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Research Article

Mortality Rate and Quality of Life in Patients with Intertrochanteric Fractures Treated with Dynamic Hip Screw

Seyyed Hossein Shafiei[1,*], Sina Ghaderzadeh[2], Mohammad Rastegar[3], Babak Siavashi[4], Mohammadreza Golbakhsh[4], Seyyed Mohammad Javad Mortazavi[5]

[1] Assistant Professor, Orthopedic Surgery Research Center, Sina Hospital, Tehran University of Medical Sciences, Tehran, Iran
[2] Medical Student, Orthopedic Surgery Research Center, Sina Hospital, Tehran University of Medical Sciences, Tehran, Iran
[3] Orthopedic Assistant, Orthopedic Surgery Research Center, Sina Hospital, Tehran University of Medical Sciences, Tehran, Iran
[4] Associate Professor, Joint Reconstruction Research Center, Tehran University of Medical Sciences, Tehran, Iran
[5] Professor, Orthopedic Surgery Research Center, Sina Hospital, Tehran University of Medical Sciences, Tehran, Iran

[*] Corresponding author: Seyyed Hossein Shafiei; Orthopedic Surgery Research Center, Sina Hospital, Tehran University of Medical Sciences, Tehran, Iran. Tel: 21-63121291, Email: dr_hshafiei@yahoo.com

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Abstract

Background: Intertrochanteric (IT) fracture is one of the most common fractures in adults. Dynamic hip screw (DHS) surgery is a surgical procedure for IT fracture treatment. This study evaluated the mortality rate and quality of life (QOL) among these patients one year after the surgery.
Methods: This cohort study was conducted on 110 patients with IT fractures treated with DHS from 2017 to 2019. A questionnaire was completed for each patient before, during, and after surgery. Preoperative information included demographics, height, weight, body mass index (BMI), smoking, diabetes, variables such as IT fracture classification, injury mechanism, lateral wall, and the American Society of Anesthesiologists (ASA) comorbidity classification. Tip-apex distance (TAD), nail position at the femoral head, and the amount of bleeding during the operation were achieved during and immediately after the surgery. The mortality rate was determined one year after the surgery, and the surviving patients were assessed by the 36-Item Short Form Survey (SF-36) questionnaire.
Results: The mortality rate among patients who underwent DHS was 31.81%. There was no significant difference between living and dead patients regarding demographic information, surgical techniques, and comorbidities. There was no association between patients regarding the average of all areas of physical, mental, and overall health and gender. There was no significant relationship between the mean of physical and mental health with the duration of hospital stay and the amount of bleeding during surgery. A history of diabetes, high blood pressure, and smoking in these patients was not associated with mortality and QOL.
Conclusion: The patient's age is the most important risk factor for mortality after the DHS surgery.

Keywords: Hip Fractures; Morbidity; Mortality; Cohort Studies

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Background

Hip fracture is a significant health problem in elderlies, and it is the leading cause of morbidity and mortality among elderlies (1, 2). The prevalence of hip fracture is about 80 in 100000 cases worldwide (3). Considering the increasing age throughout the world, the prevalence of hip fracture is estimated to be doubled in the near future (3). It is expected that the number of cases with a hip fracture will increase to 500000 by 2040, annually (4). Hip fractures are categorized into two main groups; intracapsular (femoral neck) fractures and extracapsular [intertrochanteric (IT)] fractures (2). The analysis demonstrated that the important factor in preventing mechanical failure was the caudal-cranial correction of lag screw position (5). Several factors affect the incidence of IT fractures like age, alcohol consumption, previous hip fracture, inactivity, dementia, and osteoporosis (6).

A standing surgical technique for IT fractures includes internal fixation with a sliding screw device (7). Fixation tools contain intra-medullary (gamma nail or screw) and extra-medullary devices and sliding plates like a dynamic hip screw (DHS) (12). According to the Arbeitsgemeinschaft für Osteosynthesefragen (AO) classification (8), unstable IT fractures are treated with intramedullary devices (8). During 2008 to 2019, we routinely treated all IT fractures with DHS regardless of their AO class. Most cases of IT fractures are elderlies with osteoporosis who sustained a fracture following a simple fall from a standing height (9). Kenzora et al., in their study, revealed that the number of pre-existing medical conditions and time from admission to surgery are significant risk factors for mortality (10). This study will evaluate risk factors of mortality following surgical treatment of IT fracture after at least one year of follow-up.

