

Clinical Outcome Following Treatment of Stable and Unstable Intertrochanteric Fractures with Dynamic Hip Screw

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Abstract

Introduction: Intertrochanteric (IT) fractures are associated with significant morbidity and mortality in the elderly population. We aim to compare the clinical outcome of unstable with stable IT fractures after treatment with dynamic hip screw (DHS). **Materials and Methods:** Patients with IT fractures treated with DHS at National University Hospital between 2003 and 2005 were included in the study. Patients were divided into 2 groups: stable and unstable IT fractures. Clinical outcome parameters include perioperative complications, functional outcomes, and incidence of morbidity and mortality. **Results:** One hundred and thirty-six patients were analysed. Mean age was 77 years. There were 61 stable and 78 unstable fractures. Average length of follow-up was 30 months. The rates of local complications were not significantly different between the 2 groups. The incidence of malunion and excessive impaction were significantly higher in the unstable group. The ambulatory status at one year post-surgery was not significantly different between the 2 groups. In terms of general postoperative complications and one year mortality rate, there was no significant difference between the 2 groups. The need for blood transfusion was significantly higher in the unstable group. **Conclusion:** In summary, DHS fixation provides comparable postoperative outcomes in unstable IT fractures with relatively low rates of complications. Although it was associated with a higher incidence of malunion and excessive impaction in the unstable fracture group, there was no difference in functional status at one-year compared to the stable group.

Ann Acad Med Singapore 2011;40:482-487

Key words: Hip fractures, Elderly, Outcomes

Introduction

Intertrochanteric (IT) fracture is among the most common orthopedic injuries in the elderly population, and is associated with osteoporosis. It usually occurs as a result of low energy trauma e.g. trivial falls. It carries considerable morbidity and mortality.¹⁻⁵ In Singapore, there has been an increase in the incidence of hip fractures from 1.17 per 1000 in females who are 60 years or older from 1957 to 1965, to 1.5 per 1000 in 1985.⁶ Surgical treatment of IT fractures aims to achieve early mobility and to restore the patient's walking ability to the pre-injury level.

Stable IT fractures are commonly treated with dynamic hip screw (DHS) fixation with failure rates of less than 2%.^{7,8} The treatment of unstable IT fractures is more controversial. Unstable IT fractures treated with DHS have a considerably higher rate of failure, ranging from 4% to 15%.⁷⁻¹²

Other treatment modalities for unstable IT fractures include intramedullary devices, angle blade plates and hemiarthroplasty.¹³ These methods of treatment are more technically demanding.

Despite the higher failure rate reported in the literature,⁷⁻¹² DHS is still the most widely used fixation device for unstable IT fractures in our centre. This is a retrospective review of functional outcomes, morbidity and mortality between stable and unstable IT fractures treated with DHS.

Materials and Methods

This is a retrospective study of 136 patients with 139 consecutive IT fractures admitted to the National University Hospital, Singapore who were treated with DHS between 2003 and 2005. The inclusion criteria were ages above 50

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years, IT fractures caused by low energy trauma and treated with DHS. Those with pathological fractures (e.g. tumours or Paget's disease), reversed oblique IT fractures, high-energy injuries, inflammatory arthritis and osteoarthritis of the hips were excluded from this study. Patients who were bedbound prior to the fractures were also excluded. IT fractures treated with other implants such as dynamic condylar plate, angle blade plate, reverse LISS plate, intramedullary device, hemiarthroplasty and total hip replacement and those treated non-operatively were excluded from this study.

Fracture reduction and fixation was carried out with patient supine on a traction table. DHS was inserted through lateral incision of the hip. A 6.5 mm anti-rotation screw was inserted when the IT fracture was at the level of basal neck of the femur. Sixty-one stable and 78 unstable IT fractures were included in the study. The surgeries were performed by orthopaedic consultants or senior residents. Patients with stable IT fractures with anatomical reduction after DHS insertion were allowed to weight bear. Patients with unstable IT fractures or when anatomical reduction was not achieved after DHS insertion were not allowed to weight bear.

Ethical approval was obtained from the Institutional Review Board prior to commencement of the study. DSRB reference number is DSRB Domain D/08/616.

Primary Assessment and Follow-up

Baseline data (gender, age, race, preexisting medical conditions, comorbidities and premorbid ambulatory status) were collected. Postoperatively, the patients were followed-up in orthopaedic out-patient clinic regularly. The radiographic evaluation was carried out immediately after the surgery, 6 weeks, 12 weeks and 6 months postsurgery and yearly subsequently.

Other data collected included the duration of the operation, length of hospital stay and blood transfusion. The postoperative outcomes included general and local complications, osteosynthesis complications and the ambulatory status at 1-year postoperation. Phone interviews were carried out at the end of the study to update the functional status and mortality.

