Biological Fixation with Bridge Plating of Comminuted Subtrochanteric Fractures of the Femur in Adults

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Abstract

Introduction: Comminuted subtrochanteric femoral fractures are high-energy injuries in adults. Treatment of comminuted subtrochanteric femoral fractures is still problematic. The aim of this study is to evaluate the functional and radiological outcomes of comminuted subtrochanteric femoral fractures treated with biological bridge plating fixation and dynamic HIP screw.

Material and Methods: We studied thirty cases with comminuted subtrochanteric femoral fractures. Twenty six patients were males and only 4 were females. Average age was 42 years. Patients were classified according Winquist criteria, managed with biological bridge plating fixation. All patients were followed up for an average period of 40 months to monitor the clinical and radiological progress until union.

Results: All the fractures united within 4-10 months with an average time of 6.2 months without additional procedures. Two patients had superficial infection, and 2 patients had shortening about 2cm.

Conclusion: Biological fixation with bridge plating of comminuted subtrochanteric fracture of the femur by using DHS is a useful method of surgical fixation without major complications.

Key Words: Biological fixation - Subtrochanteric fracture - DHS.

Introduction

COMMINUTED subtrochanteric fractures of the femur are high-energy injuries in adults. The subtrochanteric region extends from the upper border of the lesser trochanter to 5cm distal to it. This region is subjected to high compressive forces medially and tensile forces laterally, which can lead to fatigue failure of the implants. It represents a transition zone from the cancellous bone of the trochanteric area to the cortical bone of the femoral shaft and is slow to heal when injured. The continuity of the medial cortex is disrupted leading to important biomechanical consequences [1,2].

The treatment of the comminuted fracture of the subtrochanteric region is still problematic [3]. Minimally invasive surgery performed through limited incisions, providing axial and torsional alignment of the fractured extremity without damaging vascularity of comminuted fractures should be considered as an alternative treatment in comparison with traditional fixation methods [4,5].

Minimally invasive surgery provides relative stability and less surgical trauma that result in rapid healing of the fracture [6-8]. The purpose of this study was to evaluate the functional and radiological outcomes of the comminuted subtrochanteric femoral fractures treated with biological bridge plating fixation.

Material and Methods

From January 2008 to December 2009, thirty consecutive patients (26 males and 4 females) with comminuted subtrochanteric femoral fractures were evaluated and treated with biological bridge plating fixation.

The average age was 42 years ranged from 25 to 56 years. All fractures were caused by high-velocity accidents. Twenty four patients were involved in motor-vehicle accidents, and six had fallen from height. Fourteen had multiple injuries.

Winquist criteria was used to classify the fracture patterns: Type 1, true subtrochanteric fractures, with the proximal fragment intact to a level below the lesser trochanter; Type 2, the greater trochanter and piriform fossa intact, but the lesser trochanter fractured; and Type 3, the subtrochanteric fracture
extending into the greater trochanter and piriform fossa, with or without loss of continuity of the lesser trochanter [9].

All patients were subjected to preoperative supracondylar femoral skin traction following routine radiographic examination upon admission to emergency room.

The patients were kept in traction until their conditions were stabilized and they were fit for surgery. Delay in surgery ranged from 2 to 10 days. All patients were followed-up in the clinic to monitor clinical and radiological progress until union.

**Surgical technique:**

All the operations were performed on standard traction table. In all cases an image intensifier was used to assess the fracture alignment and the progress of fixation. It was accomplished using standard instrumentation and standard dynamic hip screw (DHS) implants. After the fracture was manipulated and satisfactory alignment was achieved, through minimal proximal incision, guide wire and compression screw were inserted into the femoral neck. With the barrel facing the surgeon, the plate was introduced from proximal to distal, beneath the muscle and over the peristeum, without stripping the surrounding soft tissues of the fracture. Then a distal minimal incision was done and the distal end of the plate was exposed. At this moment, the traction was released and plate was rotated to engage the barrel with the screw and traction was reapplied. The plate was fixed proximally and after checking the fracture alignment, length of extremity, axial and rotational alignment; it was fixed distally using 3 screws through a separate incision.

Regardless of the degree of comminution, no initial bone graft was used in any patient. The average operation time was about one hour and 45 minutes. All the patients received prophylactic antibiotics for two days and low molecular weight heparin until out of bed mobilization.

Postoperative management consisted of active exercise of the quadriceps and early ambulation unless associated with other injuries. Partial weight bearing was allowed as soon as the patient could tolerate it and full weight bearing was begun after 2.5 to 5 months based on the degree of comminution and progress of healing of the fracture.

