

Original Article

Intertrochanteric hip fracture surgery in Chinese: risk factors for predicting mortality

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Abstract: Surgery is the preferred treatment for intertrochanteric fractures. This study aimed to analyze risk factors for predicting mortality after intertrochanteric hip fracture surgery by arthroplasty and internal fixation. We performed a retrospective analysis of 1,263 patients who received surgical treatment for intertrochanteric fractures from January 2005 to December 2010. The clinical and follow-up data from 491 eligible patients were collected and analyzed. The age, activity before surgery, activity after surgery, anesthesia, medical illness, and the time between fracture and surgery were significantly associated with the mortality as single factor. Multifactor analysis showed that the activity after surgery, medical illness, and the time between fracture and surgery were correlated with postoperative mortality. In conclusion, these data suggest that the age, activity after surgery, medical illness could affect postoperative mortality of patients of intertrochanteric fractures. These factors may be used to predict the postoperative mortality of intertrochanteric fractures.

Keywords: Mortality, intertrochanteric hip fracture, arthroplasty, internal fixation

Introduction

Hip fracture is a common injury in the clinic and intertrochanteric fractures account for a large proportion of such fractures, which are often accompanied by a high mortality rate (14-47%) [1, 2]. Surgery is the preferred treatment for intertrochanteric fractures, and internal fixation and arthroplasty are two main methods of surgical treatment of femoral intertrochanteric fracture. The purpose of aggressive surgical treatment is to enable patients to take early activities, reduce complications, improve postoperative quality of life, prolong survival, and reduce postoperative mortality [3, 4]. The mortality rate has been used as one of the most important factors in the evaluation of surgery outcomes after intertrochanteric hip fracture [5, 6].

In addition to the patient's age and gender, the way of surgery, the time of surgery, medical

condition and physical activity of the patients are the risk factors that affect the recovery of the patients after surgery. In this retrospective study, we enrolled 1,263 patients who received surgical treatment for intertrochanteric fractures and analyzed the risk factors that affect the mortality of the patients after intertrochanteric hip fracture surgery.

Methods

Study design and setting

Our hospital is the largest hospital in our province to provide hip fracture surgery. Therefore, our cohort is a population-based representation of all patients with intertrochanteric hip fracture in the area. This study was approved by the Ethics Committee of Zhejiang Provincial People's Hospital, and all participants gave signed consent.

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Table 1. The effects of risk factors on the mortality

Risk factors	Death		Mortality rate (%)	χ^2	P
	-	+			
Gender					
Male	191	40	17.3	0.049	0.826
Female	213	47	18.1		
Age (years)					
≤ 60	150	3	2.00	109.3	0.000
60-70	68	9	11.7		
71-79	120	15	11.17		
≥ 80	66	60	47.67		
Types of surgery					
Internal fixation	185	36	16.3	0.563	0
Arthroplasty	219	51	18.9		
Types of fractures					
Stable fractures	216	38	15.0	2.746	0
Unstable fractures	188	49	20.7		
Activity before surgery					
Self support	212	10	4.5	108.8	0.000
Need support, no accompany	103	12	10.4		
Need support and accompany	57	39	40.65		
Bedridden	17	23	57.5		
No records	15	3	16.7		
Activity after surgery					
Self support	281	15	5.1	124.0	0.000
Need support, no accompany	94	39	29.3		
Need support and accompany	15	24	61.5		
Bedridden	0	6	100.0		
No records	14	3	17.6		
Anesthesia					
Local anesthesia	238	22	8.5	32.49	0.000
General anesthesia	166	65	28.1		
Medical illness					
Yes	99	78	44.1	131.8	0.000
No	305	9	2.9		
Time between fracture and surgery (hour)					
≤ 12	196	22	10.1	57.63	0.000
12-24	195	43	18.1		
≥ 24	13	22	62.9		

without surgical treatment and patients without effective follow-up.

Data collection

The primary sources of data were the medical records of each patient. In addition, each patient was given questionnaires for survey and follow-up.

Statistical analysis

Statistical analysis was performed using SPSS PASW Statistics 18.0 (IBM Co., USA). Univariate analysis combined with chi-square tests was performed to determine the significant factors. Multivariate logistic regression analysis was performed to analyze the correlation. Comparison between two groups was performed using the t-test. $P < 0.05$ was considered statistically significant.

