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BRIDGING STABILITY AND FUNCTION: A PROSPECTIVE COMPARATIVE STUDY OF DHS AND BDSF IN FEMORAL NECK FRACTURES

Orthopaedics

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ABSTRACT

Background Femoral neck fractures are associated with significant morbidity and functional disability. Internal fixation is preferred in younger patients to preserve the native femoral head. Dynamic Hip Screw (DHS) and Biplane Double Supported Screw Fixation (BDSF) are commonly used fixation techniques. **Aim** To compare the functional and radiological outcomes of DHS and BDSF in femoral neck fractures. **Methodology** This prospective comparative study was conducted in the Department of Orthopaedics at a tertiary care hospital in Uttar Pradesh, India. Nineteen patients aged 18–65 years with recent femoral neck fractures were included and divided into DHS (n=10) and BDSF (n=9) groups. Functional outcomes were assessed using Harris Hip Score (HHS) and WOMAC index, while radiological outcomes included femoral neck shortening and neck shaft angle. Patients were followed for 12 months. **Results** Both groups showed progressive functional improvement during follow-up. At 12 months, HHS and WOMAC scores were comparable between the groups without significant difference. Femoral neck shortening was similar in both groups at all follow-ups. DHS demonstrated significantly better maintenance of neck shaft angle in the immediate postoperative period and at 3 months; however, long-term radiological outcomes were comparable. Non-union occurred in one patient in the DHS group and two patients in the BDSF group. **Conclusion** Both DHS and BDSF provided comparable functional and radiological outcomes in femoral neck fractures. DHS was technically easier with fewer complications, while BDSF also showed satisfactory fixation and recovery.

KEYWORDS

INTRODUCTION

Femoral neck fractures represent a significant global health burden, with a projected rise in incidence in the coming decades[1]. These injuries are associated with substantial impairment in functional capacity, diminished quality of life, and increased mortality[2,3].

The management of femoral neck fractures is influenced by patient age, fracture morphology, and physiological status. In younger individuals, preservation of the native femoral head through internal fixation remains the preferred approach over arthroplasty[4]. Established classification systems such as Pauwels and Garden assist in guiding treatment decisions and prognostication[5,6].

Dynamic Hip Screw (DHS) is a well-established fixation modality that provides reliable stability and controlled fracture compression[7]. However, conventional fixation techniques may be associated with limitations, particularly in osteoporotic bone, including inadequate cortical support and a higher risk of mechanical failure[8-15].

Biplane Double Supported Screw Fixation (BDSF), introduced by Filipov, is designed to address these limitations by enhancing cortical support and optimizing biomechanical load distribution through a biplanar screw configuration[16].

Despite its proposed biomechanical advantages, clinical evidence comparing BDSF with DHS remains limited. Therefore, the present study aims to comparatively evaluate the clinical and radiological outcomes of these two fixation techniques in femoral neck fractures.

Objective-

Primary Objective

- To compare the rate of non-union between DHS and BDSF

Secondary Objectives

- To compare functional outcomes using Harris Hip Score and WOMAC index
- To compare radiological outcomes (neck shortening and neck shaft angle)

Materials and Methods

Study Design and Setting:

This prospective study was conducted in the Department of Orthopaedics at a tertiary care center in Uttar Pradesh, India. Ethical clearance was obtained from the Institutional Ethics Committee, and written informed consent was obtained from all participants.

Study Population:

Patients aged 18–65 years presenting with recent femoral neck fractures (<3 weeks) were included in the study. Patients with pathological fractures, old fractures (>3 weeks), associated fractures, pre-existing hip pathology, or those unfit for surgery were excluded.

Sample Size and Sampling:

The sample size was determined based on all eligible patients presenting during the study period who fulfilled the inclusion criteria. A consecutive sampling technique was used. A total of 19 patients were included in the study.

Grouping:

Patients were allocated into two groups based on the surgical procedure performed:

- Group 1: Biplane Double Supported Screw Fixation (BDSF) (n=9)
- Group 2: Dynamic Hip Screw (DHS) (n=10)

Procedure:

All patients were managed according to standard protocols. Fracture reduction was achieved under fluoroscopic guidance, followed by fixation using either DHS or BDSF technique as per surgeon preference. All surgeries were performed under standard aseptic precautions by experienced orthopaedic surgeons.

