ASIAN JOURNAL OF PHARMACEUTICAL AND CLINICAL RESEARCH

INNOVARE ACADEMIC SCIENCES
Knowledge to Innovation

Vol 16, Issue 3, 2023

Online - 2455-3891
Print - 0974-2441

Research Article

MANAGEMENT OF NECK FEMUR FRACTURE IN ADULT BY MINI-DHS AND BIPLANE DOUBLE SUPPORTED SCREW FIXATION TECHNIQUE

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Received: 21 October 2022, Revised and Accepted: 13 December 2022

ABSTRACT

Objective: The aim of the study was to study the management of neck femur fracture in adult by mini-DHS and BDSF technique; an innovative procedure.

Methods: This study was conducted on 20 Patients with neck of femur fractures, who underwent mini DHS with 6.5 mm cc screw with biplane double supported screw fixation technique in the Department of Orthopaedics, Government Medical College and Associated Groups of Hospitals, Kota during year 2019–2021.

Results: Out of 20 cases, 14 are male and six are female and age-wise distribution <20 years, one patient 20–40 years, 11 patients and >40 years, eight patients. Mode of injury mainly road traffic accident, Average Harris hip score 91.35, 15 patients (75%) achieved excellent result, radiologically fracture union was seen in 19 patients (95%).

Conclusion: Although anatomical reduction is crucial, Mini DHS with 6.5 mm cc screw with BDSF-method ensures reliable fixation, early rehabilitation, and good functional outcome especially in adult.

Keywords: BDSF technique, Neck femur fracture, Mini-DHS.

 DOI: http://dx.doi.org/10.22159/ajpcr.2023v16i3.46659. Journal homepage: https://innovareacademics.in/journals/index.php/ajpcr

INTRODUCTION

Despite numerous advancements in modern orthopedics, neck of femur fractures continue to be one of the most difficult injuries to repair. Among all hip-related fractures, the femoral neck fracture is the most common. About 50% of these fractures are caused by it [1]. Only around 3% of all hip fractures in young adults are intra capsular femoral neck fractures [2].

Patients frequently suffer from multiple wounds, and 20% of the time there is also a femoral shaft fracture [3]. The CT scan could aid in the diagnosis because in clinical practice, conventional radiographs can miss up to 2–10% of femoral neck fractures [4]. MRI might lessen the likelihood of missing an injury [5]. Although it is generally agreed on in the literature that the treatment of these fractures should aim for anatomical reduction and stable internal fixation, the precise function of timing of operational intervention is less certain [6]. The fundamental objective of surgical care was the restoration of pre-injury function, which included ensuring the intact blood supply, anatomic reduction, effectively preventing avascular necrosis (AVN), and providing a stable fixation while preserving the bone stock [7].

There are several surgical approaches for treating femoral neck fractures; however, they differ depending on the patient's age and fracture type [8]. Internal fixation is the best option for femoral neck fractures that are not dislocated and in younger individuals. The hip function improves after healing, it is less invasive, and the femoral head can be preserved [9]. The screw-plate system and biplane double supported screw fixation technique produce a condition that is more stable for internal fixation with multiple cannulated screws or the use of Mini DHS [10].

Internal fixation is extremely challenging due to the aforementioned problems and the intricate three-dimensional geometry. Old internal fixation procedures have been shown to have a significant failure rate and nonunion. A methodical approach is needed to try to produce a hip that is stable yet movable without any pain. The best course of action for treating these fractures is still up for debate, and continuing research is being done to find it. Therefore, the purpose of our study was to provide evidence for the internal fixation management of femoral neck fractures.

Objective

The aim of the study was to study the management of neck femur fracture in adult by mini-DHS and BDSF technique.

METHODS

The Department of Orthopaedics, Government Medical College and Associated Groups of Hospitals, Kota, conducted a prospective study on 20 patients with neck of femur fractures who underwent mini DHS with 6.5 mm cc screw with biplane double supported screw fixation technique during the 2019–2021 academic year.

The trial would not go forward until the hospital's ethics committee has given its approval. Those who meet the inclusion requirements listed below will receive an invitation to take part in the study. All patients eager to participate in the trial will provide their informed consent.

