Predictors of Mortality in Patients with Hip Fractures for Persons Aging More Than 65 Years Old

Jong Won Kang, Kap Jung Kim, Sang Ki Lee, Jin Kim,
Sang Wook Jeung and Han Gyul Choi

Department of Orthopaedic Surgery, Eulji University College of Medicine,
1306 Dunsan-dong, Seo-gu, Daejeon(322-799), Republic of Korea
Correspondent Author: Kap-Jung Kim (E-mail: oskkj@eulji.ac.kr)

Abstract

The incidence of hip fractures occurring at old age is gradually increasing. We analyzed the various factors affecting on the postoperative mortality of hip fractures for persons aging more than 65 years old. We hypothesized that the duration until surgery and the American Society of Anesthesiologists (ASA) classification were useful variables affecting on postoperative mortality rates. A retrospective review of 247 patients with hip fractures from January 2006 to June 2008 who had undergone operative treatment was performed. Overall postoperative one year mortality rate was 10.1%. The mortality rates who underwent surgery post injury for more than 3 days and less than 3 days were 11.7% and 5.9%, respectively. Higher mortality rates in ASA class 3 and 4 (9.7% and 22.2%, respectively) than in ASA class 2 (9.1%). In univariable analyses, sex and patients' age at injury had statistical significances. In multivariable analyses, duration until surgery and ASA classification had strong correlation with postoperative mortality rate. Hip fractures in elderly patients should be fixed as early as possible. Patients with preoperative higher risk (in ASA class 3 or 4) should be closely managed and care must be taken following hip fracture surgery.

Key words: *Hip fractures, Mortality rates, ASA classification*

1. Introduction

As the percentage of elderly persons in the population is constantly increasing worldwide, the yearly number of hip fracture in elderly persons are likewise increasing [1-3]. Hip fractures are mainly composed of femoral neck and intertrochanteric fractures (Figure 1). Hip fractures in the geriatric population are considered major public health problems. Hip fracture in elderly can be easily caused by trivial traumas due to osteoporotic in bone quality and most of patients have various medical underlying diseases. It is highly correlated with main causes of death. Fracture treatment can be problematic because concomitant medical underlying diseases increase operative risk. However, if untreated, it can cause various complications such as pneumonia, thromboembolism, skin break down, and *etc.* In older patients, operative risk is a major determinant of the postoperative course. Numerous factors are reportedly associated with increased risk for mortality after hip fracture and several risk scores for predicting postoperative risk have been proposed [4-6]. We analyzed the epidemiologic profiles of hip fracture and the various factors influencing to the postoperative mortality rate of hip fractures for persons aging more than 65 years old retrospectively.

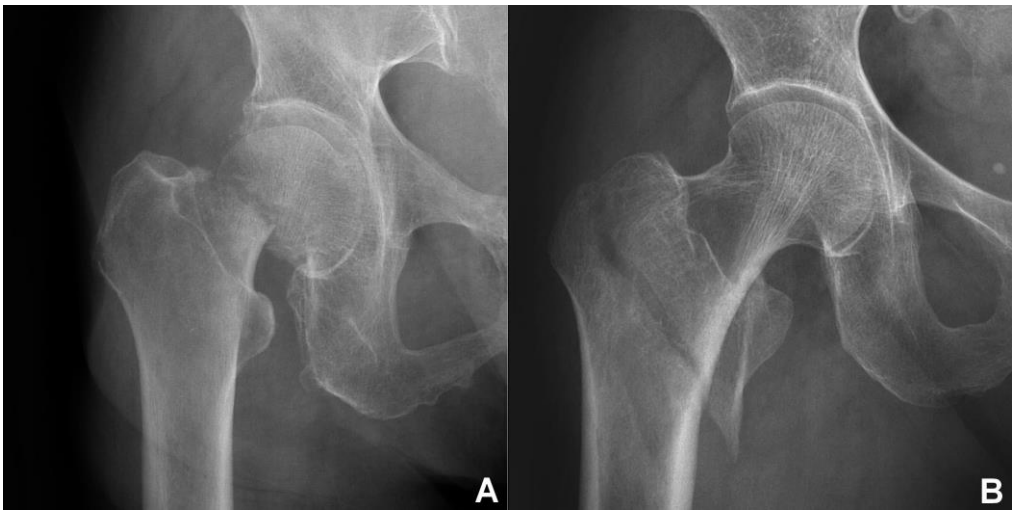

Figure 1. Radiographs showing typical hip fractures, femoral neck fracture(A) and femoral intertrochanteric fracture(B)

