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Comparison of Minimally Invasive and Conventional Surgical Approaches for Dynamic Hip Screw Fixation in Intertrochanteric Femur Fractures

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ABSTRACT

Intertrochanteric femur fractures are common in the elderly and are typically managed with surgical fixation using dynamic hip screws (DHS). While the conventional muscle-reflection approach is widely used, the minimally invasive surgical (MIS) approach has emerged as a less traumatic alternative. This study aims to compare the outcomes of these two surgical approaches in terms of operative time, blood loss, analgesic use and hospital stay. This prospective comparative study included patients with intertrochanteric femur fractures treated with DHS using either a minimally invasive surgical approach (MIS group) or a conventional muscle-reflection approach (conventional group). The primary outcomes assessed were intra-operative time, intra-operative blood loss, need for blood transfusion, duration of post-operative analgesic intake and length of hospital stay. Statistical analysis was performed to determine significant differences between the two groups. The MIS group had significantly shorter intra-operative time (mean 32 minutes) compared to the conventional group (mean 58 minutes) ($p=0.03$). Intra-operative blood loss was also significantly lower in the MIS group (mean 75mL) compared to the conventional group (mean 220mL). Three patients in the conventional group required intra-operative blood transfusions, while none in the MIS group did. Although the MIS group showed shorter durations of analgesic use and hospital stay, these differences were not statistically significant ($p=0.08$). The minimally invasive surgical approach for DHS fixation in intertrochanteric femur fractures significantly reduces operative time and blood loss compared to the conventional muscle-reflection approach. While trends in post-operative recovery were favorable for the MIS group, further studies with larger sample sizes are needed to validate these findings. The MIS approach should be considered as a viable alternative to conventional surgery, particularly in elderly patients.

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Key Words

Intertrochanteric fractures, dynamic hip screw, minimally invasive surgery, conventional approach, blood loss, operative time

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INTRODUCTION

Intertrochanteric fractures of the femur are among the most common types of fractures in elderly individuals, often resulting from low-energy trauma such as falls[1]. These fractures are associated with significant morbidity and mortality, primarily due to the advanced age and comorbidities of the affected patients[2]. Surgical fixation remains the gold standard for managing these fractures, with the dynamic hip screw (DHS) being one of the most widely used implants due to its ability to provide stable fixation while allowing controlled collapse at the fracture site, which promotes healing[3].

However, the approach used for DHS fixation can influence patient outcomes, particularly regarding surgical invasiveness, post-operative recovery and complications[4]. Traditionally, the muscle-reflecting approach has been employed for DHS insertion, requiring substantial soft tissue dissection[5]. While effective, this approach is associated with increased operative time, blood loss, post-operative pain and longer recovery periods[6]. These factors can contribute to delayed rehabilitation, prolonged hospital stay and increased healthcare costs, particularly in elderly patients who are often frail and have limited physiological reserves[7]. In recent years, there has been growing interest in minimally invasive surgical (MIS) techniques for fracture fixation. These approaches aim to reduce soft tissue damage and enhance post-operative recovery by minimizing the extent of surgical dissection. In the context of intertrochanteric fractures, MIS techniques for DHS fixation have shown promise in reducing operative time, blood loss and post-operative pain, potentially leading to faster rehabilitation and shorter hospital stays[8]. Numerous studies have compared MIS with conventional methods, with findings generally supporting the benefits of reduced surgical trauma. Despite these promising results, debate continues regarding the best surgical approach for DHS fixation, especially in terms of patient recovery and complication rates[9]. Given the increasing prevalence of intertrochanteric fractures and the need for optimal surgical techniques to ensure better patient outcomes, further research is necessary to clarify the advantages and disadvantages of MIS versus conventional approaches. This study aimed to contribute to this growing body of knowledge by comparing the outcomes of minimally invasive and conventional muscle-reflection approaches in the fixation of intertrochanteric fractures with DHS.

Aims and Objectives: The primary objective of this study was to evaluate the differences in outcomes between the minimally invasive surgical approach and the conventional muscle reflection approach in the fixation of intertrochanteric femur fractures using DHS. Specifically, the study aimed to compare intra -operative time, blood transfusion requirements, post-operative analgesic intake and the length of hospital stay between the two surgical techniques.

MATERIALS AND METHODS

This randomized controlled study was conducted in the Department of Orthopaedics at G. R. Medical College and Jay Arogya Group of Hospitals, Gwalior, Madhya Pradesh, from June 2011 to December 2012. The study population consisted of patients with intertrochanteric femur fractures who were admitted during this period. Out of the 181 patients evaluated, 98 patients were selected for inclusion based on predetermined inclusion and exclusion criteria. These patients underwent internal fixation using a dynamic hip screw (DHS). Of the 98 patients, 46 (46.9%) were treated using a minimally invasive surgery (MIS) approach, while 52 (53.1%) underwent the conventional muscle-reflection approach. To minimize the impact of potential confounding factors, randomization was used to assign patients to either the MIS or conventional approach group. Additionally, each patient in the MIS group was matched with a patient in the conventional group based on sex, age, American Society of Anesthesiologists (ASA) grade and fracture type according to the AO classification (types 31-A1.1, 31-A1.2, 31-A2.1, 31-A2.2).

