Section: Orthopaedics

Original Research Article

EVALUATION OF OUTCOME OF FRACTURE NECK OF FEMUR TREATED BY BIPLANE DOUBLE SUPPORTED SCREW FIXATION (BDSF) AT OUR TERTIARY CARE CENTER

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ABSTRACT

Background: Fracture of neck of femur is a very common injury in patients more than 50 years of age. A number of controversies exist in relation to the cannulated screw fixation for fracture neck of femur like number of screws to be used, position of screws in the head and neck and the configuration of screws to be used. The aim of this study to evaluate & analyze the functional outcomes of Fracture Neck of Femur treated by biplaner double supported screw fixation, viz efficacy of fixation of fracture neck of femur & time taking to union of fracture neck of femur.

Materials and Methods: The present study was conducted at a tertiary care center, on patients admitted in the department of Orthopaedics between September 2019 to March 2021, mostly during covid pandemic. The functional outcome assessment using Harris hip score after radiological union, ambulation, walking distance, ability to climb stairs, ability to trim nails, ability to sit on chairs for long times. Later after 6 weeks active hip mobilization exercises and partial weight bearing was allowed after reviewing follow up x rays of the patient. Later full weight bearing allowed after radiological union was seen.

Results: Out of 27 patients,14 patients were followed up regularly every month till 8-10 months and then every two months. The majority of the patients were in the limit of 51-60 yrs (33.3%) with mean age of 56.5 yrs. The youngest was 14 yrs and the oldest was 66 years and mode of injury for majority of cases was RTA 11 (40.7%) followed by fall from height 7 (25.9%), fall on ground 6 (22.2%) and fall from stairs 3 (11.1%). Harris Hip Score evaluated at maximum follow-up of our patients averaged 90.13 with the maximum score being 96 and the minimum score being 66. Overall, 19 patients (45%) achieved excellent result, 2 patients (30%) achieved good result, 1 patient (15%) achieved fair result and 5 patients (10%) achieved poor result. 75% of the patients achieved either excellent or good result.

Conclusion: The study conducted above concludes that by providing additional cortical support, the novel BDSF method enhances femoral neck fracture fixation strength, reveals excellent clinical outcomes and is a valid alternative to other treatment methods.

Keywords: Fracture Neck of Femur, Harris Hip Score, BDSF, Radiological Outcome, Functional Outcome.

INTRODUCTION

Fracture of neck of femur is a very common injury in patients more than 50 years of age. According to the present scenario, arthroplasty should be reserved for patients more than 80 years, while in patients age less than 65 sustaining fracture neck of femur, hip preservation should be attempted.[1]

A number of controversies exist in relation to the cannulated screw fixation for fracture neck of femur like number of screws to be used, position of screws in the head and neck and the configuration of screws to be used.[2-9] While some authors have suggested central screw placement,[10] others have suggested peripheral screw placement.[9-11] Some authors believe that the screws should be placed parallel to each other,[11-13] while others believe that screws should be divergent in lateral view.[9-14]

The most commonly used methods by surgeons worldwide to fix fracture neck of femur is three parallel screws inserted in inverted triangle configuration.[15,16]

The initial inter-fragmentary compression of these constructs is frequently insufficient and therefore unable to ensure stability in osteoporotic bone. When cannulated screws are used to fix a femoral neck fracture with osteoporosis, intraoperative inter-fragmentary compression alone may not ensure adequate stability during the healing process because it could soon be lost on fracture impaction.[17] To overcome this problem of osteoporosis and for those patients in which arthroplasty is contraindicated, Filipov devised a method of Biplane Double Supported Screw Fixation (BDSF) in which the two screws are laid in two planes, which makes it possible for the entry points of middle and distal screws to be placed in distal solid cortex of proximal diaphysis, the distal screw is placed in the dorsal oblique plane while the middle and proximal screws are inserted in ventral oblique plane.

MATERIALS AND METHODS

This prospective study was conducted at a tertiary care center, on patients admitted in the department of Orthopaedics between September 2019 to March 2021, mostly during covid pandemic.

