Retrograde femoral interlocking nail in complex fractures

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ABSTRACT

Retrograde interlocking nail was used as the method of fixation in 35 different cases of combination of complex femoral fractures. We performed this procedure in fractures of femoral shaft associated with fracture neck femur, pathological fractures of proximal third of femur with trochanteric pathology, ipsilateral fracture of femur and tibia in polytrauma cases with multiple other injuries, in highly obese patients with fracture shaft femur. This technique was also used in cases of pregnancy with fracture shaft femur and in unstable pelvic fracture or dislocation hip associated with fracture shaft femur. Operative technique involved with retrograde insertion of un-reamed, non-cannulated custom made nail through entrance portal in intercondylar notch was applied for fixation of the shaft femur fracture.

The other associated fracture around hip was stabilized separately using suitable implant according to type of fracture. In cases of ipsilateral fracture of femur and tibia, femur was stabilized by retrograde interlocking nail and tibia was stabilized by antegrade interlocking nail through same incision at the same setting. The case was followed up for three years; the average union time was 12 to 18 weeks. Out of 35 cases, 31 cases regained full knee movement. Out of the remaining 4 cases, 2 cases could regain up to 90° of movement, these were old fractures and non-cooperative patients. In one case, patellofemoral arthritis was developed because of an operative error where a nail was not put inside the articular surface. Mal-union was observed in an early case of the series and implant failure was nil.

Retrograde interlocking nail was used as the method of fixation in complex fracture problems. Multiple fractures of long bones can be stabilized in one stage, preventing multiple operations at different stages in polytraumatized patients. This resulted in early recovery, lesser hospital stay, and early rehabilitation of patient with good results and is economical also.

Keywords: retrograde, interlocking, complex femoral fractures

INTRODUCTION

Retrograde nail developed by Enders and Simon was primarily used for fixation of trochanteric and subtrochanteric fractures. This was inserted via medial femoral condyle and advanced into the femoral head. Later, Sanders modified the procedure and used the modified cloverleaf nail entering through extraarticular approach from medial femoral condyle to stabilize shaft fracture. However, the disadvantage
of this approach is the reduction of fracture and frequent occurrence of axial malalignment.

Green Seligson Henry (GSH) nail was used to successfully manage distal shaft fractures through retrograde intercondylar approach. In our series of 35 cases, retrograde interlocking nail was used as the method of fixation in complex femoral fracture problems such as pathological fractures of proximal third of femur with trochanteric pathology, fracture shaft of femur associated with fracture neck, fracture shaft with ipsilateral fracture of tibia, highly obese patients with fracture femur, unstable fracture pelvis with ipsilateral fracture shaft and also in pregnant patients associated with fracture shaft. With this approach, exposure of radiation to fetus can be reduced.

MATERIALS AND METHODS

A total of 35 cases of different combination fractures of shaft femur were selected for the study from 1998 to 2001. Age varied from 18 years to 90 years old. Out of 35 cases, 26 were males and 9 were females. 19 cases had ipsilateral fracture of neck of femur (14 had intertrochanteric fracture and the other 5 had intracapsular fracture neck of femur) with fracture shaft, 7 cases of fracture shaft femur had ipsilateral fracture tibia with other multiple injuries. 4 were obese patients with fracture shaft femur, 2 cases had pathological fractures with trochanteric pathology, 2 cases were of unstable fracture pelvis with fracture shaft femur and 1 case of fracture shaft femur was associated with pregnancy. We have not included those cases in the series that had a past history of septic pathology in knee joint and had knee movement less than 40° or had any open wound around the knee.

With the help of this technique, multiple fractures can be stabilized in the same sitting with minimal surgical trauma, resulting in early recovery of patient, less hospital stay and thus quite economical to the patient. A 20-year-old patient with pathology of fibrous displasia around the hip and proximal thigh with coxa vara deformity and shortening had multiple bone grafting operations in the past. The pathological fracture in proximal third of femur after trauma in this patient was successfully treated with retrograde femoral interlocking nail.

