ORIGINAL ARTICLE

Comparison of implant failure and non-unions in intertrochanteric fracture vs sub-trochanteric fracture fixed with dynamic hip screw

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Abstract

Background: Pelvic femur fractures (PFFs), including intertrochanteric and subtrochanteric fractures, are significant orthopedic injuries, often resulting in high morbidity and mortality rates. Treatment typically involves surgical interventions such as dynamic hip screw (DHS) fixation.

Aim: This study aims to compare the rates of implant failure and non-union in intertrochanteric versus subtrochanteric fractures fixed with dynamic hip screw.

Material and Methods: A comparative analysis was conducted on 32 cases of subtrochanteric and intertrochanteric fractures treated with dynamic hip screw at Ghurki Trust Teaching Hospital from August 2022 to July 2023. Patients were assessed for demographic details, mode of injury, comorbidities, infection, implant failure, weight-bearing ability, and union rates. Data were analyzed using SPSS 27.0.

Results: A total of 32 cases were included among these majority cases were observed as male in both groups (81.3% and 75%), respectively. The average age of patients in Group A was 61.75±18.16 years, compared to 49.94±21.81 years in Group B. The side of the body affected was also similar between the groups, with Group A having the majority affected from the left side. Implant failure occurred in 1 patient in Group A and 3 patients in Group B, though this difference was not statistically significant (p-value = 0.310). The ability to bear weight post-surgery was also similar, with 12 and 11 patients respectively. No significant differences were found in gender, age, side affected, mode of injury, BMI, comorbidities, infection rates, or weight-bearing ability between the groups. However, the time to union was significantly longer for subtrochanteric fractures (10.21 weeks) compared to intertrochanteric fractures (4.18 weeks), with a highly significant p-value of <.0001.

Conclusion: Subtrochanteric fractures fixed with dynamic hip screw exhibit significantly longer union times compared to intertrochanteric fractures. The location of the fracture plays a crucial role in influencing healing time, highlighting the need for tailored treatment strategies to optimize outcomes.

Keywords: Dynamic hip screw, Intertrochanteric fracture, Subtrochanteric fracture, Implant failure, Non-union, Orthopaedic surgery.

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Introduction:

Pelvic femur fractures (PFFs) are major orthopaedic injuries that frequently have high rates of mortality and morbidity. They include both intracapsular and extracapsular femoral neck fractures, as well as intertrochanteric and subtrochanteric fractures. Because of their position and the strains they exert on the surrounding muscle and bone, these fractures present particular complications.[1] Femoral neck fractures are categorized as sub-capital, mid-cervical, or basicervical fractures based on where they occur. Severe orthopaedic injuries in the form of subtrochanteric or intertrochanteric fractures are associated with a higher risk of morbidity and mortality, especially in the elderly follow-

ing consequences such as bleeding, infection, thromboembolism, cardiovascular or pneumonia.[2]

The intertrochanteric fractures occur between the greater and the lesser trochanters, while the subtrochantericoccurs below the lesser trochanter. Such fractures mainly result from low-energy falls in elderly patients due to osteoporosis or high-energy trauma in young patients.[3]

Prior studies have aimed at examining the factors associated with recovery and the duration of people inflicted with proximal femur fractures and who underwent internal fixation. It is agreed that the recommended treatment strategy for subtrochanteric and intertrochanteric femur fractures would depend on several factors such as the age of fracture, the quality of the patient's bone and overall condition. These fractures, which are often located at the lower part of the femoral neck, are typically treated surgically due to the necessity of early mobilization and the risks associated with complications. Depending on the characteristics of the fracture and the patient, the surgical options would consist of proximal femoral locking plates, dynamic hip screw fixation, or intramedullary nailing.[4-5] In addition, endeavors on the use of rehabilitation regimens are pivotal in post-operative management with a view to enhancing functional outcomes and return to pre-injury activities.[6]

In particular, for older patients, the Dynamics hip screw is the familiar and preferred surgical procedure for the treatment of subtrochanteric[7] and intertrochanteric femur fractures.[5] To achieve stability and promote bone union, this involved using a particular screw placed into the femoral head and locked to the femoral shaft with the plate. As the screw allows for controlled sliding along the femoral shaft while weight-bearing, it provides for perfect alignment of femoral components. It minimizes the chance of failure of the implant. [8]

Managing complications of Dynamics hip screw (DHS) in subtrochanteric and intertrochanteric femur fractures remains a significant challenge to orthopaedic physicians. DHS fixation is also utilized due to biomechanical considerations; however, there might be some problems.Among them are implant failure, which is frequently brought on by fracture displacement from lateral wall fractures that result in more trochanter lateralization; other causes include excessive hip screw shortening, collapse of the femur neck into different locations, and medialization of the femur shaft.[9] Further concerns include screw breakage or cutting, nonunion, malunion, loss of reduction, avascular necrosis of the femur head, and problems during surgery such as severe bleeding or nerve damage. Moreover, the risk of these problems might be increased by patient-specific variables such as osteoporosis, advanced age, and medical comorbidities.[10-12]

