tibial Plateau Fracture**

**Case Type / Diagnosis:** ICD-9: 823.00 - fracture of proximal tibia

Tibial plateau fractures can occur as a result of high-energy trauma or in low-energy trauma when bone quality is poor. The most common mechanism of injury is motor vehicle accident, followed by falls and sports injuries, with 40% of injuries being poly-trauma. The mean age of people with this type of fracture is 50. This type of fracture can occur in both younger and older patients, however usually have different etiologies. There are several methods of describing the fractures, including the Schatzker and AO systems. The Schatzker classification system, described below, is most commonly used in North America and is based on the location and extent of the fracture and associated depression of the bone.<sup>1 2</sup>

- **Type I**, or minimally displaced fracture is a wedge fracture of the lateral plateau. This most often occurs in young patients with strong bone that resists depression.
- **Type II**, or split compression (or depression) fracture, is seen when the lateral plateau fracture becomes depressed. This is often as a result of valgus stress and axial compression. Ligamentous, and meniscal injuries are often present. The proximal fibula may also sustain a fracture. Type II fractures often occur in patients with osteoporosis or poor bone quality.
- **Type III** fractures are low energy, involving elderly and osteoporotic patients where there is a central or peripheral depression of the lateral plateau without the wedge fracture seen in type I and type II. It is a “pure depression” injury.<sup>1</sup>
- **Type IV** is a fracture of the medial tibial plateau and carries the worst prognosis of all types. This is due to the associated soft tissue injury that often occurs. It can occur in elderly patients with a low energy injury as the medial tibial plateau crumbles into fragments or in young people with high velocity accidents. In traumatic fractures there is often associated intercondylar eminence avulsion, as well as cruciate and lateral ligament injury due to both varus and axial loading. There can also be peroneal nerve traction or popliteal artery injury.
- **Type V**, or a split bicondylar fracture, is a fracture of both the lateral and medial tibial plateau, usually with lateral depression. This high-energy trauma is frequently associated with meniscal detachment (seen in one half of patients) and ACL avulsions (seen in one-third of patients).
- **Type VI** fractures are bicondylar fractures with dissociation of the diaphysis from the metaphysis. Many (35%) are open and most (86%) have extensive soft tissue injuries.

Orthopedic management of tibial plateau fractures varies from conservative non-operative treatment to open reduction and internal fixation (ORIF). If the fracture is non-displaced, or if a

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patient cannot tolerate surgery, it will likely be treated with a cast or brace and non-weight bearing with controlled ROM in a hinged knee brace. However, if there is displacement, ligamentous injury, or meniscal injury, operative treatment is required. The amount of associated ligamentous injury varies from 7%-15.7% in the literature. <sup>3</sup>Blokker et al recommend ORIF for fractures that show greater than 5 mm of depression or 1 mm displacement. They also report that ORIF with the restoration of the articular surfaces will promote the best outcomes, with satisfactory results 75% of the time. <sup>3</sup> Outcomes after tibial plateau fractures are predicted primarily by the adequacy of reduction and alignment obtained and associated soft tissue damage. <sup>4</sup>

Early range of motion (ROM) of the knee and the maintenance of non-weight bearing (NWB) on the affected leg are generally considered critical. Prolonged immobilization in a cast has been found to increase stiffness that is not amenable to physical therapy. <sup>2</sup> In general, the goal should be to gain 90° flexion ROM by 4 weeks post operatively.

The average time for fracture union is 12 weeks in those over 65 years of age. <sup>1</sup>, but it often will depend on the type and extent of fracture as well as the patient's bone quality. Delayed weight bearing is most important in those who have sustained depression fractures. <sup>4</sup> With stable fractures, non-weight-bearing should be maintained for 6-8 wks, with progression to PWB (50%) at that time. After twelve weeks, patients can be full weight bearing if there is radiographic evidence of healing. In unstable fractures, NWB is maintained for twelve weeks with progression determined by radiograph and surgeon's preference. <sup>2</sup>

At Brigham and Women's Hospital (BWH), patients with tibial plateau fractures are managed with non-weight-bearing for three months with progression to partial and full weight-bearing per the surgeon. They are put in a Bledsoe hinged knee brace if there is significant varus/valgus laxity. The limb is maintained in extension as the surgical incision heals. Once this is healed sufficiently (this is according to the surgeon) they begin ROM to tolerance, without limitation, as long as an open incision is not stressed.

### **Indications for Treatment:**

Patients who have tibial plateau fractures experience edema, pain, loss of ROM, strength and function, all of which are indications for physical therapy.