All the patients admitted in SNMC & Hospital with fracture neck of femur medically fit for surgery during the study period and who informed consent for the study and fulfilling the inclusion criteria of adults aged 18-60 years, having fresh fracture (fracture up-to 3 weeks) were included in the study.

Patients having associated comorbidities such as any type of coagulopathy, uncontrolled diabetes mellitus, pelvic injury, abdominal injury etc., were excluded. Patients having old fracture neck of femur (>3 weeks), pathological fracture, open or infected fracture, fracture with open epiphysis nad I/L shaft femur & I/T fracture were also excluded in our study.

Assessment and Radiological Evaluation: Patients with neck of femur fracture usually present after a fall with swelling and pain Over hip and thigh. On physical examination hip is tender on palpation with crepitus. Patient can't bear weight on affected limb. Swelling and neurovascular status must be checked. To access the fracture, both Antero-posterior and lateral views of hip and thigh are necessary. Other associated injuries of thigh and knee joint must be checked.

Assessment of Functional Outcome Based on:

Modified Harris hip score- it has the following components:

1. Pain- 44 points maximum
2. Gait (walking maximum distance) (33 points maximum)
3. Functional activity (14 points maximum)
4. Absence of deformity (4 points maximum)
5. Range of motion (5 points maximum)

The outcome variable used was Harris Hip Score (modified) which is an objective outcome measure frequently used for the evaluation of patients following a hip surgery. The max possible score is 100. It takes into account of parameters like pain, function, gait and absence of deformity.18 A score of 90-100 was considered as excellent while scores of 70-90 and <70 were considered as fair and poor, respectively.

Preoperative Protocol: All study patients were put on either derotation boot or non-adhesive skin traction. Adequate medical management of associated co-morbid conditions like Diabetes Mellitus, Systemic Hypertension, Chronic Obstructive Pulmonary Disease and Heart Diseases were initialized to optimize patient's fitness for anesthesia. Preoperatively CT scan were taken for all patients to find out posterior wall comminution.

Approach: A straight lateral incision, starting at the level of lower border of greater trochanter, with distal length of 6 to 10 cm. First, we lay the guide wire for the distal cannulated screw. Its entry point is at 5-7 cm distally from the lower border of the greater trochanter, directed at an angle of 150 – 165°, with inclination to posterior, proximal, so that after it touches the "calcar" tangentially, the wire goes into the posterior third of femoral head. The middle guiding wire is placed second with entry point 2 to 4 cm proximally from the distal wire at an angle of 135-1400 and is inclined to anteriorproximal, so that after it touches onto the calcar tangentially, the wire goes into the anterior one third of the femoral head. Then we place the proximal guiding wire, with its entry point at 1.5-2 cm proximally from the middle wire and parallel to it. Then reaming was done and then cannulated cancellous screws application was done. The middle and proximal screws are placed first because they are perpendicular to the fracture surface. Finally, the distal screw is placed. Later wound closure was done in layers and followed by sterile dressing.

Postoperative Protocol: Passive knee mobilization exercises and quadriceps strengthening exercises were advised immediately on first post op day. Non-weight bearing for period was advised for 6 weeks from the day of surgery. Later after 6 weeks active hip mobilization exercises and partial weight bearing was allowed after reviewing follow up x rays of the patient. Later full weight bearing allowed after radiological union was seen.

Follow Up: Out of 27 patients,14 patients were followed up regularly every month till 8-10 months

and then every two months. The minimum follow-up in our study was 6 months and the maximum follow up was 12 months. During the follow up period, functional outcome was assessed using Harris hip score after radiological union, ambulation, walking distance, ability to climb stairs, ability to trim nails, ability to sit on chairs for long times.

