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Assessment of Functional Outcomes of Femur Treatment Using Modified Thoresen's Criteria in Terms of Malalignment, Knee Motion, and Associated Symptoms

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Abstract **Original Research Article**

Comminuted fracture shaft of femur is increasing day by day due to Severe violence by road traffic accident and fall from height in modern civilization and intramedullary nailing sometimes technically not feasible in this type of fracture (AO type-32B3, 32C). Reaming may aggravate the comminution and displaced the comminuted fragments and sometimes difficult in segmental fracture involving metaphyseal region. To assessment of functional outcomes of femur treatment using modified Thoresen's Criteria in terms of malalignment, knee motion, and associated symptoms. The study was carried out at the Dhaka medical college Hospital over a period of one and half year from September, 2016 to February, 2018. The total number of patients were 24. The mean age of the patients was 33.1±9.9 and the lowest and highest ages were 20-60 years respectively. Age of most (58%) of the patients were below 30 years. Three quarter of the patients (75%) were male and 37.5% were day labourer. Most of the patients (81%) were presented with right sided comminuted femoral shaft fracture. All of the injuries were closed type. In terms of type of fracture, AO type 32C2 were predominant (50%).AO type 32B3, 32C1,32C3 were 12.5%, 12.5% and 25%. Associated injury was found 6 patients that was 25% among 24 patients. Total duration of surgery <90 minute was taken in 41.5% and >90 minutes taken in 58.5% with mean deviation was 105 minutes and standard deviation was 19 minutes. 16 patients (67%) exhibited wide range of knee motion (>120), four (17%) patients slightly restricted knee motion (110-120), two patients (8%) moderately restricted knee motion (90-110) and two patients (8%) extremely restricted knee motion (<90). Evaluation of outcome by The Modified Thoresen's criteria (1985) 6 months after intervention demonstrated that 29% of the patients had excellent outcome, 57% good outcome, 9.5% fair and 4.5% poor outcome. Assessment of Functional Outcomes of Femur Treatment Using Modified Thoresen's Criteria in Terms of Malalignment, Knee Motion, and Associated Symptoms in femoral shaft fracture with locking plate and screws demonstrated excellent to good results in majority cases. Two thirds of patient returned to routine pre injury activities without limitation. Respect to soft tissue by indirect reduction and MIPO technique during operation and early mobilization due to stable fixation improve final outcome.

Keywords: Functional Outcomes, Femur Treatment, Modified Thoresen's Criteria, Knee Motion.

INTRODUCTION

Comminuted fracture shaft of femur is increasing day by day due to Severe violence by road traffic accident and fall from height in modern civilization and intramedullary nailing sometimes technically not feasible in this type of fracture (AO type-32B3, 32C). Reaming may aggravate the comminution and displaced the comminuted fragments and sometimes difficult in segmental fracture involving metaphyseal region. Negotiation of the nail is also difficult in case of excessively narrow medullary canal. Most of the cases we use open technique for reduction which needs extensive surgical exposure, impairs vascularity in the fracture site increasing the chance of infection, non-union, delayed union. Fixation by DCP plates also has the similar problems of open surgical technique. Chewcharntanakit, et al., [1] in certain situations where intramedullary nail is technically not feasible [2-4] in the treatment of grossly comminuted femoral shaft fracture (AO type-32B3, 32C),

excessively narrow medullary canal. The operative treatment as it is associated with short hospital stay, rapid return of motion in joints, prompt return to walking and a relatively short total disability time. The goal of treatment of femoral shaft fracture are restoration of alignment, length and rotation, preservation of blood supply to aid union, prevention of infection, rehabilitation of the extremity and maximizing overall function of the limb [5,6]. As a result of technical advancement, minimally invasive plate osteosynthesis has gained popularity in biological fixation for comminuted femoral shaft fracture in recent years and has achieved satisfactory clinical outcome [1, 6-8]. In this technique fracture is reduced by using fracture table or femoral distractor. The plate is inserted through percutaneous approach with separate proximal and distal incisions. [1,4,8]. An elaborate history of the selected patient regarding the cause and mechanism of injury with duration were taken. After initial resuscitation by intravenous fluid, blood, nonsteroidal analgesics, antibiotics and tetanus prophylaxis in cases with associated injuries all cases were admitted into the ward. X-ray of the affected thigh including hip and knee had been taken with antero-posterior and lateral views. Skeletal traction by upper tibial pin was applied in all cases. Fractures of the shaft of the femur are common fractures encountered in orthopaedic practice. Because the femur is the largest bone of the body and one of the principal load bearing bones in the lower extremity, fractures can cause prolonged morbidity and extensive disability unless treatment is appropriate. The operative procedure is thus simplified the damaged to the fragment minimized and the fracture healing accelerated. However inadequate reduction, prolonged hospitalization, delayed ambulation with increased chance of pulmonary complications questioned this method of treatment. Finally, when compared with internal fixation, the cost of traction are higher due to prolonged times of hospitalization [9].

