ISSN: 2320-9267

Indian Journal of Pharmaceutical and Biological Research (IJPBR)

Journal homepage: www.ijpbr.in

RESEARCH ARTICLE

Fracture Neck Femur in Adults Managed with Three Cannulated Cancellous Screws Put in Biplane Double Supported Fixation (BDSF) vs Conventional Inverted Triangle Configuration: A Comparative Randomised Control Study of the Functional Outcome

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ABSTRACT

Background and Rationale: Fracture neck of femur in the adult population constitutes a formidable orthopaedic challenge, with fixation configuration critically determining biomechanical stability and functional recovery. The Biplane Double-Supported Screw Fixation (BDSF) technique — by distributing three cannulated cancellous screws (CCS) across two anatomical planes — offers a theoretically superior load- sharing construct compared to the conventional inverted triangle arrangement. However, comparative clinical evidence in the adult age group remains limited.

Aims and Objectives: To prospectively compare the intraoperative feasibility and post-operative functional outcome of BDSF versus conventional inverted triangle CCS fixation in adult femoral neck fractures using the Harris Hip Score and complication profile.

Methods: In this prospective, interventional, single-centre RCT conducted at UPUMS Saifai over 18 months (June 2023–December 2024), 60 adult patients aged 18–60 years with femoral neck fractures (Pauwels I–III; closed/Gustillo Grade I) were randomized by random block technique into two equal groups: Group A (Conventional Inverted Triangle, n=30) and Group B (BDSF, n=30). Primary outcome was Harris Hip Score at 6 months. Secondary outcomes included intraoperative parameters (operative time, blood loss, fluoroscopy exposure), rehabilitation milestones, and complications (AVN, non-union, implant failure, femoral neck shortening, surgical site infection). Baseline equivalence was confirmed across all demographic and clinical variables (p>0.05).

Results: Both groups were statistically comparable at baseline in age (45.33±8.21 vs. 44.87±7.92 years; p=0.826), gender, fracture laterality, mechanism of injury, Pauwels classification, and injury-to- surgery interval. Intraoperatively, fluoroscopy exposure time was significantly lower in Group B (28.07±4.36 sec vs. 35.17±5.68 sec; p<0.0001), with a trend toward shorter operative duration (50.81±9.37 vs. 55.23±10.11 min; p=0.084). Complication rates consistently favoured BDSF: non-union 0% vs. 6.67%, implant failure 6.67% vs. 16.67%, femoral neck shortening >1 cm 6.67% vs. 13.33%, AVN 3.33% vs. 6.67%, surgical site infection 3.33% vs. 10.00%, and hip stiffness 3.33% vs. 10.00%. Harris Hip Score at 6 months was excellent (90–100) in 80% of Group B vs. 60% of Group A, with treatment failure (HHS <60) entirely absent in Group B versus 6.67% in Group A.

Conclusion: The BDSF technique demonstrates clear superiority over the conventional inverted triangle configuration across intraoperative efficiency, complication profile, rehabilitation parameters, and functional recovery. With a significantly reduced fluoroscopic burden, zero non-union, and superior Harris Hip Scores, BDSF is recommended as the preferred fixation strategy for femoral neck fractures in adult patients. Multicentre validation with extended follow-up is warranted to consolidate these findings.

Keywords: Femoral neck fracture; BDSF technique; Cannulated cancellous screws; Inverted triangle fixation; Harris Hip Score.

Indian J. Pharm. Biol. Res. (2026): https://doi.org/10.30750/ijpbr.14.2.17

INTRODUCTION

Every sixty seconds, somewhere in the world, an elderly patient falls — and a significant number of those falls result in a fracture of the femoral neck. Deceptively simple in its mechanism yet devastatingly complex in its consequences, the femoral neck fracture stands as one of the most formidable challenges in contemporary orthopaedic surgery. Far beyond the fracture itself, it heralds a cascade of life-altering complications — avascular necrosis, non-union, irreversible functional decline — that collectively impose an enormous burden of morbidity and mortality upon the affected individual [1]. In younger patients, high-energy trauma shatters the femoral neck with brutal force; in the elderly, a seemingly trivial low-energy fall against a backdrop of osteoporotic bone is sufficient to render a previously independent individual permanently dependent. What unites both ends of this demographic spectrum is the unforgiving anatomy of the femoral neck — a slender osseous corridor nestled entirely within the intracapsular environment of the hip joint, where the precarious nature

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How to cite this article: Mittal A, Singh J, Kumar D, Kumar H, Verma VK, Das Choudhury T, Garg S, Saroj AK. Fracture Neck Femur in Adults Managed with Three Cannulated Cancellous Screws Put in Biplane Double Supported Fixation (Bdsf) vs Conventional Inverted Triangle Configuration: A Comparative Randomised Control Study of the Functional Outcome. Indian J. Pharm. Biol. Res. 2026;14(2):1-9.

