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Arthroscopic Assisted Removal of Retrograde Intramedullary Femoral Nails: Technique

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Abstract: The use of retrograde intramedullary nails for the treatment of supracondylar and diaphyseal femur fractures is becoming a more common practice in the trauma patient. These intramedullary nails are frequently removed after fracture union in young patients, or in patients with knee pain. Clinicians face a difficult diagnostic dilemma in determining if knee pain following retrograde intramedullary femoral nailing is a consequence of intraarticular pathology sustained during the index injury or is a result of the nail itself. Little literature exists regarding nail removal. We describe a technique for arthroscopic assisted removal of retrograde femoral nails. Open techniques for removal have the increased morbidity associated with a parapatellar arthrotomy, while percutaneous techniques do not allow for adequate visualization of associated intraarticular pathology. Arthroscopic assisted removal of retrograde femoral nails can eliminate the need for a parapatellar arthrotomy, and allows for better assessment and treatment of intraarticular pathology than can be afforded by either open or percutaneous removal techniques.

Introduction

Retrograde intramedullary nailing of femoral shaft fractures has become more common in the multitrauma patient. Retrograde nails in recent studies have shown a 95% union rate, and a low rate of post operative knee pain [1]. Indications for retrograde nailing are expanding and include ipsilateral femoral shaft and tibial shaft fractures, bilateral femoral fractures, low supracondylar femur fracture, extreme obesity, femoral shaft fracture below a total hip arthroplasty or above a total knee arthroplasty, ipsilateral femoral neck and shaft fracture, ipsilateral femoral shaft and acetabular fracture, and patient pregnancy [1–5].

Little literature exists regarding removal of retrograde femoral nails. Indications for removal can include infection, nonunion, malunion, hardware failure, knee pain, or patient preference. Patterson et al [6] reported five nail removals in his series of 17 nail insertions. Four patients had nonunions and one elected for hardware removal. In the case of knee pain following retrograde nailing, it is difficult to ascertain whether pain is from the nail itself, from trauma associated with nail insertions, or from intraarticular injuries sustained during the index trauma. Morgan et al [7] recently determined the patellofemoral contact pressures after a retrograde nail insertion and found no differences in pressure as long as the nail was countersunk 3mm, therefore decreasing the likelihood of knee pain from the retrograde nail itself.

We have used an arthroscopic assisted technique for removal of retrograde femoral nails. Guerra et al [8] did present one case of an arthroscopic assisted retrograde femoral nail insertion, but this technique is technically demanding, is limited in its ability to treat intraarticular fractures, and is associated with a theoretical risk of fluid extravasation through the fracture site into the thigh, with a risk of compartment syndrome. Lucas et al [9] presented a series of 34 supracondylar fractures treated with retrograde femoral nails and reported on two patients who had arthroscopic assisted nail removal with lysis of adhesions at the time of removal. He does not detail any other intraarticular pathology in these 2 patients.

The use of an arthroscopic assisted removal technique allows for evaluation and treatment of intraarticular pathology, and is therefore particularly useful in the patient with knee pain of unknown etiology. We have performed arthroscopic assisted removal of retrograde femoral nails in thirteen patients using the following technique.

Operative Technique

Patients are positioned in a standard fashion for surgical arthroscopy of the knee. A tourniquet is applied to the thigh, taking care to position it as high as possible.

Under flouroscopic guidance, small stab incisions are made over the sight of the intramedullary rod locking screws, and all are removed, except for the most proximal screw. This screw is left in place to prevent proximal migration of the nail in the canal during the subsequent manipulation and arthroscopic debridement.

Attention is then turned to the knee, where standard medial and lateral arthroscopic portals are established. A superolateral portal also can be established to serve as an outflow portal, and may be helpful in improving visualization by more effectively removing debris during nail removal. Standard diagnostic arthroscopy is performed, with careful evaluation of the medial, lateral, and patellofemoral compartments. Special attention is directed towards the

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trochlear groove. Postoperative adhesions may limit visualization, and will frequently require lysis with an intraarticular aggressive synovial resector. Intraarticular pathology is treated at this time, including treatment of meniscal tears with meniscectomy or repair, removal of loose bodies, lysis of adhesions, and treatment of chondral defects.

