THE JOURNAL OF SURGICAL RADIOLOGY

Journal of Surgical Radiology

Site: https://journalsurgrad.com/

ISSN Print 2156-213X| ISSN Online: 2156-4566 Volume: 05 Issue: 07 Open Access

Research Article

Functional and Radiological Outcomes of Proximal Femoral Nail Antirotation-II for Intertrochanteric Fractures of the Femur: A Prospective Cohort Study

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Article History

Received: 10-06-2026
Revised: 25-06-2026
Accepted: 18-07-2026
Published: 26-07-2026

Citations:
Niranjan, Sharada H, Nitin M Bothgi. Functional and radiological outcomes of proximal femoral nail antirotation-II for intertrochanteric fractures of the femur: a prospective cohort study. J Surg Radiol, V5 (7) 423-430

Abstract: ***Introduction:*** Intertrochanteric fractures are increasingly common in ageing populations and carry substantial morbidity when treated non-operatively. The proximal femoral nail antirotation-II (PFNA-II) was redesigned for the narrower, less anteverted proximal femoral anatomy typical of Asian patients, but prospective Indian outcome data remain limited. We evaluated the surgical and functional outcomes of PFNA-II fixation for intertrochanteric fractures of the femur. **Methods:** In this prospective, single-arm cohort study, 20 consecutive adult patients with intertrochanteric fractures admitted to the Department of Orthopaedics, Ballari Medical College and Research Centre, Ballari, India, between June 2023 and January 2024 [INSERT: confirm end date; source document also states January 2025] underwent fixation with a standard-length (160 mm) PFNA-II. Intraoperative parameters, radiological union, complications, and functional outcome (Harris Hip Score, HHS) at 3 and 6 months were recorded and summarised descriptively. **Results:** The cohort comprised 8 men (40%) and 12 women (60%); 50% (10/20) were aged 60-69 years. Sixteen fractures (80%) followed a trivial fall and 11 (55%) involved the right side. On the Boyd and Griffin classification, 11 fractures (55%) were type II. Mean operative time was 54.25 minutes (range 40-90) and mean blood loss was 117 mL (range 50-250). Radiological union occurred in all 20 patients (100%), at a mean of 14.01 weeks (range 12-16). Mean HHS was 74.8 at 3 months and 83.9 at 6 months; 18 patients (90%) had a good-to-excellent functional outcome, 2 (10%) fair, and none poor. One patient (5%) had helical blade cut-out attributed to severe osteoporosis. **Conclusion:** PFNA-II fixation achieved reliable union and good-to-excellent functional outcomes in most patients with intertrochanteric fractures of the femur, with a low rate of major complications, supporting its use as a mechanically reliable implant in this population.

Keywords: Hip Fractures; Fracture Fixation, Intramedullary; Bone Nails; Aged; Treatment Outcome; Intertrochanteric fracture (non-MeSH term).

INTRODUCTION

Intertrochanteric fractures of the femur are among the most disabling injuries of late life, and their burden is rising as populations age. According to a 2021 Global Burden of Disease analysis, the global age-standardised incidence of hip fracture in older adults increased from 781.56 to 948.81 per 100,000 between 1990 and 2021 — a rise of nearly 169% — with population growth and ageing identified as the principal drivers and falls as the leading proximate cause; incidence is projected to continue rising through 2050.[1] Because these fractures occur predominantly in osteoporotic bone in patients with multiple comorbidities, they carry a disproportionate risk of loss of independence; established risk factors include low bone density, a prior fracture, impaired mobility and balance, and specific comorbid and pharmacological exposures.[2] Patients who sustain an intertrochanteric fracture are frequently confined to the home, become dependent for basic and instrumental activities of daily living, and — if immobilised — are exposed to the well-recognised hazards of prolonged recumbency, including pressure sores, urinary tract infection, pneumonia and thromboembolism.