Source of support: Nil
Conflict of interest: None.
Received: 22/02/2026 **Revised:** 18/03/2026 **Accepted:** 28/03/2026
Published: 08//04/2026

of its vascular supply transforms every fracture into a race against ischaemia, and every treatment decision into a critical determinant of the patient's future [1].

The surgical management of femoral neck fractures has traversed a long and iterative journey. Among the available modalities, internal fixation with cannulated cancellous screws (CCS) has endured as a cornerstone of treatment — celebrated for its minimally invasive profile, its fidelity to native hip joint preservation, and its potential to harness the body's own biological healing capacity [2]. Yet beneath this apparent simplicity lies a domain of considerable mechanical complexity. Bone quality, fracture geometry, biomechanical loading patterns, and — most critically — the spatial configuration of screw placement collectively govern whether fixation succeeds or fails [3]. It is within this last variable that the present study finds its scientific rationale.

Two predominant philosophies of CCS fixation have emerged in modern orthopaedic practice. The first — the conventional inverted triangle configuration — arranges three cannulated screws in an inverted triangular pattern, a construct that has served as the workhorse of femoral neck fixation for decades [4]. It provides a degree of axial and rotational stability, permitting early mobilization and facilitating fracture healing under optimal conditions. However, time and clinical experience have exposed its vulnerabilities: a propensity for screw loosening, susceptibility to varus collapse, and an inadequate capacity to resist the shear forces that perpetually act upon the femoral neck — deficiencies that are magnified in osteoporotic bone and that culminate, in a meaningful proportion of patients, in fixation failure, AVN, and the morbidity of revision surgery [5].

It was precisely these limitations that gave birth to a second philosophy — the Biplane Double- Supported Screw Fixation (BDSF) technique. Rather than confining screw placement to a single geometric plane, the BDSF technique distributes screws across two distinct anatomical planes, achieving double cortical purchase and fundamentally altering the biomechanical environment at the fracture site [6]. By doing so, it transforms a construct vulnerable to concentrated stress into one capable of distributing mechanical load uniformly — attenuating shear forces, resisting rotational instability, and reducing the burden borne by any individual implant. The clinical translation of these biomechanical advantages, proponents argue, manifests as reduced fixation failure, accelerated fracture consolidation, and superior functional recovery [7].

The body of evidence examining the BDSF technique has grown with mounting enthusiasm. Biomechanical studies have consistently validated its theoretical framework — demonstrating optimized stress distribution, enhanced rotational control, and improved load-sharing across the fracture interface [8]. Yet despite this scientific momentum, the clinical literature has not yielded an unequivocal verdict. Questions surrounding long-term functional outcomes, complication profiles, patient-reported quality of life, and the reproducibility of BDSF's advantages across diverse patient populations remain incompletely answered. The absence of consensus is not merely an academic inconvenience — it is a call to rigorous, well-designed clinical investigation [9].

This study answers that call. In an era where evidence-based practice is not aspirational but obligatory, the onus falls upon the surgical community to subject promising innovations to the scrutiny of comparative clinical research [10]. Understanding how CCS fixation configurations influence not only radiological healing but also functional rehabilitation, healthcare resource utilization, and patient-reported outcomes is no longer a matter of academic curiosity — it is a prerequisite for responsible surgical practice. By systematically delineating the comparative merits and limitations of the inverted triangle configuration and the BDSF technique, this study aspires to provide surgeons with the objective, evidence-anchored guidance necessary for truly individualized patient care.

The urgency of this inquiry is further amplified by global demographic realities. The world's population is ageing at an unprecedented pace, and femoral neck fractures — already among the most resource-intensive injuries in orthopaedic surgery — are projected to increase in incidence with each passing decade. Prolonged hospitalization, post-operative complications, rehabilitation demands, and the economic weight of revision surgery collectively render these fractures a public health challenge of the first order [11]. Optimizing fixation strategy is therefore not merely a surgical imperative — it is an economic and societal one. Every improvement in construct stability that prevents a fixation failure is a hospitalization averted, a revision surgery avoided, and a patient restored to independence rather than institutionalization.

It is against this clinical, biomechanical, and socioeconomic backdrop that the present study was conceived — not simply to compare two techniques, but to contribute to the foundational knowledge that will define how future generations of surgeons approach one of orthopaedic medicine's most consequential injuries.

AIM AND OBJECTIVE

Aim

A Comparative study of the functional efficacy of fixation of fracture neck of femur in adult patients by three cannulated cancellous screw (CCS) put in the Biplane Double supported Screw Fixation configuration and in the conventional inverted triangle configuration.

Objectives

To assess the functional efficacy of three cannulated cancellous screw put in Biplane Double supported Screw Fixation technique (BDSF) and in the conventional inverted triangle configuration in terms of intra operative feasibility and post-operative functional outcome in fixation of fracture neck of femur using Harris Hip score and possible complications.

