

Original Research Article

Risk factors affecting the outcome of management of intertrochanteric fractures with dynamic hip screw in elderly patients: a retrospective, observational study

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ABSTRACT

Background: Among the different fixation procedures for intertrochanteric fractures, dynamic hip screw fixation is the most used therapy. Present study evaluated the risk factors affecting the outcome of intertrochanteric fractures managed by dynamic hip screw fixation.

Methods: This was an observational retrospective study conducted between March 2021 and February 2022. Patients with intertrochanteric fractures aged >60 years presenting within a week after incurring the fractures were enrolled. Evan's and AO/OTA classification were used to categorize patients. "Failed" surgery was considered based on one of the following radiographic criteria. Functional outcomes were assessed at 6-months by Harris hip score (HHS).

Results: 40 patients were enrolled, majority being females (n=22, 55%) with mean age of 67.79±4.76 years. Commonest mode of injury was fall while standing (n=32, 80%). Based on Evans classification, majority cases were stable fractures (n=25, 62.5%). By the AO/OTA classification, majority patients were under A2 class (n=22, 55%). The 30 cases (75%) had outstanding to good outcomes based on HHS assessment. 8 patients (20%) had "failed" surgical outcomes of which commonest presentations were >20 mm lag screw pull-out (n=4, 10%) and mal union (n=2, 5%). Mean age, and number of obese patients were found to be significantly greater in the "failed fracture" subgroup, versus "united fracture" subgroup (p<0.05). Significantly greater number of cases in "failed fracture" subgroup belonged to Evans' class IV or V, and to A3 class of AO/OTA classification (p<0.05).

Conclusions: Patient factors like greater age, obesity and intertrochanteric unstable fractures as indicated by Evans' and AO/OTA classification were risk factors affecting the outcome of intertrochanteric fractures, managed with dynamic hip screw.

Keywords: Intertrochanteric fracture, Dynamic hip screw, HHS, Evans classification, AO/OTA classification

INTRODUCTION

Hip fractures are a prevalent injury that affects the older population both morbidly and fatally. According to epidemiological research, the frequency of hip fractures is predicted to rise with increasing lifespan and urbanisation.¹ Hip fractures are predicted to double in frequency, from 1.6 million in 2025 to 2.6 million in 2050. By the end of 2050, the Asian area will be responsible for more than half of all hip fractures.² Hip fractures that

involve both the greater and lesser trochanters are known as intertrochanteric fractures.³ Older persons with osteoporosis frequently experience these fractures, which increase mortality and morbidity in senior patients.⁴ Nearly 90% of intertrochanteric fractures occur in adults over the age of 65, despite the fact that these fractures are caused by high energy trauma in the younger population.⁵ As a result, there is a greater prevalence of poor quality of life, loss of function, and higher mortality.⁶ Age, gender, ethnicity, smoking, alcohol misuse, osteoporosis, steroid

usage, poor sun exposure, and leisure activities are a few of the researched risk factors for hip fractures.^{7,8} Situation in India is also not an exception, with rising longevity leading to increasing hip fracture issues in the country.⁹

The goal of surgical therapy is to promote an early return of the subject to their pre-fracture activities while achieving union in a favourable position with minimal morbidity. Goals of therapy include pain alleviation and improved nursing care if the patient was bedridden before the incident.¹⁰ A less invasive method, such as external fixation, may be an acceptable alternative for many patients who are not suited for surgical intervention due to low socioeconomic position or other co-morbidities such as severe anaemia, poor pulmonary condition, etc. in developing nations.¹¹ Among the different fixation procedures possible for intertrochanteric fractures, with a range of implants, dynamic hip screw fixation is the most commonly used therapy for proximal femur fractures.¹² The dynamic hip screw works on the premise of providing a controlled collapse at the fracture site. The failure rate for unstable fractures is estimated to be between 10 and 16 percent, although the causes of these problems are still debatable and poorly understood.¹³⁻¹⁵ Present study was conducted to evaluate the risk factors which will affect the outcome of intertrochanteric fractures managed by dynamic hip screw fixation, at a tertiary care hospital in Maharashtra, India.

METHODS

This was an observational prospective study conducted by department of orthopaedics at Vithalrao Vikhe Patil medical college and hospital in Maharashtra, between March 2021 to February 2022. The participants' signed informed consent was obtained prior to the intervention, and this study was authorised by the medical college's ethics committee.

In our study, we included all patients with intertrochanteric fractures aged 60 years and older who presented to our hospital's Emergency department and outpatient clinic within a week after incurring the fractures. Patients with polytrauma who required surgery for further fractures or head, chest, or abdominal injuries were not included. Patients with pathological fractures, open fractures, previous surgeries, and those unable to finish the follow-up were disqualified.

