Arthroscopic Removal of Proximal Femoral Locking Screws: A Novel Application of Hip Arthroscopy

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Abstract: The authors describe a novel application of hip arthroscopy. Symptomatic proximal locking screws can readily be removed via an arthroscope. Not only can the proximal screw be removed with much less morbidity than in previously described procedures, but the abductor mechanisms can also be evaluated for injury sustained during the index procedure. Furthermore, scarred or inflamed trochanteric bursal tissue may be resected during this arthroscopic approach.

Intramedullary nailing for the treatment of proximal femur fractures has become a common and successful procedure, with union rates as high as 99%.1 When inserted in the antegrade fashion, intramedullary nails are inserted into the femoral canal via an entry site at the piriformis fossa or the greater trochanter. Intramedullary nails are then supported proximally by locking screws inserted percutaneously after the nail has been placed and positioned. Although the procedure has been successful in terms of fracture stabilization, many authors have described reports of peritrochanteric pain and abductor weakness in patients who have previously been treated with intramedullary nailing.2-5 It has been suggested that peritrochanteric pain associated with intramedullary nailing is, to some extent, associated with the proximal locking screw’s effect on surrounding soft tissue.4,5 Fogagnolo et al6 found lateral hip pain to be the most common complication in patients who had undergone intramedullary nailing, occurring in 10 of 47 patients retrospectively analyzed. In addition, Dodenhoff et al4 found that lifestyle-altering hip pain was present in 40% of patients who had undergone intramedullary nailing and, although heterotrophic ossification was most commonly associated with the pain, all patients with pain at the site of the proximal locking screw had resolution of their pain following removal of the implant.

In a prospective randomized comparison of intramedullary and extramedullary open reduction and internal fixation for intertrochanteric femoral fractures, Hardy et al6 noted that 6 of 50 patients treated with the intramedullary hip screw reported persistent mid-thigh pain postoperatively. In 3 of these patients, the proximal locking screws were removed and all pain resolved.6 In addition to pain about the greater trochanter associated with proximal locking screws, temporary abductor weakness has also been shown to be a known complication of intramedullary nailing.2,7,8 The greater trochanteric entry site, beneficial for intramedullary nail angulation, coincides with the insertion site of the gluteus medius tendon. It has been a concern that damage may be done to the gluteus medius tendon during the reaming process as a consequence of this entry site choice. The piriformis fossa entry site is another choice for entry of the intramedullary nail, although concerns of increased operative time relative to greater trochanteric entry site exist.9 In addition, authors have described a bald spot on the posterolateral aspect of the greater trochanter, relatively free of tendinous insertion, that may decrease postoperative abductor weakness.10 It is debated whether nail entry site choice affects the severity of abductor weakness.

In a series of 34 intramedullary nail insertions via the greater trochanteric entry site in cadaveric specimens, McConnell...
et al\textsuperscript{11} found that 79\% of 17-mm reamed portals were completely contained within the gluteus medius tendon, with an average tendon insertion disruption of 27\% (range, 14.8\%-52.7\%). They concluded that gluteus medius tendon injury is an unavoidable consequence of appropriate intramedullary nail placement and abductor dysfunction should be recognized as a potential cause of postoperative morbidity.\textsuperscript{11} Furthermore, Ozsoy et al\textsuperscript{12} identified abducted and minimally flexed positions of the femur as possible risk factors for superior gluteal nerve and gluteus medius injury during intramedullary nail insertion and postulated that supine positioning is thus a risk factor for postoperative hip abduction weakness.

Although both of these studies were conducted in cadavers, their compelling evidence combined with the numerous clinical reports in the literature\textsuperscript{3,4,7,8} make gluteus medius tendon disruption a concern for proximal intramedullary nail insertion. It seems to also be true that the piriformis entry site results in hip abductor strength deficits.\textsuperscript{7} A recent randomized controlled trial of 110 patients with femoral shaft fractures compared greater trochanteric and piriformis fossa entry sites and demonstrated decreased hip abductor strength at 3 and 6 months postoperatively in both groups and a decreased but not statistically significant hip abductor strength score at 12 months postoperatively in patients treated with a greater trochanteric entry site compared with those treated with piriformis fossa entry sites.\textsuperscript{8} At this point, it is unclear to what extent entry site choice influences postoperative hip abductor weakness, and further studies are needed to better delineate the causes and extent of hip abductor tendinopathy following intramedullary nailing.