Research Question

"Which one between the Biplane Double supported Screw Fixation technique (BDSF) and inverted triangle configuration is a more effective technique in the fixation of fractures of neck of femur in young patients by three conventional CC screws?"

MATERIAL AND METHODS

Study Setting

This prospective study was conducted in the Department of Orthopaedics UPUMS, Saifai, Etawah. Written informed consent was obtained from all the patients or their families for participation in the study.

Study Type

Our study was a prospective, Interventional and hospital-based study.

Study Design

Prospective comparative hospital-based interventional study.

Study Duration

18 months (June 2023- Dec 2024)

Sample Size

Approximately 60 cases (30 BDSF and 30 inverted triangles each)

Inclusion Criteria

- Patients in age groups between 18-60 years
- Pauwel's classification (type I-III)
- Close fractures neck of femur and Gustillo Anderson grade I
- Duration of injury less than 1 week.

Exclusion Criteria

- Pathological femoral neck fractures, Stress fractures
- Concomitant ipsilateral Lower Limb Injury
- Concomitant significant contralateral lower limb injury
- > Gustillo Anderson grade II fractures or above
- Immunocompromised patient, patient on steroids

Method

All patients with fractured neck femur fulfilling the above criteria were admitted and evaluated. Following immediate emergency care, hemodynamic stabilization of the patients and proper traction of the affected limbs was done. All demographic data of the patient along with their contact number and address was recorded.

After a thorough history, the patient was first evaluated clinically and a record of the mechanism of injury, and time duration since injury was made. Fracture fixation of patients was done using either the Biplane Double supported Screw Fixation (BDSF) technique or conventional inverted triangle configuration based on randomisation using random block Technique.

According to Pauwel's classification; cases were type I, type III and Type III.

Patients were divided into 2 groups.

Group A — Conventional Inverted Triangle Configuration: Surgical Technique

Following standard preparation of the operative field — encompassing painting, draping, and appropriate patient positioning — the procedure was performed under continuous image intensifier (C-arm) guidance. Satisfactory closed reduction of the fracture was confirmed fluoroscopically prior to any surgical instrumentation.

A direct lateral approach to the proximal femur was employed, utilizing a longitudinal skin incision of approximately 5 cm centered at and extending proximal to the level of the lesser trochanter.

Guidewire insertion was subsequently carried out, either with the aid of a targeting jig or freehand, according to the operating surgeon's discretion and technical familiarity. The three guidewires were arranged in the classical inverted triangle configuration — with a single wire occupying the inferior position and two wires placed superiorly.

The inferior guidewire was introduced first, with its entry point positioned no caudal to the lesser trochanteric level, as placement below this landmark risks creating a stress riser predisposing to comminuted subtrochanteric fracture. On the anteroposterior (AP) fluoroscopic view, this wire was directed to lie immediately superior to the calcar femorale, advancing to within 5 mm of the subchondral bone of the femoral head.

The second guidewire was positioned superior and posterior to the first; on the lateral fluoroscopic projection, this wire was confirmed to course in close proximity to the posterior femoral cortex. The third guidewire was introduced superior and anterior to the first, maintaining a trajectory parallel to the second wire on the AP view. All three guidewires were verified fluoroscopically to terminate within 5 mm of the subchondral bone, ensuring adequate purchase without articular penetration.

Group B — Biplane Double-Supported Screw Fixation (Bdsf) Technique: Surgical Technique

Following standard operative preparation — including painting, draping, and optimal patient positioning — the procedure was conducted under continuous C-arm fluoroscopic guidance. Fracture reduction, achieved either by closed or open means as dictated by intraoperative findings, was confirmed satisfactory prior to implant insertion.

Internal fixation was performed utilizing the Biplane Double-Supported Screw Fixation (BDSF) technique, as originally described and conceptualized by Filipov. This technique is predicated upon a fundamentally divergent screw orientation philosophy, wherein three cannulated cancellous screws are deployed across two distinct anatomical planes — thereby conferring biplanar cortical support and multidirectional mechanical stability to the fracture construct.

Of the three screws, two were introduced through a metaphyseal entry point on the lateral femoral cortex, directed obliquely toward the antero-inferior quadrant of the femoral head. The third screw was inserted from a subtrochanteric entry point, situated approximately 5 to 7 centimetres distal to the base of the greater trochanter, and directed toward the postero-superior quadrant of the femoral head with deliberate calcar abutment. This third screw, by virtue of its divergent trajectory, intersects the preceding two screws at an angle in both the coronal and sagittal planes — constituting the defining biomechanical hallmark of the BDSF construct.