MATERIALS & METHODS

Type of Study: Prospective Interventional Study.

Period of Study: From September, 2016 to February, 2018 (18 Months).

Place of Study: Department of Orthopaedics & Traumatology, DMCH, Dhaka, Bangladesh.

Description of place of study: Dhaka medical college hospital is one of the largest tertiary level hospital in Bangladesh. Huge number of patients admitted in every year in orthopaedic department. Existing facilities, modern instruments and c- arm are suitable for management of orthopaedic patients.

Study Population: All patients with clinical and radiological evidence of comminuted fracture of shaft of femur admitted in hospitals for operation and strictly considering the inclusion and exclusion criteria.

Inclusion Criteria:

1. Age: >14 years.
2. Sex - both sex.
3. Comminuted fracture shaft of femur less than 3 weeks old associated with
   A. Closed fracture
   B. Severely comminuted fracture of shaft of femur (AO 32B3, 32C.
   C. Gustilo type 1 fracture.
   D. Ipsilateral femoral shaft and neck/ trochanter fracture
   E. Excessive narrow medullary canal
4. Cases were selected irrespective of sex, occupation, causes of injury

Exclusion criteria:

1. Age < 14 years.
2. Infected fracture.
3. Open fracture with Gustilo 2 and 3 injury
4. Pathological fracture
5. Patients who not given consent and leave follow up at least 6 month.
6. Surgically unfit patients.

Determination of sample size: Sample size was calculated by using the following formula.

$$n = \frac{z^2pq}{d^2}$$

So Sample size is 78. Due to time limitations and financial constraint only 24 cases were selected during study period.

Classification of fracture shaft of femur (AO Classification): In the A0 system, the femoral shaft is defined as the area between the inferior margin of the lesser trochanter and the upper border of a square containing the distal end of femur. For descriptive purposes the shaft is divided into proximal, middle and distal thirds. The proximal third is sometimes referred to as the subtrochanteric zone (McRae, 2006). In the AO system of classification 3 is for the femur, 2 for the diaphysis, A for simple fracture for wedge and C for complex fracture.

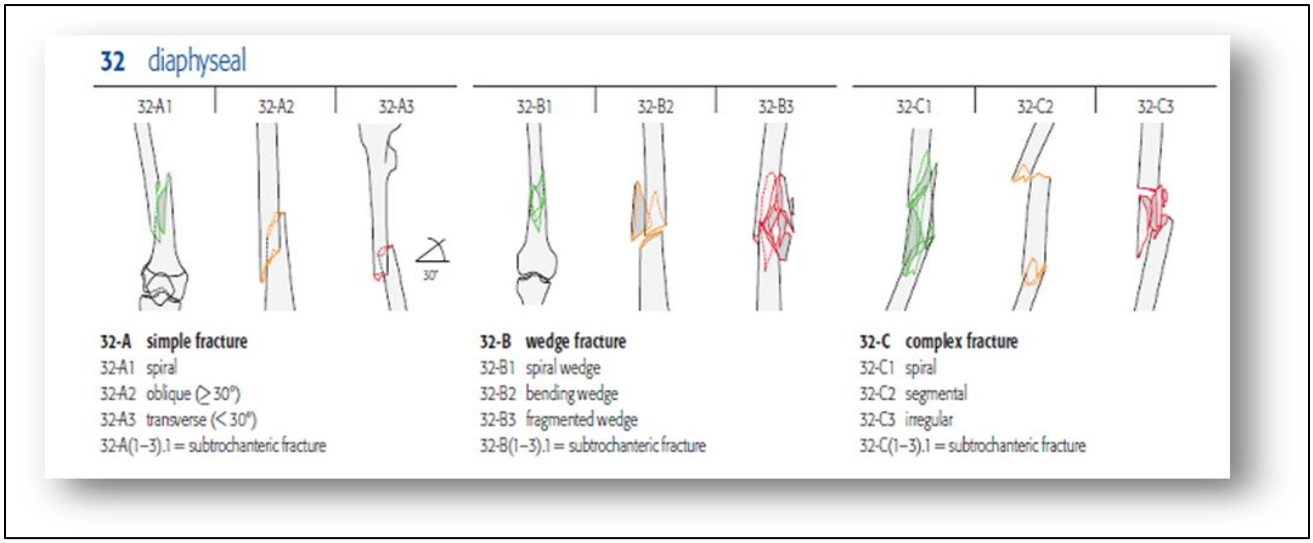

Figure 1: AO Classification of diaphyseal (Shaft femur) fracture.

