DOI: https://doi.org/10.3329/medtoday.v38i1.87835

ORIGINAL ARTICLE OPEN ACCESS

Functional Outcome of Femoral Neck Fracture Osteosynthesis by Biplane Double Supported Screw Fixation Method (BDSF)

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Abstract

Background with Objective: *Treatment of fracture neck of femur varies according to patient's age, fracture pattern and time of presentation. There are various method of fixation technique like inverted triangle, triangle and diamond shape. The aim of this study was to evaluate functional outcome in fracture neck of femur fixation by biplane double supported screw fixation (BDSF) method.* ***Materials and Methods:*** *This was a single group prospective hospital based clinical trial and was conducted in the Department of Orthopedic Surgery in Chittagong medical college hospital for a period of one and half year from July 2018 to July 2020. Sample size was 30 with (AO /OTA-31B) fracture as per set criteria treated with BDSF enrolled through inclusion and exclusion criteria. Depending on the overall functional outcome patients were grouped as having excellent to good outcome and fair to poor outcome according to Harris hip score. Patients were followed up for 12 months.* ***Result:*** *Functional outcome at the final follow-up most of the patients, 23 (82.1%) had excellent outcome. Both good and poor outcome were in 02 (7.1%) and fair outcome was in only 01 (3.6%) patients respectively according to Harris Hip Score (1969).* ***Conclusion:*** *The achieved results with the BDSF method in terms of fracture consolidation are far more successful than the results with conventional fixation methods. The BDSF method ensures reliable fixation, early rehabilitation and excellent long-term outcomes.*

Keywords: *Functional Outcome, Femoral Neck Fracture, BDSF, Harris Hip Score.*

Number of Tables: 01; Number of Figures: 03; Number of References: 10; Number of Correspondences; 04.

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Introduction:

In orthopaedic practice femoral neck fractures are a commonly encountered injury and that result in significant morbidity and mortality[1]. Fracture neck of femur is classified according to the Orthopaedic Association system as AO/OTA 31-B. This fracture is subdivided into group B1, B2 and B3. B1 fractures are subcapital with slight displacement, whereas B2 fracture are transcervical and B3 fracture are subcapital, displaced and non-impacted. The fracture is considered as vascular injury to the bone which result in nonunion and osteonecrosis of the femoral head. The healing of fracture of the neck of femur have been correlated with blood supply to the femoral head, presence of osteoporosis, the plane and displacement of the fracture and the patient age[2]. In fracture neck of femur, there is a less compressive load, high shear stress and varus load

Received: 16 August 2025 *Accepted revised version:* 25 November 2025

dominant[3]. The more vertical and lateral the line of fracture is, the more unstable it is[4]. The treatment of fractures of the femoral neck differs greatly throughout the world[5]. In situ fixation, closed or open reduction and internal fixation, hemiarthroplasty and total hip arthroplasty. Recent reports demonstrate diversity among Orthopaedic surgeons regarding the optimal treatment of femoral neck fracture and changing trend in management[1]. The concept of biplane positioning makes it feasible to place three cannulated screws at steeper angles to the diaphyseal axis with entry points located much more distally within the thicker cortex of the proximal diaphysis, thus improving their beam function and cortical support. The three screws are laid in two vertical oblique planes that medially diverge toward the femoral head on lateral view. BDSF implements two calcar buttressed screws, oriented in different coronal inclinations and intended to provide sufficient stability during various physical activities. Their medial supporting points are located 10–20 mm apart, thereby distributing the axial load over a larger cortical area. Moreover, achieving posterior cortical support using an obtusely placed screw improves construct resistance to anteroposterior (AP) bending forces[6]. The new method of biplane double supported screw fixation (BDSF) increase the fixation strength by its innovative concept of biplane positioning of the three screws, which make it possible for the screws to be placed at an increased angle so they lean on two solid supporting points[7]. The advantage of this method due to biplane placement provide enough space for a third screw, Unlike the classical authors method, just one or a maximum two implants are placed at an obtuse angle[8,9]. The distal screw is touched on the posterior cortex. The highly increased angle of this screw, provides strength of fixation at anteroposterior bending of the neck[6]. This study was aimed to find functional as well as outcome of fracture neck of femur treated with cannulated cancellous screws by biplane double supported screw fixation method (BDSF).

Materials and Methods:

This was a single group prospective hospital based clinical trial and was conducted in the Department of Orthopedic Surgery in Chittagong medical college hospital for a period of one and half year from July 2018 to July 2020. Sample size was 30 with (AO /OTA-31B) fracture as per set criteria treated with BDSF enrolled through inclusion and exclusion criteria. Ethical clearance was obtained from the Institutional Review Board (IRB) of CMCH. Purposive sampling was done according to availability of the patients. The collected data were entered into the computer and analyzed by using SPSS (version 20.1) to evaluate functional outcome in fracture neck of femur fixation by biplane double supported screw fixation (BDSF) method.

