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COMPARATIVE STUDY OF CLINICAL AND RADIOLOGICAL OUTCOME OF FEMORAL NECK SYSTEM VS DYNAMIC HIP SYSTEM FOR THE FIXATION OF FEMORAL NECK FRACTURES

Orthopaedics

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ABSTRACT

Background: Femoral neck fractures (FNF) in young adults present unique surgical challenges due to high-energy trauma and the need for joint preservation. This study compares outcomes of the Dynamic Hip Screw (DHS) and Femoral Neck System (FNS) for FNF fixation. **Methods:** This study included 26 patients (13 per group), aged 18–85 years, treated with DHS or FNS. Operative time, blood loss, demographics, complications, union time, and Harris Hip Score were recorded. Follow-ups were at 6 weeks, 3 months, and 6 months. Data were analyzed using t-tests, Mann–Whitney U, and Chi-square tests, with $p < 0.05$ considered significant. **Results:** Operative time and blood loss were significantly lower with FNS ($p < 0.001$). FNS also showed faster union (6.84 vs. 9 weeks; $p = 0.048$) and higher Harris Hip Scores at all follow-ups ($p < 0.05$). Complications were low in both groups, with one implant failure in FNS and one non-union in DHS. Functional outcomes significantly favored FNS ($p = 0.0277$). **Conclusion:** It was concluded that, the FNS system could optimise surgical procedures, with shorter operation times and lesser blood loss. The FNS offers higher postoperative hip function as compared to DHS system and comparable complications.

KEYWORDS

Femoral Neck Fracture, Dynamic Hip Screw, Femoral Neck System, Femoral Head, Functional Outcome, Harris Hip Score.

INTRODUCTION

Femoral neck fractures (FNF) represent a major challenge in orthopedic trauma care due to their complex anatomical location, high complication risk, and significant socio-economic burden. Although the majority occur in elderly patients following low-energy mechanisms, younger individuals often sustain FNFs through high-energy trauma such as road traffic accidents and falls from height[1].

The femoral neck is intracapsular and relies on a delicate vascular supply, making fracture healing vulnerable to avascular necrosis (AVN) and non-union[2]. Approximately 50% of all hip fractures involve the femoral neck[3]. In young adults, joint-preserving techniques such as internal fixation are preferred over arthroplasty due to higher activity levels, longer life expectancy, and avoidance of early revision surgery[4-8].

Historically, fixation methods such as cannulated screws, dynamic hip screws (DHS), and proximal femoral locking plates have been used with varying success[6–9]. The DHS, introduced in 1964, provides angular stability and dynamic axial compression, but is associated with complications such as femoral neck shortening and rotational instability[10].

The Femoral Neck System (FNS) is a newer device designed to provide angular stability, controlled dynamic compression, and rotational control with a minimally invasive approach[11]. Biomechanical studies suggest FNS offers improved stability and reduced soft tissue disruption compared to DHS[12-14], potentially resulting in faster healing and better functional outcomes.

Comparative studies evaluating the clinical and radiological outcome are still limited. So, the aim of this study was to evaluate the clinical and radiological outcome of patients of all ages treated with the femoral neck system and compare it to patients treated with the dynamic hip screw.

MATERIAL & METHODS

Study Design and Setting

A retrospective–prospective observational study was conducted at the Department of Orthopaedics, Netaji Subhash Chandra Bose, Subharti Medical College and Hospital, Meerut, from February 2024 to June 2025. The study compared outcomes in patients with femoral neck fractures (FNF) treated with either a Dynamic Hip Screw (DHS) or a Femoral Neck System (FNS). Ethical clearance was obtained from the institutional review board, and informed consent was secured from all participants.

Eligibility Criteria

Inclusion Criteria:

- Age 18–85 years.
- Skeletally mature patients.
- Minimum follow-up of 6 months.

Exclusion Criteria:

- Pathological or open fractures.
- Local infection prior to surgery.
- Skeletally immature patients.
- Cases managed with open reduction and internal fixation (ORIF).

Sample Size:

The sample size was calculated using the Harris Hip Score (HHS) as the primary endpoint, with a medium effect size (Cohen's $d = 0.8$), 80% power, and 5% significance. This yielded 13 patients per group ($n = 26$ total).