Extraction of proximal femoral locking screws for the alleviation of associated symptoms is rarely indicated and has appreciable morbidity. In addition, soft tissue damage resulting from intramedullary nail insertion, such as abductor tendinopathy and bursal scarring, are rarely addressed. The authors describe a novel application of hip arthroscopy to address these issues in patients who have previously undergone intramedullary nailing. Arthroscopic excision of proximal femoral locking screws can be used to eliminate significant, lifestyle-altering pain associated with these screws. This technique also allows for resection of scarred bursal tissue and evaluation of abductor tendon injury, both of which may be the result of the index procedure.

**SURGICAL TECHNIQUE**

A healthy 32-year-old woman sustained an oblique fracture of her proximal left femoral shaft following a high-speed motor vehicle collision in May 2011. She was initially treated with an antegrade intramedullary nail, which was inserted through a greater trochanteric entry site and secured proximally using a single percutaneous locking screw. No complications were associated with the procedure, and her hospital course was uneventful. She did well postoperatively but developed pain, tenderness, and weakness over her left greater trochanter at the site of proximal screw insertion over the next 7 months. She was referred to the authors’ institution for arthroscopic removal of her proximal locking screw.

For surgery, the patient was placed in the supine position. Her left hip was prepped and draped in the appropriate sterile fashion. The greater trochanter was palpated, and the peritrochanteric space was entered arthroscopically (Figure 1A). The greater trochanteric bursa was found to be considerably scarred down to both the vastus lateralis and gluteus medius (Figure 1B), and the scarred bursal tissue was excised with a mechanical shaver. The vastus lateralis muscle belly was noted to be emmeshed in modest fibrous tissue and was released using a mechanical shaver and a thermal device. The gluteus medius was visualized and found to be free of tendon violation (Figure 1C). The proximal locking screw head was then identified and palpated. It was appreciated in the posterior aspect of the greater trochanter (Figure 1D). A spinal needle was used for localization of the screw head, and a screwdriver with excellent purchase was used to remove the screw percutaneously through an ar-
Hip arthroscopy has become more widespread due to improved surgical equipment and improved techniques, as well as an expanding understanding of hip pathology. Indications for hip arthroscopy include femoroacetabular impingement, labral tears, chondral and osteochondral lesions or defects, synovial disease, ligamentum teres pathology, loose body retrieval, and septic arthritis.

In hip arthroscopy, 3 compartments have been identified: the central compartment, which is intracapsular and intra-articular (as defined by the edges of the acetabular labrum); the peripheral compartment, which is intracapsular and extra-articular; and the extracapsular peritrochanteric or lateral compartment, which is a potential space that extends from the femur to the tensor fascia lata. Within the peritrochanteric compartment, proximal screw heads can be found and bursal scarring and gluteus medius tendinopathy can be evaluated.

The current authors describe the successful use of hip arthroscopy in accomplishing 3 goals: removal of a symptomatic proximal femoral locking screw, evaluation of the extent of hip abductor tendinopathy, and release of bursal scarring from surrounding tissue. All 3 goals were accomplished arthroscopically without complication, and the patient’s lateral thigh pain resolved within 2 weeks of the procedure.

The use of hip arthroscopy for hardware removal has yet to be acknowledged in the literature. As described in this article, this technique could help patients with persistent thigh pain following intramedullary nailing and proximal locking screw fixation. It lessens morbidity experienced by the patient and affords the release and excision of inflamed bursal tissue, as well as examination of gluteus medius tendon pathology. Gluteus medius tears can now be repaired arthroscopically.

This technique would be useful to researchers wishing to prospectively evaluate whether and to what extent the incidence of gluteus medius tendinopathy in patients is affected by intramedullary nail entry site. For example, morbidity of trochanteric entry sites can be compared with that of piriformis fossa entry sites. This question has clinical significance because it could influence the ideal entry site choice.

**CONCLUSION**

Removal of proximal locking screws is sometimes indicated in symptomatic patients following intramedullary nailing. In addition, abductor morbidity is associated with intramedullary nailing. Hip arthroscopy offers a decrease in morbidity associated with the proximal locking screw, resection of scarred bursa, and evaluation of abductor pathology.

**REFERENCES**


