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A prospective comparative study of basicervical fracture neck of femur with proximal femoral nail versus dynamic hip screw with derotation screw

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ABSTRACT

Background: Basicervical femur fractures represent an intermediate between femoral neck and the intertrochanteric region. Fractures in this region have greater biomechanical instability due to their greater fracture angle, varus collapse, and are rotationally unstable. **Aims and Objectives:** The study was designed to evaluate and compare the functional outcomes, union rates, and radiological results of basicervical femoral neck fractures (BFNFs) treated using proximal femoral nail (PFN) compared to dynamic hip screw (DHS) with derotation screw (DRS) in patients aged 18 years and older. **Materials and Methods**: A simple randomized controlled trial was conducted on 30 patients with basicervical fractures admitted to Chigateri General Hospital and Bapuji Hospital attached to JJM Medical College, Davangere. All the patients underwent either PFN or DHS-DRS procedure as per the protocol. **Results:** The majority of patients were aged between 61 and 70 years. Males accounted for 60% in the PFN group and 53.3% in the DHS-DRS group. The average surgical duration was shorter in the PFN group (76.07 ± 8.12 min) compared to the DHS-DRS group (103.5 ± 5.70 min). At the 12-month follow-up, the modified Harris hip score was higher in the PFN group (90.03 ± 4.14) than in the DHS-DRS group (80.23 ± 2.11). After 1 year, 80% of PFN cases demonstrated excellent functional outcomes, in contrast to 40% in the DHS-DRS group. **Conclusion**: PFN technique may offer better surgical efficiency, reduced blood loss, improved functional recovery, and fewer complications compared to the DHS with DRS technique for the management of BFNFs.

Key words: Basicervical fractures; Modified Harris hip scores; Dynamic hip screws; De-rotation screw, Proximal femoral nail, Osteonecrosis, Non-union

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INTRODUCTION

Basicervical femoral neck fractures (BFNFs) are located between the femoral neck and the intertrochanteric region, accounting for approximately 1.8–7.7% of all hip fractures.[1] Hip fractures are generally divided into two main categories: Femoral neck fractures and intertrochanteric fractures. The interval region between these two categories is referred to as the basicervical region, and fractures here are termed basicervical femur fractures. These fractures are managed using either extramedullary or intramedullary devices with ongoing efforts to determine which offer better clinical outcomes.[2] The incidence of hip fractures shows a bimodal distribution, commonly resulting from high-intensity trauma such as motor vehicle accidents in younger patients, and low-energy trauma such as slips and falls in the elderly.[3] Basicervical femur fractures are considered biomechanically unstable and are associated with a high rate

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of clinical treatment failure.[4] Numerous clinical trials and biomechanical studies have been conducted to identify the most appropriate implants for treating BFNF.[5] The choice of implant is influenced by several factors, including the degree of fracture displacement, fracture instability, patient age, and overall health status. Common treatment options include the dynamic hip screw (DHS) combined with cancellous cannulated screws used as a derotation screw (DRS), or a proximal femoral nail (PFN).[6]

Although the surgical outcomes of BFNF were once thought to be comparable to those of intertrochanteric fractures, studies have reported a higher incidence of complications such as non-union and avascular necrosis of the femoral head in BFNF.[7] This study aims to compare the clinical, functional, and radiological outcomes of BFNF treated with PFN versus DHS with a DRS. Parameters such as surgical time, blood loss, complication rates, time to weight-bearing, and functional recovery will be evaluated to determine whether PFN provides superior outcomes compared to DHS with a DRS in the management of basicervical femur fractures.[8]

Aim and objectives

The aims and objectives of the study are to evaluate and compare the functional outcomes, union rates, and radiological results of basicervical fractures neck of femur treated using PFN compared to DHS with DRS in patients aged 18 years and older, visiting the Department of Orthopaedics at Jayadeva Jagadguru Murugarajendra Medical College and Chigateri General Hospital, Davangere.

Objectives of the study

- To compare the functional outcomes, union rates, and radiological results of BFNF treated using PFN compared to DHS with DRS in patients aged 18 years and older
- To compare the advantages and disadvantages of PFN compared to DHS with DRS.