Results

From Jan. 2005 to Dec. 2010, 1,263 patients were admitted in our department, among them 491 patients (231 males and 260 females) met the inclusion criteria and were further analyzed in this study.

The results showed that overall postoperative mortality was 16.3% and 18.9% for internal fixation and arthroplasty, respectively. The mortality was 0% at 30 days after surgery.

During the study period, Jan. 2005 to Dec. 2010, 1,263 consecutive patients with intertrochanteric hip fracture were admitted and treated at our department. The inclusion criteria for the patients were as follows: diagnosed as intertrochanteric fractures, underwent surgical treatment, had complete perioperative medical records and follow-up. The exclusion criteria for the patients were as follows: patients

To identify significant factors associated with the mortality after surgical treatment for intertrochanteric fractures, we performed univariate analysis combined with chi-square tests. The results showed that the age, activity before surgery and activity after surgery, anesthesia, medical condition, and the time between fracture and surgery had significant effects on the mortality (**Table 1**). Furthermore, we performed

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Table 2. The correlation of risk factors with the mortality

Risk factors	Odds ratio	95% confidence interval	
		Lower	Upper
Age (years)			
60-70	2.583	0.523	12.766
71-79	1.466	0.226	9.526
≥ 80	2.164	0.281	16.677
Activity before surgery			
Need support, no accompany	0.382	0.095	1.541
Need support and accompany	0.563	0.113	2.804
Bedridden	0.146	0.019	1.150
No records	0.000	0.000	.
Activity after surgery			
Need support, no accompany	4.447	1.432	13.817
Need support and accompany	20.450	4.083	102.433
Bedridden	2.203E10	0.000	.
No records	6.745E7	0.000	.
Anesthesia			
General anesthesia	0.687	0.248	1.906
Medical illness			
Yes	0.067	0.024	0.185
Time between fracture and surgery (hour)			
12-24	1.513	0.748	3.059
≥ 24	4.175	1.339	13.019

multivariate analysis and found that only postoperative activity, medical condition and the time between fracture and surgery were correlated with postoperative mortality (**Table 2**).

When arthroplasty and internal fixation were compared, arthroplasty could significantly prolong the survival of the patients after surgical treatment for intertrochanteric fractures. The number of patients with survival of more than 25 months after the surgery was significantly higher in the patients who received arthroplasty treatment than in those who received internal fixation treatment ($P < 0.05$, **Figure 1**).

Discussion

The risk factors that affect the mortality after intertrochanteric fracture surgery have been investigated but the outcomes are different. In general, the patients with intertrochanteric fracture are older than the normal population and the sex ratio for patients who die after surgery is different from that of control [7]. Old age is an important factor affecting postoperative mortality [8, 9]. In this study, among 491 quali-

fied participants 87 elderly patients (> 60 years) accounted for 96.6% of death in all patients, and the mortality rate increased gradually with increasing age. The overall mortality rate is lower for internal fixation than arthroplasty (16.3% vs. 18.9%). However, after we excluded patients less than 60 years old, postoperative mortality was higher for internal fixation than arthroplasty (27.9% vs. 26.3%). These results indicate that old age has an obvious impact on postoperative mortality, and arthroplasty could effectively prolong the survival of elderly patients. Our results are in agreement with previous studies that among elderly patients with intertrochanteric fractures, arthroplasty had the advantages compared to internal fixation treatment [10, 11].

The male to female ratio of intertrochanteric fracture patients has been reported to be 1:1.8 in USA [12]. In recent years the morbidity and mortality of intertrochanteric fracture in the male patients have gradually increased, and their ages are younger and physiological indicators of preoperative examination are worse compared to women [13-15]. However, in this study we found that the mortality did not differ significantly between male and female patients, consistent with an early report that the gender and postoperative mortality is not related [16].

The quality of life and the activity of the limbs in the patients before the operation are considered as important factors affecting postoperative mortality [17, 18]. In this study by questionnaire based survey and follow-up, we found that the activity before and after surgery were related with postoperative mortality.

