69 Proximal tibial injury

69.1 Extra-articular tibial plateau fracture

An extra-articular fracture, in the area 5cm below the tibial articular surface, not entering the knee joint capsule (69-1A) is usually the result of a violent blow to the leg most commonly occurring in road traffic crashes. Although the lower leg may bend in any direction, there is usually only a slight lateral shift and no overlap nor rotation. The fracture does not enter the knee joint. You can treat this in a long leg cast or in a cast-brace (67.4), just as you would if the fracture were more distal in the tibia.
If the fragments are displaced, manipulate them into position, and apply a long leg cast (70.4) for 6wks. Then remove it and start protected weight bearing with crutches for another 6wks.

69.2 Intra-articular tibial plateau fracture

There are 3 groups of fracture patterns with an intra-articular aspect.

(a) T-shaped tibial shaft fracture extending into the knee
An adult falls from a height, drives the shaft of the tibia up between the femoral condyles, and injures the soft tissues of the knee severely.
The condyles of the tibia may split apart (69-1B), with the tibial shaft riding up between them. Distal tibial traction (69.5) will often reduce these fractures adequately, as no fracture line affects the weight-bearing surfaces of the tibial plateau.

(b) Tibial condyle ('bumper') fracture
This fracture is usually the result of a blow to the outer side of the knee from the bumper of a car, which fractures one of the tibial condyles, usually the lateral.
There are 3 varieties of this fracture:
(1) The lateral or medial condyle may split vertically and hinge outwards (69-1C), while the fibula remains intact.
(2)The articular surface of the lateral or medial condyle may be depressed or pulped without harming the fibula (69-1D).
Minor varieties of this fracture may be difficult to see on a radiograph, so look carefully.
(3) The lateral tibial condyle may be displaced downwards, while breaking the fibular neck (69-1E).

(c) Comminuted upper tibial fracture
Here, the fragments are usually held in a sleeve of intact periosteum (69-1F). If so, try to reduce them by strong traction, and then treat use distal tibial traction (69.5).

