The Grosse-Kempf Interlocking Nail: Technique of Femoral and Tibial Fractures

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Introduction

Indications for use of an interlocking nail for repair of the lower extremity include bone loss, segmental fractures, proximal and distal one-third fractures, and comminuted fractures, or nonunion or malunion of the proximal or distal third of the femur or tibia. The patient is placed on the operating table supine. This position offers two advantages: simplification of the distal hole sighting and ease of achieving an anatomical reduction that is essential in the success of this operation. An x-ray of the contralateral extremity should be taken to measure the size of the nail to be used. This is extremely important when severe comminution, a segmental fracture, or bone loss has occurred.

Femoral Fractures

With the patient supine, a distal femoral Steinman pin is placed anterior in the distal femur for distal traction. The contralateral extremity is placed with the hip and knee in flexion to allow two-plane visualization of the femur (Fig. 1). The involved limb is adducted until anatomical reduction is viewed in the AP plane. The limb is extended until a perfect reduction is obtained in the lateral view. Bending of the trunk to the opposite side facilitates exposure to the trochanter and insertion of the nail is easier (Fig. 2). A horizontal skin incision is then made from the tip of the greater trochanter to the iliac crest (Fig. 3). The pointed awl is used to enter the medullary canal through the piriform fossa just medial to the greater trochanter (Fig. 4). Alternatively a K wire and sliding hip screw reamer may be used to over drill the K wire. The beaded guide-wire is passed across the fracture site and centered in the distal epiphysis. Sequential reaming is done up to 1 mm larger than the chosen nail (Fig. 5). The smooth guide-wire is then exchanged through the guide pin re-introducer (Fig. 6). The driver extractor is attached to the nail, which is then introduced into the canal (Fig. 7). The extractor is removed and replaced by the proximal sighting device if needed when the nail is about 2 inches from complete insertion (Fig. 8). The nailing is then carried out with the sighting device. To assure accurate sighting of the proximal hole, a firmly tightened device is required. The guide sleeve is then inserted through the oblique hole in the proximal sighting device. The 4.5 mm drill is inserted through the guide sleeve and holes are drilled through the medial and lateral cortices (Fig. 9). The guide sleeve is removed and the screw gauge is inserted for measurement (Fig. 10). The proximal cortex is drilled with the 6 mm bit. The proximal screw is then inserted through the sighting device (Fig. 11).

Attention is then directed to the distal screw holes if needed. By means of the image intensifier (Fig. 12) the distal holes are visualized as a perfect circle (Fig. 13). An incision is then made over the area of both screw holes down and through the fascia lata. The T-handled awl is centered in the proximal hole and the lateral cortex is penetrated with the awl (Fig. 14). Both cortices are then drilled with the 4.5 mm drill and the lateral cortex with a 6 mm drill (Fig. 15). Approximate screw length is measured (Fig. 16) and the screw is then inserted, making sure it is firmly tightened into the medial cortex. The distal screw is then inserted in a similar manner.

Tibial Fractures

With the patient supine, the knee is flexed and care is taken to
Fig. 2: Lateral bending of the trunk.

Fig. 3: Horizontal skin incision.

Fig. 4: Introduction of awl through piriformis fossa.

Fig. 5: Sequential reaming of intramedullary canal.

Fig. 6: Exchange of guide-wire.

Fig. 7: Introduction of intramedullary rod.
Fig. 8: Seating of intramedullary rod with sighting device.

Fig. 9: Drilling medial and lateral cortices with 4.5mm drill.
Fig. 10: Measurement with depth gauge.

Fig. 11: Insertion of screw.

Fig. 12: Image intensifier.
Fig. 13: Visualization of distal screw holes.

Fig. 14: Penetration of lateral cortex with awl.

Fig. 15: Drilling medial and lateral cortices.
Fig. 16: Measurement screw length.

Fig. 17: Surgical positioning for tibia fracture.

Fig. 18: Vertical incision over patellar ligament.

Fig. 19: Vertical split in patellar ligament.
avoid compression of the popliteal area. The foot and ankle are fixed in the foot support or by means of a trans-calcaneal pin if needed (Fig. 17). An anatomical reduction is again obtained using the image intensifier. A vertical incision is made from the distal pole of the patella to the tibial tuberosity (Fig. 18). The patellar tendon is either split in the line with the skin incision or the patellae tendon is retracted laterally (Fig. 19). The medullary canal is entered at the level of the tibial tuberosity with the awl (Fig. 20). The beaded guide-wire is inserted into the distal epiphysis with care taken to center the tip of the guide. Reaming is then performed sequentially up to 1mm greater than the chosen nail (Fig. 21). The guide-pin is exchanged using the re-introducer (Fig. 22). The nail is then introduced using the driver-extractor and exchanged with the proximal sighting device 2 inches prior to complete insertion (Fig. 23). The AP screw is placed through a sighting device after using the awl to start the hole in the anterior cortex and drilling both cortices with a 3.5 mm drill (Fig. 24). The anterior cortex is then drilled with the 5mm drill. The appropriate screw length is measured (Fig. 25) and the screw inserted with some threads in the posterior cortex (Fig. 26). Care should be utilized to avoid penetration posterior into the neurovascular structures. The horizontal screws are then inserted in a similar manner as those in the distal femur. The main exception is that a medial to lateral approach is used instead of lateral to medial. After appropriate skin incisions are made the awl is centered and the medial cortex drilled with a 3mm drill. Appropriate measurements are taken and the screws inserted are firmly attached to the medial cortices.

**Summary**

An anatomical reduction is required on both the lateral and AP view. In our hands this is easiest obtained and maintained with
the patient in the supine position. The supine position facilitates better anesthesia care in the multiply injured patient and aids in movement of the image intensifier during the procedure. Each step should be carefully followed and the horizontal screw placement is possible only when the image of the holes is perfectly round. When the previously mentioned conditions and steps are followed, a successful locking nail insertion can be achieved.

References