RESULTS

Our study shows that majority of the patients were in the limit of 51-60 yrs (33.3%) with mean age of 56.5 yrs. The youngest was 14 yrs and the oldest was 66 years and mode of injury for majority of cases was RTA 11 (40.7%) followed by fall from height 7 (25.9%), fall on ground 6 (22.2%) and fall from stairs 3 (11.1%) [Table 1]. The majority of cases were transcervical type 16 (59.3%) following by subcapital 10 (37%) and basicervical 1 (3.7%) and in our study 18 patients (66.6%) present with 1-5 days, 8 patients presented within 6-10 days and 1 patient presented after 10 days (3.7%) of injury [Table 2].

In our study out of 27 patients, 22 (81.48%) were pain free, 5 (18.5%) patients had mild pain, and 2 (7.4%) patient had moderate pain and With regards to the ability to sit for a long duration it was found that 18 (80%) of the study patients were able to sit comfortably on a chair for upto one hour while 3 patients (20%) were not able to sit on a chair for more than half an hour at a stretch [Table 3].

20 patients (74.07%) were found to be ambulating without the help of any support and the remaining 3 patients (11.1%) needed some support in the form of a cane or walker for long walks and 20 (74.07%) of the study patients could walk an unlimited distance at 4 any given point of time while 2 patients (7.4%) could walk no more than 1000 meters at a time and 1 patients (3.7%) could only manage 500 meters at a time [Table 4].

On evaluation of the patient's ability to climb stairs, it was found that 19 patients (75%) were able to climb stairs without the use of any support or railing while the remaining 2 patients (15%) were able to do so with the support of the railing, 1 patient (10%) not able to climb and Our patients did not have the habit of using shoes and socks, their ability to trim their toe nails was used as a parameter for evaluation. It was found that 19 patients (85%) were able to trim their toe nails without any difficulty while 2 patients (10%) found it difficult to do so, 1 patient (5%) not able to do [Table 5].

Harris Hip Score evaluated at maximum follow-up of our patients averaged 90.13 with the maximum score being 96 and the minimum score being 66. Overall, 19 patients (45%) achieved excellent result, 2 patients (30%) achieved good result, 1 patient (15%) achieved fair result and 5 patients (10%) achieved poor result. 75% of the patients achieved either excellent or good result [Table 6]. In our study we had 4 cases of non-union, 1 case of surgical site infection [Table 7].

Table 1: Age distribution and distribution of cases according to mode of injury of patients studied

Age (yrs)	Number	%	Mode of injury	Number	%
11-20	4	14.8	Fall on ground	6	20.2
21-30	3	11.1	RTA	11	40.7
31-50	8	29.6	Fall from height	7	25.9
51-70	12	44.4	Fall from stairs	3	11.1
Total	27	100	TOTAL	27	100

Table 2: Distribution of cases according to type of fracture and timing of presentation

Type of Fracture	Number	%	Time of Presentation	Number	%
Transcervical	16	59.3	1-5 Days	18	66.6
Subcapital	10	37.0	6-10 Days	8	29.6
Basicervical	1	3.7	>10 Days	1	3.7
Total	27	100.0	TOTAL	27	100.0

Table 3: Distribution of cases according to pain on walking

Pain	Number	%	Duration	Number	%
Pain free	22	81.48	>1/2 hr	3	20
Mild	5	18.5	Up to1 hr	18	80
Moderate/Severe	2	7.4	-	-	-

Table 4: Distribution of cases according to ambulation

Ambulation	Number	%	Distance	Number	%
Without Help	20	74.04	Unlimited	20	74.04
With Support of cane Walker	3	11.1	<1km	2	7.4
-	-	-	<500 meters	1	3.7

Table 5: Distribution of cases according to ability to climb and trim nails

Climbing	Number	%	Ability to trim nails	Number	%
Able to climb	19	75	Able to trim	19	75
Support of railing	2	15	Difficult to trim	2	15
Not able to climb	1	10	Not able to trim	1	10

Table 6: Functional outcome grade according to modified Harris hip score

Grade	HHS	Number	%
Excellent	90-100	19	70.4
Good	80-89	2	7.4
Fair	70-79	1	3.7
Poor	<70	5	18.5

Table 7: Distribution of cases according to complication

Complication	Number	%
Nonunion	4	14.8
Nil	22	81.5
Surgical site infection	1	3.7
Total	27	100.0

DISCUSSION

Our study is focused on the clinical and radiological outcomes in neck of femur fracture fixation using the biplane double-supported screw fixation method described by Orlin Filipov,[17] which states that in respect of the fixation strength, the most original and effective is the distal screw—placed at obtuse angle and supported on a large area along the distal and posterior cortex of the femoral neck.