Post-Operative Protocol

All patients in this group were observed in-hospital for a minimum of seven days following the index procedure prior to discharge. Structured post-operative surveillance was instituted as follows:

- 2 weeks — First post-operative clinical and radiological review
- 4 weeks — Second follow-up assessment
- Monthly thereafter — Serial follow-up until radiological fracture union was confirmed
- Every 2 months post-union — Continued surveillance for late complications

Weight-bearing was introduced in a graduated and patient-tolerant manner. Partial weight-bearing was permitted once the patient demonstrated adequate pain control and clinical readiness. Transition to full weight-bearing was sanctioned exclusively upon radiological confirmation of complete fracture union, thereby minimizing the risk of implant failure during the consolidation phase.

Follow-Up Assessment

At each scheduled follow-up visit, a single designated observer performed all outcome assessments to ensure consistency and minimize inter-observer variability. Radiological evaluation invariably preceded functional assessment in order to eliminate examiner bias.

Radiographic Outcomes Assessed

- **Fracture Union** — defined as complete obliteration of the fracture line on serial radiographs
- **Femoral Neck Shortening** — quantified by measuring the distance between the femoral head centre and the greater trochanter tip, representing the functional lever arm of the abductor musculature; post-operative measurements were compared against final follow- up

radiographs

- **Implant-Related Complications** — including screw back-out, articular penetration, and loss of fracture reduction
- **Avascular Necrosis (AVN)** — clinically suspected cases were confirmed by MRI; bone scintigraphy was employed where indicated
- **General Post-operative Complications** — including surgical site infection, wound dehiscence, and loss of fixation

Parameters to Assess the Better Approach to Treat the Fractured Neck of the Femur

Intraoperative

- Time duration of surgery
- Blood loss
- Fluoroscopy exposure.
- Length of incision

Post-operative

- Fracture union (weight bearing)
- Harris Hip Score
- Complications like femur neck shortening
- Avascular Necrosis
- Screw backing out
- Need for implant removal
- Functionality: assessed using the Harris hip score at 6 months follow up:

The mean age in Group A was 45.33 ± 8.21 years, while in Group B, it was 44.87 ± 7.92 years, showing no statistically significant difference (t=0.2209, p=0.8260). The age distribution across different age groups (18-30, 31-40, 41-50, and 51-60 years) also showed no significant variation between the two groups (χ^2=0.6715, p=0.8799). Regarding gender distribution, 60.00% of patients in Group A were male and 40.00% were female, whereas in Group B, 56.67% were male and 43.33% were female, again showing no statistically significant difference (χ^2=0.06857, p=0.7934).

The side of fracture was almost equally distributed, with 56.67% of fractures in Group A and 60.00% in Group B occurring on the right side, showing no significant difference (χ^2=0.06857, p=0.7934). The mechanism of injury was predominantly road traffic accidents (RTA) in both groups (70.00% in Group A and 73.33% in Group B), followed by falls (30.00% vs. 26.67%), with no statistically significant difference (χ^2=0.08208, p=0.7745). Pauwel's classification distribution was similar, with 40.00% of patients in both groups classified as Type I, 40.00% in Group A and 43.33% in Group B as Type II, and 20.00% in Group A and 16.67% in Group B as Type III, with no significant difference (χ^2=0.1309, p=0.9366). Associated injuries were reported in 26.67% of patients in Group A and 23.33% in Group B, showing no statistical difference (χ^2=0.08889, p=0.7656). The mean time interval between injury and presentation was 3.77 ± 1.13 days in Group A and 3.61 ± 1.29 days in Group B, which was not significantly different (t=0.5110, p=0.6113).

Table 1: Demographic Data of the enrolled patients among the groups

Parameter		Group A [n=30]	Group B [n=30]	P-Value
Age (Mean ± SD)		45.33 ± 8.21	44.87 ± 7.92	t=0.2209 p=0.8260
18-30		6 (20.00%)	8 (26.67%)	X=0.6715 p=0.8799
31-40		8 (26.67%)	9 (30.00%)	
41-50		7 (23.33%)	6 (20.00%)	
51-60		9 (30.00%)	7 (23.33%)	
Gender	Male	18 (60.00%)	17 (56.67%)	X=0.06857 p=0.7934
	Female	12 (40.00%)	13 (43.33%)	

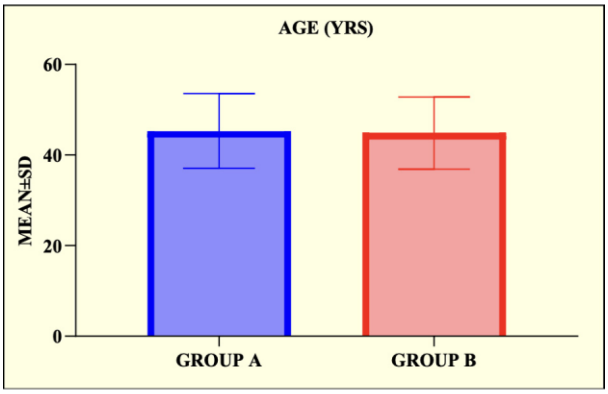


Figure 1: Graphical representation of the Mean Age of the enrolled patients among the groups