Results:

This present hospital based clinical trial was conducted between the periods of January 2019 to July 2020 for duration of eighteen months in the Department of Orthopaedic Surgery, Chittagong Medical College Hospital. In this study, adult patient undergoing surgery for fracture neck of femur was the study sample. Total 30 samples were included in the study. In this study, total four follow up were done after 1 month, 2 months, 6 months and 12 months and there was one drop out of patient at 3rd follow-up and another one drop out of patient at 4th follow-up during the study period. The overall functional outcomes were categorized according to Harris Hip Score (1969) as excellent, good, fair and poor.

Harris hip score analysis: Pain is more in 1st month while 82.1% patient has no pain at 12 months. 82.1% patient has excellent outcome regarding weight bearing and there is no limping. Maximum patient (82.1%) does not need any walking aid during walking. At 1st month most of the patient were able to move only bed and chair but after 12 months maximum patient were able to walk unlimited. At 12 months 89.3% were comfortable to sit any high chair for prolong time. 92.9% patients were able to enter public transportation after 12 months of operation. At 6th months 82.8% patient were able to climb stairs where 85.7% at 12th months. 85.7% patients were able to put on socks and shoes at 12 months. 89.3% patient had no deformity and where 10.7% had deformity. Maximum 82.1% patient were gained full range of motion at 12 months. Out of 26 patients, 18 (65.4%) patients needed 12 weeks for fracture union, 04 (15.4%) patients needed 16 weeks and only 01 (3.8%) patient needed 18 weeks. Mean ± SD time for fracture union was 13.12 ± 1.796 weeks. Range of time taken for fracture union was 12-18 weeks. After 1 month follow-up, 19 (63.3%) patients had good and 11 (36.7%) patients had fair outcome, after 2 months follow-up, 21 (70%) patients had good and 09 (30%) patients had fair outcome, after 6 months follow-up, 17 (60.7%) patients had excellent outcome and after 12 months final follow-up, excellent outcome was in 23 (82.1%) patients, good outcome was in 02(7.1%). At the final follow-up most of the patients, 23 (82.1%) had excellent outcome. Both good and poor outcome were in 02 (7.1%) and fair outcome was in only 01 (3.6%) patients respectively.

Table-I: Harris hip score analysis according to different parameter

Parameter	At 1st month N (%)	At 2nd month N (%)	At 6th month N (%)	At 12th month N (%)
Pain				
Totally disable	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
Marked	6 (20.0%)	3 (10.0%)	1 (3.5%)	2 (7.1%)
Moderate	11 (36.7%)	7 (23.3%)	1 (3.5%)	0 (0.0%)
Mild	8 (26.7%)	15 (50.0%)	1 (3.5%)	1 (3.6%)
Slight	5 (16.7%)	5 (16.7%)	9 (31.0)	2 (7.1%)
None	0 (0.0%)	0 (0.0%)	17 (58.6)	23 (82.1)
Total	**30 (100%)**	**30 (100%)**	**29 (100%)**	**28 (100%)**
Limp				
Severe	0 (0.0%)	0 (0.0%)	1 (3.5%)	2 (7.1%)
Moderate	0 (0.0%)	0 (0.0%)	2 (6.9%)	1 (3.6%)
Slight	0 (0.0%)	0 (0.0%)	6 (20.7%)	2 (7.1%)
None	0 (0.0%)	0 (0.0%)	20 (69.0%)	23 (82.1%)
Total	0 (0.0%)	0 (0.0%)	**29 (100%)**	**28 (100%)**
Support				
Two canes	0 (0.0%)	0 (0.0%)	1 (3.5%)	2 (7.1%)
One crutch	0 (0.0%)	0 (0.0%)	2 (6.9%)	1 (3.6%)
Cane most of the time	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
Cane for long walks	0 (0.0%)	0 (0.0%)	3 (10.3%)	2 (7.1%)
None	0 (0.0%)	0 (0.0%)	23 (79.3%)	23 (82.1%)
Total	0 (0.0%)	0 (0.0%)	**29 (100%)**	**28 (100%)**