Surgical Procedure:

The fractures were stabilized using either DHS or FNS. In patients managed with the Femoral Neck System, surgery was performed under general or epidural anesthesia with the patient in a supine position using an orthopedic traction device. A 4-cm longitudinal incision was made below the greater trochanter, and an antirotation wire was placed in the superior/anterior part of the femoral neck. A central guide wire was then inserted using a 130° angled guide, confirmed under C-arm fluoroscopy. After measuring the required length, reaming was performed, and the implant was placed over the central wire. Locking and antirotation screws were then inserted under fluoroscopic guidance. After fixation, soft tissue closure was done

using absorbable and nonabsorbable sutures.

In the DHS group, the surgical technique was similar but involved a longer incision. After fluoroscopic guidance, a guide pin was placed and the femoral shaft was reamed. The DHS screw was inserted into the femoral head, maintaining a depth of 5–10 mm below the cartilage surface. A side plate was then fixed and secured with locking screws, followed by final tightening and wound closure.

Postoperative Management:
Both groups received identical postoperative care. Antibiotics were administered 30 minutes before and continued for 24 hours after surgery. Early mobilization was encouraged, including active isometric lower limb exercises, ankle movements, and passive hip joint mobility. Stable fracture cases were permitted partial weight-bearing. Low molecular weight heparin (0.2–0.4 ml) was administered during hospitalization to prevent thrombosis. Upon discharge, patients received a three-week course of analgesics and anticoagulants. Partial weight-bearing with a cane was initiated between 6 weeks and 3 months, followed by full weight-bearing as per radiographic assessment after 3 months.

Clinical Evaluation:
Clinical data were collected from hospital records. All patients underwent standardized x-ray evaluations at 6 weeks, 3 months and 6 months. Baseline demographic and clinical data, surgical information, and Harris hip scores were recorded by medical staff blinded to the treatment groups. The final clinical evaluation was conducted by two independent doctors. The Harris scale was used to assess hip function, while femoral head necrosis and femoral neck shortening were evaluated using follow-up radiographs.

1) The Primary outcome of the study was to compare clinical and radiological outcomes between the femoral neck system and dynamic hip system for the treatment of femoral neck fracture.

2) The Secondary outcome was to determine which implant would be ideal for this fracture type so as to provide the best results with the least complications.

Statistical Analysis
Data analysis was performed using SPSS 21.0. Normality was assessed with the Kolmogorov–Smirnov test. Independent t-test or Mann–Whitney U test was used for continuous variables, and chi-square test for categorical data. Significance was set at $p < 0.05$.

OBSERVATION AND RESULTS
Patient Demographics and Baseline Characteristics"
A total of 26 patients were analyzed, with 13 in each group. Mean age was 50.2 ± 19.1 years (DHS) and 46.5 ± 20.5 years (FNS) (p = 0.639). Males comprised 61.53% of the study population. No significant differences were observed between groups in terms of gender, mechanism of injury, fracture classification, or side involved (all p > 0.05). (Table 1)

Intraoperative Findings
FNS procedures had a significantly shorter operative time and lower intraoperative blood loss compared to DHS. (Table 2)

Complications
Overall complication rates were low and similar between groups (p = 0.497). (Table 3)

Union Time
Patients in FNS group had significantly shorter union time (6.84 ±0.778 weeks) as compared to patients in DHS group (9±1.23 weeks). (Table 4)

Harris Hip Score
Harris Hip Score (HHS) was significantly higher in the FNS group at all follow-up intervals. (Graph1)

Functional Outcome
In our study, overall nine patients (34.61%) had excellent outcome, amongst these, 2 patients were from DHS group (7.69%) and 7 patients were from FNS group (34.61%).

Overall 15 patients had good functional outcome (57.69%), amongst these, 6 patients were from DHS group (23.07%) and 9 patients were from FNS group (34.61%).

Overall 1 patients had good functional outcome (57.69%), amongst these, 6 patients were from DHS group (23.07%) and 9 patients were from FNS group (34.61%).

