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Pitfalls in Distal Femur Fracture Fixation and a Literature Review

Babak Siavashi[1,*]

[1]MD, Joint Reconstruction Re-Search Center, Sina Hospital, Tehran University of Medical Sciences, Sina Hospital, Tehran, IR Iran

[*]*Corresponding author*: Babak Siavashi, MD, Sina Hospital, Imam Khomeini Street, Tehran, IR Iran. Tel: +98-2166348500, Fax: +98-2166348543, E-mail: siavashi@tums.ac.ir

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Abstract

Distal femur fracture is a critical fracture. It affects knee joint, which needs a wide range of motion. On the other hand, it is a weight bearing joint and needs stability for tolerating the weight of body. For achieving better results, it is necessary to have preoperative planning. It needs high quality radiography and a CT scan. Locking plates has good results in distal femoral fracture fixation. There are some pitfalls in reduction and fixation of distal femoral fractures. At-tention to details is the key for success in these fractures.

1. Context

Distal femur fracture is one of the most difficult fractures for reduction and fixation.

It is a weight bearing joint and not only must be reduced anatomically but also must be fixed rig-idly to tolerate early range of motion (1). Nearby muscles are very strong (quadriceps and ham-strings) and may create high reaction forces in the joint articular surface. Distal femur actually has 3 mixed joints, medial compartment joint, lateral compartment joint, and patellofemoral joint. All of them influence reduction and function of the other ones. Knee joint is not covered with enough soft tissue so handling of soft tissue and attention to incisions around knee joint is very important. Often, it is fractured by high energy trauma and soft tissue is already crushed, therefore, surgical incision may create second hit to damaged skin so there is high risk of skin necrosis. On the other hand, there may be distal femur fractures in osteoporotic old patients with weak bone stock. They have their own difficulties for reduction and fixation (2, 3).

2. Pre Operative Pitfalls

Before starting a operation, the surgeon must be sure about needed equipment and operation room facilities such as C arm, radiolucent table, special plates and screws, as well as trained staff (4).

There may by some distracting fractures or dislocations that make the surgeon miss distal femur fractures (5) such as hip dislocation and femoral shaft fracture. Therefore, the first pitfall is miss-ing the fracture line. There may be a non displaced fracture line extending from the apparent fracture line of the shaft of the femur (6). Detection of this fracture may change the selected de-vice for fixation of shaft of femur from intramedullary nail to plate. True anteroposterior and lat-eral radiographies with high quality can help.

A CT scan is useful in this time to detect a non-displaced fracture line (7). CT scan can also show available subchondral bone for fixation. Size and location of fracture parts can be defined and used for planning of approach and fixation.

Before starting surgery, all fracture lines should be apparent for the surgeon to make it easy for him to design a pre op plan (8). There should be a plan for operation. Planning starts with an in-cision. You should know from which side you want to start the reduction and fixation. You should choose one segment as main segment to reduce other part to it and this main segment is better seen in a CT scan.

3. Pitfalls in Operation

Starting from the main segment, attach other parts to it. Provisional fixation with the pin is mandatory before definitive fixation (9).

Pay attention not to narrow the joint (10). If there is comminution in joint line, use full threaded screws (11) for prevention of compression in distal femur and narrowing the joint.

Only accept anatomical reduction in distal femur (12). No step is accepted in the joint line. How-ever, if there is comminution in the fracture line, you can accept a gap in the joint line until the joint remains congruent. Do not remove comminuted parts in the joint line to fix non-comminuted parts with each other. This may not only narrow the joint, but it may also make in-congruent or make a step in the joint line, which are bot unacceptable.

If there is comminution and available subchondral bone is not enough for fixation with ordinary screws, you

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can fix them with headless screws (13). Even if there is not enough bone for headless screws, try esmaeili pins for holding the articular segments near each other and avoid missing joint segments. It shows the importance of cartilage and any effort should be done for saving as much cartilage as possible for reconstruction of articular surface.

He should know the fracture segments of condyles and any comminution in articular surface or metaphyseal segment. Sometimes it is better to bypass comminution with bridging technique (14). If you miss this comminution and open it, risk of nonunion will highly increase.

Furthermore, if you resect comminuted parts of metaphyseal segments, fixation of condyles to shaft and resecting comminuted parts, can lead to shortening of limb and also translation of joint in relation to shaft (15).

There are good results of fixation of distal femur fracture with locking plates. If it is used proper-ly, it can manage all fracture patterns even if there is comminution in joint line or metaphysal part. Due to the fact that screws are locked in plate, they act as angle stable device (16, 17) and can support a fracture even if there is no medial cortical contact. However, if there is any doubt about locking in distal screws, varus collapse is probable. In this manner, medial buttress plate (18, 19) is necessary to prevent varus of distal part.

If there is comminution of metaphyseal segment and for any reason it is opened, it is preferred to use bone graft (20) in comminuted segments.

Do not fix articular segment to the shaft in recurvatum (15) (posterior angulation). It is necessary to pay attention that no parts of distal segments lie anterior to the shaft in the lateral view; if this happenes, recurvatum and hyperextension of the knee will be seen.

Inserting a bolster beneath knee makes it easier for a surgeon to fix the fracture in the correct po-sition. It is necessary to check the lateral view of distal femur with C arm in cross table position (21); it shows the true lateral view. Take special care for rotation of distal articular segment (22), it affects patella tracking after fixation of articular segment to the shaft. Therefore, check these issues and after provisional fixation, do a partial range of motion to see the proper tracking of patella. One other pitfall in this time is missing the small wound around the knee joint that may change the fracture to open fracture. If it is an open fracture, antibiotic therapy, tetanus prophlaxy, timtiming of the fracture fixation and appropriate device may be changed by this fact (23). Vascular supply to extremity should be cleared and checked before operation (24). Missing time in the presence of vascular injuriy may end in amputation.

4. Post Operative Pitfalls

In postoperative period, early range of motion is encouraged. It needs rigid fixation of fractures. There is no place for post operative cast or brace to compensate non rigid fixation construct (25).

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