The entry portal for the nail in the intercondylar notch is identified, and using a combination of aggressive synovial resectors and shavers, the tip of the nail is located (Fig. 1). If the nail insertion point can not be easily identified, a flouroscope may be useful to locate its exact location before proceeding with an aggressive debridement (Fig. 2). Once the end of the nail is visualized, a limited incision is made in the midline of the patellar tendon, from the inferior pole of the patella, to just superior to the tibial tubercle. The tendon and fat pad are bluntly dissected so that access may be gained to the intercondylar notch.

Arthroscopic shavers and then progressively larger curettes are then introduced into the joint through the patellar tendon incision, until any debris in the end of the intramedullary nail is cleared. The nail extractor device is then carefully threaded onto the end of the nail under direct arthroscopic visualization (Fig. 3). Once the device is firmly seated in the nail, the proximal most locking screw is removed. The nail is then removed under direct visualization, and with extreme care to protect the soft tissue in the region of the patellar tendon splitting incision.

Following removal, the notch is thoroughly debrided so that no surface irregularities are present. The entire joint is thoroughly irrigated to clear any debris from nail removal. The incisions are closed in the standard fashion. A soft, compressive dressing is applied. Patients are allowed to begin protected weight bearing when their comfort allows.

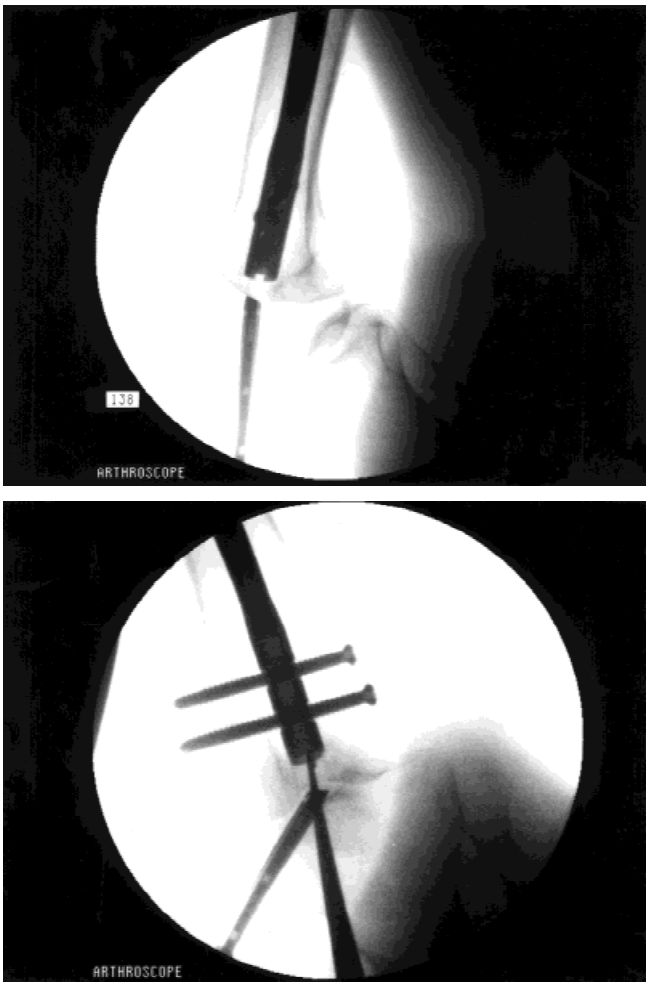

Fig. 2. (A) Intraoperative lateral and **(B)** AP flouroscopic x-ray localizing the nail in two planes. A curette may be used to push through any overlying fibrous tissue covering the nail.

