

Treatment of Fracture Shaft of Femur Using Locking Compression Plate in Adolescents: A Prospective Study.

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Abstract:

Background: There are different modalities of treatment of fracture shaft of femur in adolescents. The optimal treatment is much debated due to the peculiar skeletal age distribution in adolescents.

Objective: To evaluate the outcome and complications of fracture shaft of femur using locking compression plate osteosynthesis in adolescents (10-18 years).

Materials and methods: The study was conducted at Regional Institute of Medical Sciences, Imphal, Manipur, India. This is a prospective study in which 30 adolescents patients (10 to 18 years) with femoral shaft fractures were operated using locking compression plate between October 2014 to August 2016. Outcomes were evaluated using clinical assessment, radiological assessment and functional assessment by Schmits criteria.

Result: Clinical union was achieved in 29 (96.7%) and the mean time for union was 14.7 weeks. Overall complications were seen in 4 patients (13.3%) which were superficial infection in 2 patients (6.6%), deep infection in 1 patient (3.3%) and delayed union in 1 patient (3.3%).

Keyword: fracture shaft of femur, adolescents, locking compression plate, osteosynthesis.

I. Introduction

Femoral shaft fractures, including subtrochanteric and supracondylar fractures, represent approximately 1.6% of all bony injuries in children and adolescence. The male to female ratio of femoral fracture is 2.6:1 with a bimodal distribution. The first peak occurs in early childhood and the second in mid-adolescence. Although femoral shaft fractures are dramatic and disabling injuries, both to the patient and the family, most unite rapidly without significant complications or sequelae. Not many years ago, traction and casting were standard treatment for all femoral shaft fractures in children, and femoral fractures ranked high in duration of hospitalization for a single diagnosis. More recently, a variety of therapeutic alternatives, such as external fixation, compression or submuscular plating, and flexible or locked intramedullary nailing, have become available, decreasing impairment, increasing convenience, and decreasing cost of care. An increasingly aggressive approach to femoral shaft fractures appears to be continuing. It is important to note that treatment of pediatric femur fractures encompass the newborn to skeletally mature adolescent. Numerous treatment options are possible and should be tailored to each patient's case.¹Treatment: Treatment Options for Femoral Shaft Fractures in Children and Adolescents is given in the table below:¹

Table 1: Treatment options for femoral shaft fracture in children and adolescents.

Age	Treatment
Birth to 24 months	Pavlik harness (newborn to 6 months) Immediate spica cast Traction spica cast
24 months to 5 years	Immediate spica cast Traction spica cast External fixation (rare) Flexible intramedullary rod (rare)
5 years 11 years	Traction spica cast Flexible intramedullary rod Compression plate External fixation
12 years to maturity	Flexible intramedullary rod Compression plate Locked intramedullary rod External fixation

II. Aims And Objects

To evaluate the outcome and complications of fracture shaft of femur using locking compression plate osteosynthesis in adolescents (10-18 years).

III. Materials And Methods

The study was conducted at Department of orthopaedics, RIMS, Imphal, Manipur. This was a prospective study in which adolescents patients between the age group of 10 to 18 years irrespective of sex with femoral shaft fractures conducted between October 2014 to august 2016. The inclusion criteria were closed fractures of the shaft of femur irrespective of comminution, open fracture type 1 (Gustilo and Anderson), where as the exclusion criteria were patients who were lost to follow up, patients with physical and mental inability to co-operate, seriously mentally ill, patients who were not fit for general or regional anaesthesia, open fracture type 2 onwards. Patients were selected through simple random sampling with random number assigned and selected. Outcome variables were assessed by using clinical assessment, radiological assessment, and functional assessment using Sanders Criteria. Complications were defined as any infection (deep or superficial) non-union or delayed union, malalignment and limb length discrepancy operation was carried out using lateral approach of the thigh, open reduction and internal fixation with appropriately chosen locking compression plate and self tapping locking head screws, wounds were closed in routine fashion. Active movements of the limb were started and continued from immediate post operative day.