Classification and Outcome Measures

Based on Jensen classification,¹⁴ fractures were classified and graded for stability by the attending surgeon. The degree of osteoporosis was graded according to the Singh's index. The ambulatory status was graded as follows: A, ambulating without aid; B, ambulating with aid e.g. walking stick, walking frame; C, Wheel chair-bound; and D, bed-bound. The comorbidities graded according to Ceder et al¹⁵ were A, full health; B, illness not affecting rehabilitation, e.g.

diabetes, hypertension; and C, illness affecting rehabilitation e.g. ischaemic heart disease, cerebrovascular disease, parkinsonism.

Postoperative radiographs were assessed to determine the radiographic outcomes which included fracture union, the time to union and osteosynthesis complications such as malunion, excessive sliding and lag screw cutout. There are no specific definitions of malunion and excessive sliding of the IT fractures in the literature. We defined malunion with 2 criteria: (i) Less than 50% contact between the proximal and distal fragments in the calcar femorale, (ii) Neck-shaft angulation of less than 120 degrees. Excessive sliding was defined as supra-trochanteric shortening of more than 1 cm compared to the contralateral side.

Deep wound infection was defined as an established infection beneath the fascia requiring surgical revision. Superficial wound infection was defined as a cutaneous/subcutaneous infection requiring antibiotic therapy.¹⁶

At the end of the study, the ambulatory status of the patients was assessed according to the method mentioned above. If the patients died, the date and cause of death were collected.

Statistical Methods

The statistical software used was SPSS. Statistical analysis was performed using the Fisher exact test and the Mann-Whitney U test. Statistical significance was defined as $P < 0.05$. Estimated survival distributions were calculated by the method of Kaplan and Meier.

Results

Study Population and Baseline Data

One hundred and seventy-six cases of IT fractures were treated with DHS at the National University Hospital, Singapore during a period from year 2003 to year 2005. Thirty-seven cases had follow-up of less than one year and were not contactable at the end of the study. Thus, 139 cases were included in this study. Sixty-one cases were classified as stable fractures and 78 cases as unstable fractures. The baseline data of all patients in the stable and unstable groups were included in Tables 1 to 4. The mean age was 77 and 76 years in the stable and unstable groups, respectively. Majority of the patients were able to ambulate independently in both groups prior to sustaining the fractures. The most common comorbidities in this population were hypertension, diabetes mellitus and ischaemic heart disease. There were no significant differences between the 2 groups with regards to the demography, existing medical conditions, comorbidities, premorbid ambulatory status and fracture configurations except for the incidence of subtrochanteric extension which was significantly higher in the unstable group.

Table 1. Demographic Baseline Data for Stable and Unstable Groups

	Stable (n = 61)	Unstable (n = 78)	P value
Age (years)	77.00 ± 9.79	76.36 ± 11.73	0.792
Race (count, %)			0.202
Chinese	44 (77.0%)	70 (89.7%)	
Malay	5 (8.2%)	4 (5.1%)	
Indian	6 (9.8%)	3 (3.8%)	
Others	3 (4.9%)	1 (1.3%)	
Sex - Male (Count, %)	20 (32.8%)	29 (37.2%)	0.591

Table 2. Baseline Data in Terms of Existing Medical Conditions and Comorbidities

Existing Medical Conditions	Stable (n = 61)	Unstable (n = 78)	P value
Diabetes Mellitus	20 (32.8%)	31 (39.7%)	0.398
Hypertension	37 (60.7%)	50 (64.1%)	0.677
Cerebrovascular Accident	12 (19.7%)	14 (17.9%)	0.796
Ischaemic Heart Disease	14 (23.0%)	15 (19.2%)	0.592
Parkinson's Disease	3 (4.9%)	2 (2.6%)	0.654
Dementia	5 (8.2%)	5 (6.4%)	0.748
Renal Impairment	1 (1.6%)	7 (9.0%)	0.079
Neoplasm	7 (11.5%)	2 (2.6%)	1.042
Comorbidities	Stable (n = 61)	Unstable (n = 78)	P value
Grade A	7 (11.5%)	16 (20.5%)	0.308
Grade B	25 (41.0%)	32 (41.0%)	
Grade C	29 (47.5%)	30 (38.5%)	

Table 3. Baseline Data in Terms of Previous Contralateral Fractures, Singh's Index and Subtrochanteric Extension

	Stable (n = 61)	Unstable (n = 78)	P value
Previous Contralateral IT Fracture	4 (6.6%)	5 (6.4%)	1.000
Singh Index (median, SD)	4 ± 1.24	4 ± 1.20	0.758
Side of Current IT Fracture - right	34 (55.7%)	34 (43.6%)	0.155
Subtrochanteric Extension	3 (4.9%)	17 (21.8%)	0.005

Table 4. Baseline Data in Terms of the Premorbid Ambulatory Status

Premorbid Ambulatory Status	Stable (n = 61)	Unstable (n = 78)	P value
Independent	43 (70.5%)	57 (73.1%)	0.322
Walking with aid	15 (24.6%)	20 (25.6%)	
Wheelchair bound	3 (4.9%)	1 (1.3%)	

Surgery and Surgical Outcomes

The waiting time to surgery was 4.72 and 5.73 days on average in stable and unstable groups, respectively. The average duration of the surgery was 59 and 64 minutes in stable and unstable groups, respectively. There were no significant differences in term of the duration of operation and the length of hospital stay between the 2 groups (Table 5).

