

Outcome of Locking Compression Plate in Supracondylar Fracture of Distal Femur by Minimally Invasive Plate Osteosynthesis

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ABSTRACT

Background: The introduction of locking compression plate (LCP) based on the internal fixator principle has brought a dramatic change in the management of supracondylar fractures of distal femur. These fractures can be best managed with LCP by utilizing a MIPO technique.

Aim: To evaluate the radiological union of minimally invasive plate osteosynthesis (MIPO) for distal femoral fractures in 65 patients.

Methods: A total of 65 consecutive patients (45 male and 20 female) with closed supracondylar fractures of distal femur Muller Type-A were treated by distal locking plate using the MIPO technique. The parameter utilized was the radiological union according to the hammer et al classification of fracture healing on 2nd week interval up to 6 months.

Results: There were 45(69.22%) male and 20(30.78%) female in the study. Mean age of patients was 32.37 ± 7.86 years. 100% patients did not achieved radiological union at 2nd, 4th and 8th week follow up. 10.77% patients had achieved uncertain level of union and 89.23% patients were not achieved union level at 8th week. 6.15% patients were achieved level of union and 12(18.46%) patients achieved uncertain level of union at 12th week follow-up. 13.85% patients were achieved level of union and 83.07% patients achieved uncertain level of union at 16th week follow-up. 63(96.9%) patients were achieved level of union at 20th week and 100% patients achieved union level at 24th and 36th week follow-up. Difference between post operative union at 20th week follow up with respect to 16th, 24th and 36th week was found to be statistically significant as p-value < 0.05. No patient developed deep infection, malunion or nonunion.

Conclusion: MIPO using a LCP achieves favourable biological fixation for distal femoral fractures with few complications. Bone grafting is not needed even in cases of metaphyseal comminution.

Keywords: Distal Locking Plate, Muller Type-A, Supracondylar Fracture, Distal Femur,

INTRODUCTION

Distal femoral fractures are associated with high energy trauma in young age group and osteoporotic bones in the elderly¹. Supracondylar fracture is known as type A1 subgroup of extra-articular fractures of distal femoral fractures². Supracondylar fractures may also be associated with fractures of the tibial plateau or shaft additional, injuries like fracture to the acetabulum, the femoral neck, and the femoral shaft and ligamentus injury to the knee³.

The supracondylar fractures of femur are difficult to treat as comminution and displacement of the distal fragment, axial alignment can often be regained with traction, but the alignment is hard to maintain. Metaphyseal comminution is a challenge to conventional plate fixation. Supracondylar fracture of distal femur is managed with locking compression plate (LCP) based on the internal fixator principle by utilizing a MIPPO technique, for the restoration of

length, rotational, and axial alignment to avoid long-term morbidity and to achieved anatomic articular reduction, stable fixation, gentle soft tissue handling and early mobilization. The locking compression plate (LCP) forms a fixed angle construct and enables placement of the plate without any contact to the bone^{4,5,6,7}.

It can therefore be used in metaphyseal comminution. The pull-out strength of locking screws is substantially higher than that of conventional screws, and it is difficult for one screw to pull out or fail unless all adjacent screws do so^{4-6, 8-10}. This enables a better hold in osteoporotic bones. The preservation of osseous viability using indirect reduction methods has led to an increase in fracture union rates without the need for supplemental bone grafting procedures. We evaluated treatment outcomes of MIPO for distal femoral fractures in 65 patients.

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METHODS

This descriptive case series included 65 consecutive patients presented with closed supracondylar fractures of distal femur Muller Type-A, both male and female, aged 20-50 years were selected from Orthopedic Emergency Room, Mayo Hospital and Lahore General Hospital, Pakistan from 1st February 2013 to 30th September 2013.

The diagnosis was made among patients who present with symptoms of pain and swelling over the knee joint after trauma or fall. All patients within 24 to 48 hours of injury with supracondylar fracture of distal femur, Muller type –A were included. Patient with previous surgery of same limb, open fractures, polytrauma, pathological fractures and fractures extending into articular surfaces were excluded.

The below-knee skin traction was applied until the patients were operated in the next available list in main operation theater. Pre-op antibiotics (Injection Cefazoline 1G I/V x stat was given at the time of induction as prophylaxis. The spinal, epidural or general anesthesia was given. Tourniquet was also applied around the thigh. Maximum time for tourniquet application was no more than 90 min. The reduction was done under fluoroscopy.

All the patients received treatment with locking compression plate fixation. Monoaxial, pre-contoured, stainless steel LCPs of the same make were used. Under fluoroscopic guidance, a longitudinal incision was made over the lateral aspect of the distal femur at the level of the intercondylar notch. The tensor fascialata was split along the direction of its fibers. A submuscular tunnel was created using an osteotome. Fracture was reduced under image intensifier guidance. Following reduction, appropriate-sized plates (with 6 to 12 holes) were slid in a distal-to-proximal direction over the lateral aspect of the distal femur. The length of the plate was determined intra-operatively after reduction. At least 3 screw holes were beyond the proximal extent of the fracture, and distally the plate was not extended beyond the joint line. For proximal fixation, 2, 3, and 4 locking screws were used. For distal fixation, at least 3 metaphyseal locking screws were used.

