Tibial Plateau Fractures

AO basic course
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ICM Robertson
Anatomy

The proximal tibia is covered by skin and little else. If skin breakdown occurs due to poor surgical technique or operating when the skin is oedematous deep infection is invariable.

Avoid this by delaying operation until oedema has settled (Wait 10 days before operating) and not undermining the skin by using full thickness incisions. Bilateral incisions are to be avoided!
Initial Assessment

- Compartment syndrome
- Peroneal nerve function
- Ligamentous instability

Remember compartment syndrome is common especially in displaced fractures. The peroneal nerve is often damaged resulting in a drop foot.

Ligaments such as the ACL are often damaged in addition to the fractures. Stability should be assessed initially (often difficult) and again checked once ORIF has been done (easier).

Open fractures need immediate debridement, but closed fractures can usually wait. Use a bridging exfix over the knee as a temporary way of stabilisation in the multiply injured fracture with a plateau fracture showing shaft disassociation.
**Imaging**

- X rays
  - AP
  - Lateral
  - 15 deg caudal
- CT Scan

Because the plateau slopes backwards in the lateral plane a 15 deg caudally tilted X ray gives a good skyline view of the tibia.

In most displaced fractures a CT scan gives valuable three dimensional insight as to the position and displacement of the fracture fragments.
Plateau Fractures
Schatzker Classification

The Schatzker classification is a useful method. Displacements under 5 mm are ignored.

The majority (60%) are lateral injuries
1. - Lateral split only.
2. – Split depressed. Look for this depressed area – it may only be visible on CT scan.
3. - Depressed only. Seen if the bone is soft e.g. older people with osteoporosis.
4. – Medial plateau fracture with lateral side intact.
5. – Bicondylar but the shaft is intact (i.e. no diaphyseal metaphyseal dissociation )
6. – Bicondylar with involvement of the shaft portion – i.e. with diaphyseal metaphyseal dissociation

Partial or complete Ligamentous ruptures occur in about 15% to 45% and meniscal lesions are seen in about 5-37% of all tibial plateau fractures
Compartment syndrome is common in Type 6.
Plateau Fractures

Conservative treatment

• < 5mm displaced
• Skeletal traction - distal tibia
• Mobilise knee
• POP

Indicated in undisplaced fractures, displaced fractures that have other risk factors e.g. Sepsis and the very severe.

Works under the principle of ligamentotaxis i.e. depressed fractures will never recover.

A Denham pin is placed in the distal tibia or calcaneus and traction applied. The knee is exercised to regain motion. Once 90 degrees of motion is achieved the limb is placed in an above knee plaster cast.

Delamater used a cast brace method in 300 patients and achieved good results.

It is most important to achieve good alignment and conservative treatment usually accomplishes this, although it does poorly with depressed areas.

Reference
Plateau Fractures

The skin is your enemy! Skin breakdown will lead to sepsis with serious consequences … even resulting in an amputation. The tibial plateau is covered by a thin layer of skin and the blood supply to this area is not good. Avoid long flaps especially on the lateral side. Wait at least a week before operating on any but the most minor plateau fractures. This allows the skin to revascularise before the ‘second hit’ of surgery. At Tygerberg we admit all plateau fractures. It takes a week to get routine CT scans and this time is not wasted.

This is a bicondylar fracture - Schatzker 5
In this method of internal fixation, screws are used alone either percutaneously or through a limited incision. The danger of skin break down with subsequent sepsis are minimized. It is suitable for split type fractures only.

Another technique is “rafting” here multiple cannulated screws are placed parallel, and about 1cm below the joint surface. The idea is to prevent articular collapse.
Surgical Approach

- Avoid bilateral & extensile approaches
- Lateral - hockey stick incision
- Midline – if long buttress plate

The incision should be over the pathology and do not undermine the skin. Cut to the bone and keep the soft tissue envelope on the skin.

For minimally invasive work use the incision on the left and this can be extended down the shaft as a J or hockey stick incision if a plate is to be used.