Local anesthesia and general anesthesia in hip fractures have different effects on postoperative mortality. While no statistical difference was found between them for postoperative 30-day mortality, postoperative 120-day mortality was lower for general anesthesia than for local anesthesia [19]. In our study, the patients

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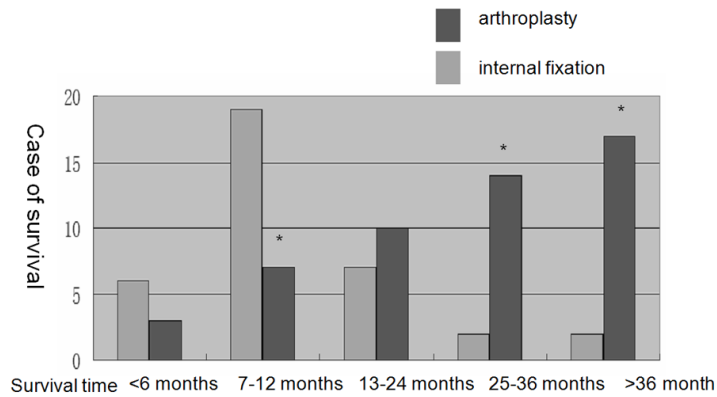


Figure 1. The comparison of survival time after internal fixation and arthroplasty. The number of case of survival of 7-12 months was significantly smaller in arthroplasty treatment group than in internal fixation treatment group (* $P < 0.05$), while the numbers of case of survival of 25-36 months and > 36 months were significantly bigger in arthroplasty treatment group than in internal fixation treatment group (* $P < 0.05$).

were divided into local and general anesthesia groups, and we found that mortality rate after local anesthesia was lower than that after general anesthesia (8.5% vs. 28.1%, OR 0.687, 95% CI 0.248 to 1.906).

For fracture type, the patients were divided into two groups, stable fractures and unstable fractures, and we found that postoperative mortality was higher for patients with unstable intertrochanteric fractures than for those with stable intertrochanteric fractures. These results are consistent with previous study [20].

The relationship of the time between fracture and surgery with postoperative mortality after fracture is still under debate due to the conflicting results reported [21-23]. We think that a lot of other factors such as the conditions of the patients contribute to these results. In this study, the patients were divided into three groups, with the time between surgery and fracture as within 12 hours, 13-24 hours and over 24 hours. The results showed that, postoperative mortality was significantly higher in patients with fractures more than 24 hours than in the other two groups (62.9% vs. 10.1% and 18.1%, OR4.175, 95% CI 1.339 to 13.019). Thus it is important for hip fracture patients to undergo surgery as soon as possible, to avoid unnecessary surgery delay. Surgery delay may be an important cause of postoperative death and it also increases the risk of decubitus ulcers.

In clinical practice, we found that the majority of patients who died postoperatively had heart disease, hypertension, diabetes and other medical illness. Therefore, in this study medical disease was considered as a risk factor and both single factor and multivariate analysis showed that these diseases were correlated with postoperative mortality (OR0.067, 95% CI 0.024 to 0.185). Based on these data, we believe that old people suffering from these diseases are high-risk group of patients subject to intertrochanteric fracture postoperative death, and should be given great attention for clinical prevention and treatment.

In conclusion, we analyzed patients with intertrochanteric fractures to identify risk factors of postoperative mortality. We found that some of the factors were associated with postoperative mortality by univariate analysis, but the association was not statistically significant by multivariate analysis. We think that the reason may be affected by the sample size. Further studies that employ larger samples will help clarify the relevant risk factors that have an impact on intertrochanteric fracture postoperative mortality, and provide more effective prevention and management strategies for intertrochanteric fracture postoperative mortality.

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Disclosure of conflict of interest

None.

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References

- [1] O'Malley NT, Blauth M, Suhm N, Kates SL. Hip fracture management, before and beyond surgery and medication: a synthesis of the evi-