Methods

This cohort study was conducted on 110 patients with IT fractures admitted to Sina Hospital (Tehran, Iran) from 2017 to 2019 for treatment with the DHS. The sample size was calculated according to a recent study (11). The current survey was approved by the Institutional Review Board and Ethical Committee of Tehran University of Medical Sciences. Written informed consents were signed by all patients. A checklist containing demographic data of patients, including their age, gender, body mass index (BMI), history of smoking, as well as a history of blood pressure and diabetes, was filled before the surgery. Furthermore, clinical data of patients, such as fracture mechanisms, fracture classification, lateral wall, and the

American Society of Anesthesiologists (ASA) type, were recorded. All patients with IT fractures who were a candidate for DHS were enrolled into the study. Patients who met the following criteria were excluded from the study: (i) unwillingness to contribute to the study, (ii) patients with other chronic diseases or anomalies, (iii) cases who were not a candidate for surgery, and (iv) patients with less than one year follow-up.

After preliminary considerations and patient selection based on inclusion and exclusion criteria, surgery with a DHS was performed for all patients under spinal or general anesthesia. Other parameters such as the tip-apex distance (TAD) anteroposterior (AP), TAD lateral, and nail position, as well as reduced quality and bleeding under surgery were considered during or immediately after the surgery. The mortality rate was evaluated among patients a year after the surgery. Additionally, the quality of life (QOL) was evaluated among survived patients using the 36-Item Short Form Survey (SF-36) questionnaire.

Statistical Analysis: All quantitative data were analyzed using the descriptive program and presented as mean ± standard deviation (SD). Crosstabs and chi-square tests were used to compare the percentage or frequency of parameters between two groups. The comparison of the mean of parametric data between the two groups was analyzed using an independent samples t-test. In this study, $P < 0.05$ was considered statistically significant. The SPSS software (version 19, SPSS Inc., Chicago, IL, USA) was applied to the data analysis.

Results

A total of 110 patients with a mean age of 72.45 ± 14.70 years and BMI of 24.80 ± 4.10 kg/m^2 were participated in the study. 61 patients (55.5%) were men, and 49 cases (44.5%) were women. 35 patients (31.81%) died a year after the surgery. There was a significant difference in the mean age of patients between the two groups (Table 1). Dead patients' mean age was significantly higher than survived patients (79.14 ± 9.60 years vs. 69.32 ± 15.60 years, P = 0.001). There was no significant difference in the other basic demographic data, such as the frequency of gender, BMI, smoking history, blood pressure, and diabetes between the two groups (Table 1).

Table 1. Comparison of the basic demographic characteristics between two groups

Variables	Alive patients (n = 75)	Dead patients (n = 35)	P-value
Age (year)	69.32 ± 15.60	79.14 ± 9.60	0.001
Gender			
Men	44 (58.7)	17 (48.6)	0.320
Women	31 (41.3)	18 (51.4)	
BMI (kg/m2)	24.96 ± 4.13	24.48 ± 4.00	0.570
Age group (year)			
< 30	2 (2.7)	-	
30-49	4 (5.3)	-	
50-69	25 (33.3)	8 (22.9)	0.230
> 70	44 (58.7)	27 (77.1)	
Smoking			
Yes	25 (33.3)	6 (17.1)	0.080
No	50 (66.7)	29 (82.9)	
Blood pressure history			
Yes	33 (44.0)	14 (40.0)	0.690
No	42 (56.0)	21 (60.0)	
Diabetes history			
Yes	25 (33.3)	13 (37.1)	0.690
No	50 (66.7)	22 (62.9)	

Data are presented as mean ± standard deviation (SD) or number and percentage
BMI: Body mass index

Comparison of the clinical data of patients between two groups is summarized in table 2. There was no significant difference in the ASA physical status of patients between the two groups (P = 0.940). Most patients in both groups (~50%) had ASA class II, while ~2.5% had ASA class IV. The frequency of ASA classes I and II in both groups was around 20%. The mean of TAD AP, TAD lateral, and TAD total in all patients was 9.35 ± 3.35 mm, 11.10 ± 3.45 mm, and 20.45 ± 6.09 mm, respectively. There was no significant difference in the mean of these parameters between the two groups of dead and survived patients. Additionally, no significant difference was found in the mean of intraoperative bleeding and hospital stay, as well as the frequency of nail position and the lateral wall between the two groups. However, reduction quality in survived patients was pretty higher compared to dead patients (46.7% vs. 25.7%, P = 0.060). There was no significant difference in the frequency of fracture mechanisms and type of fracture among patients. Domestic fall was the most common type of fracture mechanism among survived (76%) and dead (80%) patients (Table 2).