### **Contraindications / Precautions for Treatment:**

There are no specific contraindications or precautions for treatment, however therapy should be held if there is a reason to suspect loss of fracture reduction. If this is the case, the patient should be referred back to their doctor. A study by Blokker found that 10% of patients with tibial plateau fractures could have deep vein thromboses. The therapist should hold treatment until they are anti-coagulated appropriately. Myositis ossificans and psuedoarthrosis are less common

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complications, but can occur. If any of these issues are suspected they should be discussed with the referring MD.

### **Examination:**

Medical History: Review the standardized outpatient rehabilitation medical history questionnaire and longitudinal medical record (LMR). Specifically take into consideration patient's age, history of blood clots, and bone quality, including history of osteoporosis.

History of Present Illness: Review the mechanism of injury, type of fracture, associated soft-tissue injury and surgical versus non-surgical repair of the injury.

Social History: Review patient's home situation, specifically whether they have stairs and the amount of social support they have. Discuss their employment status and the physical requirements of their job. Note any recreational activities the patient was involved in before the fracture.

Medications: Review all medications through the history questionnaire and (LMR). Be aware if the patient is on anti-coagulants due to the risk of bleeding and also of any pain medication they may be taking.

### **Acute (Inpatient):**

In-patient management consists of early ROM and maximizing patient independence with an assistive device to maintain NWB on the affected leg. At BWH, patients may be kept in extension for a short time to maximize incision healing. Patients should be instructed in positioning at 0° knee extension when at rest. Physicians may prescribe a continuous passive motion (CPM) machine, with ROM to increase from 15 to 70 degrees, depending on incision healing. Begin active assistive range of motion (AAROM) exercises as ordered by the physician, as incision healing allows. Patients may be fit with a hinged knee brace to avoid varus and valgus strain at the fracture and collateral ligaments.<sup>5</sup>

### **Sub-Acute (Outpatient):**

Pain: Rate pain using a visual analog scale (VAS)

Patient Knowledge: Ensure the patient's understanding of the importance of non-weight bearing. Patient should be aware of positioning in 0° extension to avoid flexion contracture. If they have an altered mental status, they may not be appropriate for gait training and would be in need of a wheelchair to protect the healing fracture.

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Edema: Perform circumferential measurements of the knee joint, calf and thigh as appropriate. Figure of Eight measurement of the ankle may also be warranted if edema is extensive.

ROM: Assess AAROM and passive range of motion (PROM) of the knee joint, using goniometry. Also assess the ankle and hip joint motion. Assess uninvolved extremities to the extent needed, as the patient will likely need to use an assistive device to function in NWB. Initial goal is to gain 90 degrees of flexion by 4 weeks<sup>2</sup>, but this will be dependent on incision healing and surgeon preference.

Strength: Use Manual Muscle Testing (MMT) of joints proximal and distal to the knee, as appropriate. The therapist should avoid any tests that unnecessarily stress the fracture. Assess upper extremity strength and uninvolved lower extremity strength as the patient will need to use an assistive device to maintain NWB. Once the fracture is healed and the patient can be weight-bearing, MMT can be used at the knee as appropriate.

Special Tests: Assess the stability of the uninvolved lower extremity as it will bear most of the force during gait. Once the fracture of the involved leg is healed, you may assess for ligamentous and meniscal injuries, as they may be present in this injury. If the patient reports calf pain or significant lower extremity swelling, perform Homan's test to assess for deep vein thrombosis, as this can occur in up to 10% of patients.<sup>3</sup>

Balance: Assess the patient's ability to maintain balance with NWB using an assistive device. Assess balance on the involved leg as appropriate when the fracture is healed and weight-bearing status is progressed.

Proprioception: Assess as appropriate in uninvolved leg, and in involved leg once beginning weight bearing or as appropriate.

#### Function:

-Patients at BWH must remain NWB 12 weeks or until fracture has healed, unless otherwise dictated by the surgeon. They will require bilateral upper extremity support to do so. The decision to use a walker versus crutches will depend on upper body strength, balance, cognition, and endurance. If the patient is unable to safely maintain NWB, they will likely need to use a wheelchair. The therapist will modify the assistive device as appropriate.

-Initially, in the NWB period, functional assessment will be limited and will focus on activity of daily living modification, transfers and short distance ambulation and stairs.

-Once weight-bearing is allowed, the therapist will need to reassess gait, balance activities, and higher-level functional activities as appropriate.

-Outcome measures such as the Lower Extremity Functional Scale may be helpful in tracking and documenting progress.

Differential Diagnosis: Diagnosis of a tibial plateau fracture is usually confirmed by radiography. However the patient may have sustained further soft-tissue injury to the involved

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leg or to other parts of the body, as the cause of tibial plateau fractures is often traumatic. The therapist must look at the entire picture and concomitant issues when treating patients with these fractures.