UPPER TIBIAL FRACTURES

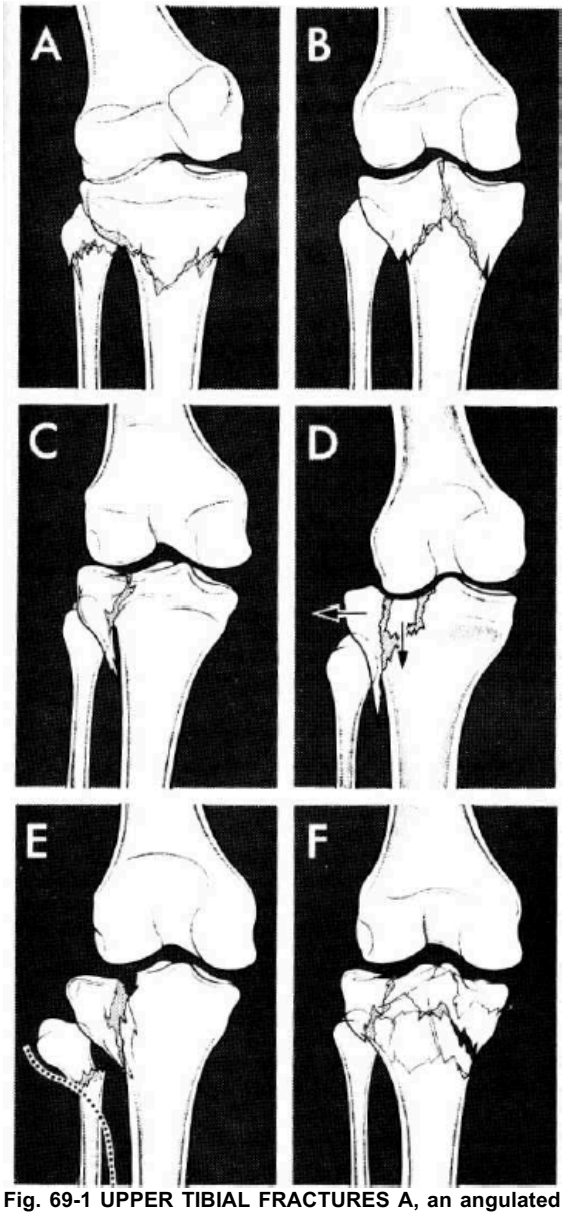

Fig. 69-1 UPPER TIBIAL FRACTURES A, an angulated infra-condylar fracture. B, a T-shaped fracture. C, a lateral tibial condylar fracture. D, a lateral tibial fracture with depression of the central part of the tibial plateau. E, downward displacement of the lateral tibial condyle with fibular neck fracture. *Note the relation of the common peroneal nerve to this fracture.* F, a comminuted upper tibial fracture. *Kindly contributed by John Stewart*

69.3 Distal tibial traction

The treatment for fractures of the proximal tibia differs considerably from the treatment of those of its shaft. If the knee joint is not involved, treat this in a long leg cast, in the same way as a distal tibial fracture, or with a cast-brace as for femoral shaft fractures (67.4). But if the fracture enters the knee joint and disturbs its articular surface, early active movements to mould the articular surfaces of the disturbed knee joint into place are necessary. *Perkins traction is not safe* because a pin through the upper tibia would pass too close to the fracture line, or through it, and might cause osteomyelitis, or infect the knee. Therefore, put a pin through the lower tibia as the middle of the tibia is much too hard. This is much better than a cast, because it reduces most of the displacement, maintains reduction, and provides early movement without weight- bearing. Early movement helps the surfaces of the knee to slide over one another and minimizes stiffness.

FRACTURES OF THE UPPER TIBIA

N.B. If you intend to refer a patient for internal fixation, *don't delay for ≥7days because the cancellous bone of the tibia soon becomes soft and difficult to fix*.

If there is a tense haemarthrosis, aspirate it.

Perform the following manoeuvres, where necessary, under ketamine, before applying distal tibial traction.

If the lateral tibial condyle is displaced, apply a strong *varus* strain on the knee, while moulding the displaced fragments proximally into place. Similarly, for a displaced medial condyle, apply a strong *valgus* strain.

If the tibial condyles are comminuted, flex and extend the knee a few times to mould the fragments into shape. If they are severely displaced, ask an assistant to pull on the leg while you squeeze them into place between both hands.

Then insert a distal tibial Steinmann pin (59.4). Use an ordinary bed with a pulley over the end. Apply 5kg or $^{1}/_{14}$ the body weight. Place a pillow lengthwise under the lower leg.

For traction if an assistant's pulling is insufficient, use 10-15kg traction for a few minutes on the Steinmann pin, and manipulate the knee.

If the knee feels unstable, test for additional soft tissue lesions while still under anaesthesia. *Look especially for meniscal* (68.7) *and collateral ligament tears* (68.5).

If there is a suspicion of a knee dislocation, or the leg is white or cold, act urgently (68.8).

CAUTION!

Never put a pad directly under the heel, or pressure sores will form. Instead, support the lower leg to keep the heel off the bed.

Don't put a pillow under the knee where it may obstruct vessels or press on the popliteal nerves.

The 2nd day, encourage hip, ankle, tarsus & toe movements. Exercise the leg gently at first, and then more vigorously.

Put a sling under the lower thigh, with a cord passing over an overhead pulley (69-2), and ending in a handle so that raising the thigh, and exercising the knee is possible, eventually up to 90°.

Don't put a sling directly under the knee, because it may injure the common peroneal nerve. However, a sling is essential because you cannot lower the fracture boards and let the leg dangle, as you can with Perkins traction.