There were 6 patients (9.8%) and 5 patients (6.4%) with superficial wound infection that did not require operation and which healed with antibiotic therapy in stable and unstable groups, respectively. One patient in each group had deep wound infection which required surgical debridement on top of the antibiotic therapy. One case of osteomyelitis occurred in unstable group. It required multiple surgical debridements (Table 6). This case was further complicated with non-union, implant loosening, excessive impaction and finally implant cut-out. Implant removal was performed in this case. Another non-union case occurred in the unstable group. It was associated with deep wound infection. There were no cases of non-union in the stable group. The rate of malunion was significantly higher in the unstable group (55.1%) compared with the stable group (13.1%) with *P* value of <0.001. Excessive impaction and medialisation were also significantly higher in the unstable group (41%) compared with the stable group (11.5%) with *P* value of <0.001. The rates of lag screw cut out were 3.3% and 3.8%

Table 5. Duration of Surgery and Admission

	Stable	Unstable	<i>P</i> value
Duration of Operation (min)	59 ± 18	64 ± 23	0.254
Operation on Postinjury Dat	4.72 ± 2.92	5.73 ± 5.05	0.488
Length of Hospital Stay	13.43 ± 5.39	16.56 ± 10.86	0.176
Discharge Postoperative Day	8.70 ± 4.00	10.83 ± 9.30	0.377

Table 6. Postoperative Surgical Site Complications

Wound Complications	Stable (n = 61)	Unstable (n = 78)	<i>P</i> value
Superficial Infection	6 9.8%	5 6.4%	0.535
Deep Infection	1 1.6%	1 1.3%	1.000
Osteomyelitis	0 0%	1 1.3%	1.000

Table 7. Osteosynthesis Complications

Osteosynthesis complications	Stable (n = 61)	Unstable (n = 78)	<i>P</i> value
Non union	0 0%	2 2.6%	0.263
Malunion	8 13.1%	43 55.1%	<0.001
Excessive Impaction	7 11.5%	32 41.0%	<0.001
Lag Screw Cutout	2 3.3%	3 3.8%	1.000

in the stable and unstable groups, respectively (Table 7). The average tip apex distances were 22.2 mm and 22.1 mm in the stable and unstable groups, respectively and were not significantly different.

Urinary tract infection was the most common postoperative general complication followed by thromboembolic disease i.e. deep vein thrombosis and pulmonary embolism (Table 8). Of these patients, 26.2% and 53.8% required postoperative blood transfusion in the stable and unstable groups, respectively. The requirement of blood transfusion was significantly higher in the unstable group. Hyponatremia and syndrome of inappropriate antidiuretic hormone hypersecretion (SIADH) were significantly higher in the unstable group (12.8%) compared with the stable group (1.6%) with *P* value of 0.023 (Table 8).

Functional Outcomes and Mortality

The ambulatory status premorbidly and at 1-year

Table 8. General Postoperative Complications

General Complications	Stable (n = 61)	Unstable (n = 78)	<i>P</i> value
Pneumonia	2 3.3%	6 7.7%	0.466
Cerebrovascular Accident	2 3.3%	1 1.3%	0.582
Acute Myocardial Infarction	1 1.6%	2 2.6%	1.000
Deep Vein Thrombosis, Pulmonary Embolism	3 4.9%	4 5.1%	1.000
Urinary Tract Infection	14 23.0%	27 34.6%	0.135
Hypotremia/ SIA DH	1 1.6%	10 12.8%	0.023
Bed Sore	0 0%	2 2.6%	0.504
Congestive Cardiac Failure	2 3.3%	1 1.3%	0.582
Blood Transfusion	16 26.2%	42 53.8%	0.01

Table 9. The Ambulatory Status at 1-year Post-surgery

1 Year Ambulatory Status	Status (n = 67)	Unstable (n = 78)	<i>P</i> value
Independent	14 23.0%	31 39.7%	0.079
Ambulant with Aid	30 49.2%	36 46.2%	
Wheel Chair Bound	14 23.0%	11 14.1%	
Bedbound	2 3.3%	0 0%	