Postoperative Care and Follow-up:

Standard postoperative care and physiotherapy were initiated. Patients were followed up at 2 weeks, 6 weeks, 3 months, 6 months, and 12 months.

Outcome Measures:

Functional outcome was assessed using Harris Hip Score (HHS) and WOMAC index at 3, 6, and 12 months. Radiological evaluation included femoral neck shortening and neck shaft angle. Complications such as non-union and implant-related issues were recorded.

Definition of Non-union:

Non-union was defined as persistence of fracture line on radiographs with associated clinical symptoms and failure of progression towards healing for at least 3 months.

Statistical analysis

Data were analyzed using SPSS software (version 20). Continuous variables were expressed as mean ± standard deviation, and categorical variables as frequencies and percentages. Comparison between groups was performed using unpaired Student's t-test and Chi-square test. A p-value <0.05 was considered statistically significant.

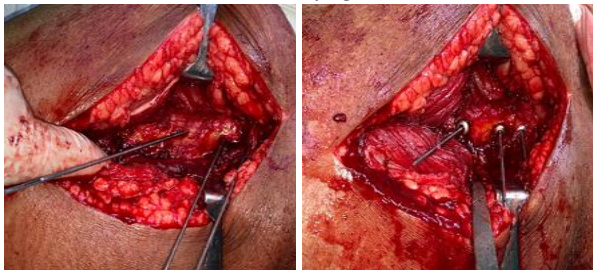

Figure 1: Intraoperative photograph showing fixation of femoral neck fracture using DHS/BDSF technique.

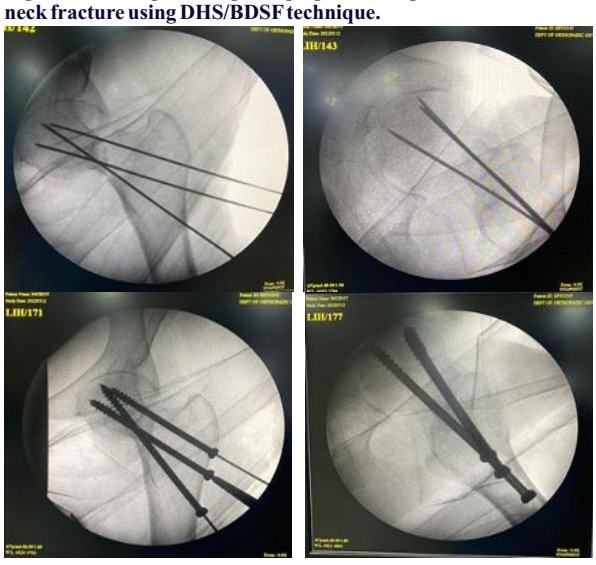

Figure 2: Intraoperative C-arm images showing stepwise fixation of femoral neck fractureFigure3:Radiological sequence of femoral

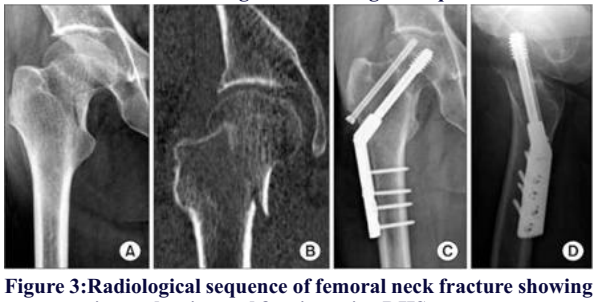

Figure 3:Radiological sequence of femoral neck fracture showing preoperative evaluation and fixation using DHS

RESULT:

Table-1 Age and Sex-wise Distribution of Participants in DHS vs BDSF Groups

		DHS		BDSF	
Age		NUMBER	%	NUMBER	%
	21-30	1	10	1	11.1
	31-40	1	10	3	33.3
	41-50	5	50	3	33.3
	51-60	0	0	2	22.2
	61-70	3	30	0	0
Sex	Male	10	100	8	88.88
	Female	0	0	1	11.11
	Total	10	100	9	100

Table2: Functional Outcome Scores at 3, 6 and 12 Months: DHS vs BDSF

Score	**Mean ±SD**		**T**	**p-value**
At 3 months				
	DHS	**BDSF**		
Harris hip score	84±2.44	76.16±14.12	1.078427	>0.05
Womac score	13.27±3.55	22.88±9.64	1.87856	>0.05
At 6 Months				
Harris hip score	89±3.0	86.25±15.5	0.394087	>0.05
Womac score	6.88±3.68	12.85±11.82	1.0823	>0.05
At 12 Months				
Harris hip score	94.5±31.35	100±0	0.23392	>0.05
Womac score	3.38±4.75	2.08±2.94	0.343631	>0.05