Elderly patients with head injuries and vascular injuries, open fractures, severe intra-articular comminuted fractures, patients with medical comorbidities, unwilling participants, and associated with other fractures were excluded from the ongoing study. Close fracture neck of femur, Age >18 and<60 years, closed injuries, and consenting were included in the study.

A primary detailed history with the following information will be kept on file: Name, age, sex, date of injury, method of injury, residence

address, occupation, and any related injuries. Vital signs and the patient's general health were observed. Both genuine anteroposterior and 15* internal rotation X-rays were taken.

All cases were completed with spinal or epidural anesthesia as part of regional anesthesia. The Flynn procedure was utilized to reduce the fracture; to sustain reduction, the hip was internally rotated, gradually extended, then abducted. This causes the capsule's spiral fibers to constrict and "locks" the reduction. The implants used were Mini DHS 3–4 holes and 6.5 mm Cannulated Cancellous Screws with sizes ranging from 120 to 130 mm. Surgery was then carried out on all patients using the standard lateral approach of the hip on the fracture table.

After 6 months, follow-up should be done every 2 months. In our investigation, the minimum and maximum follow-up periods were 6 months and 24 months, respectively. The time of radiological union was documented. Using the Harris hip score (HHS) and WHO Quality of Life Index, the final evaluation and functional outcome were evaluated during the follow-up period.

RESULTS

In our study, majority of the patients were in the age group of 20–40 years with mean age of 30 years. The youngest was 18 years and the oldest was 51 years, male patients were 14 (70%), female patients were 6 (30%), 13 patients (65%) had fracture on right side while the remaining 7 (35%) had on the left side. The mode of injury was RTA in 12 patients, followed by slip and fall in six patients and fall from height in two patients. In our study, 16 patients (80%) presented within 24 h of injury, 2 patients (10%) presented within 24–72 h, 2 patients (10%) from 72 h to 1 week. most of the fractures were transcervical in 11 patients (55%), while 5 (25%) were basicervical, 4 (20%) were subcapital. Out of 20 patients, 5 patients had diabetes, 3 patients had hypertension, one patients had cardiac disease (Table 1).

As per garden type most of the patients (10 cases) sustained Type 3 garden, followed by Type 4 garden in five cases, then Type 2 in four cases, and Type 1 in one case. As per pauwels type, majority of fractures were pauwels Type 2 (50%) in 10 cases, followed by Type 1 (25%) in five cases, then Type 3 (25%) in five cases (Table 2).

Out of 20 patients, 17 (85%) were pain free, had mild limp or no limp, 16 patients (80%) were found to be ambulating without the help of any support, 15 patients (75%) were able to climb stairs without the use of any support or railing, 17 patients (85%) were able to trim their toe nails without any difficulty and were able to sit comfortably on a chair for up to 1 h (Table 3).

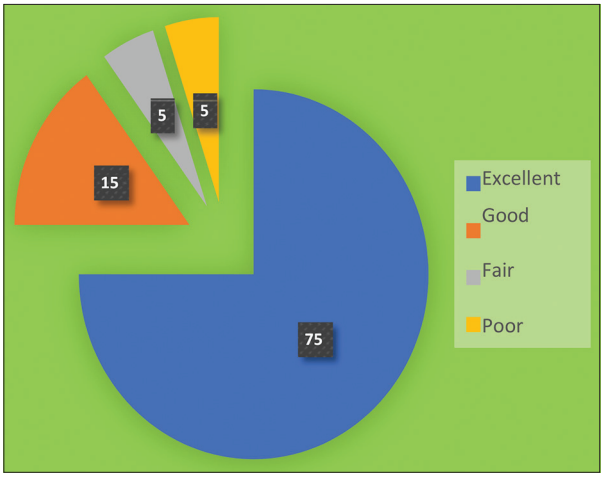
HHS evaluated at maximum follow-up of our patients averaged 91.35 with the maximum score being 97 and the minimum score being 62. Overall, 15 patients (75%) achieved excellent result, 3 patients (15%) achieved good result, 1 patient (5%) achieved fair result, and 1 patient (5%) achieved poor result. About 90% of the patients achieved either excellent or good result (Graph 1).

