

Outcomes of Retrograde Nailing for Treating Fractures of Femoral Shaft

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ABSTRACT

Objective: We assessed retrograde locked intramedullary nail outcomes in distal femur fractures patients.

Place and Duration: In the Department of Orthopaedic Bone Care trauma centre Heerabad Hospital Hyderabad Pakistan for one year duration from March 2019 to March 2020.

Methods: 26 patients of distal femur fractures (16 men, 10 women; mean age 45 years; range 23 to 66 years) were managed with a retrograde locked intramedullary nail. The bilateral fractures were noted in 2 patients. Closed fractures were noted in 19 (73.07%) and open fractures in 7 (26.9%). 10 days was the mean operative time (range 2 to 20 days). In 15 fractures: open technique was used, and 11 fractures were managed with close technique. 4 patients with floating knee preoperatively were assessed by MRI and found to have torn cruciate ligaments. Intraoperative knee examination was performed in all patients, and cruciate ligament rupture was observed in 7 patients. The HSS modified knee rating scale was used for functional results assessment at the end of a mean follow-up period of 24 months.

Results: 27 weeks was the mean time to union (range 15 to 44 weeks). Two patients showed a late union (42 weeks). In 10 knees; Range of motion was normal (38.46%), 100-110° in 12 knees (46.15%), 80° in 3 knees (11.5%) and below 80° in one knee (3.84%). Based on the modified HSS knee scale, the results were excellent in 12 (46.15%), good in 7 (26.92%), moderate in 5 (19.2) and poor in 2 (7.69%). Postoperative radiographic check-up revealed varus angulation (10°) in five patients (19.23%) and posterior angulation (10-20°) in 3 subjects. 1 patient recovered with excessive deformation (30° posterior angulation). None of the patients experienced problems or infections at the wound site. Deep vein thrombosis developed in two patients in the early postoperative period.

Conclusion: The distal femur fractures treatment with retrograde interlocked intramedullary nailing gives acceptable outcomes in adults.

Key words: Femoral fractures, Interlocking nail, Retrograde nail

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INTRODUCTION

The distal femur fractures incidence is constantly increasing with the increase of traffic accidents in our country [1]. Problems related with distal femur fractures may not be limited to the femur itself but may extend to

the internal structures of the knee. Plate and screw fixation were previously the preferred fixation method, but retrograde intramedullary nailing has become a popular option. However, knee assessment, surgical procedure and rehabilitation should be done correctly to achieve good results [2]. Locked, carved intramedullary (IM) nailing is an effective treatment for most femoral shaft fractures. Antegrade nailing is the traditional standard technique, but the use of retrograde nailing offers several advantages [3]. An alternative technique is

retrograde nailing using the intercondylar notch of the distal femur as the entry point. Retrograde medullary nailing was originally proposed for the treatment of femoral shaft fractures using a distal extra-articular access portal from the medial supracondylar femoral region. This required a twist in the nail and created a large strain [4]. The results were improved by developing an intraarticular intercondylar access site compatible with the medullary canal and using standard nail designs. This technique was originally proposed for the treatment of patients with ipsilateral fractures of the neck and femoral shaft. Its indications have been expanded to include patients with multiple injuries to facilitate the implementation of simultaneous or sequential procedures [5]. Advantages of the retrograde nail include avoiding the use of fracture table and traction, easier patient positioning and nail insertion, and shorter operation times with less blood loss. Access to the access site is easier, especially in older patients, due to less soft tissue dissection [6]. There is also no muscle dissection and less radiation exposure, especially to the pelvic organs. Femoral shaft fractures of both thighs can be treated in the same position. In general, retrograde nailing may be preferred to antegrade nailing in the following situations: 1) The presence of an accompanying (possibly non-displaced) fracture of the femoral neck; 2) The presence of a pre-placed or simultaneous internal fixation of the proximal femur fracture; and 3) The possibility of causing fracture of the femoral neck by inserting an antegrade nail [7]. The retrograde technique can be used when proximal access to the spinal canal is blocked. Although early results with retrograde nails indicate a slightly lower rate of union, the difference may be due to smaller diameter nails and other factors such as the use of unbuffered nails [8]. The use of this technique with retrograde nails adapted by drilling the diameter of the femoral isthmus has shown promising results. Findings include healing rates and results equivalent to the antegrade technique with high-speed union rates and low complications [9,10]. Access site problems can be equivalent between retrograde (knee symptoms) and antegrade (hip symptoms) techniques.