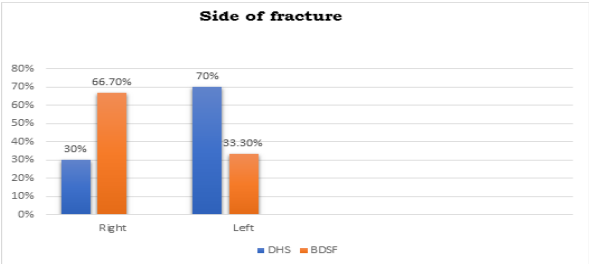

Figure 3: Distribution of Fracture Side (Right vs Left) in DHS and BDSF Groups

Fig 4: Non-Union Outcomes in DHS and BDSF

Table3: Radiological Outcome Scores at 3, 6 and 12 Months: DHS vs BDSF

Score	**Mean ±SD**		**T**	**p-value**
	DHS	**BDSF**		
Immediate Post Operative				
Femoral Neck Shortening (cm)	0.627±0.22	0.73±0.46	0.63355	>0.05
Neck Shaft angle (^{0}Degree)	134.1±2.99	128.2±3.76	3.805495	<0.05
At 3 months				
Femoral Neck Shortening (cm)	0.79±0.31	1.03±0.69	0.78834	>0.05
Neck Shaft angle (^{0}Degree)	132.83±2.56	125.87±4.45	3.410118	<0.05
At 6 Months				
Femoral Neck Shortening (cm)	1.07±0.39	1.17±0.49	0.34216	>0.05
Neck Shaft angle (^{0}Degree)	128.8±3.03	126±4.8	1.073417	>0.05
At 12 Months				
Femoral Neck Shortening (cm)	1.12±0.39	1.33±0.71	0.49487	>0.05
Neck Shaft angle (^{0}Degree)	125±5.5	129±1.41	0.95925	>0.05

As presented in **Table 1**, a total of 19 participants were included in the study, with 10 patients in the DHS group and 9 in the BDSF group. The age distribution showed that the majority of patients in the DHS group were in the 41–50 years age group (50%), followed by 61–70 years (30%), whereas the BDSF group showed a relatively even distribution, with the highest proportion seen in the 31–40 and 41–50 years age groups (33.3% each). Regarding sex distribution, all patients in the DHS group were male (100%), while the BDSF group included 88.9% males and 11.1% females, indicating male predominance in both groups.

The distribution of fracture side, as illustrated in **Figure 3**, was comparable between the DHS and BDSF groups, with no clear predominance of either right or left side. The majority of fractures were of the transcervical type, accounting for 14 (73.68%) cases, followed by basicervical type in 4 (21.05%) cases and subcapital type in 1 (5.26%) case. According to Pauwel's classification, most cases were type II (13, 68.42%), followed by type III (5, 26.31%) and type I (1, 5.26%). Similarly, as per Garden classification, the majority were type II fractures

(10, 52.63%), followed by type III (7, 36.84%) and type IV (1, 5.26%). Similarly, **Figure 4** depicts non-union outcomes, which were found to be comparable between the two groups, suggesting that both fixation methods had similar effectiveness in terms of fracture union.

Functional outcomes, as shown in **Table 2**, were assessed using Harris Hip Score and WOMAC score at 3, 6, and 12 months. Both groups demonstrated progressive improvement over time, with increasing Harris Hip Scores and decreasing WOMAC scores, indicating better hip function and reduced symptoms. However, at all follow-up intervals, the differences between DHS and BDSF groups were not statistically significant ($p > 0.05$), suggesting that both treatment modalities provide similar functional recovery.

Radiological outcomes, presented in **Table 3**, showed that femoral neck shortening increased gradually over time in both groups, reflecting expected post-operative changes; however, the differences between DHS and BDSF groups were not statistically significant at any time point ($p > 0.05$). In contrast, the neck shaft angle was significantly better maintained in the DHS group in the immediate postoperative period and at 3 months ($p < 0.05$), indicating superior early alignment with DHS fixation. However, this advantage was not sustained at later follow-ups (6 and 12 months), where the differences became statistically non-significant ($p > 0.05$), suggesting comparable long-term radiological outcomes between the two groups.