All patients had thorough medical examinations, clinical examinations, and pertinent investigations. According to Evans's radiological categorization of intertrochanteric fractures, fractures were categorised.¹⁶ In addition, AO/OTA classification was also used to classify fractures.¹⁷

On the day of the elective surgery, the procedure was carried out on a traction table with an image intensifier after the general health of the patient was optimised. For surgery, either general or spinal anaesthesia was

employed. The same team conducted all procedures using the same conventional surgical procedure. Traction and manipulation were used to lessen the fracture, and an image intensifier was used to confirm it. Fixation was carried out using a 4-hole 135-degree angle sliding plate DHS and an adequate lag screw positioned in the posteroinferior section of the femur neck while maintaining the tip apex distance (TAD). The TAD was measured as the distance from the apex of the centre of the femoral head to the tip of the screw on the AP view of both hip joints obtained immediately after surgery and the distance from the apex of the centre of the femoral head to the tip of the screw on the lateral view. A TAD ≤ 25 mm was considered favourable.¹⁸

The first post-operative day saw the beginning of supervised physical therapy. After surgery, patients were advised to avoid weight bearing and to begin light weight bearing at the start of the third post-operative week. Following up visits were advised for all patients at the second week and subsequently every fourth week for a total of six months. Patients were evaluated clinically and radiologically at each visit. At the six-month mark, the HHS was used to evaluate the functional outcome. The outcomes were classified as outstanding (HHS scores of 90 to 100), good (HHS scores of 80 to 90), fair (HHS scores of 70 to 80), and bad (HHS scores of 70).¹⁹

We investigated various factors including age, sex, body mass index (BMI), fracture side, and fracture type, that may cause impact the outcome of surgery. "Failed" surgery was considered based on one of the following radiographic criteria: greater than 20-mm pull out of the lag screw, mal union including varus deformity, perforation of the femoral head, or broken plate.²⁰

Statistical analysis

SPSS 23 was used to analyse the data. Quantitative factors like mean and standard deviation and significant qualitative variables like frequency and percentage were represented (SD). Patients were subdivided into "united fractures" and "fracture failure" sub-groups, with factors compared between the two study groups. P value was calculated using t-test or Chi-square test as applicable, with $p < 0.05$ considered significant.

RESULTS

Patient and fracture details

Demographic and baseline characteristics of intertrochanteric fractures have been mentioned below in Table 1. A total of 40 patients were enrolled in study, majority being females (n=22, 55%). Most of the enrolled patients had normal BMI (n=21, 52.5%), Majority of cases presented to the emergency department (n=30, 75%). Commonest mode of injury was falls while standing, noted in 80%. Based on Evans classification, majority cases were stable fractures, classified under type I and II (n=25,

62.5%). By the AO/OTA classification, majority patients came under A2 class (n=22, 55%), followed by A1 (n=16, 40%).

Table 1: Demographic and baseline intertrochanteric fracture characteristics of patients enrolled in study, (n=114).

Characteristics	N (%)
Age (years) (mean±SD)	38.37±10.14
Gender	
Male	83 (72.8)
Female	31 (27.2)
BMI based classification (kg/m²)	
Normal (18-24.99)	56 (49.1)
Pre-obese (25-29.99)	35 (30.7)
Obese (≥ 30)	23 (20.2)
Laterality of intertrochanteric fractures	
Right side	72 (63.2)
Left side	42 (36.8)
Mode of injury	
Fall while standing	38 (33.3)
Road traffic accidents	76 (68.7)
Frykman classification	
I and II	36 (31.6)
III and IV	51 (44.8)
V and VI	12 (10.5)
VII and VIII	15 (13.1)

HHS assessment at follow-up

The HHS was noted at follow-up for the enrolled patients. 24 of the enrolled cases (60%) had outstanding outcomes based on HHS assessment at 6 months, 6 patients (15%) had good outcome, 2 patients had fair outcome (5%) while 8 patients (20%) had bad outcome.

Fracture failure and its causes

The 8 of the 40 enrolled patients (20%) were noted to have “failed” surgical outcomes based on the defined radiological criteria. Of these, commonest presentation was >20 mm lag screw pull-out (n=4, 10%), followed by mal union (n=2, 5%). One case each showed femoral head perforation and broken plate.

Comparison of patient factors between “failed fractures” and “united fractures”

On comparing the patient factors, mean age was found to be significantly greater in the “failed fracture” subgroup, in comparison to the “united fracture” subgroup (p<0.05). Significantly greater number of patients in the “failed fracture” subgroup were noted to be obese (p<0.05). Significantly greater number of cases in “failed fracture” subgroup was noted to belong to Evans’ class IV and V, and also to A3 class based on AO/OTA classification (p<0.05). Other factors were noted to be comparable between the subgroups (Table 2).

