

Outcome of Comminuted Femoral Shaft Fractures by Locking Plate-A Hospital Based Study

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Abstract

Introduction: Maximum number of fractures often result from high-energy wounds like car accidents in young and mainly often from falls in elderly populations. Locking plates are fracture fixation expedients with threaded screw holes, in which screws allow to strand to the plate and work as a fixed-angle convenience. The study aims to investigate the outcome of locking compression plates in comminuted femoral diaphyseal fractures. **Methods:** An experimental clinical trial was carried out in the Department of Orthopedic Surgery, Bangabandhu Sheikh Mujib Medical University (BSMMU), Dhaka, Bangladesh from July 2010 to June 2012. A total number of 9 patients (N=9) following purposive sampling were enrolled in this study. Data were collected using the predesigned semi-structured questionnaire. Verbal consent was taken before recruiting the study population. Completed data forms were reviewed, edited, and processed for computer data entry. The data analysis was performed using Statistical Package for the Social Sciences (SPSS) Version 16.0.0. **Result:** Among the study population (N=9), most of the patients (3,33.3%) were between 20-29 years old, and two patients (2, 22.2) were 60 to 69 years old with a mean age of 42.7 years old. Around two-thirds of the study population (6,66.7%) were male. The majority of the study population (6,66.7%) caused the injury due to a motor vehicle accident, one patient (1,11.1%) got injured due to falling from a height, four patients (4,44.4%) right side was involved & left side was involved in rest of the patients (5,55.6%), upper tibial skeletal traction treatment was done in six patients (6,66.7%) previously & kabiraji treatment was done in three patients (3,33.3%) respectively. Based on the outcome after six months, the result was excellent, good in four patients (4,44.4%) and fair in one patient (1,11.1%). **Conclusion:** Femoral shaft fractures are a common orthopaedic injury causing severe trauma in the ageing population. Femoral shaft fractures are often related to other co-morbidities necessitating life support valuation. Among the numerous treatment measures, locking plate and intramedullary nailing are suitable with outstanding results

Keywords: Femoral Shaft Fracture, Locking Plate, Femur etc.

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INTRODUCTION

A femoral shaft fracture is a disruption of the thigh bone between the hip and the knee. Most of the fractures frequently result from high-energy wounds like car accidents in young and mainly often from falls in elderly populations [1]. Among several types of fractures; spiral or transverse is the most common fracture, then comminuted and open are the 2nd most types of fractures [2]. Injuries along with severe complications related to midshaft femur fractures in the adult can be life-threatening and may include haemorrhage, internal organ injury, wound infection, fat

embolism, and adult respiratory distress syndrome [4, 5]. Foremost physical impairment because of potential fracture shortening, and prolonged immobilization of the extremity with casting or traction leads in femoral shaft fractures [4]. The frequent procedure to demonstrate a fracture is with X-rays, which provide strong images of bone and it can also show the type of fracture and exact location [6]. Currently, intramedullary nailing is one of the approachable methods applied by most surgeons for treating femoral shaft fractures & throughout this method, a specified designed metal bar is inserted into the canal of the

femur to keep the bar in its position [7]. Locking plates are fracture fixation devices with threaded screw holes, in which screws allow to strand to the plate and work as a fixed-angle expedient. These plates may have multiple holes that let the placement of both locking and traditional non-locking screws [8]. Locking plates of diaphyseal fractures need incidental decrease with cautious extraperiosteal dissection to attain axial and rotational alignment rather than anatomical reduction, with the slight use of screws and by applying an extended plate to achieve absolute stability [9]. The locking plates and the locking intramedullary nails have both been extensively applied in clinical practice, but there are some unsolved implant-related problems. Such as; a locking plate may require more surgical time and convoluted maximum blood loss, which can raise perioperative complications [10]. The stability of the construct depends on mainly the rigidity of the plate compared to the high frictional forces at the plate interface. This indicates minimal interference with the periosteal circulation, lessening stress sheltering and enhancing the mechanical performance of implants [11]. Locking plates are preferred over conventional stainless steel dynamic compression plates to treat distinct types of fractures. Another benefit of locking plates is the freedom of applying epicortical screws which evades injury and minimizes the surgical time and is also an easy & effective method in case of femoral shaft fractures [12]. This present study intends to identify the outcome of locking compression plates in comminuted femoral diaphyseal fractures.