Arthroplasty surgeons prefer the trauma surgeon to do everything through a single midline incision, making future replacements easier. There is a real danger of skin slough in the long dissection needed to the posterolateral region and these long flaps will lead to grief in the older or vascular compromised patient.
Plateau Fractures
Surgical Treatment

Split # - reduce and screw or buttress plate

Split type fractures can either be managed with screws alone – the screw at the apex is to stop the apex sliding downwards. A buttress plate as on the right is needed with larger fragments, at the price of further soft tissue stripping and devitailisation.
Plateau Fractures
Surgical Treatment

Depressed # - reduce & Bone Graft

With depressed fractures the ‘lid’ (intact fracture segment) is lifted open and the underlying depressed bone and cartilage is elevated. Bone graft is used to expand the resulting gap. This bone supports the cartilage ‘roof’. The buttress plate over the intact fragment keeps the graft in position.
Locking plates are effective with plateau fractures. Each screw locks into the plate and works as a mini blade plate. This prevents collapse of the, often unstable, peri-articular region.
Another example of a locking plate effectively buttressing a Schatzker 2 fracture. Depressed areas need to be elevate and the gap filled with bone graft.
Limited internal fixation

L.I.S.S. Plate
• Small incision
• Femoral distractor
• Blocking K wire

The Less Invasive Stabilization System is appropriate for severe fractures (Schatzker 6) where extensive stripping would otherwise be necessary for a long plate. The joint line is opened, and just enough skin is incised to reposition the fracture fragments. The shaft section is stabilized by sliding the plate in subcutaneously. Blocking K wires are useful to guide the plate accurately down the shaft.
Schatzker 1 and 2 fractures can be treated arthroscopically. Once the blood is irrigated out the fracture is visualised. Another advantage of a 'scope is that coexisting Ligamentous and meniscal damage can be addressed at the same time. Get the knee blood free by copious irrigation at eh start of the procedure. A mini incision can be made over the major fragment to allow the surgeon to manipulate the fracture into position. Depressed areas can be elevated from the small incision below. Bone graft can be inserted via the apex of the loose fragment and punched up to the articular line. Fixation is by means of per-cutaneous screws. An advantage of arthroscopic management is that meniscal tears and cruciate damage can easily be seen and addressed during the procedure.
External fixation

**Indications**

- Severe bicondylar
- Plateau + shaft
- Open fractures

External fixation is appropriate either as a temporary bridging exfix over the knee to stabilise the fracture until definitive fixation can be done.

It can be used to permanently fix the plateau fracture. Extensive or very comminuted fractures (Schatzker 6) are suitable for this technique. A half ring – “Hybrid fixator” or a full ring such as the Ilizarov can be used. The fracture fragments can either be pulled into position by “olive” wires or Percutaneous screws can be used to fix the major bony blocks.

This patient had a shaft fracture (not shown here) in addition to this Schatzker 5 fracture. Sepsis is a complication of this methods. Keep at least 1.5 cm away from the joint line to avoid placing your wires intra-articular.
Prognosis

- Complications
  - Varus collapse
  - Sepsis 2% \(^{(1)}\)
- Age irrelevant
- Alignment NB – OA related to this
- Depression >14mm NB \(^{(2)}\)
- Undisplaced # - good results
- 70 % good or excellent

Ref: (1) Cole, A. J Orthop Trauma; Vol 18, No 8, 2004 (2) Fag & Foy, 1995, 3.3-27

Alignment must be good. Intra-articular irregularity is of secondary importance. Surprisingly few end up with arthroplasty in later years.
Summary

- Respect soft tissues
- Minimally invasive surgery
  - high energy
- Alignment > congruency
Thank You

Web Links
http://www.wheelessonline.com/ortho/tibial_plateau_fractures
http://www0.sun.ac.za/ortho/webct-ortho/plateau/plateau1.html
References

Plateau fractures

2. Narayan, C; Treatment of high-energy tibial plateau fractures; Strat Traum Limb Recon (2006)
   1:18-28 http://dx.doi.org/10.1007/s11751-006-0002-4
4. Fag & Foy, 1995, 3.3-27

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