Non-operative management of these fractures, historically reserved for medically unfit or non-ambulant patients, has consequently been abandoned as first-line treatment in favour of rigid internal fixation and early mobilisation. Implants for intertrochanteric fracture fixation fall into two broad families: extramedullary devices, of which the dynamic hip screw (DHS) remains the most widely used, and intramedullary devices, typified by the proximal femoral nail (PFN) and its successors. The DHS achieves predictable union in stable fracture patterns but permits controlled collapse at the fracture site; in unstable configurations this can progress to excessive collapse of the femoral neck, loss of hip offset, and clinically significant limb shortening.[3,4] Intramedullary nailing was developed to address these limitations by reducing the working (moment) arm between the implant and the femoral shaft, and randomised and Cochrane-reviewed evidence has shown outcomes for cephalomedullary nails at least equivalent to, and in some unstable patterns better than, extramedullary fixation.[3,4,5] Conventional two-screw PFN designs, however, introduced their own mode of failure: because the device relies on a compression hip screw and a smaller derotation screw in parallel, differential migration of the two screws can produce the so-called Z-effect or reverse Z-effect, alongside varus collapse and cut-out or penetration of the screws into the hip joint. The risk of cut-out with any cephalomedullary or sliding device is closely related to the position of the lag device within the femoral head, most commonly quantified using the tip-apex distance.[15]

To address these shortcomings, a single helical blade was substituted for the two-screw construct, giving rise to the proximal femoral nail antirotation (PFNA). The helical blade is inserted by controlled impaction rather than drilling, compacting the surrounding cancellous bone as it advances and thereby increasing purchase and cut-out resistance in osteoporotic femoral heads, while providing rotational and angular stability with a single implant. Because the original PFNA geometry — developed on European anthropometric data — mismatched the shorter, narrower, and less anteverted proximal femur typical of Asian patients, a second-generation, Asia-specific variant (PFNA-II) was introduced, reducing the mediolateral angle from 6° to 5°, flattening the lateral nail profile, and reducing the proximal nail diameter to minimise lateral cortical impingement at insertion.[6,7] Multicentre and retrospective series from Japan and France evaluating PFNA-II report low rates of intraoperative and postoperative fixation complications, generally under 10%, alongside reliable union.[6,8] Comparative studies of PFNA-II against the original PFNA have generally favoured PFNA-II on operative time, blood loss and complication rate, although some series have identified a persistent mismatch between the short, straight nail body and the natural anterior bow of the Asian femoral shaft as a source of distal cortical contact.[7,9] A recent systematic review comparing PFN with PFNA-2 across ten comparative studies similarly reported a lower absolute risk of implant-related mechanical failure with PFNA-2 (12.5% versus 23.4%) and fewer reoperations, with comparable union rates and functional scores between devices.[10] Against arthroplasty alternatives, proximal femoral nailing has also been associated with better Harris Hip Scores than bipolar hemiarthroplasty in unstable intertrochanteric fractures, albeit with a trade-off in the pace of early mobilisation.[11]

Despite this accumulating international evidence, prospective outcome data on PFNA-II from Indian tertiary-care settings remain comparatively limited, and case volumes in single-centre Indian series are typically small.[12] Existing comparative series have reported heterogeneous operative times, blood loss and complication rates depending on surgeon experience, fracture pattern and patient bone quality,[9,13,14] underscoring the value of additional prospective, setting-specific outcome data to guide implant selection and to benchmark local surgical practice against published series. We therefore undertook a prospective cohort study to evaluate the surgical and functional outcomes of PFNA-II fixation for intertrochanteric fractures of the femur treated at a tertiary-care teaching hospital in southern India.

Aim: To evaluate the efficacy of the proximal femoral nail antirotation-II in the surgical and functional outcome of intertrochanteric fractures of the hip.

Objectives: (i) to study the management of intertrochanteric fractures with PFNA-II; (ii) to document operative difficulties encountered during the procedure; (iii) to evaluate outcome in terms of radiological union and functional recovery; and (iv) to determine the indications appropriate to the use of PFNA-II in these fractures.
We hypothesised that PFNA-II fixation would achieve a high rate of radiological union with good-to-excellent functional outcomes, at operative times, blood loss and complication rates comparable to those reported in published PFNA-II series.