MATERIALS AND METHODS

This study was held in the Department of Orthopedic Bone Care trauma Centre Heerabad Hospital Hyderabad Pakistan for two years duration from March 2019 to March 2020. 26 patients of distal femur fractures (16 men, 10 women; mean age 45 years; range 23 to 66 years) were managed with a retrograde locked intramedullary nail. The bilateral fractures were noted in 2 patients. Rendering to the AO classification, the A1 fractures were noted in 12 patients, 7 with A2, 6 patients with A and C1 (n=1). Closed fractures were noted in 19 (73.07%) and open fractures in 7 (26.9%). 10 days was the mean operative time (range 2 to 20 days). In 15 fractures: open technique was used, and 11 fractures were managed with percutaneous technique. 4 patients with floating knee preoperatively were assessed by MRI and found to have torn cruciate ligaments. Intraoperative knee examination was performed in all patients, and

cruciate ligament rupture was observed in 7 patients. The HSS modified knee rating scale was used for functional results assessment at the end of a mean follow-up period of 24 months. Etiology of trauma according to frequency; traffic accident in 12 patients, simple fall in 6 patients, shooting with firearm in 4 patients, and falling from height in 4 patients. Body mass index (BMI) of the patients was calculated. In six patients, BMI was determined as 30 kg / m² or more. Additional pathologies were found in 6 cases exposed to high-energy trauma. These; 2 patients had ipsilateral tibial shaft fracture, 2 patient had head trauma, one patient had contralateral supracondylar femur fracture and one had ipsilateral fracture and elbow dislocation. In addition, three patients had anterior cruciate ligament (ACL) tear and two patients had a medial collateral ligament (MCL) tear. Dynamic hip screw was applied to the patient with patella and hip fracture in a different session in addition to the femur fracture. The patellar fracture was treated conservatively with a long leg cast. Both femurs of the patient with bilateral supracondylar femur fracture were operated in the same session. The patient, whose elbow was broken and dislocated, was operated in different sessions. Patients were evaluated with a multidisciplinary approach in orthopaedics, general surgery, and neurosurgery clinics. Routine anteroposterior and lateral radiographs of the femur were taken. Open fracture patients were treated in the emergency operating room with an open fracture approach. The mean operative time after trauma was 10 days (range, 2-20). All surgeries were performed in the supine position on the radiolucent operating table. General anaesthesia was applied to 16 patients and spinal anaesthesia was applied to 10 patients. The nail was open in 15 patients, and percutaneous technique (Mini arthrotomy) was used in 11 patients. None of the patients operated with the percutaneous technique required an open intraoperative approach. A medial parapatellar incision was preferred for the open approach, and arthrotomy was performed by turning the patella laterally. The mean operation time was 133 minutes in the open approach and 122 minutes in the percutaneous approach. Mean blood loss was 690 ml (range, 300-1200) for open approach patients and 340 ml (range, 250-500) for the percutaneous approach. Tourniquet was not used in any patient. Short nails (25 cm) were used in all patients except one. No intraoperative complications were observed in any patient and there was no problem in long-term follow-up. One lock screw was used for the proximal lock in 8 fractures, and two lock screws were used for the proximal lock in 18 fractures. The choice of one or two locking screws is at the surgeon's discretion. In three patients with ACL rupture, the fractures did not extend to the joint and elective arthroscopic ACL reconstruction was planned. The patient with grade 2 MCL tear was treated with a long leg cast. Exercise was initiated on the first postoperative day for all patients and physical therapy was applied to all patients after discharge. One patient who had an MCL tear and was treated with a long leg cast received physical therapy 4 weeks after the cast.

Anteroposterior radiographs were obtained at each visit. When binding was observed, partial loading of the weight was initiated, and full loading was initiated when sufficient binding was present. At the last follow-up, HSS (knee assessment score) by Leung et al was used. In this scoring system, pain (30 points), function (22 points), knee range of motion (15 points), muscle strength (15 points), flexion deformity (10 points) and instability (5 points). SPSS software (version 22.0 for Windows) was used for statistical analysis. Differences were compared by paired group t test. A p value of <0.05 was considered statistically significant.

RESULTS

27 weeks was the mean time to union (range 15 to 44 weeks). Two patients showed a late union (42 weeks). In 10 knees; Range of motion was normal (38.46%), 100-110° in 12 knees (46.15%), 80° in 3 knees (11.5%) and below 80° in one knee (3.84%).

Based on the modified HSS (Hospital for Special Surgery Knee Score) knee scale, the results were excellent in 12 (46.15%), good in 7 (26.92%), moderate in 5 (19.2) and poor in 2 (7.69%). Postoperative radiographic check-up revealed varus angulation (10°) in five patients (19.23%) and posterior angulation (10-20°) in 3 subjects. 1 patient recovered with excessive deformation (25° posterior angulation). None of the patients experienced problems or infections at the wound site. Deep vein thrombosis developed in two patients in the early postoperative period.

