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Augmentation of intramedullary nailing in unstable intertrochanteric fractures using cerclage wire and lag screws: a comparative study

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Proximal femoral nail
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ABSTRACT

Background: Unstable intertrochanteric fractures present a challenge to orthopaedic surgeons, with varied geometry of the fractures and a wide choice of implants and techniques. The patients are usually osteoporotic, with multiple co-morbidities and poor tolerance for complications and re-operations. Lateral wall reconstruction and stability of the trochanteric fragments are considered important in providing a better outcome of these difficult injuries. We present a technique of lateral wall and trochanteric reconstruction using Cerclage wires and lag screws in the greater trochanter in addition to intramedullary nailing, and the radiological and functional outcome of this technique of augmentation.
Materials and methods: This prospective study includes 154 patients from 2010 to 2015 presenting to the institute with an unstable intertrochanteric fracture. They were sequentially operated with intramedullary nailing (IMN) and augmentation with cerclage wire and/or Anteroposterior screw in greater trochanter, and 77 patients with IMN only. Operating time and need for blood transfusion post-surgery were documented. Patients were followed up for minimum of 12 months and radiological union time, complications and functional outcome using Harris Hip Score were noted at 1 year. Statistical analysis was performed to compare the results in both groups
Results: The mean union was 3.6 months in group A and 4.1 months in group B, with no statistically significant difference. The operating time needed for augmentation was 10 minutes more than IMN only. Blood transfusion was not required in any case. The incidence of complications like screw cut out, back out and non-union was lower in augmented group, and good functional outcome was greater in the augmented group which was statistically significant. The reoperation rate was lower in augmented group.
Conclusions: This new technique of augmentation of fixation of intramedullary nail in unstable trochanteric fractures using cerclage wires and lag screws for lateral wall reconstruction is useful in reducing complications of the procedure and provides good radiological and functional outcome. It requires little additional operating time with minimal blood loss and soft tissue injury.

Introduction

Fractures of the proximal femur are among the most common injuries in orthopaedic practice. The patients are usually osteoporotic, with multiple co-morbidities and give a history of a trivial fall. These fractures have a wide variety of geometry and present as stable and unstable types. The stability of the fracture depends on many factors, mainly the integrity of the lateral wall [1,2], posteromedial wall, greater trochanter fractures and subtrochanteric extension [3,4]. The aim of treatment of these injuries is to achieve a stable internal fixation after anatomical reduction, to return the patient back to his pre morbid level of function without pain or limp.

Unstable trochanteric fractures pose a challenge to the orthopaedic surgeon. Many options to treat these injuries are available to the surgeon, from the sliding hip screw, intramedullary nails to primary arthroplasty. Intramedullary nails (IMN) have now been accepted as the modality of treatment for very unstable trochanteric fractures, with good stability of fixation, minimal soft tissue injury during surgery and decreased complications [5–7]. Re-operations are less tolerated by these patients due to co-morbidities. Augmentation of IMN fixation aims at reducing the reoperation rates by reducing the failure rates.

The reconstruction of the lateral wall and posteromedial buttress remains an unanswered question in these fractures. Methods of fixation like trochanteric stabilization plates and proximal

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femoral locking plates have been used with limited success [8]. We used cerclage wire and lag screws to augment the fixation of the IMN for unstable fractures, and compared the radiological and functional outcomes with the cases in which IMN was used without augmentation.

Materials and methods

The study includes patients who presented to our institute from January 2010 to December 2015 with an unstable fracture of the proximal femur.

Inclusion criteria were the radiological diagnosis of an unstable trochanteric femoral fracture classified as type 31A2.2, 31A2.3, 31A3.1, 31A3.2 and 31A3.3 per the AO/ASIF classification and aged above 18 years. Exclusion criteria were inability to walk before the fracture, other fractures interfering with rehabilitation, compound trauma and pathological fractures. Two patients presented with a pathological fracture secondary to bony metastases, and one patient had a compound trauma due to high energy injury. Nine patients during the course of the study were unable to walk before the trauma due to cerebrovascular stroke and hemiplegia. All these patients were thus excluded from the study.

Fractures extending into the intracapsular part of neck femur, so called Kyle's type, were also excluded. All patients had a low energy trauma.

There were 180 patients included in the study. All patients were investigated with X-rays, and CT scans with 3D reconstruction on admission. CT scans were done in these patients for better visualization of the greater trochanteric fragment and the extent of the lateral wall comminution, which were then used for preoperative planning of the augmentation.