MATERIALS AND METHODS

Study design and setting: This was a prospective, single-arm, hospital-based cohort study (interventional case series) conducted in the Department of Orthopaedics, Ballari Medical College and Research Centre (BMCRC), Ballari, Karnataka, India, a tertiary-care teaching hospital affiliated with the Rajiv Gandhi University of Health Sciences, Bangalore. The study followed the STROBE (Strengthening the Reporting of Observational Studies in Epidemiology) recommendations for cohort studies, adapted for a single-arm interventional series without a concurrent comparison group.

Study period: Patients were recruited between June 2023 and January 2024 with clinical follow-up continuing through six months post-operatively.

Ethical considerations: The study was conducted in accordance with the Declaration of Helsinki. Written informed consent was obtained from every patient before enrolment, using a standardised consent form describing the purpose of the study and the risks of the surgical procedure.

Participants: All patients admitted with a radiologically confirmed intertrochanteric fracture of the femur during the study period were screened for eligibility. consecutive enrolment was done

Inclusion criteria: adults aged over 18 years with a fracture of the proximal femur along the intertrochanteric line, with or without comminution but with an intact lateral wall; unstable fractures with reverse obliquity; and unstable fractures with posteromedial comminution.

Exclusion criteria: pre-existing radiological osteoarthritis of the hip; age under 18 years; fractures with lateral wall comminution; any other fracture of bone in the ipsilateral limb; and patients medically unfit for surgery and anaesthesia.

Sample size: A minimum of 20 eligible patients were enrolled using consecutive sampling.

Fracture classification: All fractures were classified preoperatively on anteroposterior and lateral radiographs of the pelvis with both hips, and of the affected hip and femur, using the Boyd and Griffin classification.[16]

Preoperative work-up: On admission, all life-threatening injuries were managed according to standard airway-breathing-circulation protocols, with intravenous fluids and antibiotics, monitoring of vital parameters, blood transfusion where indicated, and provisional immobilisation of the affected limb by skin or, where surgery was delayed, skeletal traction. After stabilisation, all patients underwent baseline haematological investigations (haemoglobin, bleeding and clotting time, blood grouping and cross-matching, fasting and post-prandial blood glucose, blood urea and serum creatinine) and urinalysis. Associated injuries and medical comorbidities were evaluated and treated in conjunction with the relevant specialty, and pre-anaesthetic fitness was obtained before surgery was scheduled on an elective basis. Nail diameter was determined preoperatively from the femoral isthmus diameter on an anteroposterior radiograph, and the neck-shaft angle was measured on the contralateral, uninjured hip using a goniometer.

Implant: All patients were treated with a standard-length (160 mm) PFNA-II (proximal diameter 16.5 mm, distal diameter 9-12 mm, 11 mm helical blade with an internal locking mechanism, and a 4.9 mm distal locking screw), manufactured in titanium alloy, with a fixed 5° mediolateral valgus angle and a neck-shaft angle of 130° or 135° selected according to patient anatomy.

Operative technique: Surgery was performed with the patient supine on a fracture table, with the affected limb adducted 10-15° and closed reduction achieved by longitudinal traction and internal rotation under fluoroscopic guidance in anteroposterior and lateral projections; open reduction was reserved for fractures in which closed reduction failed. After standard preparation, draping and prophylactic antibiotic administration 30 minutes before incision, a 5 cm longitudinal incision was made proximal to the tip of the greater trochanter, with the fascia lata and gluteus medius split in line with their fibres. The entry point was identified on, or slightly lateral to, the tip of the greater trochanter under fluoroscopy, and the medullary canal was entered with a curved bone awl before passage of a guide wire. Sequential flexible reaming was performed in 0.5 mm increments to approximately 1 mm greater than the selected nail diameter, after which the nail was inserted manually without hammering, using gentle twisting movements, until the helical blade aperture lay at the level of the lesser trochanter. A 2.8 mm guide wire for the helical blade was then advanced through the aiming device to a point at least 4 mm superior to the calcar and approximately 10 mm below the subchondral bone, aiming for a tip-apex distance sufficient to minimise the risk of cut-out.[15] After lateral cortex and conical reaming over the guide wire, the helical blade was inserted and locked under fluoroscopic control, followed by distal locking with a single 4.9 mm cortical screw, in either static or dynamic mode, placed through a stab incision using the attached jig. The wound was closed in layers after saline lavage, with a suction drain used when open reduction had been required.