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- dence. *Arch Orthop Trauma Surg* 2011; 131: 1519-1527.
- [2] Cheng T, Zhang GY, Liu T, Zhang XL. A meta-analysis of percutaneous compression plate versus sliding hip screw for the management of intertrochanteric fractures of the hip. *J Trauma Acute Care Surg* 2012; 72: 1435-1443.
- [3] Luo X, He S, Li Z, Huang D. Systematic review of cemented versus uncemented hemiarthroplasty for displaced femoral neck fractures in older patients. *Arch Orthop Trauma Surg* 2012; 132: 455-463.
- [4] Vekris MD, Lykissas MG, Manoudis G, Mavrodontidis AN, Papageorgiou CD, Korompilias AV, Kostas-Agnantis IP, Beris AE. Proximal screws placement in intertrochanteric fractures treated with external fixation: comparison of two different techniques. *J Orthop Surg Res* 2011; 6: 48.
- [5] Bilsel K, Erdil M, Gulabi D, Elmadag M, Cengiz O, Sen C. Factors affecting mortality after hip fracture surgery: a retrospective analysis of 578 patients. *Eur J Orthop Surg Traumatol* 2013; 23: 895-900.
- [6] Valizadeh M, Mazloomzadeh S, Golmohammadi S, Larijani B. Mortality after low trauma hip fracture: a prospective cohort study. *BMC Musculoskelet Disord* 2012; 13: 143.
- [7] Zuckerman JD. Hip fracture. *N Engl J Med* 1996; 334: 1519-1525.
- [8] Holmberg S, Conradi P, Kalén R, Thorngren KG. Mortality after cervical hip fracture: 3002 patients followed for 6 years. *Acta Orthop Scand* 1986; 57: 8-11.
- [9] Schrøder HM, Erlandsen M. Age and sex as determinants of mortality after hip fracture: 3,895 patients followed for 2.5-18.5 years. *J Orthop Trauma* 1993; 7: 525-531.
- [10] Kayali C, Agus H, Ozluk S, Sanli C. Treatment for unstable intertrochanteric fractures in elderly patients: internal fixation versus cone hemiarthroplasty. *J Orthop Surg* 2006; 14: 240-244.
- [11] Sinno K, Sakr M, Girard J, Khatib H. The effectiveness of primary bipolar arthroplasty in treatment of unstable intertrochanteric fractures in elderly patients. *N Am J Med Sci* 2010; 2: 561-568.
- [12] Melton JL, Ilstrup DM, Riggs BL, Beckenbaugh RD. Fifty year trend in hip fracture incidence. *Clin Orthop* 1982; 162: 144-149.
- [13] Fransen M, Woodward M, Norton R, Robinson E, Butler M, Campbell AJ. Excess mortality or institutionalization after hip fracture: men are at greater risk than women. *J Am Geriatr Soc* 2002; 50: 685-690.
- [14] Trombetti A, Hermann F, Hoffmeyer P. Survival and potential years of life lost after hip fracture in men and age-matched women. *Osteoporos Int* 2002; 13: 731-737.
- [15] Endo Y, Aharanoff GB, Zuckerman JD, Egol KA, Koval KJ. Gender differences in patients with hip fracture: a greater risk of morbidity and mortality in men. *J Orthop Trauma* 2005; 19: 29-35.
- [16] Aharanoff GB, Koval KJ, Skovron ML, Zuckerman JD. Hip fracture in the elderly: predictors of one year mortality. *J Orthop Trauma* 1997; 11: 162-165.
- [17] Broos PL, van Haaften JI, Stappaerts KH, Gruwez JA. Hip fractures in the elderly: mortality, functional results and social readaptation. *Int Surg* 1989; 74: 191-194.
- [18] Elmerson S, Zetterberg C, Andersson GB. Ten-year survival after fractures of the proximal end of the femur. *Gerontology* 1988; 34: 186-191.
- [19] Holt G, Smith R, Duncan K, Finlayson DF, Grogan A. Early mortality after surgical fixation of hip fractures in the elderly: an analysis of data from the scottish hip fracture audit. *J Bone Joint Surg* 2008; 90-B: 1357-1363.
- [20] Karagiannis A, Papakitsou E, Dretakis K, Galanos A, Megas P, Lambiris E, Lyritis GP. Mortality rates of patients with a hip fracture in a southwestern district of Greece: ten-year follow-up with reference to the type of fracture. *Calcif Tissue Int* 2006; 78: 72-77.
- [21] Majumdar SR, Beaupre LA, Johnston DW, Dick DA, Cinats JG, Jiang HX. Lack of association between mortality and timing of surgical fixation in elderly patients with hip fracture: results of a retrospective population-based cohort study. *Med Care* 2006; 44: 552-559.
- [22] Moran CG, Wenn RT, Sikand M, Taylor AM. Early mortality after hip fracture: is delay before surgery important? *J Bone Joint Surg* 2005; 87-A: 483-489.
- [23] Bottle A, Aylin P. Mortality associated with delay in operation after hip fracture: observational study. *BMJ* 2006; 332: 947-951.