DISCUSSION

In the late 1980s, retrograde interlocking intramedullary nailing using the intercondylar approach became common for distal femur fractures. Before this period, systems such as 95° angled condylar wedge plate, dynamic condylar compression screw and condylar carrier plates were used successfully. Retrograde nails started to be used after this period and they have some advantages and disadvantages [11]. Usually, a lateral approach is used for plate fixation in all distal femur fractures, but these systems result in extensive soft tissue dissection and drainage of the fracture hematoma. As a result, the lateral approach can cause delayed union, infection, and a large soft tissue scar. Papadokostakis et al. Evaluated retrograde interlocking intramedullary nails in 24 studies involving 914 patients and 963 distal femur fractures and reported that retrograde nailing results were good [12]. The Less Invasive Stabilization System (LISS) is currently used to treat osteoporotic fractures of the distal femur. The approach in this system is lateral and the system does not require extensive tissue dissection, making C-type fractures suitable for this system. Zlowodzki et al. LISS compared the biomechanics of wedge plates and retrograde nails. Torsional stability was adequate and the same in all three systems, but LISS was best for osteoporotic fractures. Meyer et al. Compared the biomechanics of plate and retrograde nails in osteoporotic cadavers and found that the plate was more resistant to axial and torsional loading than the

retrograde nail [13,14]. There is less need for soft tissue dissection with retrograde nails than for plates, which becomes evident when the percutaneous technique is used. Therefore, there is less blood loss and shorter operation time. In our study, the operation time of percutaneous and open techniques was similar, but time was lost in determining the insertion point of the nail with the endoscope and/or it was caused by the surgeon's inexperience with the percutaneous technique [15,16]. Christodoulou et al. compared the retrograde nail and dynamic condylar screw systems and found that the results were equally satisfactory, but significantly less operative time and blood loss. In this study, all nails were applied percutaneously. Nail application is more biological than plates because too much pressure is applied to the plates due to the medial weight load on the femur. Less stress is loaded when using intramedullary nails. Retrograde nail application is particularly suitable for AO type A patients. The nail can also be applied to type C patients, including C3. However, with arthrotomy and fixation of the fracture with free screws, the first joint restoration should be performed, and the nail should be placed [17]. Lag screws used for joint stability should not interfere with the nail, which is a disadvantage of the system. Even if the fractured AO type A joint does not extend, an arthrotomy is required (mini arthrotomy in percutaneous technique). In these cases, opening the joint may be disadvantageous. If the fracture does not extend into the joint, open technique for arthrotomy is not required. Nails can be easily applied using a percutaneous technique and a small midline incision [18]. Arthrotomy results are not bad, and septic knee arthritis rates are acceptable, approximately 0-14%. Half of the patients experience knee pain. It is important to remember that during retrograde application of the nail, which has been shown as a complication, vascular injury or pseudoaneurysms may occur due to the pinched popliteal artery between the fracture fragments [19]. None of our patients were evaluated for pseudoaneurysm. The nail length and the number of proximal locking screws to be used during the procedure are also controversial. Sears et al. Compared the application of one or two proximal locking screws in cadavers and found no significant difference in coronal or sagittal translational stability. In our study, one or two proximal locking screws were used depending on the surgeon's preference, and we could not find any difference between one or two results [20]. In the study by Sears et al. There was more bone pressure on the proximal end of the short nails (20 cm) than on the longer nails (36 cm). As a result, they recommended the use of a proximal locking screw with long IM nails. We used short nails (25 cm) in all but one patient, and only one patient had a proximal nail tip fracture. Therefore, long retrograde IM nails are preferred in patients with supracondylar femur fractures [21]. We used a retrograde standard nail in all patients with a mid-distal femoral shaft fracture without intraoperative or follow-up problems. Not having the tip of the nail in the joint space can limit the range of motion of the knee. Interconnected retrograde intramedullary nailing is the

current treatment option for supracondylar fractures of the femur, particularly type A fractures. This technique is not as effective as LISS for comminuted fractures of the metaphysis but can be used in C1. Although stabilization and reduction of the fracture can be easily achieved with LISS for comminuted fractures of the metaphysis, retrograde stabilization of the nail is involved in the treatment of AO type C fractures [22]. Time was taken into consideration in our study. Shorter surgical procedure, shorter incision and less blood loss, therefore percutaneous technique was used. Although it is known that less blood loss occurs with antegrade femoral nailing using percutaneous technique, there is no literature supporting retrograde nailing. When open and percutaneous techniques were compared, we could not find a significant difference in the operative time [23]. However, the operation time was shorter with the percutaneous technique. The percutaneous technique has become the gold standard for floating knees and supracondylar fractures.

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