MATERIALS AND METHODS

Study design

This study is to evaluate and compare the functional outcomes, union rates, and radiological results of BFNF treated using PFN compared to DHS with DRS in patients aged 18 years and older visiting the Department of Orthopaedics at Jayadeva Jagadguru Murugarajendra Medical College and Chigateri General Hospital Davangere.

Source of data

Data for the study were obtained from patients admitted to the Department of Orthopaedics at Chigateri General Hospital and Bapuji Hospital, which are affiliated with J.J.M. Medical College, Davangere. The patients diagnosed with basicervical fractures of the neck underwent surgical treatment either using PFN or DHS with DRS and were compared.

Study period

The study was conducted over a period spanning March 2023 to March 2025.

Data collection

Patient data were collected using pre-designed case sheets, including detailed medical histories, general physical and systemic examinations, as well as radiological investigations. A total of 30 patients with basicervical neck of femur fractures were included in the study.

Inclusion criteria

1. Cases of BFNF with AO types 31B2.1
2. Age more than 18 years
3. Closed type of fracture
4. Patients who were willing to take treatment and willing to give acceptance for written informed consent.

Exclusion criteria

1. Intracapsular femoral neck fractures
2. Intertrochanteric fractures in which the head–neck fragment has a connection with the trochanter or has inferior cortical extension which can tether it to the distal fragment and prevent its spinning around the lag screw
3. Patients with advanced arthritis or pathological fractures
4. Patients medically unfit for surgery
5. Compound fractures associated with neurovascular injuries, ipsilateral femoral shaft fractures, and pelvic fractures
6. Patient is not willing to undergo treatment.

Operative procedure: DHS with DRS

Patient placed on fracture table (Figure 1). Closed reduction achieved under C-arm (Figure 2). A linear incision was made from the tip of the greater trochanter extending distally along the lateral aspect of the proximal thigh. Blunt dissection of soft tissue was done. Tensor fascia lata and vastus lateralis were split in line of skin incision to expose the proximal femur. Using an angle guide, two threaded guide pin was inserted parallel from trochanteric flair till 10 mm short of subchondral bone of femur head positioning centrally in both anteroposterior (AP) and lateral radiographs (Figure 3). This provides a temporary rotational stability which prevents head from spinning around triple reamer or lag screw. A suitable length cannulated cancellous screw 6.5 mm was inserted with washer (Figure 4). Lag screw insertion and barrel plate were fixed to the shaft (Figure 5). Coupling screw was inserted after releasing traction in order to achieve adequate compression at the fracture site.