Intraoperative and postoperative parameters: Total operative time, intraoperative blood loss (estimated from the number of soaked surgical mops, at approximately 50 mL per mop), and the number of fluoroscopic exposures were recorded for every case. Postoperatively, patients were monitored in a recovery area before transfer to the ward, with intravenous antibiotics continued for 48 hours before conversion to the oral route. Static quadriceps exercises were commenced on the third postoperative day, and active quadriceps and hip flexion exercises on the sixth or seventh postoperative day; wound dressings were changed on the second and fifth postoperative days and sutures removed on the twelfth day. Patients were mobilised non-weight-bearing with a walker or axillary crutches as soon as tolerated, progressed to partial weight-bearing at approximately six weeks, and allowed full weight-bearing once clinical and radiological union was confirmed.

Follow-up and outcome assessment: Patients were reviewed clinically and radiologically at 6 weeks, 3 months, 6 months and 12 months, with assessment of fracture union, deformity, shortening, and hip and knee function at each visit. Functional outcome was assessed at 3 and 6 months using the Harris Hip Score (HHS),[17] which grades pain, limp, use of walking aids, walking distance, stair-climbing, use of public transport, sitting, and absence of deformity, together with hip range of motion, on a 100-point scale conventionally interpreted as excellent (90-100), good (80-89), fair (70-79) or poor (<70).

Statistical analysis: Data were entered into [INSERT: software used for data entry/analysis, e.g., Microsoft Excel or SPSS, with version number] and summarised descriptively as frequencies and percentages for categorical variables and as means with ranges for continuous variables. As this was a single-arm descriptive case series without a comparator group, no inferential statistical testing was performed.

RESULTS

Twenty patients meeting the eligibility criteria were enrolled and underwent PFNA-II fixation during the study period; all 20 were included in the analysis of intraoperative and radiological outcomes, and functional outcome data are reported for all 20 patients at both the 3-month and 6-month assessments .

The cohort comprised 8 men (40%) and 12 women (60%). By age band, 3 patients (15%) were 50-59 years, 10 (50%) were 60-69 years, and 7 (35%) were 70-79 years (Table 1). [INSERT: pooled mean age and SD/range — the source document reports a mean age of 65 years in the abstract and 66.5 years in the results narrative, with an oldest patient of 78 years in one section and 85 years in another; these figures could not be reconciled from the data supplied and should be confirmed against the original case records] The injury followed a trivial fall in 16 patients (80%) and a road traffic accident in 4 (20%) (Table 1). The right hip was affected in 11 patients (55%) and the left in 9 (45%) (Table 1). On the Boyd and Griffin classification, 2 fractures (10%) were type I, 11 (55%) were type II, 5 (25%) were type III, and 2 (10%) were type IV (Table 1) — 13 fractures (65%) were therefore of the more stable type I/II pattern and 7 (35%) of the unstable type III/IV pattern.

All patients were treated with a standard-length (160 mm) PFNA-II. Mean operative time was 54.25 minutes (range 40-90 minutes), with longer operative times generally required for Boyd and Griffin type III and IV fractures. Mean intraoperative blood loss, estimated from soaked mops, was 117 mL (range 50-250 mL) and was greater in cases requiring open reduction. A mean of 23.5 fluoroscopic exposures (range 16-34) was used per case, with higher counts again required for type III and IV fracture patterns (Table 2).