Patients were evaluated at 3 to 6 weeks intervals until fracture union and at 3 to 5 months intervals thereafter. The activities of daily living and level of pain were assessed 1 year after fracture. Walking ability was evaluated according to the criteria of Parker and Palmer as follows:

<table>
<thead>
<tr>
<th>Walking ability</th>
<th>No difficulty</th>
<th>Alone with an assistive device</th>
<th>With help from another person</th>
<th>With no help</th>
</tr>
</thead>
<tbody>
<tr>
<td>Able to walk inside house</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Able to walk outside house</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Able to go shopping or visit family</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>0</td>
</tr>
</tbody>
</table>

* The maximum possible score is 9 points [10].
Pain was scored as absent when no painkillers were used, mild when painkillers were used occasionally, moderate when they were used regularly, or severe when pain was difficult to treat by oral painkillers or when narcotic analgesics were used regularly.

Results

The mean follow-up period was 40 months (range: 30-50 months). Twelve patients (40%) were Winquest type 1, and 18 (60%) were Winquest type 2 fractures. The patients were hospitalized for an average of 20 days (range: 15-30 days). Union was achieved in all of the fractures after a mean of 6.2 months (range: 4-10 months) without additional procedures.

Bone union was defined radiologically as the visualization of bridging callus on 3 planes and clinically as painless full weight bearing. Full weight bearing was delayed for 4 months in all patients.

Mobility was scored as 9 points in 20 patients (66.6%) and 6 points in 10 patients (33.3%) 1 year after fractures.

At the same time, Pain was absent in 18 (60%), mild in 6 (20%), and moderate in 6 (20%).

Two patients (6.6%) had superficial wound infection and were treated with parental antibiotics for 1 week.

There was no significant varus or valgus malunion but 2 patients (6.6%) were shortened by about 2cm and no one had significant rotational malalignment as determined by clinical examination.

In all cases there is no difference between the range of motion of the hip and ankle joints of the injured limb and healthy one measured at the last follow-up.

Discussion

Fixation of the comminuted subtrochanteric fractures presents a challenging problem for orthopedic surgeon [11,12]. No single treatment option has generally been accepted as the method of choice. The fracture must be fixed with sufficient strength to allow early mobilization, and at the same time, to maintain good vascularity of the fragments, leaving the soft tissues and fracture hematoma undisturbed to optimize bone healing potential [13].

In the past, meticulous anatomical reduction and bone grafting, in addition to plating, was recommended, frequently resulting in extensive devascularization of fragments and high risk of infection and nonunion [11,14].

The use of a long plate applied biologically through the lateral side better strengthens the lateral cortex against tensile forces and decreases the risk of fixation failure [14].

The good results, obtained with minimally invasive percutaneous plating could be explained by rapid fracture healing due to preserved blood supply [15]. Kinast C et al., compared the treatment options for subtrochanteric fractures with direct and indirect reduction, used condylar blade plate for both groups. In the direct reduction group, 16.6% of patients had non union and 20.8% had infection problem. Thus, fewer complication and better healing time was reported in the indirect reduction cases [16]. Siebenrock et al. and Krettec et al., reported their results after biological fixation of comminuted subtrochanteric femoral fractures. They found that union was achieved in 4-5 months in general and there were no complication regarding union and infection [1,8].

Intramedullary nails have been considered the technique of choice for fixation of simple type subtrochanteric femoral fractures throughout the literature. However, various problems have been met in intramedullary nail applications in comminuted fractures. Intraoperative complications included error in the entry point of the nail resulting in malalignment, fracture of the trochanter major, varus deformity, peroneal nerve paralysis, shaft fracture during surgery, perforation in the femoral neck or knee joint and fixation device breakage. Postoperative complications included delayed union [17].

Bergman et al., observed that five cases out of 131 cases of comminuted subtrochanteric femoral fractures treated by intramedullary nailing had non union & all of the fractures were unstable, had a posteromedial butterfly fragment. Nail breakage and varus deformity were among the complications encountered [18].

The average length of hospital stay in our series was 20 days (average: 15-30 days). Cemil et al., in his study reported a length of stay about 14 days [13]. Long hospital stay in our study can be explained by multiplicity of injuries in 12 patients. All fractures in this study had united within average period of 6.2 months without additional procedures. Two patients had limb shortening that was not significant. Only Two cases had superficial infec-
tion but it was treated with preventive therapy. There was no significant varus or valgus malunion or rotational malalignment. Therefore, biological fixation of comminuted subtrochanteric femoral fracture of femur by using DHS and a bridge plate achieves good satisfactory results. No case developed limitation of hip or knee movements postoperatively. Similar observations were recorded by Chrisovitsions et al., he did not report any valgus malunion or any rotation mal-alignment in a study on a series of 20 cases of comminuted subtrochanteric fractures femur treated with the same manner [11].

**Conclusion:**

Biological fixation of comminuted subtrochanteric fractures of the femur by using bridge plating & dynamic hip screws (DHS) is a useful method of treatment, which gives good results without major complications.

**References**