Table 2. Comparison of the clinical data of patients in both groups

Variables	Alive patients (n = 75)	Dead patients (n = 35)	P-value
ASA group			
I	19 (25.3)	8 (22.8)	0.940
II	40 (53.3)	18 (51.5)	
III	14 (18.7)	8 (22.8)	
IV	2 (2.7)	1 (2.9)	
TAD anteroposterior (mm)	9.45 ± 2.50	9.14 ± 3.60	0.650
TAD lateral (mm)	11.39 ± 3.28	10.49 ± 3.76	0.200
TAD total (mm)	20.80 ± 5.79	19.63 ± 6.72	0.330
Bleeding under surgery	500 (400-600)	450 (350-600)	0.370
Hospital stay (day)	9 (7-11)	10 (7-12)	0.390
Nail position			
C + C	26 (34.7)	11 (31.4)	0.530
C + A	8 (10.7)	3 (8.6)	
C + P	8 (10.7)	5 (14.3)	
S + C	4 (5.3)	4 (11.4)	
S + A	5 (6.7)	2 (5.7)	
S + P	4 (5.3)	-	
I + C	9 (12.0)	5 (14.3)	
I + A	3 (4.0)	4 (11.4)	
I + P	8 (10.7)	1 (2.9)	
Reduction quality			
Good	35 (46.7)	9 (25.7)	0.060
Bad	40 (53.3)	26 (74.3)	
Lateral wall			
Positive	48 (64.0)	21 (60.0)	0.830
Negative	27 (36.0)	14 (40.0)	
Fracture mechanisms			
Domestic fall	57 (76.0)	28 (80.0)	0.870
RTA	17 (22.7)	7 (20.0)	
Assault	1 (1.3)	-	
Type of fracture			
31A1:2	34 (45.3)	13 (37.1)	0.420
31A1:3	22 (29.3)	14 (40.0)	
31A2:2	14 (18.7)	7 (2.0)	
31A2:3	3 (4.0)	-	
31A3:1	2 (2.7)	-	
31A3:3	-	1 (2.9)	

Data are presented as mean ± standard deviation (SD), number and percentage, or median and interquartile range (IQR)
ASA: American Society of Anesthesiologists; TAD: Tip-apex distance; RTA: Road traffic accident

The mean of SF-36 scores and QOL degree after surgery in survived patients and its comparison between men and women can be seen in table 3. There was no significant difference in the mean of each SF-36 score between men and women. Moreover, the QOL degree between men and women was not statistically different. Approximately, 20% of the surviving patients had better physical functioning, mental health, and overall health, while nearly 50% of these cases had suffered from physical malfunctioning and mental and overall health problems.

The frequency of QOL grade in each basic and clinical issue after surgery in survived patients is depicted in table 4.

There was no significant relationship between the QOL degree and all parameters. While 50% of patients aged 30-49 years had poor QOL, approximately 50% of cases in the other age groups had a good QOL.

Table 3. The mean of 36-Item Short Form Survey (SF-36) scores and quality of life (QOL) degree after surgery in survived patients

Variables	Alive patients (n = 75)	Men (n = 44)	Women (n = 31)	P-value
Physical functioning	48.87 ± 34.52	52.27 ± 33.17	44.03 ± 36.34	0.310
Role limitations attributed to physical problems	43.33 ± 43.75	44.32 ± 44.74	41.93 ± 43.00	0.820
Role limitations attributed to emotional problems	51.55 ± 45.62	53.79 ± 44.44	48.39 ± 47.79	0.620
Energy and fatigue	47.80 ± 23.11	49.43 ± 21.41	52.13 ± 25.50	0.470
Well-being	53.49 ± 24.01	54.45 ± 23.50	52.13 ± 25.10	0.680
Social functioning	57.73 ± 24.71	59.43 ± 22.94	55.32 ± 27.25	0.480
Pain	51.60 ± 24.94	55.68 ± 22.63	45.80 ± 27.23	0.090
Overall health	47.67 ± 21.55	50.11 ± 18.88	44.19 ± 24.77	0.240
General health perception	47.87 ± 26.84	50.60 ± 26.62	44.00 ± 28.46	0.300
Mental health	52.64 ± 26.25	54.28 ± 24.45	50.33 ± 28.87	0.520
Physical functioning degree				
Good	15 (20.0)	10 (22.7)	5 (16.1)	0.860
Moderate	20 (26.7)	11 (25.0)	9 (29.0)	
Bad	40 (53.3)	23 (52.3)	17 (54.8)	
Mental health degree				
Good	20 (26.7)	9 (20.5)	11 (35.5)	0.110
Moderate	21 (28.0)	16 (36.4)	5 (16.1)	
Bad	34 (45.3)	19 (43.2)	15 (48.4)	
Overall health degree				
Good	15 (20.0)	8 (18.2)	7 (22.6)	0.680
Moderate	24 (32.0)	16 (36.4)	8 (25.8)	
Bad	36 (48.0)	20 (45.5)	16 (51.6)	