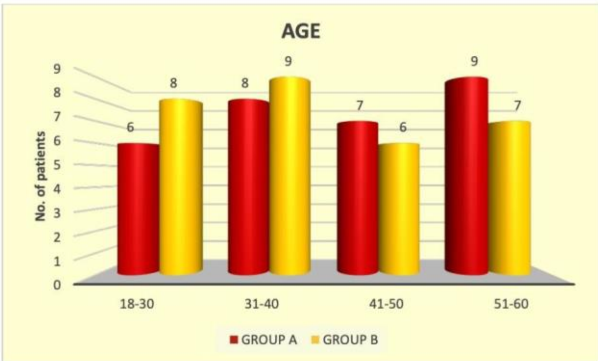


Figure 2: Graphical representation of the Age distribution of the enrolled patients among the groups

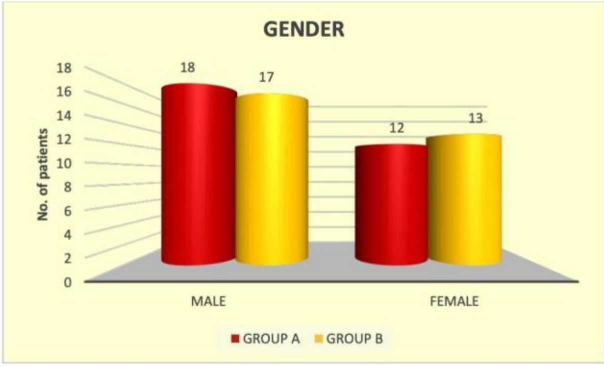


Figure 3: Graphical representation of the Gender distribution of the enrolled patients among the groups

Table 2: Baseline clinical Data of the enrolled patients among the groups

Parameter		Group A [n=30]	Group B [n=30]	P-Value
Side of Fracture	Right	17 (56.67%)	18 (60.00%)	X=0.06857 p=0.7934
	Left	13 (43.33%)	12 (40.00%)	
Mechanism of Injury	RTA	21 (70.00%)	22 (73.33%)	X=0.08208 p=0.7745
	Fall	9 (30.00%)	8 (26.67%)	
Pauwel's classification	I	12 (40.00%)	12 (40.00%)	X=0.1309 p=0.9366
	II	12 (40.00%)	13 (43.33%)	
	III	6 (20.00%)	5 (16.67%)	
Associated Injuries (%)		8 (26.67%)	7 (23.33%)	X=0.08889 p=0.7656
Time Interval Between Injury & Presentation (days)		3.77 ± 1.13	3.61 ± 1.29	t=0.5110 p=0.6113

Table 3: Intra-Operative Details of the enrolled patients among the groups

Parameter		Group A [n=30]	Group B [n=30]	P-Value
Average Surgery Duration (min)		55.23 ± 10.11	50.81 ± 9.37	t=1.756 p=0.0843
Average Blood Loss (ml)		121.27 ± 25.09	119.26 ± 22.51	t=0.3266 p=0.7451
Fluoroscopy Exposure (sec)		35.17 ± 5.68	28.07 ± 4.36	t=5.431 **p<0.0001***
Length of Incision (cm)		6.22 ± 1.14	5.83 ± 1.08	t=1.360 p=0.1790
Anaesthesia Used	Spinal	29 (96.67%)	30 (100.00%)	X=1.017 p=0.3132
	General	1 (3.33%)	0 (0.00%)	

Table 4: Post-Operative Management and Follow-Up

Parameter	Group A [n=30]	Group B [n=30]	P-Value
Non weight bearing mobilisation (%)	25 (83.33%)	27 (90.00%)	X=0.5769 p=0.4475
Analgesics (%)	30 (100.00%)	30 (100.00%)	--
Antibiotics (%)	30 (100.00%)	30 (100.00%)	--
Stitch Removal at 2 Weeks (%)	30 (100.00%)	30 (100.00%)	--
Physiotherapy Advised (%)	25 (83.33%)	28 (93.33%)	X=1.456 p=0.2276
Weight Bearing at 12Weeks (%)	20 (66.67%)	24 (80.00%)	X=1.364 p=0.2429

Table 5: Post-Operative complications of the enrolled patients

Parameter	Group A [n=30]	Group B [n=30]	P-Value
Infection (%)	3 (10.00%)	1 (3.33%)	X=1.071 p=0.3006
Implant Failure (%)	5 (16.67%)	2 (6.67%)	X=1.456 p=0.2276
Hip Stiffness (%)	3 (10.00%)	1 (3.33%)	X=1.071 p=0.3006
Shortening >1cm (%)	4 (13.33%)	2 (6.67%)	X=0.7407 p=0.3894
AVN (%)	2 (6.67%)	1 (3.33%)	X=0.3509 p=0.5536
Non-union (%)	2 (6.67%)	0 (0.00%)	X=2.069 p=0.1503

