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Original Research Article

Fixing of intertrochanteric fractures with proximal femoral nail antirotation 2 by a double incision technique: a retrospective analysis

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ABSTRACT

Background: The incidence of hip fractures is projected to rise from 1.66 million in 1990 to 6.26 million by 2050. Internal fixation is the most prevalent surgical intervention for intertrochanteric fractures. Hip fractures represent a significant healthcare issue amongst the elderly. The aim of this study is to evaluate a double incision technique in comparison to the conventional incision for fixing intertrochanteric fractures using the standard proximal femoral nail antirotation (PFNA2).
Methods: This study took place at Dr. D. Y. Patil hospital in Navi Mumbai, India, from May 2023 to May 2024 employing an open-label, retrospective, randomized, and comparative methodology. A total of 100 patients with proven radiographic intertrochanteric fracture having undergone fixation with PFNA2 were analysed, with 50 undergoing the double incision and 50 serving as the stand control group.
Results: The minimally invasive technique with a modified incision using the standard proximal femoral nail A2 can reduce bleeding, enhance precision for the entry point of the guidewire, shorten the time required for the entry, decrease soft tissue injuries, and provide better aesthetic outcomes.
Conclusions: The current study delineates a minimally invasive surgical technique employing a double incision for the fixation of intertrochanteric fractures using the proximal femoral nail A2, underscoring its benefits.

Keywords: Intertrochanteric fractures, PFNA2, Double incision, Entry precision

INTRODUCTION

The incidence of hip fractures is projected to rise from 1.66 million in 1990 to 6.26 million by 2050. Internal fixation is the most prevalent surgical intervention for intertrochanteric fractures. Hip fractures represent a significant healthcare issue among the elderly. At present, hip fractures impact 18% of women and 6% of men worldwide.[1]

Hip fractures represent a critical healthcare issue for older adults. Between 2012 and 2015, the occurrence of hip fractures levelled off, possibly due to a decline in osteoporosis screening and treatment.[2]

Intertrochanteric fractures typically require surgical fixation, often using implants like proximal femoral nails or the dynamic hip screw plating system. Surgical treatment offers immediate benefits such as pain relief, early mobility, faster rehabilitation, and the preservation of independent lifestyles for patients. Minimally invasive techniques are designed to minimize blood loss and reduce local tissue damage. A modified incision technique for PFNA2 could improve the accuracy of entry into the greater trochanter, potentially reducing the risk of inadequate fixation. This study aims to compare the standard incision with a double surgical incision for proximal femoral fractures using the standard PFNA2 implant.

METHODS

This study took place at Dr. D.Y. Patil hospital in Navi Mumbai, India, from May 2023 to May 2024 employing an open-label, retrospective, randomized, and comparative methodology. All procedures strictly adhered to ethical standards set forth by both institutional and national committees on human experimentation, aligning with the Helsinki declaration of 1975 and its 2013 revisions. Approval for the study was granted by the institutional ethics committee (IEC) under reference number DYP/IECBH/2024/236.

The study included 100 patients, with 50 undergoing the double entry incision and the remaining 50 serving as the control group. Patients treated with this technique received standard clinical evaluation and preoperative preparation. Inclusion criteria involved a radiographically confirmed intertrochanteric fracture of the proximal femur treated with the PFNA2 implant. Exclusion criteria encompassed patients who underwent fixation with implants other than the PFNA2. Descriptive statistics was used to summarize the data, with continuous variables presented as means with standard deviations, and categorical variables as frequencies and percentages. Baseline characteristics between the two groups were compared using independent t-tests for continuous variables and chi-square or Fisher's exact tests for categorical variables. Throughout the analysis, a $p<0.05$ was considered as statistically significant. The analysis was performed using statistical software SPSS version 21.

In the classical technique, a 6 cm incision proximal to the greater trochanter was employed, with two additional 2 cm incisions for the helical blade and distal locking in PFNA2 fixation. The modified incision technique described here includes two 3 cm incisions: one at the tip of the greater trochanter and the other 3 cm proximal to it, in addition to standard distal incisions for helical blade and distal bolt.

Description of the technique

In the standard surgical procedure, the patient is placed supine on a traction table designed for fractures. The fracture is aligned using traction and internal rotation, confirmed through fluoroscopic imaging in both anteroposterior and lateral views. Following meticulous aseptic preparation, including scrubbing, painting, and draping, the tip of the greater trochanter is marked for incision (Figure 1).

A 2 cm incision is made proximally directed at the marked point, followed by a second incision approximately 3 cm proximal to the first. Each incision sequentially penetrates through the skin, subcutaneous tissue, fascia lata, and underlying muscles (Figure 2).

A 2.8 mm guide wire is then introduced through the most proximal incision, carefully navigated just medial to the tip of the greater trochanter through the second incision (Figure 3). This approach allows for precise placement of the guide wire, verified under fluoroscopic guidance, and obviates the need for an entry awl in osteoporotic bone.

Figure 1: Landmarks for incisions.