In this case, we used custom made nails making cross locking hole for better stability in proximal part of femur which was weak because of fibrous displasia. We locked the nail in AP and lateral plane. We performed bone grafting also from the retrograde route using a long barrel tube of 10 mm diameter with a piston up to the fracture site and pushed the bone grafts at the fracture site before fixing the fracture with retrograde interlocking nail.

In another case of bilateral fracture shaft femur in a 26-year-old female, her right thigh fracture was stabilized with antigrade interlocking nail and on the left side she had an oblique supracondylar fracture shaft femur with massive soft tissue injury around the greater trochanter and proximal aspect of thigh. In this case we used custom made retrograde nails with modified oblique hole in proximal part of the nails to give interfragmentory compression at the fracture site using a 6.5 mm cancellous screw.

In most of the cases, nailing was performed as soon as the general condition of the patient was stable. In patients with ipsilateral fractures of neck and shaft femur, the shaft was stabilized first with retrograde interlocking femur and then suitable implant was used for fixation of neck fractures. All intracapsular fractures neck femur were stabilized with 6.5 cancellous screws and intertrochanteric fractures were stabilized with dynamic hip screw.

**Figure 1** Comminuted fracture shaft of femur with trochanteric fracture treated with retrograde interlocking nail and DHS.
We did not use this technique in simple fracture cases except in very obese patients with fracture shaft femur in which antigrade nailing was a problem due to obesity. We encouraged the patients to do physiotherapy on their knees as soon as they were comfortable, usually on the third day after removal of suction drain.

Operative technique

We used the standard operative technique. The patient was in a supine position with fractured limb on sterile radiolucent bolster at 45°. With this positioning, movement of the C arm is free in both AP and lateral position around the hip and thigh. It is advisable to keep a sand bag under the hip for better view. A small midline incision from the inferior pole of the patella to the tibial tubercle was given, a ligament patella was splitted and intercondylar notch is palpated. A guide wire was placed 1Cms anterior to attachment of posterior cruciate ligament, in midline of the shaft in both AP and lateral view. A 10 mm cannulated drill was used over the guide wire with a sleeve to make entry portal. Nail length was measured up to the lesser trochanter, keeping in mind that the nail should go 2 mm inside the articular surface.

We also used a 9 or 10 mm diameter non-cannulated nail with 2 locking holes in proximal and distal part of the nail. In one case we modified the direction of the distal hole to oblique to give an interfragmentary compression in an oblique supracondylar fracture of distal shaft. In one pathological fracture of proximal third of femur we made 2 distal holes (towards the lesser trochanter), 1 locking hole in the AP direction and other in lateral medial direction to give a cross locking effect for better stability.

Figure 2  Fibrous dysplasia around hip in a 22-year-old patient with pathological fracture upper third of femur.

Figure 3  Pathological fracture stabilized using retrograde femoral interlocking nail. Bone grafting was also done through same incision before nailing by using long barrel and piston to push the graft at fracture site.

Figure 4  Old healed intertrochanteric fracture with gross coxavara deformity and shortening in a 90-year-old woman. Traumatic fracture shaft femur treated with retrograde interlocking nail.
In all cases except one, reduction of fracture was achieved by applying manual traction over the bolster. We had to use external fixator as distracter to achieve reduction. After stabilization of the fracture with nails, proximal locking was done with the help of a jig, and distal locking was done with free hand technique using radiolucent guide. The wound has closed after meticulous suction and washing of the joint under suction drain. Regular knee exercises were started as soon as the patient was comfortable, usually after the removal of suction drain.

We advised partial weight bearing with crutches after appearance of bridging callus X-rays were done at different intervals. Patients were encouraged to do hip, knee and ankle exercises.

Results

The preliminary results of retrograde interlocking nail in 35 cases of complex femoral fracture problems with follow up of more than three years were extremely encouraging.

The main anxiety of the intraarticular approach was joint involvement resulting in knee arthrosis, but was not seen in this series. Out of 35 cases, 31 patients got full knee movement within three weeks time with regular physiotherapy started from the third postoperative day, or as soon as patient is comfortable. Most patients could only achieve movement up to 90°. One case developed patello femoral arthritis because of operative error; its nail was protruding out of the articular surface.