Parameter	At 1st month N (%)	At 2nd month N (%)	At 6th month N (%)	At 12th month N (%)
Distance walked				
Bed & chair only	20 (66.7%)	5 (16.7%)	1 (3.5%)	2 (7.1%)
Indoor only	5 (16.7%)	15 (50.0%)	2 (6.9%)	1 (3.6%)
Two or three block	4 (13.3%)	5 (16.7%)	1 (3.5%)	0 (0.0%)
Six block	1 (3.3%)	5 (16.7%)	2 (6.9%)	2 (7.1%)
Unlimited	0 (0.0%)	0 (0.0%)	23 (79.3%)	23 (82.1%)
Total	**30 (100%)**	**30 (100%)**	**29** (100%)	**28** (100%)
Sitting				
Unable to sit comfortably	2 (6.7%)	1 (3.3%)	2 (6.9%)	2 (7.1%)
On a high chair for 30 minutes	25 (83.3%)	19 (63.3%)	2 (6.9%)	1 (3.6%)
Comfortably for 1 hour	3 (10.0%)	10 (33.3%)	25 (86.2%)	25 (89.3%)
Total	**30 (100%)**	**30 (100%)**	**29** (100%)	**28** (100%)
Enter public transportation				
Yes	0 (0.0%)	13 (43.3%)	26 (89.7%)	26 (92.9%)
No	30 (100%)	17 (56.7%)	3 (10.3%)	2 (7.1%)
Total	**30 (100%)**	**30 (100%)**	**29 (100%)**	**28 (100%)**
Climbing stairs				
Unable	0 (0.0%)	0 (0.0%)	1 (3.5%)	2 (7.1%)
In any manner	0 (0.0%)	0 (0.0%)	2 (6.9%)	1 (3.6 %)
Using a railing	0 (0.0%)	0 (0.0%)	2 (6.9%)	1 (3.6 %)
Without railing	0 (0.0%)	0 (0.0%)	24 (82.8%)	24 (85.7%)
Total	0 (0.0%)	0 (0.0%)	**29 (100%)**	**28 (100%)**
Put on socks				
Unable	0 (0.0%)	8 (26.7%)	2 (6.9%)	2 (7.1%)
With difficulty	0 (0.0%)	12 (40.0%)	3 (10.3%)	2 (7.1%)
With ease	0 (0.0%)	10 (33.3%)	24 (82.8%)	24 (85.7%)
Total	0 (0.0%)	**30 (100%)**	**29 (100%)**	**28 (100%)**
Absence of deformity				
Yes	0 (0.0%)	5 (16.7%)	24 (82.8%)	25 (89.3%)
No	30 (100%)	25 (83.3%)	5 (17.2%)	3 (10.7%)
Total	**30 (100%)**	**30 (100%)**	**29 (100%)**	**28 (100%)**
Range of motion				
31°-60°	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
61°-100°	14 (46.7%)	0 (0.0%)	2 (6.9%)	2 (7.1%)
101°-160°	16 (53.3%)	12 (40.0%)	2 (6.9%)	1 (3.6%)
161°-210°	0 (0.0%)	18 (60.0%)	1 (3.5%)	2 (7.1%)
211°-300°	0 (0.0%)	0 (0.0%)	24 (82.8%)	23 (82.1%)
Total	**30 (100%)**	**30 (100%)**	**29 (100%)**	**28 (100%)**

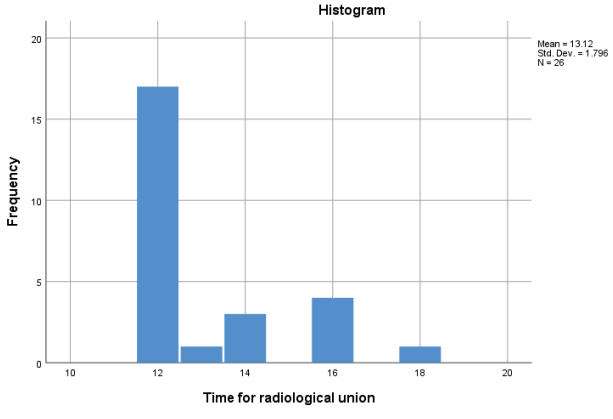

Figure-1: Histogram showing time taken for radiological union (n=26)

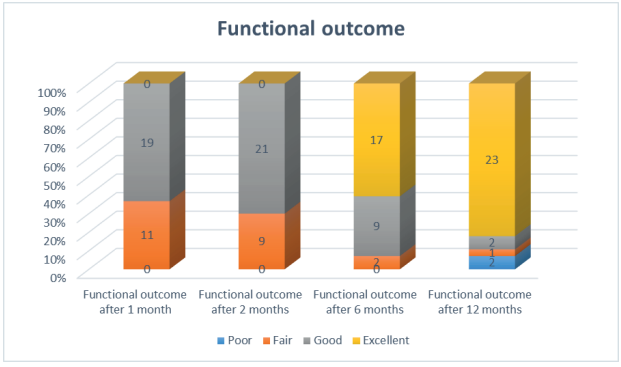

Figure-2: Functional outcome after 1 month (n= 30), 2 months (n= 30), 6 months (n= 29) and 12 months (n= 28)

Figure-3: Functional outcome at 12 months (n= 28)

Discussion:

