Distal Femoral Fractures

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The distal femoral fractures include supracondylar fractures, intercondylar fractures, and their combinations. As in most articular and juxta-articular fractures, operative treatment gives the best clinical result by achieving anatomical reduction of the articular fractures and providing early skeletal stability, which leads to early mobilization and return of joint function. The commonest method of treating these fractures is open reduction with internal fixation by plating [1–3, 8–10]. The open procedure requires a long incision with extensive dissection, which not infrequently results in devitalization of the fracture fragments. Bone grafting is required in fractures with comminution, which typically happens on the medial side of the distal femur where mechanical stability cannot be restored by lateral plating. This very often leads to delay in weight-bearing walking before the fracture consolidates and also leads to implant failure. The load-shielding biomechanical characteristic of the plates results in stress concentration proximal to the fixation, which can lead to fracturing of the femoral shaft proximal to the implant. This is particularly important in geriatric patients in whom these fractures occur quite frequently. The use of intramedullary implants had been advocated [4, 11, 13]. Most of them are open procedures and skeletal stability has to be augmented by additional fixations such as cerclage wires or bone grafting. The closed technique with intramedullary locked nails, as in the treatment of diaphyseal fractures, provides immediate skeletal stability irrespective of the fracture comminution. The extended use of the closed intramedullary fixation with these difficult fractures can certainly avoid many of the complications of the open procedures. In this chapter, the indications and surgical technique are described.

Surgical Principles

The use of the intramedullary fixation for distal femoral fractures follows the principles of closed treatment of fractures. The fracture hematoma is not disturbed and the reamed material during the preparation of the medullary canal provides osteogenic material, which, dispersed into the fracture site, makes bone grafting unnecessary. The load-sharing biomechanical property of the intramedullary fixation also helps to prevent secondary fracture in the femoral shaft and the splintage effect reinforces the relatively weak femur in geriatric patients with osteoporotic bone.

As the fractures are very distal where the medullary canal flares, the use of the locked nails is mandatory. The nails must be inserted to the subchondral region. For very distal fractures, the distal part of the nail has to be removed just inferior to the distal locking screw hole.

Fractures with intercondylar elements that can be reduced with the closed method can also be treated with this method. The intercondylar fractures can be fixed with percutaneous lag screws inserted under fluoroscopic control with supplementary fixation using the distal locking screws of the intramedullary nail.

This technique cannot be applied to very distal fractures and condylar fractures that cannot be reduced by closed means. Fractures in the coronal plane may not be treated with this method.

Indications

1. Supracondylar fractures of the femur irrespective of the comminution, AO classification [7] A1, A2, and A3 (Fig. 3.1).
2. Supracondylar fractures with condylar extension, AO classification C1 and C2, which can be reduced anatomically by the closed method.
medullary diameter, and the degree of anterior bowing of the diaphysis, which may be excessive in geriatric patients. Determining the length of the femur before operation may preclude the need for cutting the distal end of the nail during operation. The nail can be modified before the operation with a better prepared tip for insertion. However, this is not always possible and intraoperative length estimation is usually more reliable in this operation.

**Special Instruments and Implants**

Apart from the standard instrumentation for the intramedullary locked nail, the following equipment modification and instrumentation are required:
- A traction table with adjustable thigh support attached to the traction bar is essential for the reduction of the fracture in the sagittal plane (see “Closed Reduction”) (Fig. 3.2). A sterile stirrup for traction may be helpful in case skeletal traction through the femoral condyle is required for fracture reduction.
- An extra long reamer guide (950 mm) is useful during the process of reaming. As the fractures are very distal, the use of the standard reamer guide (600 mm) may lead to frequent loss of the position of the reamer guide in the distal fragment when backing out the reamer for the change of the reamer heads during reaming.
- A sterile hack saw and an iron file should always be available so that the nail can be modified during the operation. The tip of the nail has to be cut and smoothed so that the most distal locking screw can be inserted in the subchondral area of the distal femur.
- A pair of large reduction forceps and the instruments for the insertion of the lag screws should also be available for fractures with condylar extension.

**Operative Technique**

**Positioning and Anesthesia**

The patient is positioned supine on a traction table (Fig. 3.3). The upper trunk is flexed towards the opposite side to have better exposure of the greater trochanter and facilitate the insertion of the nail. The lateral flexion of the trunk is maintained by using a proper guard. The opposite lower limb is flexed and elevated to make room for C-arm positioning, as in standard femoral nailing procedures.

The operation can be performed under either general or spinal anesthesia.