Data management and Analysis: Collected data were compiled and presented in the form of tables and charts based on key variables and functional assessment scoring. The analysis of different variables was done according to standard statistical analysis. The results were analyzed by using statistical package for social science (SPSS) version 20.0.

RESULTS

Total 24 patients of comminuted fracture shaft of femur were selected according to the inclusion and exclusion criteria. Mean±SD =33.1 ±9.9 years, Standard Deviation=9.9 Range= 20 to 60 years. Out of 24 fourteen patients (58%) were up to 30 years old, 25% were within 30-40 years and 17% were above 40 years old. The mean age of the patients were 33 years and the lowest and highest ages were 20 and 60 years. Three quarter (75%) of the patients were male18 in number and the rest were female 06 in number (25%) giving a male female ratio=3:1 n = 24 total number of patient. Out of 24 nineteen patients (83.3%) were presented with right sided comminuted fracture shaft of femur and five patients (16.7%) with left sided fracture.

Table I: Distribution of patients by type of fracture (n=24)

Type of fracture	Frequency	Percentage
AO type 32B3	3	12.5
AO type 32C1	3	12.5
AO type 32C2	12	50
AO type 32C3	6	25

Out of 24 patients, in terms of type of fracture, AO type 32C2 were predominant (50%), AO type 32C2 were 25 and AO type 32B3 and AO type C2C1 each were of 12.5% (Table-I).

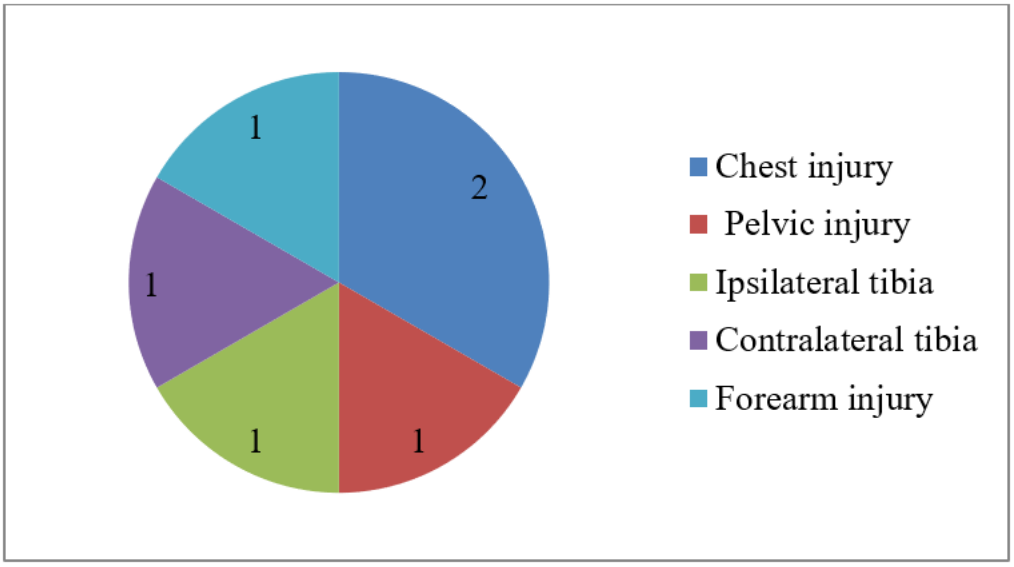

Fig-2: Associated injuries (n=24)

Pie chart-1 showing associated injury among 24 patients 6 patients (25%) had associated other injury (Chest injury- two patients (rib fracture), Pelvic injury (Superior rami fracture, ipsilateral tibia fracture, contralateral tibia fracture and forearm bone fracture in each one in number.

Table- II: Duration of surgery

Time (In minutes)		
<90	10	41.5
>90	14	58.5
Mean + SD	105 +19 (minutes)	
Ranges	75 to 140 minutes	

Table II showed duration of surgery <90 minute in 41.5 % (10 patients) and >90 minutes in 58.5% cases (14 patients). Mean time was 105 minutes with standard deviation was 19 minutes.