Objectives

General Objective:

1. To identify the outcome of locking compression plate in comminuted femoral diaphyseal fracture.

Specific Objectives:

1. To assess fracture healing time by follow up both clinically & radiologically.
2. To evaluate post-operative complications of locking compression plate in comminuted femoral diaphyseal fracture.
3. To monitor any sort of disability or activity of daily living.
4. To determine the range of motion in hip and knee joints in affected limbs.

METHODS

An experimental clinical trial was carried out in the Department of Orthopedic Surgery, Bangabandhu Sheikh Mujib Medical University (BSMMU), Dhaka, Bangladesh from July 2010 to June 2012. A total number of 9 patients (N=9) (Because of the non-availability of the patients) following a purposive sampling technique maintaining inclusion and exclusion criteria were enrolled in the study. A questionnaire was prepared by the researcher considering key variables like age, sex, presenting complaints, clinical findings,

associated medical conditions, investigations, perioperative findings and outcome of the surgery which was verified by the guide. Ethical clearance was taken from the ethical committee of the Bangabandhu Sheikh Mujib Medical University (BSMMU) Dhaka, Bangladesh. The information was kept confidential only to be used for the study purpose.

Inclusion Criteria:

- Patients having comminuted femoral diaphyseal fracture of 20 to 70 years age group of both sexes
- Two to 28 weeks old fracture shaft of the femur
- Any site-diaphyseal fractures of femoral shaft between 5 cm distal to lesser trochanter and 9 cm proximal to the joint line of knee.
- Fracture femoral shaft with or without neurovascular involvement.
- Failure of previous surgery.

Exclusion Criteria:

- Recent fracture (less than 1 week), Pathological fracture
- Infected non-union
- Fracture in children
- Persistence of wound or open fractures
- Unstable medical illness

Data analysis:

The study coordinators performed random checks to verify data collection processes. Completed data forms were reviewed, edited, and processed for computer data entry. Frequencies, percentages, and cross-tabulations were used for descriptive analysis. The data analysis was performed using Statistical Package for the Social Sciences (SPSS) Version 16.0 for Windows (SPSS Inc., Chicago, Illinois, USA). The significance level of 0.05 was considered for all tests.

RESULT

Among the study population (N=9), most of the patients (3,33.3%) were between 20-29 years old, and two patients (2,22.2) were 60 to 69 years old with a mean age of 42.7 years old. Around two-thirds of the study population (6,66.7%) were male. Around one-fifth of the study population (2,22.2%) were farmers, around one-fifth of the study population (2,22.2%) were businessmen, and three patients (3,33.3%) were housewives (Table 1). The majority of the study population (6,66.7%) caused the injury was due to motor vehicle accidents, one patient (1,11.1%) got injured due to a fall from height, four patients (4,44.4%) right side involved & left side was involved in rest of the patients (5,55.6%), upper tibial skeletal traction treatment was done in six patients (6,66.7%) previously & Kabiraji treatment was done in three patients (3,33.3%) respectively (Table 2). The minimum age of injuries was eight days and the maximum age of

injuries was twenty days, the minimum post-hospital stay was nine days and maximum post-hospital stay was fifteen days, the minimum time taken for the union was ten days and the maximum time taken for the union was twenty days with the mean was $14.4 \pm SD$, $10.5 \pm SD$, $13.7 \pm SD$ days respectively (Table 3). Based on postoperative complications, no pain was observed in four patients (4,44.4%), three patients (3,33.3%) had mild complications. Most of the patients (6,66.7%) walked without support, and three patients (3,33.3%) needed a stick to walk. During extensions, hip flexion of the affected limb was found at 90° or above in most of the patients (7,77.8%) with the mean being $94.5 \pm SD$, and hip abduction of the affected limb was found at 30°

or above in seven patients (7,77.8%), with the mean was $34.6 \pm SD$. Functional outcome was excellent in six patients (6,66.7%) & was good in around one-third of the patient (3,33.3%) (Table 4). Limb length discrepancy was more than 1 cm, found in one patient (1,11.1%), & between 1 to 3cm , found in one patient (1,11.1%) (Table 5). The Middle third was affected in most of the patients, the distal third was affected in around one-third of the patient (3,33.3%) with a mean was $2.2 \pm SD$ (Table 6). Based on outcome after six months, result was excellent in four patients (4,44.4%), good in four patients (4,44.4%) and fair in one patient (1,11.1%) (Table 7).