The distribution of functional outcome was significantly different amongst both the group (p=0.0277) (Table 6)

Table 1: Patient Demographics And Baseline Characteristics:

Variable	Category	DHS (n = 13)	FNS (n = 13)	Total (n = 26)	P-value
Age (years)	Mean ± SD	50.2 ± 19.1	46.5 ± 20.5	—	0.639*
	Median	48.0	45.0	—	
	Min–Max	21.0–75.0	17.0–84.0	—	
Gender	Male	7 (26.92%)	9 (34.61%)	16 (61.53%)	0.420#
	Female	6 (23.07%)	4 (15.38%)	10 (38.47%)	
Mode of Fracture	Fall from Height	2 (7.69%)	3 (11.53%)	5 (19.23%)	0.708#
	Slip and Fall	5 (19.23%)	6 (26.08%)	11 (42.30%)	
	RTA	6 (23.07%)	4 (15.38%)	10 (38.47%)	
Type of Fracture	Trans-cervical	7 (26.92%)	7 (26.92%)	14 (53.84%)	1.000#
	Basi-cervical	6 (23.07%)	6 (23.07%)	12 (46.15%)	
Pauwel Type	Type 3	6 (23.07%)	9 (34.61%)	15 (57.69%)	0.234#
	Type 2	7 (26.92%)	4 (15.38%)	11 (42.30%)	
Garden Type	Type 4	6 (23.07%)	9 (34.61%)	15 (57.69%)	0.234#
	Type 3	7 (26.92%)	4 (15.38%)	11 (42.30%)	
Side Involved	Left	9 (34.61%)	5 (19.23%)	14 (53.84%)	0.116#
	Right	4 (15.38%)	8 (30.76%)	12 (46.15%)	
***Independent Students T Test**	#Chi square test	p>0.05 considered significant			

Table 2: Intraoperative Findings:

Parameter	Statistic	DHS	FNS	p-value
Duration of Surgery	Mean ± SD	90.0 ± 3.54 min	62.7 ± 6.33 min	< 0.001
	Median	90.0	60.0	
	Min–Max	85.0 – 95.0	55.0 – 75.0	
Blood Loss	Mean ± SD	209 ± 25.0 ml	105 ± 23.3 ml	< 0.001
	Median	200	100	
	Min–Max	190 – 270	80.0 – 170	

Table 3: Complications

	Procedure			Chi square test
Complications	DHS	FNS	Total	
Nil	10 (38.46%)	11(42.30%)	21 (80.76%)	0.497
Non-union	1 (3.84%)	0(0%)	1 (3.84%)	
Superficial Infection	2 (7.69%)	1 (3.84%)	3 (11.53%)	
3 weeks follow up implant failure, patient went for THR	0 (0%)	1 (3.84%)	1 (3.84%)	
Total	13 (50%)	13 (50%)	26 (100%)	

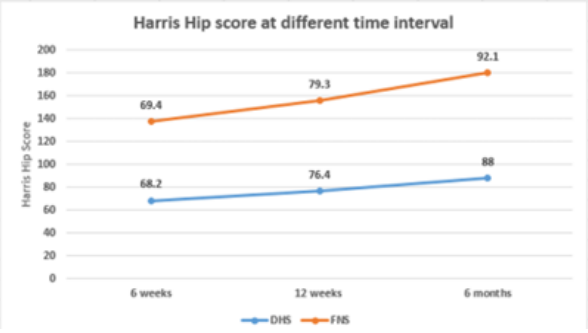
Table 4: Union Time

Union time (in weeks)	DHS	FNS	Independent Samples paired T-Test
Mean	9	6.84	0.048*
Median	8.50	5.75	
Standard Deviation	1.23	0.778	
Minimum	0.00	0.00	

Maximum	11.00	9.00	

Table 5: Functional Outcome

	Procedure			Chi square
Functional Outcome	**DHS**	**FNS**	**Total**	
Excellent	2 (7.69%)	7(26.92%)	9 (34.61%)	0.0277*
Good	6 (23.07%)	9 (34.61%)	15 (57.69%)	
Poor	1 (3.84%)	1 (3.84%)	2 (3.84%)	
Total	13 (50%)	13 (50%)	26	



Graph 1: Harris Hip Score

DISCUSSION

This study compared clinical and radiological outcomes of the Femoral Neck System (FNS) and Dynamic Hip Screw (DHS) in managing femoral neck fractures (FNF).

Baseline Demographic And Injury Characteristics: were comparable, FNS demonstrated significant intraoperative and postoperative advantages, including shorter operative time, reduced blood loss, faster fracture union, and better functional recovery.

In the present study the mean age in the DHS group was 50.2 ±19.1 years and 46.5±20.5 in FNS group. No difference in age distribution was observed in both the groups.