Table 10. The Causes of Death of Patients Included in this Study

Cause of Death	No. of Patients
Pneumonia	7
Malignancy	3
Urosepsis/ UTI	2
Renal Failure	1
Cerebrovascular Accident	1
Gastrointestinal Bleeding	1
Cardiomyopathy	1
Rupture Abdominal Aortic Aneurysm	1
Unknown	4

post-surgery was compared in Table 9. Those who were ambulating independently without aid in the stable and unstable groups were 23% and 39.7% respectively. Those who were wheel chair bound in the stable and unstable groups were 23% and 14.1% respectively. Those who were bedbound in the stable and unstable groups were 3.3% and 0% respectively. The percentage of patients who maintained the premorbid ambulatory status at 1-year post-surgery is 47.3% and 58%, respectively.

A total of 9 patients died within 1-year post-surgery. Four patients were from the stable group and 5 from the unstable group, giving a P value of 1.000 (Fig. 1). Another 4 patients in the stable group and another 8 patients in unstable group died more than one year after the surgery. The most common cause of death was pneumonia followed by malignancy (Table 10).

Discussion

This study compared stable and unstable IT fractures treated with DHS fixation. The study population and the baseline data (age, race sex, medical comorbidities and the premorbid ambulatory status) were similar between the 2 groups. The study's limitations include the fact this is a retrospective study with all the problems inherent with this methodology. During the period of this study, DHS fixation was the mainstay of treatment of IT fractures. Other methods of fixation such as intramedullary devices or angle blade plate were not commonly used.

The rates of wound infection were similar between the 2 groups. The rates of deep wound infection in this study for stable and unstable groups were 1.6% and 1.3% respectively and were considered to be lower than previously published studies which ranged between 2.6%¹ and 3%.⁹ The rate of non-union was higher in the unstable group

but not statistically significant ($P = 0.263$). Given the low incidence of non-union, the difference of the rate of non-union may become significant with a larger study. The rate of malunion and excessive impaction were significantly higher in the unstable group ($P < 0.001$). The rates of osteosynthesis complications (55.1% for malunion; 41.0% for excessive impaction) and lag screw cut-out (3.8%) in unstable IT fractures treated with DHS in this study were higher compared to the previous published studies. Madsen reported technical failures of 34% when unstable IT fractures were treated with DHS alone. It reduced to 9% when unstable IT fractures were treated with trochanteric support plate on top of the DHS.⁹ Despite the significant differences in the rate of malunion and excessive impaction, the ambulatory status at one year post-surgery were similar between the 2 groups. Ambulatory status has been used as a marker of function in hip fracture studies, including a previous local study.^{5,17-19} It can be easily used to compare the functions pre-fracture and at 1 year after the treatment of the fractures.

Thirty-seven cases that had follow-up of less than one year and were not contactable had possibly expired from other causes. This phenomenon contributed to the mortality rate of 26% which was comparable to published studies.⁴ There is wide variation in the published mortality rate at one year, although most other series did not have large numbers. It ranged from 15% mortality rate with 219 patients³ of average age 75 years to 37% in a series of 131 patients.²⁰ Recent study on mortality in patients after a hip fracture showed a rate of 11% to 23% at 6 months and 22% to 29% at one year from injury.⁴ Earlier study of patients with hip fractures in Singapore in 1995 showed mortality rate of 9% and 15% at 6 months and 12 months after the injury, respectively.⁵ The mortality rate following hip fractures are generally lower in Asian populations compared to Western populations.^{5,17,18}

Conclusion

In summary, unstable IT fractures treated with DHS produced comparable results to the stable ones in terms of the local and systemic postoperative complications, the rate of union and the ambulatory status at one year postsurgery. Significantly higher rates of malunion and excessive impaction in the unstable groups did not produce significant difference in term of postoperative ambulatory status.

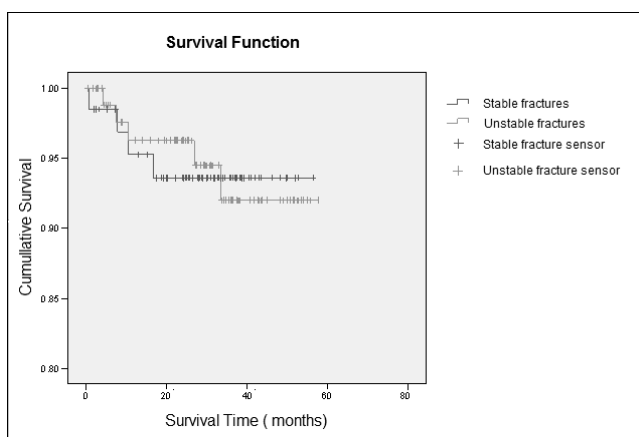


Fig. 1. Kaplan Meier survival curve comparing patients with stable and unstable IT fractures.

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