Table 1: Distribution of the study population based on Characteristics (N=9)

Characteristics	Locking compression plate
Age	(N,%)
20-29	3,33.3%
30-39	2,22.2%
40-49	1,11.1%
50-59	1,11.1%
60-69	2,22.2%
Mean \pmSD	42.7\pmSD
Sex	
Male	6,66.7%
Female	3,33.3%
Occupation	
Farmer	2,22.2%
Businessman	2,22.2%
House wife	3,33.3%
Labourer	1,11.1%
Service holder	1,11.1%

Table 2: Distribution of the study population based on Description (N=9)

Descriptions	(N,%)
Causes of injury	
Motor vehicle accident	6,66.7%
Fall from height	1,11.1%
Assault	1,11.1%
Blunt Trauma (others)	1,11.1%
Side involvement	
Right	4,44.4%
Left	5,55.6%
Previous treatment	
Upper tibial skeletal traction	6,66.7%
Others (by kabiraz)	3,33.3%

Table 3: Distribution of the study population based on Treatment method (N=9)

Treatment Method	No of Cases	Age of Injuries(days)		Mean in days
		Minimum	Maximum	
Locking compression plate	9	8	20	$14.4 \pm SD$
Post-operative hospital stay	9	9	15	$10.5 \pm SD$
Time taken for union (Weeks)	9	10	20	$13.7 \pm SD$

Table 4: Distribution of the study population based on Postoperative complications (N=9)

Complications	(N,%)
Post-operative complication (Pain severity score)	
No pain	4,44.4%
Mild	3,33.3%
Moderate	2,22.2%
Severe	0
Mean±SD	11.6±SD
Activity of daily living	
Walk without support	6,66.7%
Walk with a stick	3,33.3%
Hip flexion of the affected limb	
90° or above	7,77.8%
70-90°	2,22.2%
Mean±SD	94.5±SD
Hip abduction of the affected limb	
30° or above	7,77.8%
20-30°	1,11.1%
10-20°	1,11.1%
Mean±SD	34.67±SD
Knee flexion of affected limb	
90° or above	9,100.0%
Mean±SD	106.6±SD
Functional outcome	
Excellent	6,66.7%
Good	3,33.3%

Table 4: Distribution of the study population based on Limb length discrepancy (N=9)

Limb length discrepancy	(N,%)
None	7,77.8%
<1 cm	1,11.1%
1-3 cm	1,11.1%
Mean ± SD	2.2±SD

Table 5: Distribution of the study population based on fracture site (N=9)

Descriptions	(N,%)
Proximal Third	1,11.1%
Middle Third	5,55.6%
Distal Third	3,33.3%

Table 6: Distribution of the study population based on outcome after 6 months (N=9)

Descriptions	(N,%)
Excellent	4,44.4%
Good	4,44.4%
Fair	1,11.1%

DISCUSSION

Femoral shaft fractures are a common orthopaedic injury occurring in high-energy trauma or low-energy trauma in the elderly [13]. The suitable management of length-unsound femoral injuries is still a controversial issue. External fixation is an easy or simple technique to maintain anatomic alignment for a femur fracture, however, complications are moderately common, such as increased time to union, re-fracture, and pin tract contagion [14].

In this study, the mean age was 42.7±11.5 years with a range from 22 – 69 years. Another prospective randomized trial suggested that the mean age of the patients who met the inclusion criteria was 53.8 years old [15]. A comparative study found that 58 patients were below the age of 55 years and 47 above the age of 55 years [16]. Another distinct study found that the mean age of the patients was 32.5 years old [17].

In this study, 6(66.7%) cases were male and 3(33.3%) cases were female. Similarly, other studies

found males predominant [18, 19]. Other articles depicted that male participants were 55.5% and 87.5% respectively [20, 21]

Males are the major working force of our society and thus more consistently exposed to the external environment, which probably accounts for this predominance. On the other hand, another published article found that female predominance [22].