Radiological union was achieved in all 20 patients (100%), at a mean of 14.01 weeks (range 12-16 weeks). No case of varus malunion, non-union, or peri-operative or post-operative femoral shaft fracture was recorded.

Seven complication events were recorded among the 20 patients (Table 3): superficial surgical-site infection in 1 patient (5%), which resolved with intravenous antibiotics; abductor lurch in 2 patients (10%; 1 man and 1 woman); persistent hip pain at follow-up in 2 patients (10%, both women); helical blade cut-out in 1 patient (5%), attributed to severe osteoporosis, for whom revision surgery was advised but declined by the patient; and deep vein thrombosis in 1 patient (5%), managed conservatively. No patient required revision surgery, and there were no cases of malunion, non-union, or deep infection.

Mean Harris Hip Score was 74.8 at 3 months and 83.9 at 6 months post-operatively (Table 4). On HHS grading at final follow-up, 2 patients (10%) had an excellent outcome, 16 (80%) a good outcome, and 2 (10%) a fair outcome; no patient had a poor outcome. Overall, 18 of 20 patients (90%) achieved a good-to-excellent functional result. Fair outcomes were more frequent among older patients and among those with higher (type III/IV) Boyd and Griffin fracture patterns.

Table 1. Baseline demographic and injury characteristics of the study cohort (N = 20)

Characteristic	n	%
Sex — Male	8	40.0
Sex — Female	12	60.0
Age group, years — 50–59	3	15.0
Age group, years — 60–69	10	50.0
Age group, years — 70–79	7	35.0
Mode of injury — Trivial fall	16	80.0
Mode of injury — Road traffic accident	4	20.0
Side affected — Right	11	55.0
Side affected — Left	9	45.0
Boyd and Griffin type — I	2	10.0
Boyd and Griffin type — II	11	55.0
Boyd and Griffin type — III	5	25.0
Boyd and Griffin type — IV	2	10.0

Percentages calculated with denominator N = 20 for each variable. Age is reported by the decade bands recorded in the source case series; individual patient ages and a pooled mean ± SD were not available for independent verification (see Methods and Results).

Table 2. Intraoperative parameters (N = 20)

Parameter	Mean	Range
Operative time, minutes	54.25	40–90
Intraoperative blood loss, mL	117	50–250
Fluoroscopic exposures, shots	23.5	16–34
Time to radiological union, weeks	14.01	12–16

Values are mean (range) as reported in the source dataset; standard deviations were not available. Blood loss estimated from the number of soaked surgical mops (~50 mL/mop).

Table 3. Post-operative complications (N = 20)

Complication	n	%
Superficial surgical-site infection	1	5.0
Abductor lurch	2	10.0
Persistent hip pain at follow-up	2	10.0
Helical blade cut-out	1	5.0
Deep vein thrombosis	1	5.0
Revision surgery	0	0.0
Non-union	0	0.0
Malunion	0	0.0
Deep infection	0	0.0

Some patients may have experienced more than one complication; overlap between complication categories was not specified in the source data (see Discussion, Limitations).

Table 4. Functional outcome — Harris Hip Score (N = 20)

Timepoint / Grade	Value	
Mean HHS at 3 months	74.8	–
Mean HHS at 6 months	83.9	–
Grade — Excellent (90–100)	2	10.0%
Grade — Good (80–89)	16	80.0%
Grade — Fair (70–79)	2	10.0%
Grade — Poor (<70)	0	0.0%

Grading based on final Harris Hip Score at 6-month follow-up, per standard Harris Hip Score interpretive bands.

DISCUSSION

In this prospective cohort of 20 patients with intertrochanteric fractures of the femur treated with PFNA-II, radiological union was achieved in every patient, and 90% (18/20) had a good-to-excellent functional outcome on the Harris Hip Score at six months, with a comparatively low burden of major implant-related complications — most notably, a single case of helical blade cut-out (5%) in the context of severe osteoporosis, and no cases of non-union, malunion, or peri-implant femoral fracture.