2. Materials and Methods

From January 2006 to June 2008, we have treated 262 patients of hip fracture aging more than 65 years old in our institution. Among them, 247 patients of hip fracture were included. According to anatomical locations, femoral neck fractures were 133 cases and intertrochanteric fractures were 114 cases. Among the 247 patients with hip fracture were 63 male patients and 184 female patients. The mean age was 77.1 years old (range, 65~101) and the mean follow up period was 24.3 months (range, 1~41). The mean duration from injury to surgery was 5.5 days (range, 0~12).

We evaluated the age distribution of patients, injury mechanisms, incidence of medical underlying disease, duration from injury to surgery, ASA (American Society of Anesthesiologists) grade [7], and overall postoperative 1-year mortality rate. We also analyzed the statistical significances of each variable.

The above data was analyzed using statistical software (SPSS version 17.0). We then performed a univariate of the main variable of interest (postoperative mortality rates) as well as the other covariates by constructing Kaplan-Meier survival curves. $P<0.05$ was considered significant.

3. Results

3.1 Age distribution of patients

All patients were classified into three groups; Group I, from 65 years to 74 years old, Group II, from 75 years to 84 years old and Group III, above 85 years old. The number of each group was eighty one patients of Group I, one hundred twenty three of Group II and forty three of Group III (Figure 2). Group II, from 75 years to 84 years old was considered the most prevalent age group.

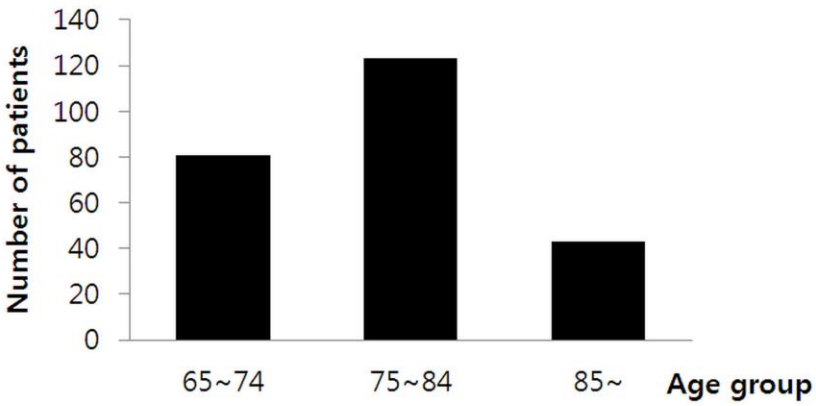

Figure 2. Graph showing age distribution of patients. From 75 years to 84 years old was the most prevalent age group

3.2 Injury mechanisms

Two hundred twenty six fractures (91.5%) were injured by slip down. The rest of fractures were injured by eleven cases of traffic accident (4.5%) and ten cases of fall from a height (4.0%). Slip down was the most common injury mechanism which was more than 90%.

3.3 Incidence of medical underlying disease

Hypertension was the most prevalent medical underlying disease, wherein eighty nine patients had suffered from it. The rest of them had forty one patients of diabetes mellitus, thirty patients of cerebrovascular disease, thirty patients of pulmonary disease, twenty four patients with ischemic heart disease, seven patients with liver disease, five patients with dementia and four patients with renal disease (Table 1).

Table 1. Patient's medical underlying disease

Medical underlying disease	Number of patients
Hypertension	89
Diabetes mellitus	41
Cerebrovascular disease	30
Pulmonary disease	30
Ischemic heart disease	24
Liver disease	7
Dementia	5
Renal disease	4

3.4 Duration from injury to surgery

The mean duration from injury to surgery was 5.5 days (range, 0~12). Two hundred four patients (82.6%) were operated within 3 days of injury and four patients were operated within post-injury 24 hours. We tried to stabilize the hip fractures as early as possible. Remaining forty three patients (17.4%) were delayed the surgery for more than 3 days due to co-morbidities or intolerable conditions for surgery at the time of suffering injury.