A small incision over the proximal portion of the plate enabled reduction of the fracture and placement of compression screws/locking screws as necessary¹¹. Under fluoroscopic guidance, the incision was made over the lateral aspect of the thigh at the level of the proximal screw holes. The tensor fascia lata and vastus lateralis were split in the direction of their fibers. This proximal incision was used to check the approximation of plate to bone. Postoperatively, the operated limb was kept elevated on a splint with the knee in 10° to 15° of flexion.

Active hip and knee mobilization and static quadriceps exercises were allowed at postoperative day 1. Full weight bearing was not permitted until consolidation of the fracture site.

The radiological union (assessed according to the Hammer et al classification of fracture healing) was noted on subsequent follow up visits. Plain radiographs were taken to know the bony union. The patients were assessed for the outcome parameters i.e. normal weight bearing. All the information was collected on a specially designed Performa. The patients were discharged next day after surgery. The follow up of the patients was done at 2nd week interval up to 6 months.

Statistical analysis: All the collected data was entered into SPSS version 20 and analyzed. Quantitative data like age (in years), time of union (in days) and range of motion for knee and hip was presented as means ± standard deviations. Qualitative data like demographics (sex; male or female) and bony union (yes or no) was presented with frequency and percentages. Paired sample t test was applied to compare the post operative quantitative assessments i.e., (range of motion) while for qualitative i.e., (union) chi-square test was used. P-value ≤0.05 was considered as significant. All tests applied were two tailed.

RESULTS

Mean age of patients was 32.37±7.86 years. There were 45(69.22%) male and 20(30.78%) female in the study. At 2nd week follow up all patients presented with grade V radiological union that is no callus formation. At 8th week follow up 7(10.77%) patients presented with Grade-IV radiological union (no bridging of fracture line and 58 (89.23%) patients were presented with grade-V radiological union i.e. no callus formation. At 12th week follow up 4(6.15%) patients presented with Grade II Radiological union i.e. Massive bone trabeculae crossing fracture line, 12(18.46%) patients were presented with grade III radiological union i.e. apparent Bridging fracture Line and 49(75.39%) patient presented with Grade IV radiological union i.e., Trace No bridging of fracture line

At 16th week follow up 9(13.85%) patients presented with Grade II Radiological union i.e. Massive bone trabeculae crossing fracture line, 54(83.07%) patients were presented with grade III radiological union i.e. apparent Bridging fracture Line and 2(3.08%) patient presented with Grade IV radiological union i.e., Trace No bridging of fracture line while difference between post operative union at 2nd, 8th, 16th weeks were found to be insignificant as p-value > 0.05.

At 20th week follow up 5(7.69%) patients presented with Grade I Radiological union and 58 (89.23%) patients presented with grade II radiological union and 2(3.08%) patients presented with Grade III. While at 26th and 32nd week all patients had Grade-I radiological union as per formation of homogenous bone structure. Difference between post operative union at 20th week follow up with respect to 16th, 24th and 36th week was found to be statistically significant as p-value < 0.05.

DISCUSSION

According to the results time to union was achieved in 16 weeks post operative only 14.07% patients achieved radiological union grade-II. At 20th week post operative 97.2% patients had achieved radiological union grade-I & II while at 24th and 36th week all patients had grade-I radiological union i.e., homogenous bone structure was achieved respectively.

Very few studies have worked on the LCP with the use of MIPO for treating supracondylar fracture of distal femur. However the few studies who had addressed this technique showed good functional and promising outcome as well as early recovery from the injury. The use of LCP in supracondylar fracture of distal femur seems to be associated with a good union and range of motion at knee and hip joint. LCP is definitely helpful in Muller type-A fractures which were earlier associated with poor results when other implants were used. The use of LCP in these conditions results in improved outcomes.

Our results are comparable with the previous literature by Nayak¹² evaluated treatment outcomes of minimally invasive plate osteosynthesis for distal femoral fractures in 31 patients, found 93.54% patients had good or excellent outcomes with radiological union grade-I & II and the mean time to union was achieved in 3.7 (range, 2.8–4.6) months. None of the patients had patient had angular or rotational deformity of >10°.

Sirbu¹³ et al analyzed fractures of the distal femur (type A2-A3/AO) treated by MIPO technique, using a plate, accomplished that MIPO technique is safe and has the biological advantage of a faster rate of union (grade I) as excellent in 15 cases (60%), grade II as satisfactory in 9 cases (36%) and grade IV and V as unsatisfactory in one case (4%), with low complication rate with a mean healed time of 11.4 weeks.

Chandrab¹⁴ et al assessed the outcome of locking compression plate in the management of distal femur fractures. Results showed mean time to union was achieved in 16.8 weeks as initiated

excellent (85-100) in 84% of the patients radiological union grade-I and good (70-84) in 16% of the patients radiological union grade-II. Our study showed similar results compare to the Nayak¹² and Chandrab¹⁴ et al studies.

CONCLUSION

The MIPO technique combined with distal femur locking plates appears to be useful and safe for treating supracondylar fracture of distal femur in terms of union at knee and hip joint as all patients treated with this technique had achieved favorable radiological union after 16th week follow-up. We had no data concerning co-morbidities and osteoporosis, which may have a significant effect on the union of elderly patients.

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