These findings are consistent with the mechanical rationale underlying the PFNA-II design. Compared with a two-screw cephalomedullary construct or a sliding hip screw, a single helical blade inserted by controlled impaction compacts the surrounding cancellous bone, increasing purchase in osteoporotic femoral heads and providing rotational stability without the differential-migration failure modes (Z-effect and reverse Z-effect) described with dual-screw nails.[3] Our mean operative time of 54.25 minutes and mean blood loss of 117 mL are numerically favourable in comparison with several published PFNA/PFNA-II series: Li and colleagues, comparing PFNA-II with the original PFNA in 188 Chinese patients, reported a significantly shorter operative time with PFNA-II (66.25 ± 13.15 versus 79.50 ± 21.12 minutes) and lower blood loss (131.86 ± 69.16 versus 162.14 ± 66.18 mL), alongside a lower complication rate (25% versus 46%);[9] our operative time and blood loss fall below even the shorter PFNA-II arm of that comparison, although our small, single-technique sample limits any formal comparison. Similarly, Sahin and colleagues found significantly shorter operative time with PFNA than with an AO dynamic condylar screw-plate (57 versus 87 minutes) and better functional outcomes with the intramedullary device,[14] consistent with the broader evidence, summarised in a Cochrane review of intramedullary nail designs for extracapsular hip fractures, that cephalomedullary nailing performs at least as well as extramedullary fixation across fixation complications, re-operation and mortality.[5]

Our union rate of 100% at a mean of 14.01 weeks is comparable to, if marginally slower than, the mean union time of 10.3 ± 3 weeks reported by Soucanye de Landevoisin and colleagues in a retrospective series of 102 PFNA-II patients with a substantially older mean age (84.9 years) than our cohort;[8] that series similarly reported no non-union, although mechanical complications (blade back-out, 15.7%; cephalic cut-out, 2.9%) exceeded the corresponding rate in our smaller series. Our overall cut-out rate (1/20, 5%) sits within the range reported across PFNA-II series and is consistent with cut-out being strongly related to lag-device position within the femoral head rather than to the implant per se: the tip-apex distance described by Baumgaertner and colleagues remains the most widely used predictor of cut-out risk with any fixed-angle cephalomedullary or sliding device, and our single cut-out occurred in a patient with severe osteoporosis, consistent with the recognised interaction between poor bone quality and fixation failure.[15] A recent Indian prospective series of 74 patients treated with a (two-screw) proximal femoral nail for unstable peritrochanteric fractures reported a comparable trajectory of functional recovery — mean HHS of 57.8 at 6 weeks, 72.2 at 3 months and 85.7 at 6 months — with complications including superficial infection (4.05%), screw back-out (1.3%), reverse Z-effect (1.3%) and non-union (1.3%);[12] our 3-month and 6-month HHS values (74.8 and 83.9) are broadly concordant with this contemporary Indian series, and our absence of reverse Z-effect is consistent with the single-implant design of PFNA-II eliminating that specific failure mode. A recent systematic review of ten comparative studies (794 patients) similarly reported a lower absolute risk of implant-related mechanical failure with PFNA-2 than with two-screw PFN constructs (12.5% versus 23.4%), fewer re-operations, and comparable union rates and functional scores between the two devices,[10] supporting the pattern in our findings that a single-blade construct does not compromise, and may improve, mechanical reliability relative to older nail designs. Against arthroplasty, a recent meta-analysis reported better Harris Hip Scores with proximal femoral nailing than with bipolar hemiarthroplasty in unstable intertrochanteric fractures, albeit with a trade-off favouring hemiarthroplasty for immediate weight-bearing and simplified rehabilitation,[11] a consideration that may be relevant when selecting between fixation and arthroplasty in the frailest patients, although our cohort did not include an arthroplasty comparator.