DISCUSSION

The outcome of femoral neck fracture fixation depends on patient age, fracture displacement, and the quality of reduction and internal fixation. Internal fixation is preferred over arthroplasty in younger patients to preserve native bone and avoid future revision. The method of fixation influences union and osteonecrosis rates. Traditionally, DHS and cannulated cancellous screws have been used; however, **Orlin Filipov**[16]described Biplane Double-Supported Screw Fixation (BDSF), which provides improved biomechanical stability through enhanced inferoposterior cortical support. This prospective study compares the clinical and radiological outcomes, non-union rates, and complications following fixation of femoral neck fractures using DHS and BDSF.

This prospective study compares clinical and radiological outcomes, non-union rates, and complications following DHS and BDSF fixation in femoral neck fractures. The overall mean age was 45 years, with most patients in the 41–50 years group. Age plays an important role in union and outcomes. The mean age in our study is comparable to studies by **Zhibing Chen et**al.,[17]**Wu-ren Hou et al**[18]and **Sherif Galal et al.**[19]while **Michele Bisaccia et al.**[37]reported a higher mean age.

According to **anatomical classification**, in the DHS group, 50% cases were transcervical, 40% basicervical, and 10% subcapital fractures, whereas in the BDSF group, all cases were transcervical. Similar findings were reported by **Sherif Galal et al.,**[19] where transcervical fractures predominated. This indicates that transcervical fractures are more common than subcapital and basicervical types.

According to Pauwel's classification[7], the DHS group had 70% type II and 30% type III fractures, while the BDSF group had 11.1% type I, 66.6% type II, and 22.2% type III fractures, which is comparable to findings by **Sherif Galal et al**.[19] Regarding **Garden classification**[8], most cases in our study were type II and III in both groups, whereas **Sherif Galal et al.**[19] reported a higher proportion of type III and IV fractures. Prognosis was better in **Garden type II and III** fractures, while type IV fractures showed higher rates of non-union and avascular necrosis.

Functional outcomes in our study were comparable between both groups throughout follow-up. Previous studies by **Orlin Filipov,**[16]**Abdus Sami,**[21] **Wernbo Zhao,**[22] **Wu-ren Hou**[18]**also** reported good functional results with satisfactory Harris Hip Scores (HHS). In our study, after 12 months follow-up, the mean HHS was 94.5±31.35 in the DHS group and 100±0 in the BDSF group, which was statistically non-significant ($p>0.05$). WOMAC scores were also comparable, with mean scores of 3.38±4.75 in DHS and 2.08±2.94 in BDSF groups. Mean femoral neck shortening after 12 months was 1.12±0.39 cm in DHS and 1.33±0.71 cm in BDSF group without significant difference. The mean neck shaft angle immediately postoperatively was significantly higher in DHS group, but after 12 months both groups showed comparable values. Non-union was observed in 3 (15.78%) patients overall, including 1 (10%) case in DHS and 2 (22.2%) cases in BDSF group. Our findings suggest that both quality of reduction and proper screw positioning play important roles in fracture healing and functional outcome.

CONCLUSION

The present study compared DHS and BDSF in displaced femoral neck fractures. Both methods showed comparable functional and radiological outcomes. BDSF provided good fixation strength and early mobilization, while DHS was technically easier and associated with fewer complications such as non-union, AVN, screw backout, and screw penetration.

Limitations

The present study has certain limitations including a small sample size, single-center design, and relatively short follow-up duration. In addition, patient allocation was based on surgeon preference rather than randomization, which may introduce selection bias. Larger multicentric randomized studies are required to validate these findings.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Funding Statement

No funding was received for this study.

Ethical Statement

The study was conducted after approval from the Institutional Ethics Committee. Written informed consent was obtained from all participants/patients included in the study.

Guardian/Patient Consent

Written informed consent was obtained from the patient/guardian for publication of this study and accompanying images/data.

CRediT Author Statement

Dr. Ramkishor: Methodology,Data Collection,Conceptualization, Surgery, Literature review
Dr. Chandan Kumar: Supervision, Review
Dr. Sanjay Kumar: Supervision, Review
Dr. Vandana Kain: Manuscript drafting,,editing

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