Figure 1: Position on fracture table

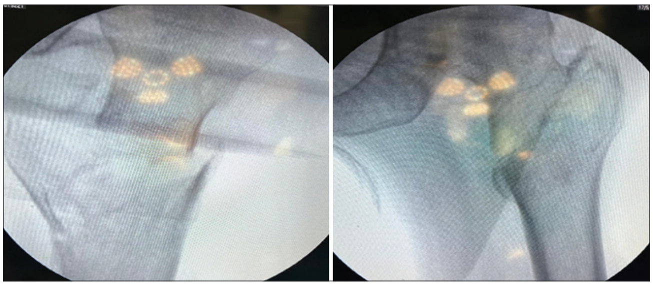

Figure 2: Closed reduction under C-arm – anteroposterior and lateral view

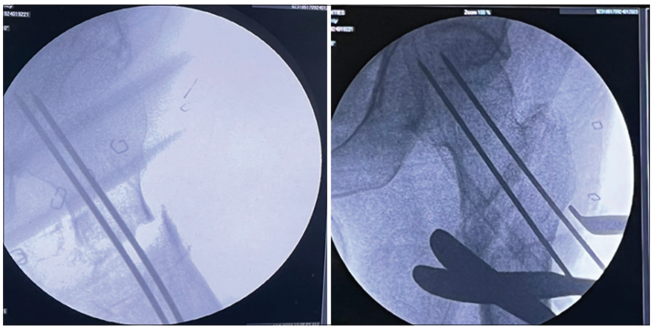

Figure 3: Guide pin insertion- anteroposterior and lateral view

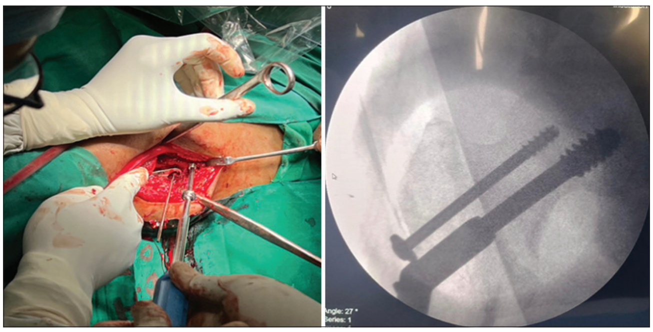

Figure 4: Derotation screw insertion with washer

Operative procedure: PFN

Using standard lateral approach, entry was made using an awl in AP and lateral view (Figure 6). Nail inserted and guide pin were inserted into the center of the femoral head to guide the placement of the screws both in AP and lateral views (Figure 7). Lag screw and DRS screw placed after reaming (Figure 8). Distal locking screws were inserted to prevent rotation of the nail (Figure 9). The quality of reduction was ensured on the AP and lateral view.

Post-operative protocol

All patients were positioned supine with the affected lower limb placed in 20–30° of abduction and slight external

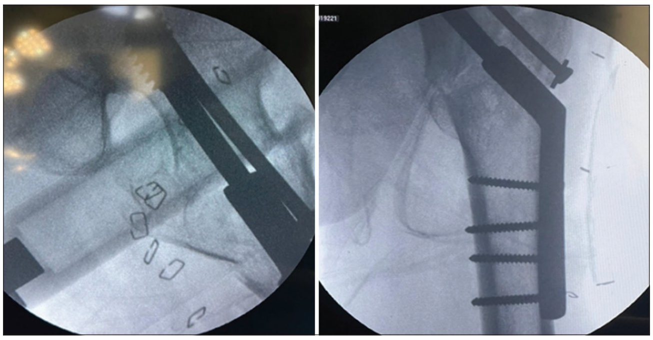

Figure 5: Lag screw insertion and barrel side plate fixation using non-locking cortical screws

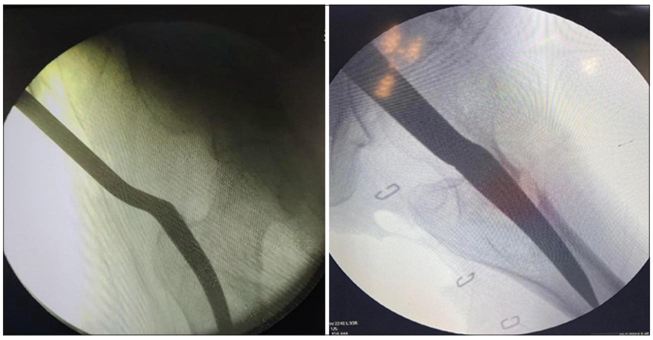

Figure 6: Entry with AWL – anteroposterior and lateral view

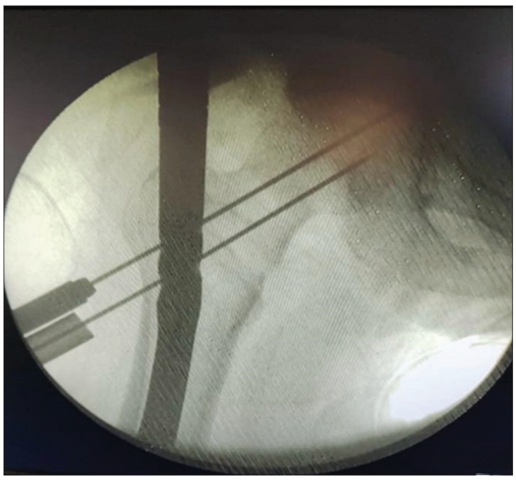

Figure 7: Nail and guide pin inserted

rotation. For patients under spinal anesthesia, foot-end elevation was adjusted based on their post-operative blood pressure. Vital signs, including blood pressure, pulse rate, temperature, and respiratory rate, were monitored every 30 min during the first 24 h. Postoperative blood transfusion was administered when required. The surgical drain if it was put removed between 24 and 48 h, depending on the volume of fluid collected. Patients were encouraged to sit up on the 2nd post-operative day and begin standing with a walker between the 3rd and 7th day. Depending on pain tolerance, non-weight-bearing walking with a walker was allowed between the 5th and 10th postoperative day. Sitting cross-legged and squatting were prohibited.

Staples were removed between the 10th and 12th post-operative day.