In this study, motor vehicle accidents were found to be the more common causative factor of the injury accounting for 6(66.7%). Motor vehicle accident was the commonest cause of fracture found in 81.25% of cases with the 2nd most common cause being fall from height (12.5%), described in another study [23].

In this study right side involvement was seen in 04 (44.4%) cases and left side in 05 (55.6%) cases. An analysis found 66.76% of the cases with a left femoral fracture in their series [24].

In this study, it was observed that 66.7% of cases received upper tibial skeletal traction. Others (kibiraz) treatment received previously 3(33.3%). Another article found that the use of skeletal traction in orthopaedic trauma was lacking [25].

In this series, the time elapsed between injury and surgery varied from 8 to 20 days. The mean duration of time elapsed between injury and surgery was 14.4 ± 4.6 days. Regarding the fracture it was observed that 1(11.1%) case was in the proximal third, 7(77.8%) cases in the middle third and 1(11.1%) case in the distal third fracture. Another source reported that the mean union time was 15.45 weeks after treatment of femoral shaft fractures by locking plate [26].

Another study found that knee mobilization was started before 4 weeks in 40% of patients till 13-16 weeks & and the range was 2 to 14 weeks [26]. An article reported that the mean union time was $16.38 (\pm 2.78)$ weeks which varied from 13-24 weeks [20]. Another study depicted the treatment of nonunion femoral shaft fracture by locking a compression plate with a union rate of 100%. [27]. Another article found that the union rates were 95.0%, 98.0%, and 100.0% respectively [28].

In this present analysis, all 9 cases of femoral shaft fracture both clinically and radio-logically were found to unite. The union rate was 100%. Another article reported that the union rate was 100%, and femoral shaft fracture was treated by a locking compression plate [20].

Regarding the postoperative complications, it was observed in this current study that no complications occurred. About the postoperative pain, it was observed in this current study that 4(44.4%) had no pain, mild

pain 03(33.3%) cases and moderate pain 2(22.2%) cases at the end of 24 weeks (6 months follow up). Regarding the post-operative activity of daily living walking, 6(66.7%) walk without support, and 03 (33.3%) patients walk with a stick. In this study, 06 (66.7%) cases had excellent functional outcomes and 03 (33.3%) cases had a good outcomes. An author reported that 5 (31.25%) cases had excellent functional outcomes, 9 (56.25%) cases had good, 1 (6.25%) case had fair outcomes and 1 (6.25%) case had poor outcomes. The outcome was analyzed based on functional outcome, time was taken for union, infection and sciatic nerve palsy, in this study, excellent result in 04 (44.4) cases, good in 04 (44.4%) cases, fair in 01 (11.1%) case. In this current study, a satisfactory result was in 8 (88.9%) cases and unsatisfactory in 01 (11.1%) cases. Another study depicted that, 31.25% of patients had an excellent result, 56.25% of patients had a good outcome and 6.25% of patients had an either fair or poor result, & overall a satisfactory result was found in 87.5% of cases and unsatisfactory in 12.5% of cases [23]. A similar study found that the overall outcome score was excellent in 47.6%, good in 19%, fair in 28.6% and poor in 4.8% of patients [29].

Poor bone quality is common in adults. It causes technical exertion and complications in the operative treatment of fractures. Plates are used to lessen the gap between bone at the fracture site and provide inflexible fixation. Locking plates are mainly useful for patients with osteoporosis and fractures with several sections [30].

CONCLUSION

Femoral shaft fractures are a common orthopaedic injury causing serious trauma in the elderly population. Femoral shaft fractures are often related to other co-morbidities requiring life support assessment. Among the several treatment procedures, locking plate and intramedullary nailing are suitable with outstanding results. Locking compression plates should be useful in conditions in which intramedullary nailing cannot be used and they should be applied in comminuted femoral shaft fractures, osteoporosis fractures and intra-articular fractures conditions.

Limitations of the study

A small sample size due to the unavailability of the patients' longer duration of postoperative follow-up makes it difficult to obtain necessary data from the patient. The study and the follow-up period were short in comparison with other series. Due to a lack of logistic support and surgical expertise close interlocking nailing was not done.

RECOMMENDATIONS

A similar type of study should be performed on a large sample size. Follow-up of similar type of study should be done over in prolonging period. Adequate facilities and expertise should be available.

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