Table 2: Comparison of patient factors between failed fractures and united fractures’ subgroups.

Parameter assessed	Failed fractures, (n=8) (%)	United fractures, (n=32) (%)	P value
Mean age (Years)	70.34±3.56	61.25±4.12	0.001
Gender			
Male	6 (75)	12 (37.5)	0.13
Female	2 (25)	20 (62.5)	
BMI classification (Kg/m²)			
Normal (18-24.99)	2 (25)	19 (59.38)	0.17
Pre-obese (25-29.99)	1 (12.5)	12 (37.5)	0.35
Obese (≥30)	5 (62.5)	1 (3.12)	0.001
Laterality of intertrochanteric fractures			
Right side	4 (50)	17 (53.12)	0.87
Left side	4 (50)	15 (46.88)	
Evans classification			
I and II	2 (25)	23 (71.88)	0.03
III	1 (12.5)	8 (25)	0.77
IV	3 (37.5)	1 (3.12)	0.02
V	2 (25)	0	0.04
AO/OTA			
A1	2 (25)	14 (43.75)	0.57
A2	4 (50)	18 (56.25)	0.75
A3	2 (25)	0	0.04



Figure 1: United intertrochanteric fracture after surgery with DHS.



Figure 2: A “failed” intertrochanteric fracture after surgery with DHS.

DISCUSSION

Present study enrolled elderly patients above 60 years who suffered from intertrochanteric fractures. The mean age in our study was 67.79 years, with an age range noted to be 62 years to 78 years. Published literature shows that mean age of these patients lies between 71 to 76 years.²⁰⁻²² Overall, the proportion of females was slightly greater than males (55% vs 45%, ratio-1.22:1). In the similar study by Jain et al the female to male ratio was 1.3:1, similar to our study. Gallagher et al. reported female to male ratio of 1.7 to 1, while Dahl series showed a female to male ratio of 8:1.^{23,24}

Around 1980, a number of publications reported using a dynamic hip screw to treat femoral intertrochanteric fractures with outstanding outcomes.^{25,26} According to Steinberg et al., when this increased sliding was more than 15 mm, the failure rate rose.²⁷ We observed that sliding over 20 mm caused the afflicted limb to shorten and hip discomfort to be present. The most common reasons for fixation failure include osteoporosis, osteoporotic fractures, absence of anatomic reduction, fixation device failure, and screw placement in the femoral head.²⁸⁻³¹

Keeping the causes and the radiological findings of intertrochanteric fractures in mind, the failed fractures were defined after surgical management. Overall, the proportion of patients with failed fractures was noted to be 20%, which was similar to the other study findings. Jain et al showed a failure rate of 20.6%, which was very close to our study findings. In the study by Hsueh et al 6.8% cases with intertrochanteric fractures were noted to have screw cut out indicating poor outcome.³² In the study by Shah et al only 1.94% cases of intertrochanteric fracture required revision.³³

On comparing the patient factors, greater age, obesity, unstable fractures as indicated by Evans' class IV and V, and A3 class based on AO/OTA classification were found to be significantly associated with the "failed fracture" subgroup, in comparison to the "united fracture" subgroup ($p < 0.05$). Published literature have mentioned that aging has been associated with decreased bone mass, bone strength, and bone mineral density.^{34,35} These effects on the bone affect the bone fragment support after postoperative loading, which may result in excessive sliding.³⁶ The study by Ju et al showed that patients which age > 70 years, unstable fractures (AO/OTA class A3), and BMI in obesity range were all related with lower HHS, indicating poor functional outcomes, and these findings are in sync with our study findings.³⁷

Unstable fractures using Evans' classification had a high rate of collapse (27.7%) in the study by Jain et al Chan and Gill reported that patients with femoral intertrochanteric fractures treated with a hemiarthroplasty had substantially more weight bearing on the injured limb in the immediate post-operative period when compared with patients in whom a stable or unstable fracture was treated with

internal fixation.³⁸ In elderly patients a good pre-operative assessment of instability of their fracture using Evans' classification can predict post-operative collapse, or failure.

The study had a few limitations. It was research conducted with limited sample size, and only one hospital was involved. The results of this study thus could not exactly represent the situation throughout the entire country.

CONCLUSION

Patient factors like greater age and obesity, and intertrochanteric unstable fractures as indicated by Evans' class IV and V, and A3 class based on AO/OTA classification were risk factors affecting the outcome of intertrochanteric fractures, managed with dynamic hip screw.

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