3.5 ASA classification and mortality rates

We checked the ASA class [7] of patients preoperatively and analyzed the effects on mortality rates of each class. Each class was consist of three patients of class I, one hundred sixty four patients of class II, sixty two patients of class III and eighteen patients of class IV. Most of the patients were class II (66.4%). Each mortality rate of each class was 0% of class I, 9.1% of class II, 9.7% of class III and 22.2% of class IV. There were strong statistical significance between ASA classification and postoperative mortality rates ($p<0.05$).

3.6 Overall postoperative mortality rate

The overall postoperative mortality rate was 10.1% (Figure 3), twenty five patients out of two hundred forty seven patients had died within postoperative of one year.

The mortality rates for patients who underwent surgery post injury for more than 3 days and less than 3 days were 11.7% and 5.9%, respectively (Figure 4). The duration from suffering the injury to undergoing surgery had influenced on postoperative mortality rates statistically ($p<0.05$).

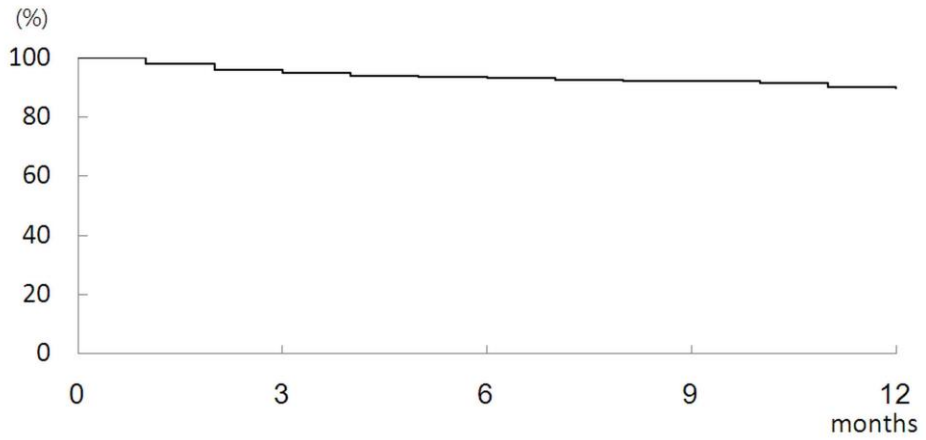

Figure 3. The graph showing overall postoperative 1-year mortality rate

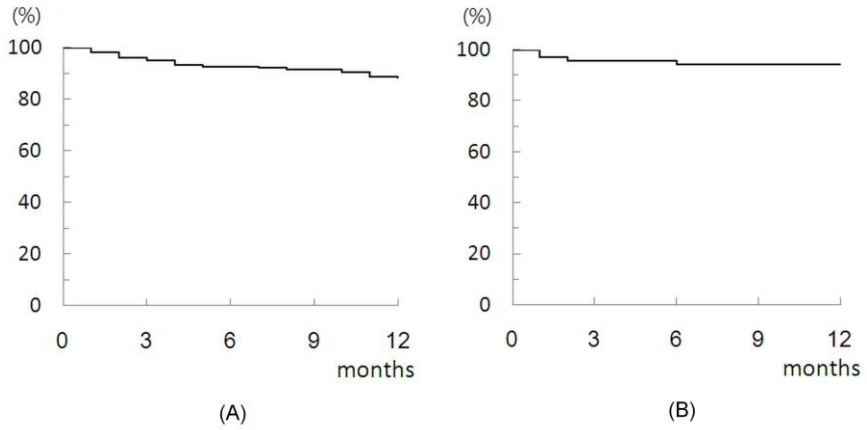

Figure 4. The graphs showing mortality rates of each group due to the duration from injury to surgery. The mortality rate those who were underwent surgery post-injury more than 3 days(A) and the mortality rate of patients post-injury less than 3 days(B)

4. Discussion

In 1990, the population over the age of 65 was estimated at 323 million, and is expected to reach 1,555 million by 2050 [2]. The number of hip fractures is expected to increase from 1.7 million in 1990 to 6.25 million in 2025 [2]. Hip fracture is one of the most common fracture types in elderly, requiring costly interventions and frequently resulting in functional impairment, loss of independence, and mortality [8, 9]. The postoperative 1-year mortality rates are reported from 13% to 36%, depending on various risk factors; the most widely reported average is about 25% [10, 11].