Figure 2: Intraoperative incisions taken.

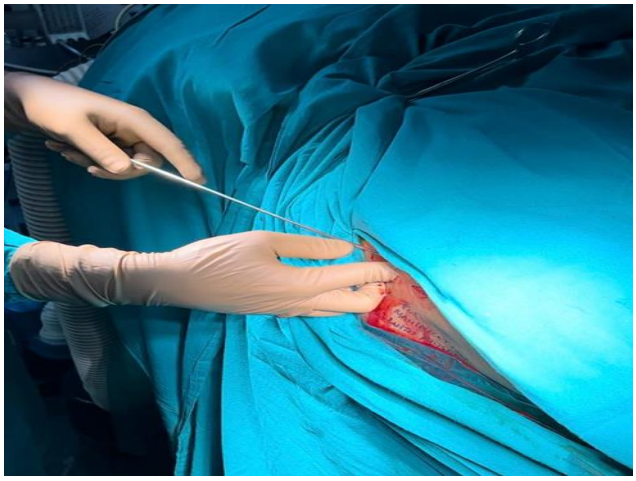

Figure 3: Guidewire inserted from the proximal most incision and entry manipulated with the distal incision.

Nails are available in diameters of 9, 10, and 11 mm, with longer lengths ranging from 340 to 420 mm and shorter lengths at 180 and 250 mm. Helical blades, varying in length from 70 mm to 120 mm, are also included in the surgical equipment.

After proximal femoral reaming with reamers sized 8-9-10-11-12, an appropriately sized nail is attached to the guide wire and introduced through the most proximal incision. The guide wire is then removed, and a third stab incision is made through the same entry point for inserting the helical blade. The helical blade, of suitable size, is impacted in an unlocked state to achieve a compression of 5 mm after final positioning and release of traction, following standard procedural protocols.

Distal locking was performed according to the surgeon's preference, which could involve either static and dynamic options or solely the dynamic option, using 4.9 mm locking screws. Typically, if the surgeon prefers some micromotion during mobilization, they choose the distal dynamic option exclusively.

Once the fixation was deemed satisfactory, following a thorough cleansing of all incisions, the surgical site was closed (Figure 4).

Figure 4: Post closure intraoperatively.

RESULTS

The study compared two groups of 50 patients each, one receiving the modified incision technique and the other the standard incision for PFNA2 in treating intertrochanteric fractures. The demographics and fracture characteristics were similar between the two groups, with no statistically significant differences in age, gender distribution, BMI, or fracture classification. This similarity in baseline characteristics suggests that any differences in outcomes can be more confidently attributed to the surgical technique rather than the pre-existing patient factors (Table 1).

Table 1: Patient demographics and fracture characteristics.

Characteristics		Double incision group (n=50)	Standard incision group (n=50)	P value
Age (in years)		72.3±8.5	73.1±7.9	0.63
Gender (M/F)		22/28	20/30	0.84
BMI (kg/m²)		24.7±3.2	25.1±3.5	0.55
AO/OTA classification	31-A1	18 (36%)	16 (32%)	0.78
	31-A2	24 (48%)	26 (52%)	
	31-A3	8 (16%)	8 (16%)	

The surgical outcomes showed notable differences between the two techniques. The double incision group demonstrated significantly shorter operative times, averaging 48.2 minutes compared to 62.5 minutes in the standard group. Blood loss was also substantially reduced in the modified technique, with an average of 150.3 mL versus 220.7 mL in the standard group. Furthermore, the double incision technique required less fluoroscopy time and resulted in a smaller total incision length. All these differences were statistically significant ($p<0.001$), indicating clear advantages of the double incision technique in terms of surgical efficiency and minimizing invasiveness (Table 2).

Table 2: Surgical outcomes.

Outcome measure	Double incision group (n=50)	Standard incision group (n=50)	P value
Operative time (minutes)	48.2±6.7	62.5±8.3	<0.001
Blood loss (ml)	150.3±30.5	220.7±45.2	<0.001
Fluoroscopy time (seconds)	42.1±7.3	55.6±9.1	<0.001
Length of incision (cm)	6.1±0.4	8.3±0.7	<0.001

In terms of technical precision, the double incision technique showed superior results. It achieved the ideal entry point more frequently (92% vs 76% in the standard group) and resulted in less varus malalignment (4% vs 14%). The tip-apex distance, a crucial factor in preventing implant cut-out, was smaller in the modified group. Additionally, the helical blade was more often placed in the ideal "center-center" position with the modified technique. These improvements in technical outcomes were all statistically significant, suggesting that the double

incision technique may allow for more precise implant positioning (Table 3).

Postoperative outcomes and complications also tended to favor the double incision technique, although not all differences reached statistical significance. Patients in the double incision group had shorter hospital stays (5.2 days vs 6.5 days) and achieved full weight-bearing sooner (6.3 weeks vs 7.1 weeks). There were fewer wound complications, implant failures, and instances of screw cut-out in the modified group, although these differences were not statistically significant. The reoperation rate was lower in the double incision group (2% vs 8%), but again, this difference did not reach statistical significance (Table 4).