LATER CARE

Fully controlled flexion and extension of the knee to ≥90° should be possible by 4wks. Continue to apply traction for 6wks, then walking on crutches for another 6wks (66.1), without weight bearing but following the normal movements of walking. Follow this by partial weight bearing with crutches for 6wks more.

At 12wks, walking without a stick should have commenced, except in the frail & elderly.

N.B. If traction is continued for too short a time, there is risk of lateral angulation. Most patients can move their injured knees and walk normally at 6months.

DISTAL TIBIAL TRACTION USING A SLING

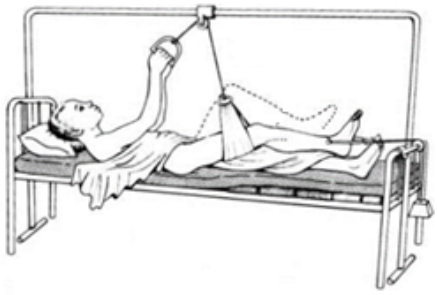

Fig. 69-2 DISTAL TIBIAL TRACTION WITH A SLING UNDER THE THIGH. ***This must avoid the common peroneal nerve!*** **If there is an upper tibial fracture involving the knee joint, put a pin through the distal tibia and exercise the knee like this.** ***N.B. If the pin is placed in the distal tibia, you cannot lower the fracture boards.***

69.4 Surgical treatment for proximal tibial fracture

Surgical treatment of proximal tibia fractures is complex, so plan referral when this is necessary. Refer early enough, preferably ≤7days after trauma, to allow for correct soft tissue management and surgical planning.

Indications are, if you have performed the reduction manoeuvres under anesthesia described and correctly applied tibial traction:
(1) an articular step >3mm,
(2) distance >5mm between the condylar fragment and the rest of the tibia,
(3) fracture with *varus* or *valgus* instability because of high suspicion of associated lesions
(4) all bicondylar fractures
(5) all medial plateau fractures because of the high risk of associated vascular lesions owing to fracture-dislocation of the knee
(6) severe open fractures needing several soft-tissue interventions

69.5 External fixation for proximal tibial fracture

When placing an external fixator for a fracture around the knee, *it must span the knee*. This means that the construction is biomechanically less sound than an external fixator for a diaphyseal injury. Knee-spanning external fixators are known to have a very high rate of non-union and will lead inevitably to a stiff knee. Therefore *don't use the X-fix outside the limited indications listed:*

INDICATIONS FOR X-FIX
Tibial plateau fracture with:
(1) severe open fracture needing several soft-tissue interventions, to facilitate the wound care and the repetitive visits to the operating theatre,
(2) severely comminuted fractures that cannot be transferred and that you cannot reduce adequately using traction and reduction manoeuvres,
(3) as a temporary measure to transfer a patient to another hospital, where you want to avoid losing the (partially) obtained reduction of bone fragments.

PROCEDURE (GRADE 3.2)
You will need all the basic external fixator equipment (59.5), a C-arm X-ray machine & GA (*e.g.* ketamine). *You do not need a traction table nor a Steinmann pin to provide traction*. Manual traction by an assistant or nurse should be sufficient.

Place pins in the distal part of the femoral shaft and in the tibial diaphysis. With the patient supine, disinfect the whole leg & place the sterile drapes. The most practical is to disinfect & drape the whole leg, so you can mobilize it per-operatively. Place the pins as closely as possible to the fracture zone without being in the fracture. Check where and under which angle to place the pins. Make a stab incision through skin and dissect the muscles carefully until you reach the femur. Place the pins under direct visualization using the C-arm. Reduce the fracture and attach the pin bars using a simple frame, preferably with 2 parallel bars (59.5).

SAFE ZONES FOR PIN INSERTION

In the femur place the pins as closely as possible to the joint line, without putting them intra-articularly. A safe distance is 1.5cm away from the joint line.