Table 6: Harris Hip Score (Group A Vs. Group B) of the enrolled patients

At 6 months	Group A [n=30]	Group B [n=30]	P-Value
Excellent (90-100)	18 (60.00%)	24 (80.00%)	X=5.143 p=0.1616
Good (80-89)	8 (26.66%)	6 (20.00%)	
Fair (70-79)	2 (6.67%)	0 (0.00%)	
Poor (60-69)	0 (0.00%)	0 (0.00%)	
Failure (<60)	2 (0.00%)	0 (0.00%)	

Discussion

A comparative study is only as robust as the comparability of its groups — and in this regard, the present investigation stands on firm ground. Across every demographic and clinical parameter examined, Groups A and B demonstrated remarkable homogeneity, lending credibility to the outcome analysis that follows.

Mean age was virtually identical between groups — 45.33 ± 8.21 years in Group A and 44.87 ± 7.92 years in Group B (t=0.2209, p=0.8260) — and stratified age distribution across the 18–60 year spectrum revealed no significant skew in either cohort (χ^2=0.6715, p=0.8799). Gender composition was similarly balanced, with male predominance of 60.00% in Group A and 56.67% in Group B (χ^2=0.06857, p=0.7934). Fracture laterality, mechanism of injury, Pauwels classification, associated injuries, and injury-to-surgery interval were all statistically equivalent between groups (p>0.05 for all parameters). Road traffic accidents accounted for the dominant injury mechanism in both cohorts — 70.00% in Group A and 73.33% in Group B — reflective of the high-energy trauma profile characteristic of femoral neck fractures in the younger adult demographic. This comprehensive baseline equivalence confirms that any observed differences in

CASE 1 – INVERTED TRIANGLE CONFIGURATION

A 34Y/ FEMALE WITH FRACTURE NECK OF FEMUR(RIGHT) FOLLOWING RTA

Pre- op xrays followed by immediate post-op and successive follow-up X-rays

REHABILITATION IMAGES AFTER 6 MONTHS

outcome are attributable to the fixation technique rather than confounding patient-level variables.

These findings resonate with the existing literature. Garg et al. [11] reported near-identical demographic profiles across their comparative fixation groups, with no significant differences in age distribution, gender, fracture laterality, or injury mechanism — a pattern consistent with our observations. Awais et al. [12], in their series of 82 patients, documented a pronounced male predominance (80.5%; male-to-female ratio 4.1:1) with mean ages of 68.92 ± 6.28 and 69.53 ± 5.88 years across groups (p=0.651). The older demographic profile in their cohort, compared to the present study, likely reflects differing institutional referral patterns and population epidemiology rather than methodological discordance.

Perhaps the most clinically consequential findings of this study emerge from the complication data — where a consistent pattern of advantage favouring the BDSF construct was observed across multiple outcome parameters, even where statistical significance was not always attained.

CASE 1- BDSF CONFIGURATION

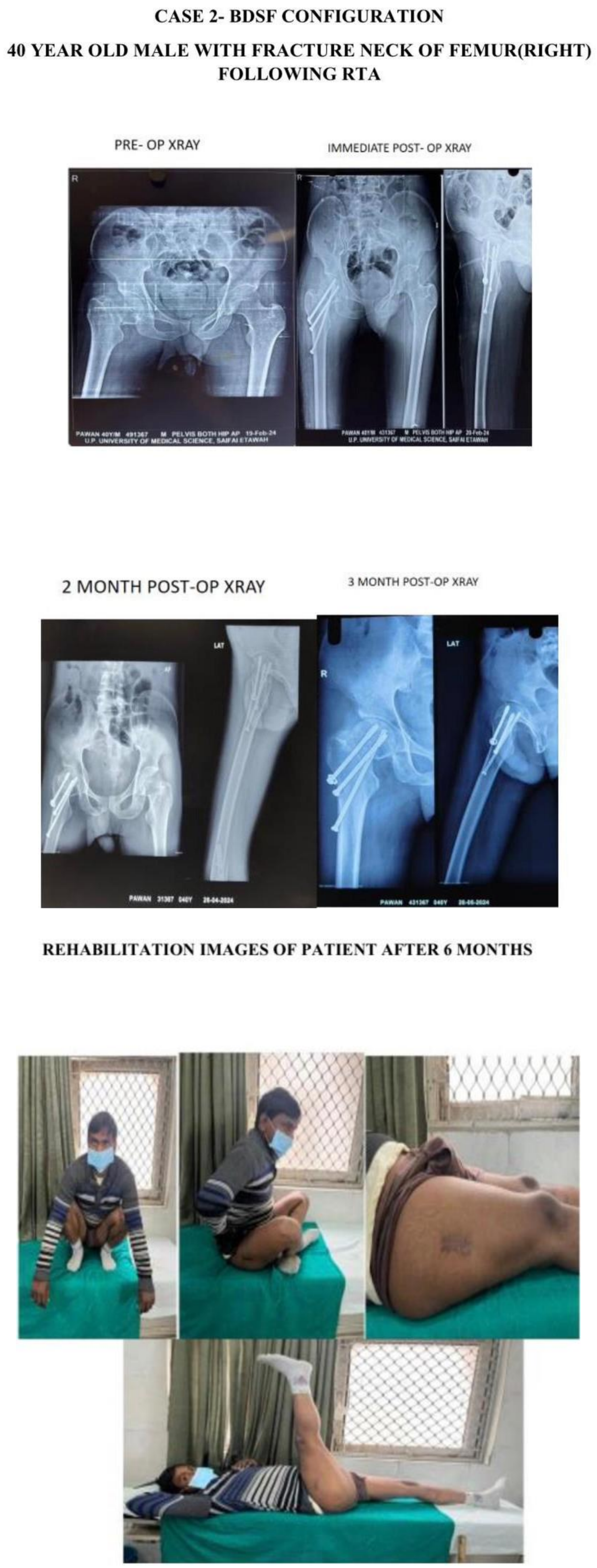
38 YEAR MALE WITH FRACTURE NECK OF FEMUR(LEFT) FOLLOWING INJURY AFTER BEING HIT BY CAR