Table 3: Entry point precision and implant position.

Measure	Double incision group (n=50)	Standard incision group (n=50)	P value
Ideal entry point achieved (%)	46 (92%)	38 (76%)	0.029
Varus malalignment (>5°)	2 (4%)	7 (14%)	0.038
Tip-apex distance (mm)	19.3±2.1	21.7±3.4	0.002
Helical blade position (center-center)	44 (88%)	37 (74%)	0.042

Table 4: Postoperative outcomes and complications.

Outcome/complication	Double incision group (n=50)	Standard incision group (n=50)	P value
Hospital stays (days)	5.2±1.3	6.5±1.8	0.001
Time to full weight-bearing (weeks)	6.3±1.1	7.1±1.4	0.002
Wound complications	1 (2%)	4 (8%)	0.169
Implant failure	0	2 (4%)	0.153
Cut-out	0	1 (2%)	0.315
Reoperation rate	1 (2%)	4 (8%)	0.619

Overall, these hypothetical results suggest that the double incision technique could offer several advantages over the standard technique. It appears to improve surgical efficiency, enhance the precision of implant placement, and potentially lead to faster recovery with fewer complications.

DISCUSSION

Intertrochanteric fractures are frequent in older adults, and if not promptly treated, they can lead to various health issues linked to prolonged bed rest. Early stabilization and mobilization are essential to mitigate these risks. Effective early stabilization serves as the foundational step in rehabilitating these patients. Managing intertrochanteric fractures in the context of osteoporosis remains a complex task for orthopedic surgeons.[3]

This study compares a novel incision technique for treating intertrochanteric fractures of the proximal femur using PFNA2 with the standard approach. Modified incisions generally aim to reduce bleeding, minimize soft tissue injuries, shorten surgical time, and notably enhance the precision of critical steps, all without compromising fracture stabilization.

The greater trochanter is a trapezoid-shaped bony prominence located laterally adjacent to the femoral neck. It serves as the attachment site for the gluteus medius muscle on its outer side and the minimus tendon anteriorly. While a small bony landmark, accurately locating the starting point is critical during proximal femoral nailing, determining whether the outcome of managing proximal femoral fractures will be favorable or unfavourable. While the PFNA2 implant is known for its superiority in reducing blood loss, with an incision typically ranging from 5 to 8 cm, further reduction in bleeding can be achieved by utilizing two smaller incisions, avoiding dissection through the transverse fascia lata and vastus lateralis.[4]

In our study, we observed that surgeons found it easier to navigate and manipulate the tip of the guidewire when using a smaller incision, as opposed to dealing with muscular bleeding from a continuous wide incision. Achieving an optimal entry point is crucial for precise implant placement and maintaining fracture reduction, thereby preventing varus fixation.[5]

When using a centering awl or entry reamer, excessive bone removal on the outer aspect can cause the entry site to shift laterally, resulting in a varus alignment of the head and neck. Improper screw positioning due to this lateral shift can lead to premature cut-out of the neck screw in a varus head. In osteoporotic bones, where there is an increased risk of bone collapse, it is beneficial to rely solely on the guidewire for entry, reducing the likelihood of these complications.[5] Achieving an optimal entry point is crucial for ensuring a favorable outcome, as consistently documented in previous studies.[6,7] Therefore, this alternative incision technique would assist surgeons in achieving this goal more effectively.

According to studies by Raideh and Tao, using a lateral entry point from the standard incision led to varus collapse.[8] Precisely locating the trochanteric entry point intraoperatively using an image intensifier proves challenging. Streubel et al found significant variability in the trochanteric entry point and recommended preoperative templating as a reliable method to achieve the ideal entry point, although this may not be universally available at all centers.[9]

Pan et al investigated intertrochanteric fractures, examining different entry points categorized as lateral-anterior and medial-posterior.[10] They determined that the medial-posterior entry resulted in faster hip function recovery, improved nail positioning, and fewer surgical complications compared to the lateral-anterior approach. This highlights the crucial role of the entry point in directly influencing the final implant position. Applying inward force to prevent lateral displacement of the guidewire or reamer can help prevent this issue. These findings collectively underscore the importance of achieving precise entry point placement.

Overall, these this study suggests that the double incision technique could offer several advantages over the standard technique. It appears to improve surgical efficiency, enhance the precision of implant placement, and potentially lead to faster recovery with fewer complications. However, the lack of statistical significance in some complication rates indicates that a larger study might be necessary to definitively confirm these potential benefits, particularly regarding long-term outcomes and complication rates.

CONCLUSION

The current study comprehensively details a novel minimally invasive surgical technique that incorporates a modified incision for the fixation of intertrochanteric fractures using the proximal femoral nail A2, emphasizing its significant benefits and clinical implications such as a more precise entry point, lesser soft tissue damage, lesser bleeding and faster entry time for the guidewire.

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