CHAPTER 4.5

Antegrade Femoral Nailing Without the Aid of a Fracture Table

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Introduction

The preferred treatment for fractures of the femoral shaft has become the antegrade insertion of a femoral nail. Multiple authors have demonstrated high union rates, restoration of limb function and low complication rates utilizing this technique [5]. One of the few drawbacks to this procedure is that most surgeons perform the surgery with traction being applied via a fracture table. Although this set-up provides mechanical traction that aids in realignment, there are a number of complications that have been reported with the use of a fracture table. These include pudendal nerve palsy [2], transient impotence and compartment syndrome of the opposite leg [3]. Some surgeons attempt to minimize these complications by performing this procedure with traction being applied with the patient in the lateral position; however, this position is difficult to set up and potentially compromising to patients with multiple injuries. In addition to these potential complications, a skeletal traction pin is required and there is significant amount of time spent positioning a patient on a fracture table.

These drawbacks have led some to perform this procedure without the use of a fracture table. In appropriate circumstances this can facilitate starting point creation, save time and eliminate the potential for complications related to the technique [4, 6].

Technique

Patient Preparation

The reduction of a femoral shaft fracture is easiest if surgery is performed soon after the fracture has occurred. Delays can lead to muscle spasm, which makes length restoration difficult. Ideally, surgery is performed on the day of injury after “advanced trauma life support” protocols have ruled out concomitant injury. If delays of 24 h or more are anticipated prior to surgery, it is helpful to place a skeletal traction pin with one-fifth of the patient’s body weight attached. This will prevent muscle shortening and will facilitate subsequent reduction. Muscle-relaxing anesthesia is administered as well as prophylactic antibiotics. Prior to positioning, it is of great value to determine nail length from the intact femur. This is done with fluoroscopic examination of the opposite knee and hip with varying length rods held adjacent to the leg. The nail length that most closely extends from the piriformis fossa to the distal physisal scar is chosen. Alternatively an electrocautery cord can be fluoroscopically visualized and used to measure the length of the medullary canal. The opposite leg is also examined to assess the patient’s normal limb rotation so that this may be reproduced during surgery. This requires that the C-arm be aligned with a reproducible rotational femoral marker and the foot’s rotational position noted in relation to this axis. The best marker in the proximal femur is the lesser trochanter. In an anteroposterior projection, the femur can be internally rotated until the lesser trochanter is eclipsed by the femoral shaft and no longer visible. This same radiographic marker can be used to check rotation in the fractured limb after nail interlocking to assure restoration of physiologic rotational position.

The use of a completely radiolucent operating table is strongly recommended as multiple oblique fluoroscopic projections will be required. Metal side-rails will interfere with some of these projections. Femoral nailing without a fracture table can be performed in a lateral position. This is particularly useful for subtrochanteric fractures because flexion of the fractured leg removes the deforming influence of the ilioptosas. In all remaining patients positioning with the ipsilateral buttock elevated 20 cm from the table surface with sheets is preferred because of simplicity and physiologic advantages (Fig. 4.5.1). Prior to skin preparation a fluoroscopic check is performed to ensure that coronal and sagittal imaging of the
Fig. 4.5.1. Leg positioned to allow for adduction and access to the piriformis fossa

Fig. 4.5.2. The leg is draped to allow access proximal to the trochanter and free manipulation

entire femur is possible. In this position the limb is draped free with split-sheets applied in a fashion that leaves a large area of skin proximal to the greater trochanter exposed (Fig. 4.5.2).

Surgery

Controversy exists over the ideal starting point, with some surgeons preferring a trochanteric start position rather than one in the piriformis fossa. If a nail without a trochanteric bend is chosen, it is generally preferable to utilize the piriform fossa because this point is in line with the medullary canal. Deviation from this position will generate large hoop stress during nail insertion or lead to malunion. To gain access into the piriformis fossa, the hip is flexed, adducted and internally rotated. A 2-cm longitudinal skin incision is placed proximal to the trochanter in a spot that represents the virtual extension of the axis of the proximal femur. This should be confirmed fluoroscopically in both planes with a guide wire placed collinear with the femoral axis. This is typically one handbreadth proximal to the trochanteric tip. If adhesive drapes are used, they should be removed around the margin of the incision to ensure that they are not caught within the rotating reamers. The fascia of the gluteus maximus is incised and a finger is used to create a path through this muscle, exposing the underlying gluteus medius and trochanter. With the hip flexed it is possible to gain entrance into the piriformis fossa posterior to the gluteus medius with digital palpation. Staying posterior to the muscles minimizes insertion damage and postoperative abductor weakness. Once a path has been created, a 3.2-mm guide-wire is drilled into the piriformis fossa and its position verified with binocular image intensification. The wire is drilled down to the level of the lesser trochanter (Fig. 4.5.3) and then the hole is expanded with a 12-mm cannulated drill. It is critical that this channel be created exactly in line with the axis of the proximal segment. There is a tendency for inserting muscles to pull this segment into varus and flexion. This must be avoided or malunion will result, particularly in subtrochanteric fractures. Following channel creation a ball-tipped guide wire is introduced into the proximal medullary canal.

Passage of the guide wire across the fracture is occasionally challenging without the use of a fracture table and represents the greatest argument against this technique. The initial strategy is to match the axis of the proximal segment by bringing the distal segment to it. With assistants pulling on the leg, the surrounding musculature will often align the segments allowing for passage of the wire (Fig. 4.5.4). Sustained pulls are generally most effective in overcoming muscle shortening because of their viscoelastic properties. If several attempts fail, a number of alternative measures may prove helpful. One of these is to ream the proximal segment to 11 mm and then insert an intramedullary reduction tool (Fig. 4.5.5). This tool will allow for control of the proximal fragment and allow the surgeon to align this with the distal segment and subsequently pass the wire through the cannulated tool. Occasionally, fracture angulation or translation will prevent entrance into the distal segment. This can usually be corrected with application of strategically placed opposing forces through the skin. If a segment is posteriorly translated or the fracture angulated posteriorly, then sterile bumps placed posterior to