This matching ensured that the effect of these variables on outcomes was controlled, allowing for a more accurate comparison of the surgical approaches. The inclusion criteria for the study were skeletally mature patients aged 18 years or older, with AO classification types 31-A1.1, 31-A1.2, 31-A2.1 and 31-A2.2 fractures. Only patients with closed fractures were included and those with multi-systemic or polytrauma conditions were eligible for the study. Patients classified as ASA Grade 1 or 2 were included to ensure the study population consisted of those with a relatively low risk of anesthesia-related complications.

RESULTS AND DISCUSSIONS

Out of 181 patients, 128 patients (71%) were males and 53 (29%) were female with a male to female ratio of 2.4:1. The mean age of presentation of patients with fracture intertrochanteric femur in this hospital was 58.7 years with 72% of the patients falling between 40-to-80-year age group. Out of all the patients, 58 (32%) were A1 type, 92 (51%) were A2 type while 31 (17%) were A3 type. i.e. half the cases were of 31-A2 type fractures. There was right sided dominance over left side in fracture incidence as 100 (55%) fractures were on right side while 81 (45%) were on left side.

The most common cause of fracture was the fall/ slip during walking (n=49) followed by road traffic accident (n=37). Fall from height (n=25) and fall from bed (n=22) constituted the next most common causes. (Table 1).

Table 1: Description of the Study Participants

Variable	Frequency (n)	Proportion (%)
Gender		
Males	128	71%
Females	53	29%
Mean Age	58.7 years	-
Age Group (40-80 years)	-	72%
Fracture Type		
A1	58	32%
A2	92	51%
A3	31	17%
Fracture Side		
Right	100	55%
Left	81	45%
Cause of Fracture		
Fall/Slip during walking	49	27%
Road Traffic Accident	37	21%
Fall from Height	25	14%
Fall from Bed	22	12%
Other Causes	48	26%

The intra-operative time, i.e. from skin incision to closure of wound was in a range of 18-45 minutes with a mean value of 32 minutes in MIS group while it was in a range of 28-85 minutes with a mean value of 58 minutes in conventional group (p=0.03). (Fig. 1) The intra-operative blood loss was in a range of 25-105mL with a mean value of 75mL in MIS group while it was in a range of 100-600mL with a mean value of 220mL in the conventional group. (Fig. 2) Three patients from the conventional group required blood transfusion intra-operatively. The duration of regular analgesic intake was in a range of 7-21 days with a mean value of 10.5 days in MIS group while it was in a range of 10 to 26 days with a mean value of 14.5 days in conventional group. (Fig. 3) However, the difference in the duration of analgesic intake between the two groups was not statistically significant (p=0.08). The duration of hospital stay after surgery was in a range of 02-12 days with a mean value of 4.1 days in MIS group while it was in a range of 03-19 days with a mean value of 8.6 days in conventional group. The duration of stay in the hospital was also not statistically significant (p=0.08). (Fig. 4).

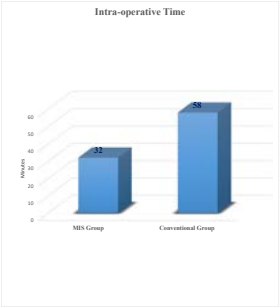

Fig. 1: Bar Diagram Comparing the Mean Value of Intra-Operative Time (in minutes) Between MIS Versus Conventional Group

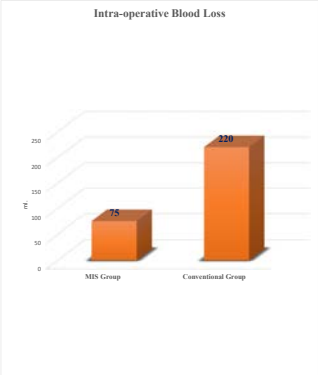

Fig. 2: Bar Diagram Comparing the Mean Value of Intra-Operative Blood Loss (in Millilitres) Between MIS Versus Conventional Group

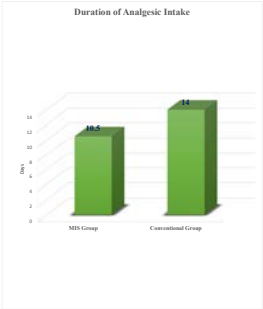

Fig. 3: Bar Diagram Comparing the Mean Value of Duration of Regular Analgesic Intake in Days Between MIS Versus Conventional Group