SAFE ZONES FOR PIN INSERTION IN THE DISTAL FEMUR & PROXIMAL TIBIA

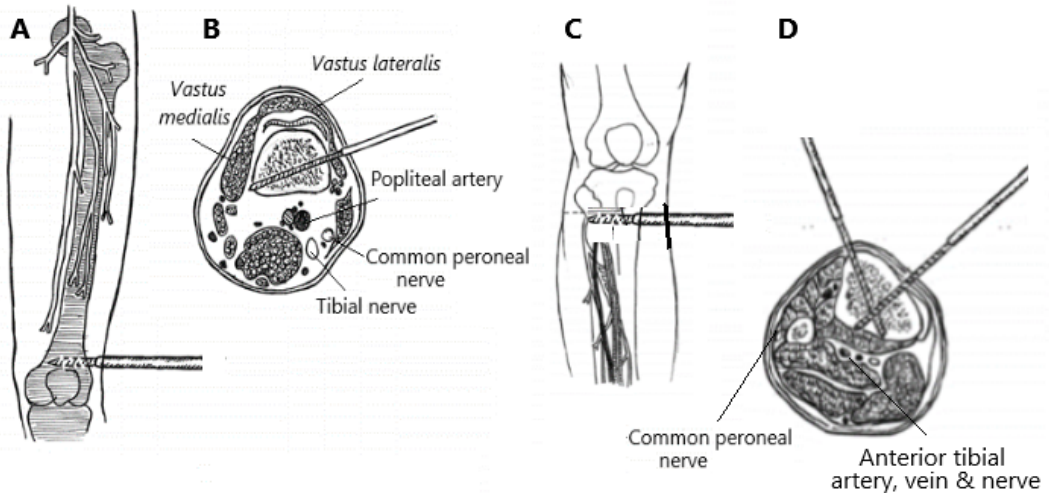

Fig 69-3 SAFE ZONES FOR PINS IN THE DISTAL FEMUR & PROXIMAL TIBIA. A,C, a-p views. B,D, cross sections.

In the distal femoral $^1/_3$, there are less soft tissue structures to worry about. Make a lateral approach under an angle of c.30°. This avoids most of the *vastus lateralis* muscle, and the frame is then not too posterior to interfere with the bed mattress.

In the proximal tibial shaft, distal to the tibial tuberosity, there is very little soft tissue covering the anterior tibial crest and the medial face of the tibia. These are both safe zones for pin insertion. The easiest zone is the medial surface of the tibia. Take this between the thumb and index finger of one hand and with the other hand, locate the midline of the medial surface. Make this your point for pin insertion & insert the pin perpendicular to the medial surface. Always try to put your pins across both cortices in the tibia for increased stability. *But make sure the pins don't extrude >2mm* in order to avoid lesions to the neurovascular bundle which lies immediately posterior to the tibial surface.

Your final construction will look like (69-4). Because the tibial pins are inserted on medially and the femoral pins laterally, you cannot connect both using a single bar. You need to attach a bridging bar connecting the tibial pins, a bridging bar connecting the femoral pins, and then a 3rd bar connecting the tibial and femoral bars. This construction is called a modular construction. Use double bars when possible.

KNEE-SPANNING EXTERNAL FIXATOR FOR TIBIAL PLATEAU FRACTURES

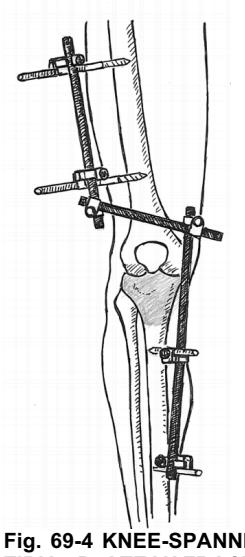

Fig. 69-4 KNEE-SPANNING EXTERNAL FIXATOR FOR TIBIAL PLATEAU FRACTURES. Femoral pins are lateral & tibial pins medial, so you need a connecting cross bar