Data are presented as mean ± standard deviation (SD) or number and percentage

Table 4. The frequency of life quality grade in each basic and clinical issue after surgery in survived patients

Variables	Life quality			P-value
	Good	Moderate	Bad	
Age group (year)				
<30	1 (50.0)	1 (50.0)	-	0.320
30-49	1 (25.0)	1 (25.0)	2 (50.0)	
50-69	11 (44.0)	8 (32.0)	6 (24.0)	
>70	24 (54.5)	14 (31.8)	6 (13.6)	
Fracture mechanisms				
Domestic fall	9 (15.7)	18 (31.5)	30 (52.6)	0.200
RTA	5 (21.7)	9 (39.1)	9 (39.1)	
Assault	1 (100)	-	-	
Nail position				
C+C	8 (30.7)	10 (38.4)	8 (30.7)	0.370
C+A	2 (25.0)	3 (37.5)	3 (37.5)	
C+P	1 (12.5)	3 (37.5)	4 (50.0)	
S+C	-	-	4 (100)	
S+A	-	1 (20.0)	4 (80.0)	
S+P	-	1 (25.0)	3 (75.0)	
I+C	2 (22.2)	2 (22.2)	5 (55.5)	
I+A	2 (66.6)	-	1 (33.3)	
I+P	-	4 (50.0)	4 (50.0)	
Reduction quality				
Good	8 (22.8)	11 (31.4)	16 (45.7)	0.840
Bad	7 (17.5)	13 (32.5)	20 (50.0)	
Lateral wall				
Positive	9 (18.7)	16 (33.3)	23 (47.9)	0.950
Negative	6 (22.2)	8 (29.6)	13 (48.1)	
Type of fracture				
31A1:2	8 (23.5)	11 (32.3)	15 (44.1)	0.570
31A1:3	2 (9.0)	7 (31.8)	13 (59.0)	
31A2:2	3 (21.4)	4 (28.5)	7 (50.0)	
31A2:3	1 (33.3)	2 (66.6)	-	
31A3:1	1 (50.0)	-	1 (50.0)	
31A3:3				

Data are presented as number and percentage
RTA: Road traffic accident

Most patients with domestic fall and road traffic accident (RTA) fractures had moderate to poor QOL. The frequency of good QOL among patients with domestic falls and RTA fractures was 15.78% and 21.73%, respectively. The frequency of good QOL among patients with good and bad reduction quality was 22.85% and 17.50%, respectively (P = 0.840).

The frequency of QOL grade in health issues after surgery in survived patients is depicted in table 5. About 36% of patients with physical health issues had a good QOL. The frequency of good QOL in both issues of limitations attributed to physical and emotional problems was equal to 40%. Only 17% of patients with energy and fatigue issues had a good QOL. The frequency of good QOL in well-being, social functioning, and the pain was around 24% to 33%. The frequency of good QOL in overall health issues was 16%.

The result of the Pearson correlation between SF-36 score with the hospital stay and bleeding within the surgery is depicted in table 6.

Table 5. The frequency of life quality grade in each 36-Item Short Form Survey (SF-36) issue after surgery in survived patients

Variables	Good (%)	Moderate (%)	Bad (%)
Physical functioning	36	16	48
Role limitations attributed to physical problems	40	7	53
Role limitations attributed to emotional problems	40	15	45
Energy and fatigue	17	32	51
Well-being	29	28	43
Social functioning	33	25	42
Pain	24	27	49
Overall health	16	31	53

A significant and negative correlation was found between the mean of the hospital stay and physical pain (r = -0.23, P = 0.041). Besides, the average intraoperative bleeding was negatively correlated to the physical pain (r = -0.22, P = 0.046). A negative trend was found between an increased hospital stay (r = -0.20, P = 0.080) and the rate of bleeding in surgery (r = -0.21, P = 0.060) with physical functioning.