The period defined in the literature for occurrence of bone union after osteosynthesis of femoral neck fractures is usually within 3 months post operation, and all complications related to mechanical and/or biological deficiencies, called with the collective term non -union, occur within 6 months, including failure of fixation and pseudoarthrosis. Therefore, we assumed a minimal follow-up period of 12 months as sufficient to demonstrate occurrence of bone union and other associated complications.[17]

It is reported that the quality of reduction is the single most important factor within the surgeon's control influencing the rate of healing /complications.[19,20] Besides the quality of reduction, a biomechanical stable fixation like BDSF method can prevent or reduce the failure rate. We understood that the placement of guide wire for the distal screw at steeper angle of 150-160 degree was a tedious task, which can be mastered over time and experience.

In our study, we analyzed the following parameters especially: age, fracture type according to Garden and Pauwel, time of presentation, timing of surgery and degree of posterior wall comminution with functional outcome of the patient.

In a study by Karl Stoffel et al,[21] in addition to evaluation of clinical results by HHS, important parameters namely: age, gender, relief of pain (good, poor), mobility (good, poor) and putting on socks and shoes skills (easy, difficult), degree of fracture displacement, incidence of AVN were analyzed. He concluded that among all 207 patients, the Harris hip score was 86.2 ± 18.9 (range 10–100), with no significant difference between genders. In Karl Stoffel et al,[21] study, Harris hip score for patients aged below 65 years was similar to the age group 66–70 years, but significantly higher than in all other age groups.

In our study we found that patient in younger age group preferably below 60 yrs had good functional outcome compared to patients above 60 years. With regarding to time of presentation and functional outcome, 7 patients who presented within 24 hrs of injury and operated earlier had good functional outcome with average Harris hip score of 89.5.

Our study shows that patients with Pauwels type 3 (22.72%), and garden type 4 (36%) had low Harris hip score in comparison to other types. Moreover among 3 patients (15%) with posterior wall comminution, 2 patients had good functional outcome, while 1 patient had poor functional outcome.

Karl Stoffel et al,[21] highlighted that 88.4% were pain free, 83.6% had good mobility, 80.7% of patient were able to put shoes and socks with ease.37 In our study out of 27 patients, 81.4% were pain free, 74.07% had good mobility, 85% of patients were able to trim nails with ease. Incidence of non-union in operated patients in Orlin Filipov study was 6 out of 83 patients (7.2%).[22]

In our study the incidence of non-union was 4 out of 27 cases (14.8%). The rate of AVN seems to be similar worldwide and is slightly influenced by the applied fixation method and type of fracture pattern, rating about 9% (range 6–19%) for undisplaced and about 16% (range 9–32%) for displaced fractures.[21] Orlin filipov stated that the incidence of AVN in their study using this BDSF method is less (12.07%) when compared to conventional method of fixation (10-45%) quoted in the literature. In our follow up period of 1 yr there were no AVN in our patients.[17]

All the patients with the time of union of 3 months achieved excellent functional outcome. Other patients with longer union time achieved either good or fair functional outcome.

CONCLUSION

BDSF method was devised mainly to address that group of patients who have contraindications for arthroplasty and we have found this as an excellent method in terms of fracture consolidation and functional outcome. By providing additional cortical support, the novel BDSF method enhances femoral neck fracture fixation strength, reveals excellent clinical outcomes and is a valid alternative to other treatment methods.

Limitation: Due to covid-19 pandemic situation, only 27 patients were included in the study for given

time period. Therefore, a more generalized study is needed for an accurate comparison of outcome.

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