Similar to our findings, In the study by, **Konrad Schuetze (2022) [15]** The mean age was 69.5±15.4 years and did not differ between the groups (DHS 68.5±15.1; FNS 66.6±21.5; $p > 0.05$)

Similarly, In the study by **Zilu Ge (2023) [16]**, mean age in the DHS group was 50.4 ±8 years and 48.2±7.5 in FNS group. No difference in age distribution was observed in both the groups. Majority of the patients were male (N=16,61.53%) No difference in gender distribution was observed in both the groups Similar to our findings,

In the present study, majority of the patients had pauwel type 3 classification (N=15,57.69%), while 11(42.30%) patients had Pauwel type 2 fracture. No difference in Pauwel type classification of fracture was observed in both the groups.

Majority of the patients had Garden type 4 classification (N=15.57.69%), while 11(42.30%) patients had Garden type 3 fracture. No difference in Garden type classification of fracture was observed in both the groups

In the study by, **Konrad Schuetze (2022) [15]** There was a significant difference within the groups with twice the number of patients with 31-B3 fractures in the DHS group. There were slightly more patients that were treated for dislocated Garden III and IV fractures in FNS group. Using Pauwels classification there were 39 Grade III fractures in DHS group and 40 in FNS group. There was no difference between the groups for Pauwels and Garden classification.

In our study, majority of the patients had slip and fall (42.30%), RTA was the mode of fracture in 38.47% cases, whereas 19.23% cases reported fall from height as the mode of fracture.

In the study by **Leyi Cai (2024) [17]**, majority of the patients had RTA (48.75%), falling from heights was the mode of fracture in 40% cases, 15% cases reported Slip and fall and 20% reported other reasons.

In our study, majority of patients had left side fracture involvement (53.84%). Right side involvement was seen in 46.15%.DHS group had majority of the patients with left side involvement (34.61%) whereas in FNS group, majority of the patients had right side involvement (30.76%).

In the study by **Leyi Cai (2024) [17]**, majority of patients had left side fracture involvement (60%). Right side involvement was seen in 40%. DHS group had majority of the patients with left side involvement (62.5%) similarly in FNS group, majority of the patients had left side involvement (57.5%)

In the present study, FNS had significantly shorter duration of surgery(62.7±6.33mins) as compared to DHS (90±3.54 mins)

Similar to our findings, In the study by **Zilu Ge (2023)[16]** FNS had significantly shorter duration of surgery(47.09±9.19mins) as compared to DHS(52.90±9.64 mins).

A significantly faster operation time in FNS group was likely due to the smaller footprint and a streamlined surgical procedure with the use of a single central guide wire.

FNS had significantly lesser blood loss (105 ±23.3 ml) as compared to DHS(209 ±25.0 ml) Similar to our findings, In the study by **Zilu Ge (2023)[16]** FNS had significantly lesser blood loss (48.53±10.69 ml) as compared to DHS (65.31±17.91 ml).

In our study, majority of the patients had no complications post-surgery (80.76%). In DHS group, 38.46% patients had no complication, 1 patient had nonunion (3.84%) whereas 2 patients had superficial infection (7.69%).

In FNS group, 42.30% patients had no complications, 1 patient had superficial infection (3.84%) and 1 patient (3.84%) had implant failure at 3 weeks follow up, the patient was managed by THR. **Samuel et al. (2023)[18]** performed a study comprising 105 patients who received FNS for FNFs. One-year implant failure rate 13% and mortality rate 21% were reported. No significant difference in the complications was observed amongst the groups.(p=0.497) **Amit et al. (2022)[19]** retrospectively analysed a multi-centre study cohort of 102 FNF patients managed with FNS, and demonstrated that the FNS group had significantly lower complication rates compared to CCS and DHS fixation groups**.**

In the study by, **Konrad Schuetze (2022)[15]** Femoral neck compression showed no difference between the groups and exceeded 5 mm in 27.6% of all cases. The rate of surgical complications showed no significant difference between the groups. In the DHS group there were 11 cut outs, 3 implant related infections and 6 patients with hematoma. All infections were successfully treated with multiple local debridement and antibiotics keeping the implant.