Table 6. The correlation between 36-Item Short Form Survey (SF-36) score with hospital stay and bleeding within the surgery

Variables	Hospital stay (r-value)	P-value	Bleeding within surgery (r-value)	P-value
Physical functioning	-0.200	0.080	-0.210	0.060
Role limitations attributed to physical problems	-0.100	0.390	-0.020	0.860
Role limitations attributed to emotional problems	0.002	0.990	-0.050	0.660
Energy and fatigue	0.150	0.110	0.007	0.950
Well-being	0.150	0.110	0.040	0.750
Social functioning	-0.063	0.590	-0.026	0.820
Pain	-0.230	0.041	-0.220	0.046
Overall health	-0.150	0.180	0.080	0.470
General health perception	-0.180	0.130	-0.150	0.190
Mental health	0.001	0.990	-0.060	0.580

Discussion

IT fractures are one of the most common fractures in the elderly, which usually happen after minor trauma. Post-traumatic care is costly. There are various therapeutic methods for the treatment of IT fractures. At present, two treatment methods are DHS and intramedullary hip screw (12). DHS is the most acceptable therapeutic method for unstable IT fractures. In the current study, we evaluated

the mortality rate of 110 patients with IT fractures a year after surgery and found that the mortality rate among them was 31.81%. There was no significant discrepancy in the other basic and clinical findings such as BMI, history of diabetes and blood pressure, TAD AP, TAD lateral, and TAD total, as well as hospital stay, nail position, reduced quality, lateral wall, mechanisms, fracture types, and ASA grade between dead and survived patients. However, we found a meaningful disagreement in the mean age of alive and dead cases; a mean age greater than 70 years was a risk factor for death a year after surgery.

There was no association between the average physical and mental health areas, overall health, and gender in patients. Furthermore, there was no significant relationship between the mean of physical and mental health with the hospital stay and the amount of bleeding during surgery. Our data also showed that a history of diabetes, high blood pressure, and smoking in these patients was not associated with mortality rate and QOL. There was no meaningful discrepancy in the QOL measurements based on the fracture mechanism, nail position of the femoral head, the postoperative reduction, the lateral wall, the mechanism and fracture type, and also the ASA grading. In the study of Fakoor et al., it was found that the QOL in these patients was significantly correlated with age, economic status, and fracture-surgery interval. Besides, the QOL in cases with IT fracture was moderate to low (13), which is consistent with the results of our study. In another study, Schnell et al. considered the mortality rate of patients with hip fractures a year after surgery. They concluded that the overall one-year mortality rate was 21.2% (14), which was somewhat lower than that in our study. It is maybe because of differences in the sample population in terms of life expectancy, quality of the health care system, and postoperative care. Shyu et al. investigated the relation of health and long-term QOL one year after the discharge in elderly patients. They concluded that different areas of health would be decreased after surgery, but health in different areas of SF-36 would be improved over time (15).

In another study, Nasab and Khorramdin evaluated the rate of mortality and disability after retrosynthetic fracture surgery with DHS in patients over 60 years. They found that the mortality rate in these patients was relatively high (36%) even after the surgery; this high rate was strongly related to the age of the patients (11). Furthermore, the QOL of these patients after the surgery was low, indicating that more and better care services are needed after surgery. This mortality rate was somewhat higher than that reported in our study. More importantly, the average age of patients with mortality in the Nasab and Khorramdin study (11) was higher than that of our patients. That may be the reason for the difference in the mortality rate of the two societies. In this perusal, patients' QOL in different age groups was also examined, which considering that the undesirable quality in the age groups was higher than the desired and good quality, the results of these two articles were similar.

More recently, Mohan and Kumar compared the DHS fixation with proximal femoral nail (PFNA) methods (16). They concluded that PFNA was superior to DHS due to less bleeding time and less hospital stay. However, a one-year follow-up of the patient's life quality with the modified Harris Hip Score (MHHS) and 12-item Short Form Survey (SF-12) questionnaires did not significantly change the QOL between the two groups. Given the fact that the patients' QOL and the results of postoperative complications such as bleeding and hospitalization stay were not significantly changed in our study, it can be concluded that DHS, like PFNA, is a suitable option for the treatment of IT fractures even unstable types. However, evaluation of the QOL and possible complications based on this method can help patient's follow-up and increase the patient's QOL.

Our patients with IT fractures had a high average age and other comorbidities, which is a limitation of the present study. It was not possible to differentiate between the effect of this fracture on morbidity and mortality after the surgery and corrective comorbidities. Some patients could not refer for follow-up after the surgery or possibly were referred to another center. Given the importance of follow-up, which was provided for all patients and those referred for regular follow-up, they were not removed from the study.

Conclusion

Our data revealed that the mortality rate of these patients depended on their age. Furthermore, the QOL of these patients in different areas such as physical, mental, and overall health was examined and showed non-significant results. Therefore, it can be concluded that the DHS method is acceptable for treating IT fractures as it does not significantly affect the patient's QOL.

Conflict of Interest

The authors declare no conflict of interest in this study.

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