According to Harris Hip Score (1969) patients were categorized into four subdivisions- excellent, good, fair and poor. In this study after 1 mponth follow-up, 19 (63.3%) patients had good and 11 (36.7%) patients had fair outcome, after 2 months follow-up, 21 (70%) patients had good and 09 (30%) patients had fair outcome, after 6 months follow-up, 17 (60.7%) patients had excellent outcome and after 12 months final follow-up, excellent outcome was in 23 (82.1%) patients. Similar result was reported by Kalia et al. (2018), the mean Harris Hip score was 81.2[10]. Out of the 25 patients, 3 (8.57%) had poor HHS, 4 (11.42%) had fair HHS, 9 (28.57%) had good HHS, while excellent HHS was seen in 9 (51.42%) patients. Also, in the study done by Filipov (2011)[7], assessment according to the Harris hip score (modified): poor results in 10 patients (11.36%). Fair results in 20 patients (22.72%). Good results in 21 patients (23.86%). Excellent results in 37 patients (42.040%). Regarding union time at fracture site, out of 26 patients 18 (69.2%) patients needed 12 weeks for fracture union and 04 (15.4%) patient needed 16 weeks. Mean ± SD time for fracture union was 13.12 ± 1.796 weeks. Range of time taken for fracture union was 12-18 weeks. Similarly, Kalia et al. (2018) showed, the mean duration of union was 10 weeks[10]

Conclusion:

The achieved results with the BDSF method in terms of fracture consolidation are more promising.The BDSF method ensures reliable fixation, early rehabilitation and excellent long-term outcomes, even in non-cooperative patients. BDSF is mainly addressed to patients, who are not permissible for arthroplasty

Conflict of Interest: None.

Acknowledgements:

The authors are grateful to the entire staff of department of Orthopaedic Surgery at Chittagong Medical College Hospital, Chittagong during the study period.

Reference:

1. Florschutz, A. V., Langford, J. R., Haidukewych, G. J. and Koval, et al. Femoral Neck Fractures: Current Management. J Orthop Trauma. 2015; 29: 121-129.

https://doi.org/10.1097/BOT.0000000000000291

https://doi.org/10.1097/BOT.0000000000000288

2. Rehnberg, L. and Olerud, C. The stability of cervical hip fractures and its influence on healing. J Bone Joint Surg Br. 1989; 71-B (2): 173-177.

https://doi.org/10.1302/0301-620X.71B2.2925729

PMid:292572

3. Lykke, N., Lerud, P. J., Stromsoe, K. and Thorngren, et al. Fixation of fractures of the femoral neck: a prospective, randomised trial of three Ullevaal hip screws versus two Hansson hook-pins. J Bone Joint Surg Br. 2003; 85(3): 426-430.

https://doi.org/10.1302/0301-620X.85B3.13788

PMid:12729123

4. Booth, K. C., Donaldson, T. K. and Dai, Q. G. Femoral neck fracture fixation: a biomechanical study of two cannulated screw placement techniques. Orthopedics. 1998; 21(11)1173-1176.

https://doi.org/10.3928/0147-7447-19981101-04

PMid:9845448

5. Gjertsen, J. E., Vinje, T., Engesaeter, L. B., et al. Internal screw fixation compared with bipolar hemiarthroplasty for treatment of displaced femoral neck fractures in elderly patients. J Bone Joint Surg Am. 2010; 92(3):619-628.

https://doi.org/10.2106/JBJS.H.01750

PMid:20194320

6. Walker, E., Mukherjee, D. P., Ogden, A. L., et al. A biomechanical study of simulated femoral neck fracture fixation by cannulated screws: effects of placement angle and number of screws. Am J Orthop. 2007; 36(12): 680-684.

7. Filipov, O. Biplane double-supported screw fixation (F-technique): a method of screw fixation at osteoporotic fractures of the femoral neck. Eur J Orthop Surg Traumatol. 2011; 21(7):539-543.

https://doi.org/10.1007/s00590-010-0747-9

PMid:21966288 PMCid:PMC3178023

8. Filipov, O. The method of biplane double-supported screw fixation (BDSF) at femoral neck fractures-principle and clinical outcomes. J of IMAB. 2013; 19(1): 423-428.

https://doi.org/10.5272/jimab.2013191.423

9. Filipov, O. and Gueorguiev, B. Unique stability of femoral neck fractures treated with the novel biplane double-supported screw fixation method: a biomechanical cadaver study. Injury. 2015; 46(2):218-226.

https://doi.org/10.1016/j.injury.2014.11.013

PMid:25527457

10. Kalia, A., Singh, J. and Ali, N. Role of Biplane Double Supported Screw Fixation for Fracture Neck Femur in Elderly Population: A Prospective Study. The Open Orthopaedics Journal. 2018; 12: 514-524.

https://doi.org/10.2174/1874325001812010514