Ethical clearance was obtained from the Institutional Ethics Committee, and written informed consent was secured from participants before data collection. The IEC number was ECR/731/INST/KA/2015/RR-21, Date: April 20, 2023.

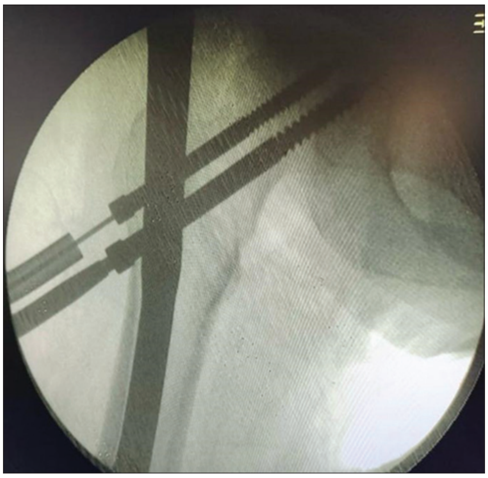

Figure 8: Lag (8 mm) and derotation screw (6.2 mm)

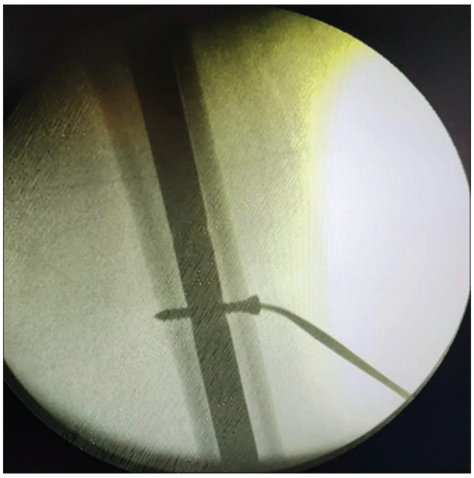

Figure 9: Distal locking with non-locking cortical screw

A total of 30 patients with basicervical fractures of the neck admitted to the orthopedic ward were recruited for the study.

Sample size estimation

Sample size calculation was done using G*Power software 3.1.9.7.

- For an effect size of 0.9
- Power of the study (1-β) 80%
- Marginal error (α) of 5%, minimum 30 patients were needed.

A total of 15 patients were required for each group.

RESULTS

A prospective simple randomized controlled trial was conducted on 30 patients with basicervical femoral fractures admitted to the Department of Orthopaedics at JJM Medical College and Chigateri General Hospital, Davangere. The study population was divided into two groups: those treated with a PFN and those treated with a DHS and DRS. The mean age of participants in the PFN group was 68.2 years, while it was 62.2 years in the DHS-DRS group. Males constituted the majority in both groups, accounting for 60% in the PFN group and 53.3% in the DHS-DRS group. Right-sided fractures were more common in the DHS-DRS group, whereas left-sided fractures predominated in the PFN group. Self-falls (SFs) were identified as the leading cause of these fractures.

In terms of surgical and clinical outcomes, Table 1 represents that the mean surgical time was significantly shorter in the PFN group at 76.07±8.12 min compared to 103.5±5.70 min in the DHS-DRS group. Similarly, Table 2 represents that the mean blood loss[9] was lower in the PFN group, recorded at 180±20.39 mL, while it was 250±25.07 mL in the DHS-DRS group. At 12 months

Table 1: Operative Time

Variable	PFN (N=15)	DHS-DRS (N=15)	t-value	p-value
Operative time (minutes)	76.07±8.12	103.5±5.70	-2.662	0.03 (S)

Table 2: Post-operative Blood Loss

Variable	PFN (N=15)	DHS (N=15)	t-value	p-value
Blood loss (ml)	180±20.39	250±25.07	1.738	0.093 (NS)

postoperatively, the modified Harris hip score (MHHS) was higher in the PFN group (90.03±4.14) than in the DHS-DRS group (80.23±2.11), indicating better functional outcomes as represented in Table 3.

Regarding complications and functional recovery, superficial infection[10] was reported in 6.7% (1 case) of the PFN group and 13.3% (2 cases) of the DHS-DRS group. Limping was observed in 6.7% of DHS-DRS cases, and knee stiffness occurred in two patients (13.3%) of the same group as represented in Table 4. Table 5 represents radiological union at the end of 12 months and (Figure A1a-d and A2a-d) shows that case follow-ups for radiological union were achieved in all patients from both groups.