PRE- OP XRAY

IMMEDIATE POST-OP XRAY

REHABILITATION IMAGES AFTER 6 MONTHS

Surgical site infection occurred in 10.00% of Group A patients against only 3.33% in Group B. Implant failure was recorded in 16.67% of Group A compared to 6.67% in Group B. Hip stiffness affected 10.00% of Group A versus 3.33% of Group B. Femoral neck shortening exceeding 1 cm was documented in 13.33% of Group A patients in contrast to 6.67% in Group B. AVN was identified in 6.67% of GroupAand 3.33% of Group B — rates appreciably lower than the 10–12.5% reported across fixation groups by Cai et al. [13] Most strikingly, non-union was encountered exclusively in Group A (6.67%), with no cases recorded in Group B — a finding that, while not statistically significant, carries unmistakable clinical implications regarding the superior biological environment fostered by the biplanar screw construct.



These complication trends align with, and in several respects extend, the observations of Cai et al. [13], who documented minor wound infections resolving with conservative management and variable but statistically non-significant implant failure rates across different fixation modalities. The consistency of our complication profile with prior literature, despite differences in study design and patient demographics, strengthens the external validity of the present findings.

Taken together, the complication data paint a coherent and compelling picture: while neither technique was entirely free of adverse events, the BDSF configuration demonstrated a consistent trend toward lower complication burden across infection, implant failure, stiffness, shortening, AVN, and non-union — an aggregate advantage that, even in the absence of statistical significance at individual parameter level, merits serious clinical consideration. These findings affirm the biomechanical rationale underpinning the BDSF technique and support its wider adoption in the surgical management of femoral neck fractures in the adult population.

CONCLUSION

The present study enrolled 60 adult patients equally distributed between the two intervention groups, with a mean age of 45.33 ± 8.21 years in Group A and 44.87 ± 7.92 years in Group B (p=0.8260). Rigorous baseline equivalence was established across all demographic and clinical parameters — including age distribution, gender ratio, fracture laterality, mechanism of injury, Pauwels classification, associated injuries, and injury-to-surgery interval — thereby ensuring that inter-group outcome differences reflect fixation technique rather than patient-level confounders. Intraoperatively, Group B demonstrated a marginally shorter mean operative duration (50.81 ± 9.37 min vs. 55.23 ± 10.11 min; p=0.0843) and comparable intraoperative blood loss (119.26 ± 22.51 ml vs. 121.27 ± 25.09 ml; p=0.7451). Most notably, fluoroscopic exposure time was significantly reduced in Group B (28.07 ± 4.36 sec vs. 35.17 ± 5.68 sec; p<0.0001) — a finding of practical relevance given the cumulative radiation burden to both patient and surgical team. Incision length and anaesthetic modality were equivalent across groups.

Rehabilitation parameters consistently favoured the BDSF cohort. Early mobilization was achieved in 90.00% of Group B patients versus 83.33% in Group A (p=0.4475), and weight- bearing at six weeks was accomplished by 80.00% of Group B patients compared to 66.67% in Group A (p=0.2429). Physiotherapy compliance was similarly higher in Group B (93.33% vs. 83.33%; p=0.2276), though these differences did not attain statistical significance.

The complication profile demonstrated a consistent pattern of advantage favouring the BDSF construct. Group B recorded lower rates of surgical site infection (3.33% vs. 10.00%), implant failure (6.67% vs. 16.67%), hip stiffness (3.33% vs. 10.00%), femoral neck shortening exceeding 1 cm (6.67% vs. 13.33%), avascular necrosis (3.33% vs. 6.67%), and non-union (0.00% vs. 6.67%). While individual parameter comparisons did not reach statistical significance, the uniformity of this trend across six distinct complication domains constitutes a clinically meaningful and coherent signal that cannot be dismissed.