Patients were admitted in the hospital for surgery and were assigned a number in the study. Using an online randomization tool, the numbers were randomly distributed into two groups namely group A (augmentation done) and group B (no augmentation done), thus minimizing selection bias.

Informed consent was taken from the patients, explaining to them the nature of fixation and implants used, as well as risks involved. Ethical approval from the ethics committee of the institute was received.

All patients were operated by the same surgeon, who is experienced in treating these fractures, and is well familiar with the technique. Patients were operated with closed reduction of the fracture and internal fixation with IMN and a derotation screw. In 90 cases, additional fixation or augmentation of the fixation of IMN using cerclage wire or a lag screw in the Greater Trochanter (GT) or both were used (Group A). In 90 cases, no augmentation was used in addition to the IMN and Derotation screw, (Group B).

Operative technique

Using image intensification a closed reduction is performed to as near an anatomical position as possible. A 4 cm incision is made just proximal to the greater trochanter. An Awl is positioned on the medial tip of the greater trochanter and advanced within the canal to the level of the lesser trochanter. A guide rod is advanced in the medullary canal, so that it is in the centre of the canal in both AP and Lateral views, and then the canal is reamed. Once the nail is seated, the targeting device is used to make a 2cm stab incision. Guide pin are advanced into the femoral head. The correct length of pin is measured by the calibrated reamer. The screw is placed in the both centre of the head or slightly inferiorly within 5 to 10 mm of subchondral border. Distal locking screws are placed through the zig. All patients had similar position of the screw in the femoral head, and no intra-operative complications were encountered. The Tip-Apex distance in all cases was about 20mm.

Percutaneous cerclage wire

At the level of the lesser trochanter (LT) a stab incision is made, and a cerclage wire (SS wire) is passed using a AO cerclage instruments. The two ends of the wire now project in the wound. Through the incision of the IMN entry portal, Kocher forceps are introduced and passed sub muscularly distally and the anterior end of the cerclage wire is grasped and delivered proximally. Another stab incision is made at the level of the GT anterolaterally. Kocher forceps is introduced into the wound and into the abductor muscles. The forceps are now brought into the entry point incision and the end of the wire is grasped and brought medial to proximal end of the IMN. The same Kocher forceps, grasping the wire is now passed distally in a sub muscular plane down to the previous stab incision. Now both wires are held and tensioned. The excess wire is cut and the knot bent and tapped inside the wound. A figure-of-eight wire is seen on lateral view of the femur on C-arm, as shown in Figures 1 and 2.

AP screw in GT

Fractures with coronal split of the GT were augmented with this technique. Under C-arm guidance, the proper entry point of the screw is determined and a stab incision is made on the anterolateral aspect of the thigh. Using a 3.2mm drill bit with sleeve, a hole is drilled in the greater trochanter. A 6.5 mm cancellous screw is then passed in an anteroposterior direction after measuring the length required. The length and position are again verified under C-arm, as seen in Figures 1 and 2.

The blood loss and operating time of each surgery was noted. The post-operative protocol was same for both groups. Post-operative antibiotics were given for 24–48 hours as per protocol. Oral and parenteral analgesics were given as required. Active and passive hip and knee flexion was started on day 2 post-operatively as pain permitted. The patient was instructed to walk using walker with bearing weight as tolerated on the operated limb for 1 month. Sutures were removed 15 days after surgery.

Patients were followed up at 1.5 months, 3 months, 6 months and 1 year. At follow-up, the patients were asked about pain, functional outcome was assessed by Harris Hip Score (HHS) and X-rays of the proximal femur in AP and lateral projections were obtained. Union time, complications and HHS was recorded at every follow-up.

Results

Of the 180 patients, 19 patients were lost to follow-up and thus were not included in the final analysis. Five patients died within 2 months of surgery due to unrelated co-morbidities and 2 patients died within 1 year post-op. Thus 154 patients were available for the final analysis. The mean age of the patients was 74 years.

Union time

Union was determined clinically by absence of pain and radiologically by complete bridging of the fracture site in both orthogonal projections.

The mean union time in group A was 3.61±0.746 months while that of group B was 4.1±0.746 months. The result was not statistically significant at $p>0.05$, using the Student t test.

Harris Hip score (HHS)

The post-operative status was determined by Harris hip score calculated at end of 1 year follow-up. The outcome was classified as poor if <70, fair if 70–79, good if 80–89 and excellent when more than 90.