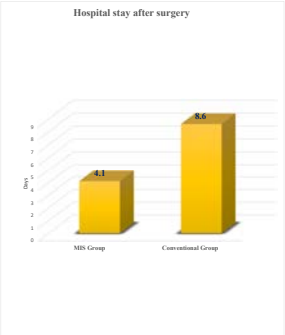

Fig. 4: Bar Diagram Comparing the Average Hospital Stay of Patients After the Surgery (Days) Between MIS Versus Conventional Group

The present study aimed to evaluate the differences in outcomes between the minimally invasive surgical (MIS) approach and the conventional muscle reflection approach in the fixation of intertrochanteric femur fractures using a dynamic hip screw (DHS). The parameters assessed included intra-operative time, blood transfusion requirements, analgesic intake and length of hospital stay. The findings of this study reveal that the MIS approach significantly reduced intra-operative time compared to the conventional method (32 minutes versus 58 minutes, p=0.03), which aligns with the existing body of literature. Several

studies, such as those by Wong[10] and Chong[11], reported similar results, where MIS techniques consistently demonstrated shorter operative times compared to conventional approaches. In Wong's randomized controlled trial, the MIS group had a shorter surgical time and reduced post-operative complications, indicating that the technique minimizes tissue trauma and allows faster recovery. Similarly, Chong[11]. concluded that the MIS-DHS technique led to better overall outcomes, including reduced blood loss, shorter hospital stays and quicker patient rehabilitation, echoing the findings of the present study. The intra-operative blood loss in the present study was significantly lower in the MIS group (mean 75mL) compared to the conventional group (mean 220mL), with three patients in the conventional group requiring blood transfusions. This observation is consistent with findings from Panesar[12] and Ho[13], where both studies showed that the minimally invasive techniques led to lower blood loss compared to conventional surgery. Additionally, Ma[14] found in their meta-analysis that the MIS approach for DHS fixation resulted in significantly reduced blood transfusion rates, further validating the reduced intra-operative blood loss seen in the current study. The duration of analgesic intake was shorter in the MIS group (mean 10.5 days) compared to the conventional group (mean 14.5 days), though the difference was not statistically significant (p=0.08). This trend is consistent with results from Wang[15] and Dai[16], both of which found that patients undergoing MIS for DHS fixation reported less post-operative pain and a shorter duration of analgesic use. The lack of statistical significance in the current study could be attributed to the sample size or individual pain tolerance differences, yet the overall trend favors MIS in reducing post-operative pain. In terms of hospital stay, the present study found that patients in the MIS group had a shorter hospital stay (mean 4.1 days) compared to the conventional group (mean 8.6 days), although this difference was not statistically significant (p=0.08). Similar findings were observed in studies by Knobe[17] and Foulongne[18], where patients treated with the MIS technique demonstrated shorter hospital stays and faster mobilization. These studies emphasize that the MIS technique not only reduces intra-operative time and blood loss but also promotes faster post-operative recovery, contributing to reduced hospitalization duration, although factors such as pre-operative health status and fracture severity may influence this outcome. In comparison with the study by Saarenpää[19], who evaluated the difference between the gamma nail and DHS in similar fractures, the present study's focus on the MIS versus conventional approaches for DHS fixation highlights the value of minimizing surgical invasiveness. While Saarenpää emphasized the importance of fracture classification in determining the appropriate fixation method, the current study demonstrates that, even within the use of DHS, surgical technique plays a crucial role in optimizing patient outcomes. Overall, the findings of the present study support the growing body of evidence favoring minimally invasive techniques for the fixation of intertrochanteric fractures. The significant reduction in operative time and blood loss with the MIS approach, along with the trend towards shorter analgesic use and hospital stays, underscores the advantages of this technique. Future studies with larger sample sizes could further validate these findings and help establish MIS as the standard of care for intertrochanteric fracture fixation.

CONCLUSION

In conclusion, the MIS approach for DHS fixation should be considered as a viable and potentially superior option to the conventional approach for treating intertrochanteric fractures, especially in high-risk and elderly patients. Surgeons should be trained and encouraged to adopt this technique to improve patient care and reduce operative risks.