The reason for performing a study to compare the implant failure and nonunion rates of intertrochanteric and subtrochanteric fractures fixed with a dynamic hip screw (DHS) arises from the need to improve the treatment of orthopaedic trauma because this study has not been explored in Pakistan. It compels the researcher to seek ways of improving patient-care outcomes. Intertrochanteric and subtrochanteric fractures represent two different morphologic types, reflecting differences in their biomechanics and fracture profiles. Comparative evaluation methods such as the one described above allow orthopaedic surgeons to analyze the outcomes and appropriateness of DHS fixation of each fracture type, including making treatment choices, surgical approaches, and postoperative care guidelines. Understanding potential risk indicators for undesirable outcomes in each fracture type helps in risk stratification. It caters to the individual needs of the patient, thus improving surgical outcomes and decreasing the rate of complications as a way to increase the quality of treatment for patients suffering from the intertrochanteric and subtrochanteric femur.

Material and Methods:

Our comparative analysis included 32 cases of subtrochanteric and intratrochanteric fractures from August 2022 to July 2023 after obtaining Ethical clearance from the Ethical Committee

Table 1: Study parameters (N=32)

Parameters	Group A (intertrochanteric) (n=16)	Group B (sub-trochanteric) (n=16)	p-value
Gender			
Male	13(81.3)	12(75)	1.000
Female	3(18.8)	4(25)	
Age (years)	61.75±18.16	49.94±21.81	.107
Side effected			
Left	7(43.8)	6(37.5)	.719
Right	9(56.3)	10(62.5)	
Mode of Injury			
RTA	4(25)	5(31.3)	.786
Fall	10(62.5)	8(50.0)	
Others	2(12.5)	3(18.8)	
BMI (kg/m^2)	24.28±4.60	23.61±3.56	.651
Comorbidity			
Diabetes Mellitus	-	2(12.5)	
Hypertension	1(6.3)	1(6.3)	
Others	-	1(6.3)	
No	15(93.8)	12(75)	
Infection			
Yes	1(6.3)	-	
No	15(93.8)	16(100)	
Implant failure			
Yes	1(6.3)	3(18.8)	.310
No	15(93.8)	13(81.3)	
Weight Bearing			
Mobile	12(75)	11(68.8)	.694
Non-mobile	4(25)	5(31.3)	
Union (weeks)	4.18±1.30	10.21±4.30	<.0001**

*** Statistically significant at 5 % level of significance*

of Ghurki Trust Teaching Hospital, Lahore. The study involved male and female patients over 16 years old who underwent treatment with DHS for intertrochanteric and subtrochanteric fractures and were deemed surgically fit. Patients treated with methods other than DHS, such as PFN, were excluded. Informed consent was obtained from all patients. All surgical procedures were conducted at Ghurki Trust Teaching Hospital, with implant selection based on individual surgeon preference and experience. Pre-operative antibiotics were universally administered. For patients undergoing DHS, a standard system featuring a 38 mm, 135° barrel, and a dynamic compression plate containing 5 to 10 holes was utilized, along with 4.5-mm cortical screws. Surgical procedures were performed on a traction table under intra-operative fluoroscopic guidance. Post-operatively, patients received thromboprophylaxis and antibiotic treatment as per department protocol, with regular monitoring through complete blood count and urea and electrolyte blood tests. Patients were assessed at three weeks, six weeks, three months, and six months for union rates and implant failure incidence. An electronic patient record system was utilized to gather relevant data, including demographic details such as age, gender, and BMI. SPSS 27.0 was employed for data analysis, and a comparison of results chi-square test of independence was applied.

Results:

This study compares the outcomes of intertrochanteric fractures (Group A) and sub-trochanteric fractures (Group B) fixed with Dynamic Hip Screws (DHS). The critical parameters analyzed include gender, age, side affected, mode of injury, BMI, comorbidity, infection, implant failure, weight-bearing ability, and time to union.

In terms of gender distribution, Group A had 13 males and 3 females, while Group B had 12 males and 4 females, showing no significant difference (p= 1.000). The average age of patients in Group A was 61.75±18.16 years, compared to 49.94±21.81 years in Group B, but this difference was not statistically significant (p= .107). The effected side was also similar between the groups, with Group A having 7 left-sided and 9 right-sided fractures and Group B having 6 left-sided and 10 right-sided fractures (p= .719).

Regarding the mode of injury, both groups showed comparable distributions with no significant difference (p = .786). BMI was also similar between the groups, with Group A having an average BMI of 24.28±4.60 kg/m^2 and Group B having 23.61±3.56 kg/m^2, resulting in a non-significant difference (p-value = .651).