Table III: Incidence of complication (n=24)

Complications	Frequency	Percentage
Deformity	02	8.25
Muscle wasting	02	8.25
Moderate to severe	04	16.5
Knee movement restrictions		
Shortening	01	4.25
Infection	00	00

In terms of complications 4 patients (16.5%) developed moderate to severe knee movement restrictions, 2 patients (8.25%) develop deformity (recurvatum 5˚), and Muscle wasting of 2 cm and limb shortening of 1.5 cm for 1 patient (4.25%) (Table-III).

Table IV: Outcome of patients based on range of knee motion (n=24)

Range of knee motion (degree)	Frequency	Percentage
>120	16	67
110-120	04	17
90-110	02	8
<90	025	8

Objective evaluation of knee motion revealed that 16 patients (67%) exhibited normal range of knee motion (>120), 4 patients (17%) mildly restricted knee motion (110-120), and moderately restricted knee motion and severely restricted knee motion were shown in each two patients (8%) (Table-IV).

Table V: Outcome of patients based on the Modified Thoresen's criteria (1985) (n=21)

The Modified Thoresen's Criteria (1985)	Frequency	Frequency
Excellent	06	29
Good	12	57
Fair	02	9.5
Poor	01	4.5

According to The Modified Thoresen's criteria (1985) excellent and good outcome are considered as satisfactory and fair and poor outcome are considered as unsatisfactory. Evaluation of outcome by The Modified Thoresen's criteria (1985) 6 months after intervention demonstrated that 29% of the patients had excellent outcome, 57% good outcome, 9.5% fair and 4.5% poor outcome (Table-V).

DISCUSSION

Then this method of biological fixation was evolved. The LCP offers improved fixation stability for comminuted fractures. The additional stability per screw compared with that of DCP enhances the application of MIPO for fracture stabilization. It is better option in young patient with comminuted fracture shaft of femur sustained high energy trauma [3]. Total number of case 24.in the study of Heitemeyer and Hierholzer, et al., [8] total number of cases were 29 and in the study of Wenda et al., [10] total number of cases 17. For better evaluation of outcome study with adequate sample size is required. It is also mandatory to compare it with other established modalities of treatment. Duration of hospital stay was high in this study (21.3±5.5 days). Measures should be taken to

reduce this for reduction the cost of money and ultimately burden to society. In this study, the age of the patients was between 20-60 years, mean age being 33.1±9.9 years. Almost similar findings were reported by one study where the mean age of the patients were 32 years Bicimoglu et al., [11]. Among 24 patients 18(75%) were male and 6(25%) were female. Male female ratio 3:1. In the study of Apivatthakakul and Chiewcharntanakit, et al., [1] there were 29 males and 5 females, another study was under taken with 15 male and 2 female patients Necmioglu et al., [12] Nineteen patients (81%) were affected on the right side and five (19%) patients were affected on the left side. In the study of Apivatthakakul and Chiewcharntanakit, et al., [1] associated injury was found 40%, in this series associated injury was 25% that demonstrated high velocity injury and affect functional outcome due to delay of early mobilization. Regarding configuration of fracture in this study most of the fracture was AO type 32C 75% followed by 32B3 (25%). In study of Ksyali et al., [4] showed similar study. Average hospital study was 21.3 days with the range of 13-36 days. Total duration of surgery <90 minutes was in 41.5% cases and >90 minutes in 58.5% case, mean time of total duration of surgery was 105 minutes with standard deviation 19 minutes that is similar in study of Dr. Rahul N. Bade et al., [13]. In future care should be taken to reduce the injury operation interval and total hospital stay. This may aid better outcome. Regarding range of knee motion 16 patients (67%) had wide range of knee motion (>120˚) four patients (17%) had slight restriction (110-120), two (8%) had moderate 90110 and two (8%) had severe restriction of knee motion (<90). Early operation and immediate postoperative knee bending exercise are the main stay to preserve adequate knee motion. In the final follow up, satisfactory result (Excellent and good) was 86% of which 29% excellent and 57% goods results. The results obtained in this series were comparable to results obtained in previous series (table-4.9.8). The functional results were affected by associated injuries (25%) as weight bearing was delayed.

CONCLUSION

Assessment of Functional Outcomes of Femur Treatment Using Modified Thoresen's Criteria in Terms of Malalignment, Knee Motion, and Associated Symptoms in femoral shaft fracture with locking plate and screws demonstrated excellent to good results in majority cases. Two thirds of patient returned to routine pre injury activities without limitation. Respect to soft tissue by indirect reduction and MIPO technique during operation and early mobilization due to stable fixation improve final outcome.

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