Radiological analysis

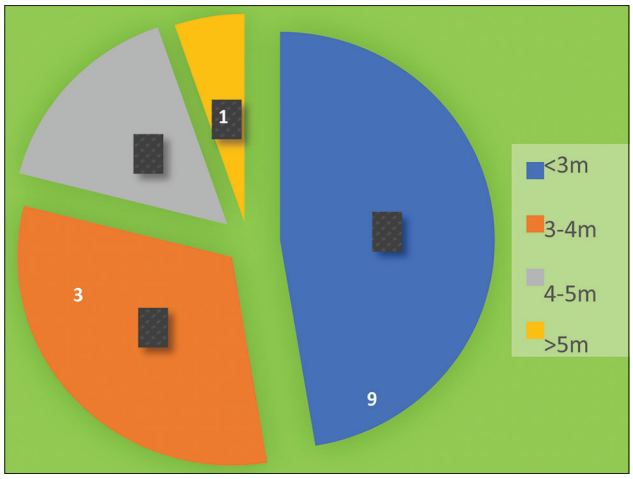
On analyzing the anteroposterior view X-ray of pelvis with hip in 15° of internal rotation, the radiological parameters such as fracture union, non-union changes, AVN in head, and arthritic changes in the joint were analyzed. Fracture union was seen in 19 patients and non-union in one patients. The average time of union was <3 months in 9 patients (47.36%), 3–4 months in 6 patients (31.57%), 4–5 months in 3 patients (15.78%), and in 1 patient (5.26%) union achieved at 5½ months. we had one case of fixation failure which later on resulted in non-union (Graph 2).

In our study we had 1 case of superficial wound infection, 2 cases of screw pull out which fall under minor complications.

Major complications like non-union of fracture were reported in 1 cases with poor functional outcome.



Graph 1: Harris hip score



Graph 2: Time of union

DISCUSSION

Our study focuses on the clinical and radiological outcomes in neck of femur fracture fixation using the biplane double-supported screw fixation method described by Filipov, who claims that the distal screw, which is placed at an obtuse angle and supported on a significant portion of the distal and posterior cortex of the femoral neck, is the most novel and effective in terms of fixation strength. In addition, Mini-DHS has medial cortical supporting points that distribute the weight-bearing load over roughly 50% of the length of the femoral neck cortex without concentrating stress in one location.

In addition, Filipov *et al.* performed a biomechanical cadaveric study in 2014 on eight fresh frozen and six embalmed human femoral pairs, demonstrating that the BDSF method of fixation is a more biomechanically stable fixation than the conventional method [11]. We conducted this study to offer our knowledge of the BDSF method of fixation.

The time frame specified in the literature for bone union following osteosynthesis of femoral neck fractures is typically within 3 months of surgery, and all complications related to mechanical and/or biological deficiencies, referred to as non-union, take place within 6 months, including failure of fixation and pseudoarthrosis. To demonstrate the occurrence of bone union and other associated complications, we assumed that a minimum follow-up period of 12 months would be sufficient [12].

Table 1: Age and sex profile of study subjects

Age	No. of patients	Percentage
<20	1	5
20–40	11	55
>40	8	40
Sex		
Male	14	60
Female	6	40

Table 2: Distribution of type of fracture among study subjects

Garden type of fracture	No. of patients	Percentage
Garden type 1	1	5
Garden type 2	4	20
Garden type 3	10	50
Garden type 4	5	25
Pauwels type of fractures		
Type 1	5	25
Type 2	10	50
Type 3	5	25

Table 3: Distribution of clinical features among study subjects

Pain	No. of patients	Percentage
No pain	17	85
Mild pain	2	10
Sever pain	1	5
GAIT		
No/mild limp	17	85
Moderate	2	10
Sever	1	5
Ambulation		
Without support	16	80
With support	4	20
Distance walked		
Unlimited	17	85
<1 km	2	10
<500 meters	1	5
Climbing stairs		
Without support	15	75
With support	4	20
Not able	1	5
Ability to trim nails		
With ease	17	85
With difficulty	2	10
Not able	1	5
Ability to sit on chair for long duration		
>1 h	17	85
<1/2 h	3	15

In 2017, Chen *et al*. [13] conducted a study using DHS fixation for a neck femur fracture and found that the HHS was 86.10% and the rate of comorbidities was 13.90%.