IV. Results

The mean age of the patients were 16.1 years with highest number of patients in 17 years age group (46.7%) followed by 18 years (20%) and 6.7 each in 15 and 16 years age group respectively. Majority of the patients were males with 66.7%. Road traffic accidents for majority of the injuries with 53.3 % respectively followed by self fall (26.7%) and fall from height (20%). The pattern of fractures were transverse (43.3%), oblique (36.7), spiral (10%) and comminuted (10%) with 60% involvement of the right femur. The mean time interval between trauma and surgery were 5.5 days (range 2 to 7 days). Almost all patients (96.7%) were operated under spinal anaesthesia. The mean operating time was 86.3 minutes (range 60 to 120). The average blood loss was 156 ml. Twenty six (86.7%) patients stayed in hospital for 18 days, 2 patients (6.7%) for 2 days and another 2 patients (6.7%) for thirty days. Sixty percent of the patients went into union at 10 to 12 weeks, 33% of the patients went into union at 12 to 18 weeks, 3.3% in 18 to 24 weeks and 3.3 % in 24 to 36 weeks. Full weight bearing was possible for 70% at 10 to 12 weeks 20% at 12 to 18 weeks.6.7% at 18 to 24 weeks and 3.3 % at 24 to 46 weeks. Almost all (93.3%) the patients achieved full range of movements. There was no limb length discrepancy in any patients. Union was achieved in 96.7% and one patient (3.3%) had a delayed union for which bone grafting was done. Functional assessment using Sanders' criteria were excellent in 76.6%, good in 16.7 % and fair in 6.7 %. Overall 4(13.3%) patients had complications which were superficial infection in 2 patients (6.6%), deep infection in 1 patient (3.3%). And delayed union in 1 patient (3.3%).



Fig 1: showing fracture shaft of femur and united fracture shaft of femur with implant in situ



Fig 2: showing full range of movement of adjoining joints and full weight bearing

V. Discussion

In the present study 19.9% were in the age group 10 to 14 and 81.1% were in the age group of 15 to 18 years. The mean age being 16.1 years. Ramseier LE et al⁴ in their study assessing 190 patients found the mean of age to be 13.2 years (range 11 to 18 years). May C et al¹⁶ in their study found mean of age as 10.2 years. Out of the total of 30 patients, there were 20 male (66.7%) and 10 girls (33.3%) in our study. Hammad A³ studied total of 15 patients of which 12 (80%) were boys and 3 (20%) were girls. Sakia KC et al¹² studied 22 patients of which 18 (82%) were boys and 4 (18%) were girls. Lee YHD²¹ studied 63 patients of which 42 (66.7%) were boys and 21 (33.3%) were girls. In the present study majority of the injury (16 patients, 53.3%) was due to road traffic accident (RTA) related, followed by self fall (8 patients, 26.7%) and fall from height (6 patients, 20%). Mahesh DV⁵ in his study of 10 patients, 7 (70%) of the injury was due to RTA and 3(30%) of the injury were due to fall. Ibrahim M et al¹⁸ studied a total of 10 patients of which all were injured due to fall from height (100%). The patterns of fracture were mostly transverse with 13 patients (43%), followed by oblique in 11 patients (36.7%), spiral in 3 patients (10%) and comminuted fractures in 3 (10%). Ramseier LE et al⁴ in their study found the fracture were transverse in 97 patients (50%), oblique in 47 patients (24%), spiral in 50 patients. Lee YHD²¹ et al in their study found transverse fracture in 35 patients (56%), oblique in 15 patients (24%) and spiral in 13 patients (20 %). In our study 18 (60%) patients had right femur fracture and 12 (40%) had left femur involvement. However there was no case involving bilateral femur. Ramseier LE⁴ in their study found that 56 % were right femur fracture, 41% were left femur fracture and 2.5% were bilaterally involved.

