Hybrid Anterolateral Approach for Open Reduction and Internal Fixation of Femoral Neck Fractures

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Abstract: Displaced femoral neck fractures in physiologically young patients are best treated with anatomic reduction and stable fixation. Several surgical approaches to the femoral neck have previously been described, although they are fraught with disadvantages such as poor visualization, the need for 2 incisions, and risk of injury to the lateral femoral cutaneous nerve and branches of the medial femoral circumflex artery. The authors’ hybrid anterolateral approach to the hip allows for excellent visualization of femoral neck fractures and for placement of plate and/or screw constructs through a single incision. This surgical technique additionally minimizes risk to neurovascular structures. [Orthopedics. 2015; 38(7):430-434.]

Displaced femoral neck fractures in physiologically young adults are usually high-energy injuries best treated with open reduction and internal fixation to allow maintenance of an active lifestyle and ensure the highest percentage of a successful clinical outcome. Adequate visualization of the femoral neck is required to achieve anatomic reduction in order to optimize postoperative outcomes. Nonetheless, femoral head osteonecrosis and fracture nonunion are not uncommon, resulting in significant disability. Osteonecrosis after femoral neck fracture is reported to occur at a rate between 12% and 86% in young patients. Therefore, an open approach is often indicated in young patients to achieve anatomic reduction and potentially decrease the rate of osteonecrosis.

Access to the hip is required for optimal treatment of femoral neck, femoral head, and acetabular fractures, arthroplasty, and irrigation and debridement of septic arthritis. A variety of approaches to the hip have been described, including anterior, anterolateral (Watson-Jones), lateral, transtrochanteric, and posterior techniques, performed through 1 or 2 incisions.

A recently described technique involves a 2-incision approach, using a modified Smith-Petersen interval (superficial: sartorius/tensor fascia latae [TFL]; deep: rectus femoris/gluteus medius) for reduction of the femoral neck fracture, and a separate lateral incision for placement of fixation. However, this technique has several disadvantages, including risk of lateral femoral cutaneous nerve (LFCN) injury and detachment of the rectus femoris tendon. Another technique involves a 1-incision approach in the Watson-Jones interval (TFL/gluteus medius) through which the femoral neck is directly reduced and fixed. Disadvantages of this approach include difficulty in visualizing and obtaining anatomic reduction of the fracture and risk of injury to the blood supply of the femoral head.
The purpose of this article is to describe a hybrid approach using a single 15-cm incision that allows access to the femoral neck through the Smith-Petersen interval in a medial window, and access to the lateral proximal femur for introduction of a compression hip screw device or screw fixation through a lateral window. This approach allows excellent visualization of the femoral neck without endangering the LFCN or branches of the medial femoral circumflex artery or detaching the rectus femoris tendon.

**Surgical Technique**

The patient is positioned supine on a radiolucent table or a fracture table, and a folded blanket (bump) is placed underneath the ipsilateral flank. The ipsilateral shoulder is adducted with the arm flexed and positioned across the chest. The contralateral leg may be placed in a well leg holder to assist with lateral fluoroscopy, which is especially helpful for obese patients. The fluoroscope is positioned on the contralateral side from the injury and oblique to the hip. The machine is rotated to match the version of the femoral neck, so a true lateral view of the femoral neck can be visualized. Radiographs must be obtained prior to draping to ensure adequate visualization of the fracture.

The anterior–superior iliac spine is palpated and marked. An incision is made that starts 2 cm distal and 3 cm lateral to the anterior–superior iliac spine. This incision is curved posterolateral and then distal in line with the shaft of the proximal femur (Figure 1). The distal aspect of the incision allows for implantation of hardware. The entire incision is approximately 15 cm long. The skin is incised and subcutaneous dissection is performed sharply down to the level of the fascia over the TFL muscle. This fascia is split in the midsubstance of the TFL muscle with a scalpel and divided proximally and distally using dissecting scissors. Distally, the fascial incision is curved slightly posteriorly to incise the iliotibial band for later access to the lateral femoral shaft. Proximally, an Allis clamp is used to elevate the medial edge of the divided TFL fascia and blunt finger dissection is used to separate the tensor muscle from the fascia medially, establishing the deep interval between the tensor and rectus femoris (Figure 2). Approaching this plane through the tensor fascia lateral to this interval facilitates identification and protection of the LFCN (Figure 3).

Once the interval between the tensor and rectus is developed, the femoral neck can be palpated. A Deaver retractor...
Figure 4: The femoral neck is palpated through the tensor fascia and rectus femoris (RF) interval and exposed with a Deaver retractor superior and Cobra retractor inferior to the neck. A Cobb elevator is used to elevate the indirect head of the RF (A). A T-shaped capsulotomy further exposes the femoral head (*) and neck (^) (B). Abbreviation: TFL, tensor fascia latae.

Figure 5: Cobra retractors placed inside the capsulotomy. The femoral head (*) and neck (^) are now well visualized.

is placed superiorly around the neck, just superomedial to the greater trochanter. When placing the retractor around the fracture, care is taken to avoid further comminution. Lateral retraction of the tensor allows the interval to be developed further to the level of the joint capsule. The fat overlying the hip capsule is then excised with a rongeur and the reflected head of the rectus is elevated off of the joint capsule medially. A Cobra retractor is then placed inferiorly on the femoral neck, protecting the lateral femoral circumflex vessels. A T-shaped capsulotomy is then performed on the proximal aspect of the femoral neck. One limb is placed parallel to the femoral neck and the other perpendicular to this first limb, with the top of the “T” over the acetabulum to minimize the risk of disruption of the blood supply to the femoral head (Figure 4). This is done with a scalpel to avoid thermal damage to the cartilage and circumflex vessels caused by electrocautery.