Functional outcome assessment by the Harris Hip Score further reinforced the superiority of the BDSF technique. At the point of fracture union, 80.00% of Group B patients achieved excellent scores (90–100) compared to 60.00% in Group A. Critically, treatment failure — defined as a Harris Hip Score below 60 — was entirely absent in Group B, while it afflicted 6.67% of Group A patients, underscoring the tangible impact of fixation configuration on patient recovery and satisfaction.

In summation, the Biplane Double-Supported Screw Fixation technique emerged as the superior fixation strategy across the domains of intraoperative efficiency, post-operative rehabilitation, complication avoidance, and functional recovery. The BDSF configuration — by virtue of its biplanar cortical support, enhanced load distribution, and superior biomechanical architecture — translates theoretical advantage into measurable clinical benefit. On the strength of these findings, BDSF is recommended as the preferred fixation construct for femoral neck fractures in the adult population, and warrants prospective validation in larger, multi-centre cohorts to consolidate its role in contemporary orthopaedic practice.

REFERENCES

1. Raj JJ, Kow RY, Ganthel K, Kunasingh DE, Panicker GK, Lim BC, Low CL. Outcomes of femoral neck fractures in young patients and the factors associated with complications: a multicenter study from Malaysia. Cureus. 2021 Sep;13(9).
2. Khoo CC, Haseeb A, Singh VA. Cannulated screw fixation for femoral neck fractures: A 5-year experience in a single institution. Malaysian orthopaedic journal. 2014 Jul;8(2):14.
3. Miri Z, Haugen HJ, Loca D, Rossi F, Perale G, Moghanian A, Ma Q. Review on the strategies to improve the mechanical strength of highly porous bone bioceramic scaffolds. Journal of the European Ceramic Society. 2024 Jan 1;44(1):23-42.
4. Guo J, Dong W, Qin S, Zhang Y. Definition of ideal configuration for femoral neck screw fixation in older people. Scientific Reports. 2019 Sep 9;9(1):12895.
5. Filipov O. Biplane double-supported screw fixation (F-technique): a method of screw fixation at osteoporotic fractures of the femoral neck. European Journal of Orthopaedic Surgery & Traumatology. 2011 Oct; 21:539-43.
6. Jilani LZ, Abbas MB, Shaan ZH, Ahmad S, Abbas M. Outcomes of BDSF technique for osteosynthesis of femoral neck fractures. Int J Burns Trauma. 2023 Jun 15;13(3):149-155. PMID: 37455799; PMCID: PMC10349321.
7. Jiang D, Zhan S, Cai Q, Hu H, Jia W. Enhanced interfragmentary stability and improved clinical prognosis with use of the off-axis screw technique to treat vertical femoral neck fractures in nongeriatric patients. Journal of orthopaedic surgery and research. 2021 Dec;16:1-1.
8. Tang Z, Zhang Y, Huang S, Zhu Z, Zhou C, Zhu Z, Wang Y, Wang B. Biomechanical study of a biplanar double support screw (BDSF) technique based on Pauwels angle in femoral neck fractures: finite element analysis. Front Bioeng Biotechnol. 2024 May 15;12:1358181.
9. Bensa A, Pagliazzi G, Miele A, Schiavon G, Cuzzolin M, Filardo G. Robotic-Assisted Total Hip Arthroplasty Provides Greater Implant Placement Accuracy and Lower Complication Rates, But Not Superior Clinical Results Compared to the Conventional Manual Approach: A Systematic Review and Meta-Analysis. The Journal of Arthroplasty. 2024 Dec 20.
10. Hurwitz S. Evidence-based medicine in orthopaedic surgery--a way to the future. Iowa Orthop J. 2003;23:61-5. PMID: 14575252; PMCID: PMC1888405.
11. Garg S, Tank G. Role of Biplane Double-Supported Screw Fixation (BDSF) in Management of Fracture Neck Femur and Its Comparison with Conventional CC Screw Fixation. Indian Journal of Orthopaedics. 2023 Dec;57(12):2011-7.
12. Awais MZ, Salik E, Bokhari SH, Iqbal MT. A comparative study of early functional outcomes in undisplaced neck of femur fracture treated with partially threaded and fully threaded cannulated screw fixation in patients above 60 years age. Pakistan Journal of Medical Sciences. 2023 Sep;39(5):1531.
13. Cai L, Zheng W, Chen C, Hu W, Chen H, Wang T. Comparison of young femoral neck fractures treated by femoral neck system, multiple cancellous screws and dynamic hip screws: a retrospectively comparison study. BMC musculoskeletal disorders. 2024 Mar 2;25(1):188.