In FNS group there were 14 cut outs and 1 hematoma. Implant failure occurred 12 times at the side of the blade and 2 time at the 1-hole plate. Both implants allowed a comparable mean femoral neck shortening of 5 mm over 3 months. In the study by, **Zilu Ge (2023) [16]** postoperative complications, including femoral neck shortening, nonunion, screw pull-out, femoral head necrosis, and infection, were recorded. In both groups, most patients had satisfactory outcomes. Femoral neck shortening was significantly less in the FNS group than in the dynamic hip screw (DHS) group (3.93 ± 2.40, $n = 39$ vs. 5.22 ± 2.89, $n = 44$, $P = 0.031$). The percentage of patients with femoral neck shortening of <10 mm at the last follow-up was 78.8% in the DHS group and 86.0% in the FNS group. However, three cases in the DHS group and two cases in the FNS group had femoral neck shortening of >10 mm postoperatively. Although the number of cases of severe clinical outcomes, including non-union, screw pull-out, and femoral head necrosis, were lower in the FNS group than in the DHS group, there was no statistical difference between the two groups ($P = 0.537$). There was one case in the DHS group of *Staphylococcus aureus* infection at the incision region at 5 days postoperatively. In the study by **Leyi Cai(2024)** [17], Superficial wound infection was present in one case in each group, and resolved with wound cleansing and antibiotics. There was no deep infection and other wound-healing complications. There were 2 patients in FNS group, 2 patients in MCS group and 3 patients in DHS group suffered internal fixation failure. The FNS, MCS and DHS groups showed a similar mean rate AVN of 4(10%), 4(10%) and 5(12.5%) respectively.

In our study, overall, nine patients (34.61%) had excellent outcome,

amongst these, 2 patients were from DHS group (7.69%) and 7 patients were from FNS group (34.61%).

Overall, 15 patients had good functional outcome (57.69%), amongst these, 6 patients were from DHS group (23.07%) and 9 patients were from FNS group (34.61%).

Overall 1 patients had good functional outcome (57.69%), amongst these, 6 patients were from DHS group (23.07%) and 9 patients were from FNS group (34.61%).

The distribution of functional outcome was significantly different amongst both the group (p=0.0277)

Functional Outcome

In the present study, FNS group showed excellent outcome in 7 patients, good in 9 and poor in 1 while in DHS group, 2 patients had excellent outcome, 6 had good outcome and 1 had poor outcome.

In the study by **Zilu Ge (2023)** [16], There were 5 patients had poor, 8 had medium, 28 had good and 11 had excellent Harris scores in DNSb group. And there were 3 patients had poor, 5 had medium, 20 had good and 15 had excellent scores in FNS group.

Union Time

In our study, patients in FNS group had significantly shorter union time (6.84 ±0.778 weeks) as compared to patients in DHS group (9±1.23 weeks).

Jae Youn Yoon, 2024[20] reviewed Fixation of femoral neck fracture with femoral neck system in 43 patients. The Radiological bone union was confirmed in 39 patients (90.7%), and the mean time to union was 3.6 months.

Non Union

In our study, DHS group had 1 patient with nonunion (3.84%) whereas in FNS group nonunion was not reported in any case.

In the study by **Zilu Ge (2023)[16],** DHS group had 3 patients with nonunion (5.8%) whereas in FNS group 2 patients (4.7%) had nonunion.

CONCLUSION

In this comparative study, the Femoral Neck System (FNS) demonstrated several advantages over the Dynamic Hip Screw (DHS) in the management of femoral neck fractures. FNS was associated with significantly shorter operative time, reduced intraoperative blood loss, faster fracture union, and better early functional outcomes without an increase in complication rates. While our results suggest FNS may be the preferred fixation method in this patient population, larger randomized controlled trials with longer follow-up are needed to confirm long-term outcomes and potential benefits in preventing avascular necrosis and other late complications.