Not all series report outcomes as favourable as ours. Studies from Japan and China evaluating the Asia-specific PFNA-II geometry have identified an anatomical mismatch between the short, straight nail body and the natural anterior bow of the Asian femoral shaft, with radiologically detectable anterior cortical contact (“mismatch”) in around 10% of patients in a large Japanese multicentre series, and abutment against the anterior cortex in over a third of a Chinese cohort using longer nails.[6,7] We did not specifically assess femoral bow mismatch in this study, which — together with our exclusive use of the 160 mm standard-length nail — represents a limitation, since longer nails, more likely to be needed in taller patients or in fractures with subtrochanteric extension, appear more prone to this phenomenon.

Strengths

The principal strengths of this study are its prospective design, a standardised operative technique and postoperative protocol applied to every patient, and the use of a validated, widely reported functional outcome measure (the Harris Hip Score) assessed at pre-specified time points.

Limitations

This study has several limitations. The sample size (n = 20) is small and was not derived from a formal power calculation, limiting precision around the reported estimates and the ability to detect associations between fracture pattern, patient age, and outcome. The single-arm design, without a concurrent comparator (DHS, conventional PFN, or arthroplasty), precludes comparative or causal inference regarding the relative performance of PFNA-II. Follow-up was limited to six months, insufficient to capture late complications such as implant-related peri-prosthetic fracture, delayed cut-out, or the influence of fixation on medium-term mortality. The study was conducted at a single centre by [INSERT: number of operating surgeons and level of experience — not specified in the source data], which may limit generalisability. Finally, some numerical details in the underlying clinical dataset (participant age, duration of hospital stay, and follow-up completeness) could not be fully reconciled between the abstract and the detailed results and are flagged above pending verification against the original case records.

Clinical implications

Within these limitations, our findings support PFNA-II as a reliable option for the fixation of both stable and unstable intertrochanteric fractures in a resource-constrained Indian tertiary-care setting, permitting early mobilisation and thereby plausibly reducing exposure to the complications of prolonged recumbency that historically drove the abandonment of non-operative management.

Future research

Adequately powered, multicentric randomised or comparative cohort studies directly comparing PFNA-II with conventional PFN, DHS, and arthroplasty — with longer follow-up, formal sample size justification, and pre-specified handling of confounders such as fracture pattern and bone density — are needed to define the comparative place of PFNA-II in routine practice, alongside cost-effectiveness analysis relevant to resource-limited settings.

CONCLUSION

In this prospective cohort of 20 patients, PFNA-II fixation of intertrochanteric fractures of the femur achieved radiological union in all patients and good-to-excellent functional outcomes, on the Harris Hip Score, in 90%, with a low rate of major implant-related complications. These findings support PFNA-II, with its single helical blade and Asia-adapted geometry, as a mechanically reliable option for both stable and unstable intertrochanteric fracture patterns, permitting early mobilisation in an elderly, comorbid population. Given the small, single-arm, single-centre design of this series, these findings should be regarded as hypothesis-generating; larger comparative studies with longer follow-up are needed before firm recommendations on implant choice can be made.

Declarations

Acknowledgements: [INSERT: names and specific contributions of anyone who assisted with data collection, statistical input, or manuscript preparation but does not meet ICMJE authorship criteria]

Funding: [INSERT: confirm — the source document does not report a funding source] Proposed standard statement, pending author confirmation: “This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.”

Conflicts of interest: [INSERT: confirm — not stated in the source document] Proposed standard statement, pending author confirmation: “The authors declare no competing interests.”

Data availability: The datasets generated and analysed during the current study are available from the corresponding author on reasonable request.

Ethics approval and consent to participate: The study was conducted in accordance with the Declaration of Helsinki. [INSERT: Institutional Ethics Committee name, approval number, and date of approval]. Written informed consent was obtained from all participants prior to enrolment.

Trial/study registration: [INSERT: registry name and number, if applicable — not identified in the source document]

CRediT authorship contribution statement: Niranjan: Conceptualization, Investigation, Data curation, Writing – original draft. Santosh: Conceptualization, Methodology, Supervision, Writing – review & editing. [INSERT: confirm role allocation with both authors]; both authors read and approved the final manuscript.

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