When evaluating comorbidities, Group B had slightly more cases of diabetes mellitus(2) compared to Group A(0), but both groups had one patient each with hypertension and similar

counts of other comorbidities, leading to no significant differences. Infection rates were low in both groups, with only one case in Group A and none in Group B.

Implant failure occurred in 1 patient in Group A and 3 patients in Group B, though this difference was not statistically significant (p-value = .310). The ability to bear weight post-surgery was also similar, with 12 patients in Group A and 11 in Group B being mobile showing no significant difference (p = .694).

The most significant finding was in the time to union. Group A patients had an average union time of 4.18 ±1.30 weeks, while Group B patients had a significantly longer union time of 10.21±4.30 weeks, with a highly significant p-value of <.0001.

Discussion:

This study aimed to compare the outcomes of utilizing dynamic hip screws (DHS) to treat subtrochanteric fractures (Group B) and intertrochanteric fractures (Group A). Factors such as gender, age, side affected, injury mechanism, BMI, comorbidities, infection, implant failure, weight-bearing capacity, and time to union were crucial elements under evaluation. Data analysis revealed no significant differences in gender distribution, age, side affected, injury mechanisms, BMI, comorbidities, infection rates, implant failure, or weight-bearing capacity between the groups. However, the time to union was significantly longer for subtrochanteric fractures (10.21 weeks) than for intertrochanteric fractures (4.18 weeks) ($p<0.001$).

The findings align with prior studies indicating longer union times for subtrochanteric fractures compared to intertrochanteric fractures; subtrochanteric fractures took an average of 19.68 weeks to heal, according to Kumar et al.[13] In this study, the majority were male cases with common age group ranging from 21 to 40 years. Weight-bearing time was 17 weeks.

Similarly, Goyal et al.[14] observed that intertrochanteric fractures averaged 14.99±2.56 weeks. The extended union duration for subtrochanteric fractures suggests a crucial role of the fracture site in the healing process, particularly when DHS fixation is utilized. This aligns with the biomechanical characteristics of the two fracture types, with subtrochanteric fractures located below the lesser trochanter being more prone to displacement and instability.[15] In cases of subtrochanteric fractures, the DHS screw's dynamic design, allowing controlled movement along the femoral shaft during weight-bearing activities, may not adequately counteract these forces, leading to prolonged healing times.[16]

Agrawal et al.[17] performed a study on patients with intertrochanteric fracturestreated with DHS, and the findings indicate that the mean union time was 17.6 weeks.In 40 cases of unstable intertrochanteric fracture, the mean union time was 16.5 weeks in a study conducted by Dhamangaonkar et al.[18] This study was similar to the study performed by Herode et al.[19]

What is unique about this research is that instead of comparing the results of two different modes of treatment for the same type of fracture (in this case, intertrochanteric and subtrochanteric fractures), the researchers are comparing the results of two different types of fractures – intertrochanteric and subtrochanteric – that were treated using the identical surgical method: DHS fixation. This approach often proves useful since it allows for a more straightforward comparison of the effects of the fracture location on the general healing process. Besides, in the course of the study, morphological and paraclinical data made the comprehensive evaluation of the specified factors that influenced the results of the surgery and contributed to the assessment of the patient's progress in recovery.

However, the study has some limitations that one ought to take into consideration when evaluating the findings of the study. One of the studies' limitations is that the sample size is relatively small in each of the groups, with only 15 patients. Larger sample population adds to the strength of the study by providing a higher statistical capacity to make sufficient conclusions.

Thirdly, the study design is a retrospective study, and, therefore, the study researchers did not control the variables, meaning there could be issues of confounding variables arising from the allocation of the patients to the treatments.

The observed longer union times in the patients with subtochanteric fractures raised a pointer that the place of the fracture should equally be taken into account before enlisting in a specific strategy. Therefore, one can state that while the DHS fixation could be suggested for both types of fractures, there is an implication that, possibly, further steps are required to gain the maximum rate of success in the subtrochanteric fractures, for instance, increased stability of the fixation devices or the use of the bone grafts.

Being a preliminary study, there is a need for further long-term studies to assess a variety of fixation methods in order to identify the efficacy of intramedullary nailing in relation to locking plate fixation of subtrochanteric fractures. More extensive or intensive studies targeting other aspects specifically involving the patient as a unique person, such as the quality of bone and other related diseases, may be of assistance in the determination of healing results.

Conclusion:

Subtrochanteric fractures fixed with DHS exhibit significantly longer union times compared to intertrochanteric fractures. The location of the fracture plays a crucial role in influencing healing time, highlighting the need for tailored treatment strategies to optimize outcomes.

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Role and contribution of authors:

Musadique, collected the data, references and did the initial writeup.

Syed Kashif Shah Bukhari, critically review the article and made final changes

Sharjeel Khan, collected the data and helped in introduction writing.

Asif Ali, collectged the references and helped in discussion writing.

Sajjad Ali, collected the data, references and helped in interpretation of data.

Akbar Abbas, went through the article and made final changes.

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