REFERENCES

1. Parker M, Johansen A. Hip fracture. Bmj. 2006 Jun 29;333(7557):27-30.
2. Hanoun A, Henari SF, Kumar V. Fracture Neck of the Femur. InThe Hip Joint 2021 Nov 10 (pp. 595-638). Jenny Stanford Publishing.
3. Davidson A, Blum S, Harats E, Kachko E, Essa A, Efraty R, Peyser A, Giannoudis PV. Neck of femur fractures treated with the femoral neck system: outcomes of one hundred and two patients and literature review. International orthopaedics. 2022 Sep;46(9):2105-15.
4. Peng P, Xiao F, He X, Fang W, Huang J, Wang B, Luo Y, Zhang Q, Zhang Y, He W, Wei Q. Global research status and trends of femoral neck fracture over the past 27 years: a historical review and bibliometric analysis. Frontiers in Surgery. 2022 Jun 14;9:875040.
5. Mody BS, Mody K. Arthroplasty in young adults: options, techniques, trends, and results. Current reviews in musculoskeletal medicine. 2014 Jun;7(2):131-5.
6. Stake CE, Talbert PY, Hopkinson WJ, Daley RJ, Alden KJ, Domb BG. Hip arthroplasty or medical management: a challenging treatment decision for younger patients. The Journal of Arthroplasty. 2015 Jun 1;30(6):950-4.
7. Goodnough LH, Wadhwa H, Fithian AT, DeBaun MR, Campbell ST, Gardner MJ, Bishop JA: Is percutaneous screw xation really superior to non-operative management after valgus-impacted Page 10/13 femoral neck fracture: a retrospective cohort study. Eur J Orthop Surg Traumatol 2021, 31(1):65–70.
8. Li J, Wang M, Zhou J, Zhang H, Li L: Finite element analysis of different screw constructs in the treatment of unstable femoral neck fractures. Injury 2020, 51(4):995–1003.
9. Fletcher JWA, Sommer C, Eckardt H, Knobe M, Gueorguiev B, Stoffel K: Intracapsular Femoral Neck Fractures-A Surgical Management Algorithm. Medicina (Kaunas) 2021, 57(8).
10. Xiao YP, Shu DP, Bei MJ, Ji T, Kan WS, Li SG: The clinical application of a novel method of internal fixation for femoral neck fractures-dynamic locking compression system. J Orthop Surg Res 2018, 13(1):131.
11. Shu DP, Xiao YP, Bei MJ, Ji T, Peng YJ, Ma B, Li SG: Dynamic compression locking system versus multiple cannulated compression screw for the treatment of femoral neck fractures: a comparative study. BMC Musculoskelet Disord 2020, 21(1):230.
12. O'neill F, Condon F, McGloughlin T, Lenehan B, Coffey JC, Walsh M. Dynamic hip screw versus DHS blade: a biomechanical comparison of the fixation achieved by each implant in bone. The Journal of Bone & Joint Surgery British Volume. 2011 May 1;93(5):616-21.
13. Kowaleski MP. Minimally invasive osteosynthesis techniques of the femur. Veterinary Clinics: Small Animal Practice. 2020 Jan 1;50(1):155-82.
14. Kim CH, Kim JW. A recent update on the fixation techniques for femoral neck fractures: A narrative review. Journal of Clinical Orthopaedics and Trauma. 2024 Jul 1;54:102497.
15. Schuetze K, Burkhardt J, Pankratz C, Eickhoff A, Boehringer A, Degenhart C, Gebhard F, Cintean R. Is new always better: comparison of the femoral neck system and the dynamic hip screw in the treatment of femoral neck fractures. Archives of orthopaedic and trauma surgery. 2023 Jun;143(6):3155-61.
16. Ge Z, Xiong W, Wang D, Tang Y, Fang Q, Wang L, Zhang Z, Lin W, Wang G. Comparison of femoral neck system vs. dynamic hip system blade for the treatment of femoral neck fracture in young patients: A retrospective study. Frontiers in Surgery. 2023 Feb 3;10:1092786.
17. 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.
18. Stegelmann SD, Butler JT, Mathews DJ, Ostlie HC, Boothby BC, Phillips SA. Survivability of the Femoral Neck System for the treatment of femoral neck fractures in adults. Eur J Orthop Surg Traumatol. 2023; 33: 2555-63.
19. Davidson A, Blum S, Harats E, Kachko E, Essa A, Efraty R, et al. Neck of femur fractures treated with the femoral neck system: outcomes of one hundred and two patients and literature review. Int Orthop. 2022; 46: 2105-15. doi: 10.1007/s00264-022-05414-0Chaurasia BD. The Lower Limb chapter 2. In: Human anatomy regional and applied dissection and clinical. 4th ed. Vol (2). India: CBS publishers; 2004: 142 147.
20. Yoon JY, Byun SE, Cho YH. Fixation of femoral neck fracture with femoral neck system: a retrospective cohort study of 43 patients. BMC musculoskeletal disorders. 2024 Jan 2;25(1):8