According to reports, the single most significant element under the surgeon's control influencing the rate of healing/complications is the quality of the reduction. A biomechanical stable fixation, such as mini DHS with BDSF method, can prevent or lower the failure rate in addition to the quality of reduction.

We recognized that positioning the guide wire for the cannulated cancellous screw at a steeper angle of 150–160° was a laborious task that could be mastered with practice and time.

In our study, we specifically looked at the following factors: Patient functional outcome, age, fracture type according to Garden and Pauwel, time of presentation, scheduling of surgery, and degree of posterior wall compromise.

In a study by Stoffel *et al*., key factors such as age, gender, pain relief (good, poor), mobility (good, poor), the ability to put on socks and shoes (easy and difficult), the degree of fracture displacement, and the incidence of AVN were examined in addition to the clinical results' evaluation by HHS. He came to the conclusion that there was no discernible gender difference in the HHS among all 207 patients, which was 86.2 18.9 (range 10–100). Patients with Garden III fractures had a considerably higher score than those with Garden IV fractures.

In addition, the HHS was considerably lower for individuals who reported poor versus good pain alleviation, poor versus good mobility, and difficult versus easy putting on socks and shoes [11].

In the study by Filipov *et al*., the HHS for patients under the age of 65 was comparable to that of patients between the ages of 66 and 70, but much higher than in all other age groups [12].

In our study, we discovered that patients in the younger age group preferably those under 40 years old had better functional outcomes than individuals over 40. In terms of timing of presentation and functional results, 16 patients who came within 24 h after the accident and underwent surgery sooner had good functional results with an average hip score of 89%.

According to our research, patients with Garden Type 4 (25%) and Pauwels Type 3 (20%) had lower HHS than those with other kinds. In addition, two of the three patients (15%) with posterior wall comminution had satisfactory functional outcomes, whereas the other patient had a poor functional outcome.

According to Filipov *et al*., 88.4% of patients reported no pain, 83.6% had good mobility, and 80.7% found it easy to put on their shoes and socks [11].

Out of 20 patients in our study, 85% were pain-free, 80% had good mobility, and 85% were able to easily trim their nails.

In one instance of fixation failure that was reported in our study, the screws were misplaced in one case, and there was a notable loss of posterior cortical support in the second, which ultimately led to nonunion and a subpar functional outcome.

In the Filipov research, the incidence of non-union occurred in six out of 83 patients (7.2%) [14].

One out of every 20 occurrences (about 5%) in our study involved a nonunion.

The prevalence of AVN is estimated to be around 9% (range 6–19%) for undisplaced fractures and around 16% (range 9–32%) for displaced fractures worldwide, with a slight influence from the applied fixation method and type of fracture pattern [11].

According to Filipov, as compared to the standard way of fixation (10–45%) mentioned in the literature, the incidence of AVN in their study employing this BDSF approach is lower (12.07%) [12]. There were no AVN in our patients over the course of the 2 years of follow-up.

The previous studies have not mentioned the likelihood of iatrogenic subtrochanteric fracture caused by the cannulated cancellous screw's precarious positioning. This may be explained by the fact that the tensile pressures acting on the lateral cortex are distributed over a greater area in the BDSF, which has screws spaced widely apart (20–40 mm) so as to prevent weakening of the subtrochanteric femur bone [12].

With a 3 month union period, every patient had a fantastic functional outcome. Other patients with longer union times had functional outcomes that were either good or fair.

CONCLUSION

Even if anatomical reduction is important, the Mini DHS with 6.5 mm cc screw and BDSF-method guarantees reliable fixation, prompt rehabilitation, and good functional outcomes, particularly in adults. Functional outcomes and overall radiological union were multifactorial. The primary determinants of favorable results were age, fracture type, posterior comminution, and reduction quality. Although our study had an excellent functional outcome, more patients and a longer period of follow-up are needed to draw firm conclusions. However, in addition to other treatment choices, the approach used in our study may be an useful option for managing fractured necks of the femur in young and active individuals.

ACKNOWLEDGMENT

We owe a debt of gratitude to the SPMC for assistance during the course of the research.

AUTHORS' CONTRIBUTION

All the authors have contributed equally.

CONFLICTS OF INTEREST

The authors declare no conflicts of interest.

AUTHOR'S FUNDING

The authors hereby state that they did not get any financial assistance for their research, writing, or publication of this paper.

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