The time interval between trauma and surgery was 2 to 7 days with an average of 5.5 days. Hamad A³ in his study found that the time interval between trauma and surgery was 1 to 9 days with an average of 3 days. Mahesh DV⁵ in his study found it to be between 3 to 15 days with an average of 9 days. Twenty nine (96.7%) patients were operated under spinal anaesthesia and only one (3.3) patient was operated under general anaesthesia, where as Gupta MN et al²⁰ in their study all the operative cases were operated under general anaesthesia. The mean operating time was 86.3 minutes (range 60 to 120). Hammad A³ found the operating time ranges from 60 to 80 minutes and Mahesh DV⁵ found that the operating time ranges from 90 to 180 minutes. The average blood loss was 156.6 ml in the present study where as in Saha P et al¹⁹ study the average blood loss was 80 and 70 ml for TENS nailing and enders nailing respectively. There were 2 (6.6%) patients who had superficial infection and 1 (3.3%) patient who had a deep infection which was similar to the study by Hierholzer C et al¹³, superficial infection in 4 (3.47%) patients and deep infection in 1 (1.73%) patients. The mean hospital stay in the present study was 18.07 with a range of 7 to 30 days. Sakia KC et al¹² in their research found the mean duration of hospital stay to be 9.8 days where as Singh R et al¹⁴ found it to be 12.3 days. Using the assessment criteria in the study, 23 (76.7%) had excellent outcome, 5 (16.7%) had good outcome, and 2 (6.7%) had fair outcome. Sanders R et al¹⁵ reported 5 (55.6%) patients had good outcome and 4 (44.4%) had a fair outcome. Clinical union was achieved in 29 (96.7%) patients where as 1 (3.3%) patient went into delayed union which was managed with bone grafting and replating, which finally unite. The findings were similar to that of the result found by Hadequist et al⁴ and Kregor PJ¹¹ where all the fracture were found united. The mean time for union was 14.7 weeks. This is comparable to study by Ramsier LE et al⁴ where it took mean time of 13.1 weeks for the cases to go to union. The mean time for full weight bearing was 13.3 weeks. In the study by Hadequist D et al², the mean time for full weight bearing was 10.7 weeks. Full range of movement of was achieved in 28 patients (93.3%) and there was moderate restriction in 2 patients (6.7%). In the study Hammad A³ 13 patients gained full range of motion of the knee but 2 patients had lost last 20 degrees of flexion. Where as in the studies by May C et al¹⁶ and Saha P¹⁹ all patient regained full range of motion. There was no limb length discrepancy detected in the present study. Hadequist et al² and Ibrahim M et al¹⁸ in their respective study found no limb length discrepancy similarly. Four patients (13.3%) had complications which were superficial infection in 2 patients (6.6 %), deep infection in 1 patient (3.3 %) and delayed union in 1 patient (3.3%). The findings were similar to the study conducted by Hierholzer C et al¹³ and Hadequist et al².

VI. Conclusion

Based on our study findings, we concluded that locking compression plating is an alternative method in the treatment of fracture shaft of femur in adolescents between the age group of 10 to 18 years. It provides a good mechanical and biological fixation. It acts as an internally placed external fixator and a weight sharing device to the fractured femoral shaft there by helping in the union process of the fracture in good position, alignment and length as desired. It also helps in the early return of the joints function. It gives excellent outcome when performed properly with proper selection of patients.

It is simple, easy, rapid, reliable and effective method for management of femoral shaft fracture between the age group of 10 to 18 years, with shorter operative time, lesser blood loss, no radiations, shorter hospital stay and reasonable time to bony healing.

Use of LCP in adolescents for definitive fixation is a reliable physical protective treatment method. It also eliminates the possibility of osteonecrosis of the femoral head as compared with other intramedullary devices. It can be used in any fracture pattern regardless of comminutions.

This research results provides new evidence of alternative treatment method for femoral shaft fracture in a resource poor region where instruments, Operation theatre and intraoperative imaging technology are at scarce. Hence surgeons may choose this treatment modality for results comparable and safer to that of other treatments available presently.

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