### **Evaluation / Assessment:**

Establish diagnosis and need for skilled services: Patients who have tibial plateau fractures experience edema, pain, loss of ROM, strength and function, all of which are indications for physical therapy.

### Problem List:

- Pain
- Edema
- Loss of ROM
- Loss of strength
- Decreased function
- Decreased joint mobility
- Impaired balance
- Impaired proprioception
- Decreased patient knowledge regarding precautions and home program

Prognosis: Depends on the type of fracture, age of patient, bone quality and concomitant injury, as discussed in the beginning of this standard of care.

Goals: Measurable, individualized goals with time frames will be established by the primary PT.

### Short Term Goals:

- Decrease pain
- Decrease edema
- Increase lower extremity A/AA/PROM per MD orders and protecting incision
- Patient is independent in transfers, short distance ambulation and stairs, while maintaining NWB.
- Improve patellar mobility
- Patient demonstrates understanding of precautions and NWB status.
- The patient is independent with self-management of symptoms.
- Patient is independent with initial home exercise program

### Long Term Goals:

- Continue to manage and minimize pain
- Continue to minimize edema
- Gain knee and ankle ROM WFL
- Gain 5/5 lower extremity strength

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- Independent transfers, ambulation and reciprocal stair climbing with appropriate assistive device and no limp. The ultimate goal is to function without an assistive device and without a limp.
- Continue to gain normal patellar mobility and tibial-femoral mobility once fracture is healed
- Balance on the involved lower extremity is equal to the uninvolved lower extremity, using single leg stance time to measure.
- Patient is independent with discharge home exercise program

Age Specific Considerations: Tibial plateau fractures occur in young patients involved in high velocity injuries or in the elderly and osteoporotic population with low energy forces. It may be difficult for the elderly to safely maintain NWB gait that is required for fracture healing. Advanced age, changes in cognitive status and medical issues that are associated with this must be considered when deciding which assistive devices to use in this population.

### **Treatment Planning / Interventions**

Established Pathway	<input type="checkbox"/> Yes, see attached.	<input checked="" type="checkbox"/> No
Established Protocol	<input type="checkbox"/> Yes, see attached.	<input checked="" type="checkbox"/> No

### **Interventions most commonly used for this case type/diagnosis**

This section is intended to capture the most commonly used interventions for this case type/diagnosis. It is not intended to be either inclusive or exclusive of appropriate interventions.

It is thought that early movement, started immediately or by 10 days post op, may be important in neochondrogenesis and reshaping of the joint surfaces. <sup>3</sup>The integrity of the incision must be maintained and considered as the patient begins ROM. The patient may be in a hinged knee brace if there is ligamentous instability, which will be discharged according to the referring MD's orders.

- Pain management
- Edema management
- Modalities can be used at the therapist's discretion and can include ice, heat, and electrical stimulation. Please see Department of Rehabilitation Services Modality specific procedures.
- P/AA/AROM
- Functional training with appropriate assistive device, with progression to high level activities as healing allows.

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- Patellar mobilization initially, with possible tibial-femoral mobilization once fracture fully healed
- Patient education
- Home exercise program
- Strengthening – initially of proximal limb, then progressing to full limb as dictated by healing and surgeon preference
- Balance and proprioception training, as appropriate

### Frequency & Duration

**Frequency:** Likely to have more frequent visits at 2-3 times per week for the first 4 weeks to gain early ROM, edema control and to be certain the patient is independent in an initial home exercise program and safe in NWH gait. Once this is achieved, therapy will taper off until patient is ready to progress to weight bearing and more functional activities.

**Duration:** May be up to 5-6 months given that weight bearing generally isn't permitted until 12 weeks. The patient may be temporarily discharged and re-referred once weight bearing status is advanced.

Patient / family education should include importance of maintaining NWB and progression of WB as appropriate, safety with assistive device as well as instruction in home exercise program and edema management.

Recommendations and referrals to other providers: Return to referring physician if sudden increase in pain, significant increase in swelling, suspicion of loss of fracture reduction or increased instability of the knee joint. Elderly patients who are not able to maintain NWB or who concomitant medical issues may need a referral to inpatient rehabilitation.

### **Re-evaluation / assessment**

Standard Time Frame: Re-asses at 30 days. The patient should fill out a functional outcome measure at this time to track progress

Other Possible Triggers: sudden change of status or suspicion of loss of fracture reduction.

### **Discharge Planning**

Outcomes at discharge depend on age, severity of fracture, and soft tissue injury. Please refer to the first section of this standard of care for more details. In general, the patient should progress to independent function without an assistive device.

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Patient's discharge instructions include appropriate weight bearing status, self-management techniques, and home exercise program. They should follow up with the referring MD if there is a change in status.

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