Table 6 represents MHHS criteria,[11] 80% of patients in the PFN group achieved excellent outcomes, while 53.3% of those in the DHS-DRS group had good results at the end of 12 months, further supporting the superior performance of PFN in managing basicervical femoral fractures.

DISCUSSION

BFNF represents a biomechanically unstable and relatively uncommon subtype of proximal femur fractures, accounting for 1.8–7.7% of all hip fractures. These fractures lie at the junction of the femoral neck and intertrochanteric region, often exhibiting characteristics of both femoral neck and intertrochanteric fractures, thereby posing a unique challenge in terms of classification and optimal management strategy. This prospective randomized controlled trial compared the functional, clinical, and radiological outcomes of two widely used fixation methods: PFN[8,12] and DHS with a DRS.[13] The study demonstrated that PFN yielded superior outcomes across multiple domains, including operative time, blood loss, complication rates, functional recovery, and duration of hospital stay.

The demographic analysis revealed that the majority of patients were males aged between 61 and 70 years, and SF[14] was the leading cause of injury for basicervical femur fractures[15] consistent with global trends indicating a higher incidence of fragility fractures in the elderly due to low-energy trauma. Notably, left-sided fractures were predominant in the PFN group, although laterality had no observed effect on the outcomes. Surgical efficiency was significantly improved in the PFN group, with a shorter mean operative time (76.07±8.12 min) compared to the DHS-DRS group (103.5±5.70 min). This finding aligns with existing literature suggesting that intramedullary devices, being more biomechanically favorable, allow for a faster and more straightforward fixation process, particularly in unstable fracture patterns. Furthermore, the PFN group exhibited significantly lower intraoperative blood loss (180±20.39 mL vs. 250±25.07 mL), likely due to the minimally invasive nature of the PFN technique and reduced soft tissue dissection.

Postoperative management also favored PFN, with a shorter duration of intravenous (IV) antibiotic

Table 3: Modified Harris Hip Score (MHHS) Scoring

Variable	PFN (N=15)	DHS-DRS (N=15)	t-value	p-value
MHHS	90.03±4.14	80.23±2.11	0.290	0.001 (HS)

Table 4: Post-operative Complications

Complications	PFN (N=15)	DHS-DRS (N=15)	χ^2 value	p-value
None	14 (93.3%)	10 (66.7%)	0.854	0.491 (NS)
Superficial infection	1 (6.7%)	2 (13.3%)		
Limping	0	1 (6.7%)		
Knee stiffness	0	2 (13.3%)		

Table 5: Radiological Union

Radiological Union	At 6 months PFN	At 6 months DHS-DRS	At 12 months PFN	At 12 months DHS-DRS	χ^2 value	p-value
Not-united	7 (46.7%)	10 (66.7%)	0	0	0.309	0.031 (S)
United	8 (53.3%)	5 (33.3%)	15 (100%)	15 (100%)		

Table 6: Modified Prognosis

Score	Grade	At 6 months PFN	DHS-DRS	At 12 months PFN	DHS-DRS	χ^2 value	p-value
≥90	Excellent	0	0	12 (80%)	6 (40%)	0.309	0.031 (S)
80–89	Good	14 (93.3%)	10 (66.7%)	3 (20%)	8 (53.3%)		
70–79	Fair	1 (6.7%)	5 (33.3%)	0	1 (6.7%)		

therapy[16] (3.07±1.10 days vs. 3.90±1.34 days) and a higher proportion of patients (86.7%) achieving earlier discharge. This not only reflects reduced perioperative morbidity but also has important implications for healthcare cost and resource utilization, especially in high-volume trauma centers. Complications were more frequent in the DHS-DRS group, with higher incidences of superficial infections, limping,[17] and knee stiffness. These issues may stem from prolonged operative time, more extensive dissection, and potentially less stable fixation. Conversely, only one patient in the PFN group developed a superficial infection, with no major functional impairments noted. Functional outcomes assessed using the MHHS at 12 months revealed significantly better recovery in the PFN group (90.03±4.14) compared to the DHS-DRS group (80.23±2.11). Notably, 80% of PFN patients achieved "excellent" scores, whereas only 53.3% of DHS-DRS patients reached the "good" category. These findings reinforce the growing body of evidence suggesting that PFN offers superior functional rehabilitation, likely due to enhanced axial and rotational stability, which facilitates earlier mobilization and weight-bearing.