REFERENCES

1. Chua, Y.P., M.K. Kwan and A. Saw., 2005. Operative treatment of trochanteric fractures with Dynamic Hip Screw - Is perioperative blood transfusion needed? Med J Malaysia., 60: 78-82.
2. Alexa, O., B. Puha, B. Veliceasa and D. Paduraru., 2009. Posterior dislocation of the hip associated with ipsilateral trochanteric fracture--a very rare case. Chirurgia (Bucur)., 104: 761-764.
3. Anwar, R., V. Boorgula and J.E. Nicholl, 2007. Intrapelvic Penetration of the Dynamic Hip Screw During Removal: Lesson Learnt-Always Use a Coupling Screw. J. Trauma: Injury, Infec. & Crit. Care, 63: 105-106.
4. Arrington, E.D. and N.A. Davino., 1999. Subcapital femoral neck fracture after closed reduction and internal fixation of an intertrochanteric hip fracture: a case report and review of the literature. m J Orthop (Belle Mead NJA)., 28: 517-521.
5. Craig, N.J.A. and N. Maffulli, 2005. Subtrochanteric fractures: Current management options. Disability Rehabilitation, 27: 1181-1190.
6. Dec, J., T.S. Gazdzik and B. Wójcik., 2001. Intertrochanteric fractures of the hip treated with Dynamic Hip Screws (DHS). Chir Narzadow Ruchu Ortop Pol., 66: 167-171.

7. Dhar, S.A., B.A. Mir, M.F. Butt, M.I. Wani, M.A. Halwai, M.F. Ali and I.H. Dar, 2007. The dynamic condylar screw in the management of subtrochanteric fractures: Does judicious use of biological fixation enhance overall results? Strategies Trauma Limb Reconstruction, 2: 77-81.
8. Haq, R.U. and I.K. Dhammi, 2012. Clinical Outcome Following Treatment of Stable and Unstable Intertrochanteric Fractures with Dynamic Hip Screw. Ann. Acad. Med., Singapore, 41: 275-276.
9. Haynes, R.C., R.G. Pöll, A.W. Miles and R.B. Weston, 1997. An experimental study of the failure modes of the Gamma Locking Nail and AO Dynamic Hip Screw under static loading: A cadaveric study. Med. Eng. And Phys., 19: 446-453.
10. Wong, T.C., Y. Chiu, W.L. Tsang, W.Y. Leung and S.H. Yeung, 2009. A double-blind, prospective, randomised, controlled clinical trial of minimally invasive dynamic hip screw fixation of intertrochanteric fractures. Injury, 40: 422-427.
11. Chong, K.W., M.K. Wong, I.S. Rikhraj and T.S. Howe., 2006. The use of computer navigation in performing minimally invasive surgery for intertrochanteric hip fractures -The experience in Singapore. Injury., 37: 755-762.
12. Panesar, S.S., S. Mirza, G. Bharadwaj, V. Woolf, R. Ravikumar and T. Athanasiou., 2008. The percutaneous compression plate versus the Dynamic Hip Screw: a meta-analysis. Acta Orthop Belg., 74: 38-48.
13. Ho, M., G. Garau, G. Walley, F. Oliva, A.S. Panni, U.G. Longo and N. Maffulli, 2009. Minimally invasive dynamic hip screw for fixation of hip fractures. Int. Orthop.s, 33: 555-560.
14. Ma, J., D. Xing, X. Ma, W. Xu, J. Wang, Y. Chen and D. Song, 2012. The percutaneous compression plate versus the dynamic hip screw for treatment of intertrochanteric hip fractures: A systematic review and meta-analysis of comparative studies. Orthop.s and Traumatology: Surg. And Res., 98: 773-783.
15. Wang, J.P., T.F. Yang, Q.Q. Kong, S.J. Liu, H. Xiao, Y. Liu and H. Zhang, 2009. Minimally invasive technique versus conventional technique of dynamic hip screws for intertrochanteric femoral fractures. Arch. Orthop. Trauma Surg., 130: 613-620.
16. Dai, M., F. Zou, B. Zhang, T. Nie, M. Cheng, Y. Zou and C. Jiang., 2012. Effectiveness comparison of improved anterolateral approach and lateral approach in treatment of senile intertrochanteric fracture. Zhongguo Xiu Fu Chong Jian Wai Ke Za Zhi., 26: 910-914.
17. Knobe, M., R. Münker, R. Sellei, B. Schmidt-Rohlfing, H. Erli, C. Strobl and F. Niethard, 2009. Die instabile pertrochantäre Femurfraktur. Komplikationen, Fraktursinterung und Funktion nach extrand intramedullärer Versorgung (PCCP™, DHS und PFN). Zeitschrift für Orthopädie und Unfallchirurgie, 147: 306-313.
18. Foulongne, E., M. Gilleron, X. Roussignol, E. Lenoble and F. Dujardin, 2009. Mini-invasive nail versus DHS to fix pertrochanteric fractures: A case-control study. Orthop.s and Traumatology: Surg. and Res., 95: 592-598.
19. Saarenpää, I., T. Heikkinen and P. Jalovaara, 2007. Treatment of subtrochanteric fractures. A comparison of the Gamma nail and the dynamic hip screw: Short-term outcome in 58 patients. Int. Orthop.s, 31: 65-70.