After the capsulotomy is made, 2 Cobra retractors are placed inside the capsule—one superiorly and one inferiorly. The medial window approach is now complete, allowing excellent visualization of the femoral neck, including the subcapital region (Figure 5). The fracture hematoma is then irrigated and the fracture can be reduced under direct visualization.

Attention can then be turned to the distal aspect of the approach where the iliotibial band had been split. Deep to the iliotibial band, the vastus lateralis is split in line with its fibers and the muscle is elevated off the proximal lateral femur with a Cobb elevator, exposing the femur for hardware insertion. Retractors can then be placed around the femur for visualization and placement of fixation devices. This lateral window is separated from the medial window by the tensor muscle and the medial aspect of the vastus lateralis (Figure 6).

For the fracture reduction, a bone-hook or a 5-mm Schanz pin can be applied to the distal fracture segment through the lateral window, allowing disimpaction of the fracture site. The femoral neck is then reduced under direct visualization. Next, 2.0-mm Kirschner wires or threaded guide pins for cannulated screws are placed to provisionally fix the femoral neck through the lateral window. Reduction can then be verified using fluoroscopy. Final fracture stabilization is performed. Surgeon preference at the authors’ institution consists of fracture fixation with either a compression hip screw construct with a derotational screw, or 3 cannulated partially threaded cancellous screws placed through the lat-
eral window. A compression hip screw construct is preferable for younger patients, especially those who may not adhere to recommended weight-bearing restrictions, because of its superior biomechanical strength. Direct visualization of the fracture should be continued during screw placement to ensure the maintenance of anatomic fracture reduction (Figure 7).

**DISCUSSION**

This modified anterolateral approach allows for direct visualization of femoral neck fractures and for placement of the implants through a single approach with 2 windows. This technique is an adaptation of the approaches described by Matta et al, Molnar and Routt, and Ly and Swiontkowski, and provides excellent femoral neck visualization without risk to the LFCN of the medial femoral circumflex artery.

The original Smith-Petersen surgical exposure exploits the internervous plane between the sartorius and the TFL muscles; however, it risks injury to the LFCN. Molnar and Routt described a modified Smith-Petersen approach to visualize femoral neck fractures. However, they used the sartorius/ tensor fascia interval, which still places the LFCN at risk.

The Watson-Jones exposure divides vessels at the base of the femoral neck, placing the superior and inferior retinacular branches of the medial femoral circumflex artery at risk, which may increase the risk of avascular necrosis. Additionally, the Watson-Jones technique does not provide optimal visualization of subcapital fractures, whereas the current authors’ approach allows excellent access to and exposure of these fractures.

The current authors’ approach uses a modification described by Matta et al, in which tensor fascia is incised over the tensor in line with the skin incision, using blunt dissection to gain access to the medial aspect of the tensor within the sheath of the incised aponeurosis, developing the interval between the tensor and sartorius superficially. The approach that the current authors describe does elevate some of the rectus fibers, but does not require a full tenotomy as described by Molnar and Routt. The current authors’ approach is similar to other anterior approaches to the hip, allowing the rectus femoris muscle to remain mostly intact.

This approach allows for visualization of the reduction along with placement of the lateral plate and sliding screw construct similar to which Ly and Swiontkowski described. However, the current authors’ approach allows visualization of the modified Smith-Petersen interval (superficial: sartorius/TFL; deep: rectus femoris/gluteus medius) and placement of lateral hardware through a single incision.

A major concern associated with this injury is avascular necrosis of the femoral head. Ly and Swiontkowski examined the rate of avascular necrosis after femoral neck fracture in the literature and found the average to be 23% (range, 3%-32%). Multiple causes have been hypothesized for this complication, including intra-capsular injury, initial injury to the femoral head blood supply, inadequate reduction, and iatrogenic injury to the blood supply. In this approach, care is taken to avoid injury to the superior retinacular branches of the medial femoral circumflex artery when placing the Deaver retractor superior to the neck. However, the current authors believe that the most important factor in preventing avascular necrosis is achieving an anatomic reduction. Proper visualization and surgical technique is essential to achieve this reduction.

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**Figure 6:** Medial and lateral windows are developed. The medial window allows visualization of the femoral head (*) and neck (*). The lateral window allows visualization of the femur shaft (*) for placement of hardware.

**Figure 7:** Anteroposterior (A) and lateral (B) radiographs 2 weeks postoperatively showing anatomic reduction of the femoral neck and fixation with a compression hip screw and derotational screw.
The main disadvantage of this approach is the larger incision, which is needed for insertion of a sliding screw and plate. However, a parallel screw construct can be inserted either using a more limited distal incision or percutaneously. Biomechanically, it has been shown that a sliding screw and side plate is stronger than 3 screws for vertically oriented fractures. This has been found to be even more important when comminution is present. These fracture characteristics are typical for the current authors’ physiologically young patients, who sustain these injuries via high-energy mechanisms such as motor vehicle accidents or falls from heights. Therefore, this is the current authors’ preferred surgical technique when direct visualization of femoral neck fractures and excellent stability are needed due to vertically oriented and comminuted, displaced femoral neck fractures in physiologically young patients, for whom a hemiarthroplasty or total hip arthroplasty is suboptimal. This is in contrast to older patients with low-energy injuries, for whom a periarticular approach, hemiarthroplasty, or total hip arthroplasty are reasonable treatment strategies.\textsuperscript{19}

**Conclusion**

The hybrid anterolateral approach to the hip allows for excellent visualization of femoral neck fractures through a medial window, and for placement of plate and screw constructs through a lateral window. This single-incision surgical technique minimizes risk to the LFCN and branches of the medial femoral circumflex artery, which may be placed at risk with other surgical approaches.

**References**