



Controlling the Distal Femoral Metaphysis for Fracture Reduction: A Technical Note

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Abstract

Closed reduction of a fractured distal femur is a crucial and often challenging step of Minimal Invasive Percutaneous Plate Osteosynthesis (MIPPO) or retrograde femoral nailing. We describe a simple, easy-to-use, reproducible and efficient technique facilitating the intra-operative reduction of complex distal femoral fractures (AO/OTA type 33A-B-C, as well as peri-prosthetic fractures) using a cannulated screw and cerclage wire traction technique.

Introduction

Closed reduction of a fractured distal femur is a crucial and often challenging step of Minimal Invasive Percutaneous Plate Osteosynthesis (MIPPO) or retrograde femoral nailing. The control of the short metaphysical fragment to restore length and alignment in all planes is often difficult. Reduction in the sagittal plane is mostly achieved with the use of a bolster below the fractured distal femur. Rolling of the bolster under fluoroscopy control distally reduces a procurvatum, whilst rolling it proximally addresses a recurvatum displacement. In distally extended fractures often a Schanz pin inserted from anteromedially/laterally to posterolaterally/medially can assist on fine tuning the reduction in the sagittal plane [1]. However, for the control of the reduction in the transverse (rotation), coronal (varus or valgus), as well as for axial traction to restore the femoral length, clinicians struggle especially when the distal fragment is short and minimal invasive techniques are utilized. Commonly used techniques for the reduction of the distal femoral metaphysis include the use of a king-tong ball spiked clamp, of a bridging-the-knee external fixator or of the femoral distractor, or rely to the continuous pull of the leg below the knee from an assistant, the self-centralizing properties of a long nail in contact with the femoral isthmus, the use of external levers and pushers or of the plate as a template for the limb re-alignment [1,2]. We describe a simple, easy-to-use, reproducible and efficient technique facilitating the intra-operative reduction of complex distal femoral fractures (AO/OTA type 33A-B-C, as well as peri-prosthetic fractures) using a cannulated screw and cerclage wire traction technique.

Technical Report

After standard positioning, draping of the patient and surgical approach according to the fracture configuration and the surgeon's preference the intra-articular components of the fracture (if any) are addressed first [1]. Reduction and provisional K-wire fixation usually is followed by the insertion of one or two large diameter cannulated lag screws. These are strategically placed not to interfere with the subsequent instrumentation (can be inserted medially too laterally or the head can be countersunk not to impinge to the footprint of a peri articular plate). The cannulation of one of these lag screws is used as described below. In case of fractures without an intra-articular element, we insert one cannulated screw (6.5 mm) usually from medial to lateral (especially if MIPPO is performed) (Figure 1). The screw size is measured accurately before insertion, so that not to protrude laterally/medially, allowing for the application of a peri articular plate over the lateral (usually) femoral condyle. A 1.5 mm to 2.0 mm cerclage wire is then inserted through the lumen of the cannulated screw (preferably the screw should be parallel to the joint line). A loop is then formed and gentle longitudinal traction by the assistant is applied under image/intensifier guidance (Figure 1). This allows for axial distraction and reduction in length. To control the metaphysis and restore the axis in the coronal and transverse planes, the assistant uses both hands (as holding gently the horse reins) adjusting gently in varus/valgus as well as internal/external rotation under fluoroscopic control. Axial, coronal plane (varus/valgus), as well as rotational alignment is achieved in this way by adjusting the axis of the assistant's traction, whilst rolling a bolster underneath the distal femur allows alignment in the sagittal plane. The subsequent instrumentation steps follow

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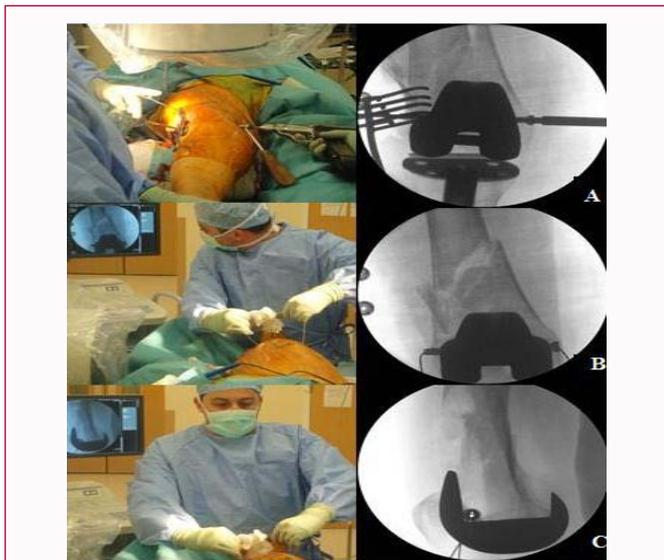


Figure 1: A) Insertion of a medial to lateral 6.5 mm cannulated screw, B) Control of distal femoral metaphysis by axial traction over the wire loop passing through the lumen of the cannulated screw, C) Image intensifier lateral view showing the position of the cannulated screw positioned so that it would not obstruct the subsequent instrumentation.

standard operating steps either when a retrograde intra medullary nailing (entry point, guide wire insertion, reaming, nail insertion and locking) or a peri articular bridging plating (kwire temporary fixation of the plate to the metaphysis and then to the shaft, insertion of clusters of screws to the plate distally and proximally) is performed. Before closure the cerclage wire is removed, as well as the cannulated screw, if it does not add to the fracture fixation (i.e. in pure supra condylar fractures) (Figure 2).

Discussion

The importance of restoration of length and alignment at all planes during fixation of load bearing bones, as well as the value of achieving this with the least possible biologic insult is highlighted in numerous contemporary studies [2,3]. This simple intra-operative technique is fast, requires minimal extra equipment, is safe especially in challenging cases with severe osteoporosis or obesity, and spares the knee joint without bridging it, which allows free adjustment of knee flexion to accommodate reduction in the sagittal plane and relaxation of the deforming force of the gastrocnemius. The use of the screw cannulation does not permit the wire to cut out from bone or damage further the poor metaphysical bone stock. Most importantly, it allows



Figure 2: Anteroposterior and Lateral views of the same case pre-operatively and post-operatively (minimal invasive percutaneous plate osteosynthesis using a distal femoral Poly axial® Biomet 12 hole plate).

control of the distal metaphysis in the coronal plane, restoration of the femoral length, as well as rotational alignment and reduction of the metaphysis to the shaft. No bulky or obstructing instrumentation or stress risers are created at the femur or tibia, as when using half-pins/joysticks, or external fixators/femoral distractors. The senior author (NKK) has successfully used the same principle of traction and reduction *via* the lumen of a cannulated screw in at least 25 distal femoral fractures during retrograde intra medullary nail fixation or retrograde femoral bridge plating including cases of severe obesity, osteoporosis or near a stable total knee arthroplasty. No complications have been noted including any incidence of screw cut out, or failure to remove the wire and the screw at the end of the procedure.

Conclusion

Using the loop of a cerclage wire, which is inserted through the lumen of a parallel to the joint line cannulated screw, to control the metaphysis/short fragment of a distal femoral fracture in the axial, coronal and transverse planes is an effective and minimal invasive reduction technique.

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