Discussion

Arthroscopic assisted removal of retrograde femoral nails has several distinct advantages. Arthroscopic assisted re-

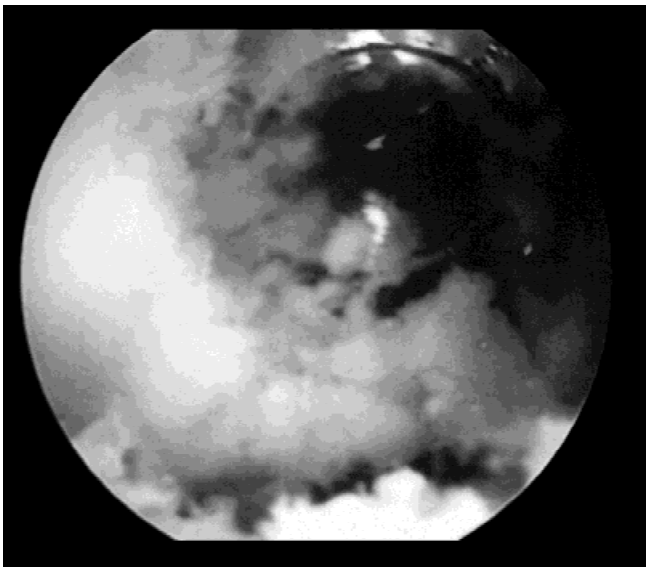

Fig. 1. Arthroscopic view of the partially exposed tip of the retrograde nail.

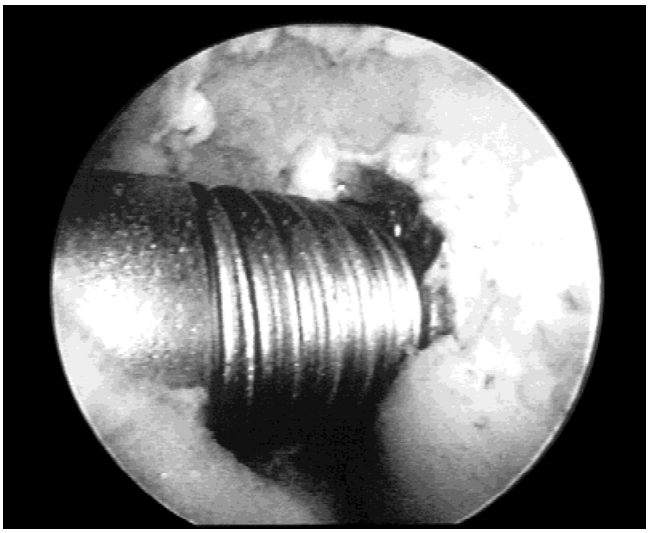

Fig. 3. The extraction device is threaded into the nail and the nail is extracted through the infrapatellar portal.

moval allows for diagnosis and treatment of intraarticular pathology that can not be accessed via a limited percutaneous removal technique and prevents the morbidity and prolonged rehabilitation associated with a parapatellar arthrotomy.

This technique is particularly useful in cases where the nail is being removed for knee pain because it is often unclear whether the pain is from the nail, from an injury sustained during the insertion of the nail, or from the index trauma itself. In addition, postoperative adhesions, which are almost always present in our experience, are easily treated via the arthroscope.

In our current series, 13 patients had an arthroscopic procedure for removal of a retrograde femoral nail. Two of these patients had intraarticular infections (enterobacter and staphylococcus aureus) prompting nail removal and debridement, and the remainder had knee pain of indeterminate etiology. The nail was successfully removed arthroscopically in 12 of the 13 patients (92%), while one patient required a median parapatellar arthrotomy in addition to the arthroscopic procedure. This patient, however, also had two intraarticular interfragmentary screws that required arthrotomy for removal. The intramedullary nail was removed via the same arthrotomy incision.

Twelve of the thirteen patients (92%) had intraarticular pathology treated at the time of removal. Treatment at the time of nail removal included meniscal repair, meniscal debridement, loose body excision, chondroplasty, lysis of adhesions, synovectomy, and irrigation and debridement of intraarticular infection. One patient had a negative diagnostic arthroscopy and only underwent removal of the intramedullary nail. The high percentage of patients with treatable intraarticular pathology supports to the notion that their knee pain may not always be attributed to the nail itself, supporting to the use of the arthroscopic removal technique.

The simplicity and high success rate of this technique, along with its potential benefits, makes it our technique of choice for the removal of all retrograde intramedullary femoral nails.

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