Figure A1a-d and A2a-d shows that radiological union[18] was observed in all patients by the end of 12 months, suggesting that both fixation methods are ultimately capable of achieving bony union when used appropriately. However, the time to functional recovery and overall patient satisfaction appear to favor PFN in this study.

Limitations of the study

Significant limitation of this study is its small sample size and the fact that it was conducted at a single center. Therefore, caution is advised when attempting to generalize these findings to broader populations.

CONCLUSION

This study found that when comparing fixation methods for basicervical femur fractures, PFN demonstrated superior performance over DHS-DRS in terms of functional outcomes (based on MHHSs at 6 and 12 months) and several intraoperative factors, including duration of surgery, intraoperative blood loss, length of skin incision, use of IV antibiotics and analgesics, hospital stay duration, and the timing of initial weight bearing. However, DHS-DRS required fewer fluoroscopic exposures. There was no statistically significant difference in post-operative complications between the two groups. Therefore, PFN is recommended for fixation of basicervical fractures due to its advantages in promoting faster recovery and improved patient rehabilitation and outcomes.

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Author's Contribution:
VSK- Literature survey, implementation of study protocol; **PR-** Statistical analysis, interpretation of study; **NG-** Literature survey, preparation of study content, preparation of manuscript, concept, design, clinical protocol, following up the study protocol, editing and revision of study, data collection, data analysis, submission of article; **JB-** Providing guidance for the study, helping in study corrections and follow-ups.

Work attributed to
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Source of Support: Nil, **Conflicts of Interest:** None declared.

APPENDICES

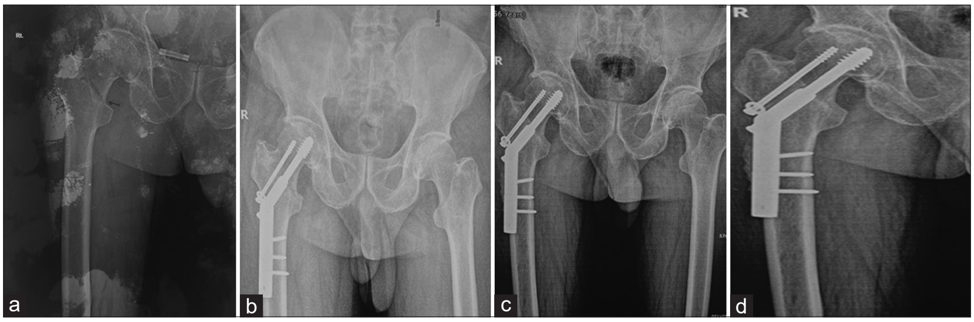

Figure A1: Case 1: 56-year-old male, right basicervical neck of femur fracture, dynamic hip screw – derotation screw. (a) Pre-operative X-ray (b) immediate post-operative X-ray (c) 6-month follow-up (d) 12-month follow-up

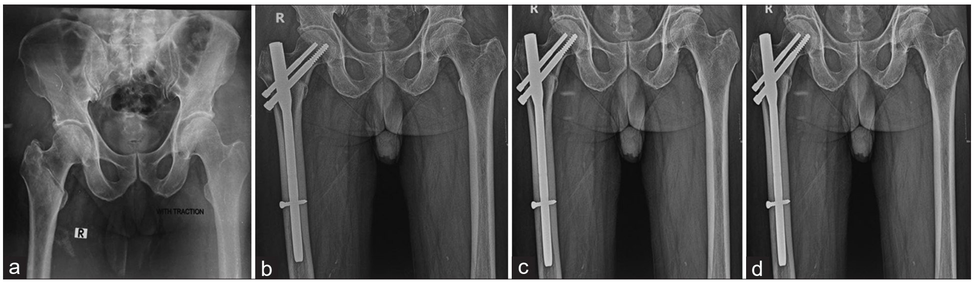

Figure A2: Case 2: 61-year-old male, right basicervical neck of femur – proximal femoral nail (a) pre-operative X-ray (b) immediate post-operative X-ray (c) 6-month follow-up (d) 12-month follow-up