Mal-union was observed in one early case of the series, implant failure was nil. We were very much concerned in regards to rotational malalignment, and made all precautions to avoid it. Union time was 12 to 18 weeks (average 16 weeks). One grossly comminuted burst fracture required bone grafting. Partial weight bearing started as soon as appearance of bridging callus. In some cases, delay in weight bearing was caused by associated injuries. We also used intraarticular hydrocortisone injection in one case, where the patient persistently complained of knee pain in spite of full knee movement.

DISCUSSION

Interlocking nail has become an established method for treatment in long bones fractures. But in the event of complex fracture problem, the use of antigrade interlocking nail is limited. In cases of fracture shaft of femur associated with intracapsular fracture neck femur, antigrade nailing through piriformis fossa for shaft fracture and stabilization of femoral neck fracture either by ‘mis a nail technique’ or ‘re-con nail’ can further hamper the blood supply to the neck. This increases the possibility of vascular necrosis of head of femur. With retrograde fixation of fracture shaft femur, the fracture neck femur can easily be stabilized using cancellous screws in different planes as desired, thus giving a better stability. Pathological fracture of proximal third of femur with associated trochanteric pathology in a 20-year-old male, retrograde nailing with grafting was the only option of stabilization of proximal femoral fracture at this young age. Antigrade nailing was not possible in this case because of trochanteric pathology. We can think of applying custom made long stem THR at later age.

In another case, traumatic bilateral pathological fracture of femur in an 89-year-old patient with metabolic bone disorder with bilateral trochanteric pathology, this was the only way to stabilize his pathological fractures of shaft femur and made him comfortable.

Besides this, retrograde interlocking nail is the
method of treatment in polytraumatized patients with complex fractures. This technique has several advantages. In case of ipsilateral fracture of femur and tibia, retrograde interlocking nailing was applied for femur and antgrade interlocking nailing was applied for tibia through the same incision and sitting. This results in early recovery of patients. It is the method of choice in open and unstable fracture of pelvis with associated fracture shaft femur, ipsilateral dislocation of hip with fracture shaft femur, in highly obese patients with fracture shaft femur where antgrade nailing is a problem because of obesity.

In 1984, Swiontkowski used extraarticular approach in 7 patients through medial femoral condyle for fixation of ipsilateral fracture of shaft femur with fracture neck femur. He used standard kunchter nail and had complications in the form of varus malalignment and implant failure.

 Sanders et al also used extraarticular approach with changes of different implants- AO/ASIF universal nail with locking. He presented a series of 29 fractures of femoral shaft, for which he had technical difficulties in fracture reduction and mal-union.

 Berton and Watson published a series on 20 multiply injured patients with associated ipsilateral tibial fracture and neck femur fracture along with fracture shaft femur. He treated the fracture shaft with retrograde interlocking nail through entrance portal in intercondylar notch with good results.

 We have used the same technique in most complex fracture problems in polytrauma patients and could stabilize multiple fractures simultaneously, which otherwise would have required repeated operative procedures. Our observation in this short series of 35 cases is that this intraarticular approach through entrance portal in intercondylar notch has no adverse effect on knee joint movement. We did arthroscopy evaluation in one case before implant removal and found no new bone formation and entrance portal was filled with fibro cartilage and was confirmed with biopsy of tissue. Arthroscopic surgeons Berg and Mathews did a study on synovial fluid and concluded that synovial fluid contains catalytic enzymes and growth inhibitor factor that interfere with new bone formation.

 This technique of fracture stabilization is simple and technically easy. It should be done with strict aseptic precautions, as infection is the disastrous complication.

 In our series we used un-reamed, non-cannulated nail of 9 or 10 mm diameter. We used custom made nail in 2 cases in which we modified the locking holes. It is important while making entry portal that debris of bone should not fall into the joint. To prevent this, we used sleeve over the cannulated drill, performed meticulous suction and saline lavage of joint before closure under suction drainage. The disadvantage of this technique is that extraction of nail requires reopening of joint.

REFERENCES