Other serious problems of hip fractures in elderly were the concomitant medical underlying diseases. Postoperative mortality rates are strongly correlated with associated pre-existing pathology [12-14]. Mnif reported that advanced age and associated co-morbidities are two decisive factors of mortality secondary to trochanteric fracture [13].

The ability to improve the result and decrease of the mortality rate for patients with hip fracture has been major concerns and the effect of the duration from suffering injury to undergoing surgery has been extensively studied. During the 1960s, elective surgery after preoperative evaluation was common for the elderly patients [15]. There was a report suggesting that emergency surgery or surgery within 12 hours should not be performed in elderly hip fracture patients [16]. Many reports have indicated that early surgery has no effect on the mortality rate [6, 17-19]. Although there have been some variability and controversies in the reports concerning this, many studies have shown delay from suffering injury to undergoing surgery to be a major predictor of mortality [20-22]. There could be a few reasons for the delay to undergoing surgery from suffering injury including the time to optimize a patient's medical condition and intolerable conditions for performing surgery at the time of acquiring injury. The remarkable advantages of early surgery are decreasing pain and improving mobility, which in turn decreases the pulmonary complications such as atelectasis,

pneumonia and pulmonary thromboembolism [23-26]. In this study, we found that duration from suffering injury to undergoing surgery was strongly correlated with decreasing postoperative mortality rate and had a statistical significance.

Our study had several limitations. We didn't divide hip fractures due to anatomical location or surgical device types into subgroups, which were the major limitations. Also, we do not have an assessment of the patients' mental status, which has been reported to be an independent predictor of mortality [4]. Personal characteristics and medical treatments couldn't be considered as well. Moreover, we do not have information about the rehabilitation programs followed by the patients after the discharge which might affect the results.

5. Conclusion

In conclusion, hip fractures in elderly age group should be fixed as early as possible in order to decrease the mortality rate. Needless delay to undergo surgery upon suffering from injury should definitely be avoided. Also, proper care must be given to those who are identified as being at higher risk (ASA class 3 or 4) preoperatively should be closely managed following hip fracture surgery.

Acknowledgements

No benefits in any form have been received or will be received from a commercial party related directly or indirectly to the subject of this article.

References

[1] E. Papadimitropoulos, P. C. Coyte, R. Josse and C. E. Greenwood, "Current and projected rates of hip fracture in Cananda", CMAJ, vol. 157, **(1997)**, pp. 1357-1363.
[2] C. Cooper, G. Campion and L. J. Melton, "Hip fractures in the elderly: a world-wide projection", Osteoporosis Int., vol. 2, **(1992)**, pp. 285-289.
[3] B. Gullberg, O. Johnell and J. A. Kanis, "World-wide projections for hip fracture", Osteoporosis Int., vol. 7, **(1997)**, pp. 407-413.
[4] J. Elliott, T. Beringer, F. Kee, D. Marsh, C. Willis and M. Stevenson, "Predicting survival after treatment for fracture of the proximal femur and the effect of delays to surgery", Clin. Epidemol., vol. 56, **(2003)**, pp. 788-795.
[5] H. X. Jiang, S. R. Majumdar, D. A. Dick, M. Moreau, J. Raso, D. D. Otto and D. W. Johnston, "Development and initial validation of a risk score for predicting in-hospital and 1-year mortality in patients with hip fractures", Bone Miner Res., vol. 20, **(2005)**, pp. 494-500.
[6] J. E. Kenzora, R. E. McCarthy, J. D. Lowell and C. B. Sledge, "Hip fracture mortality: Relation to age, treatment, preoperative illness, time of surgery, and complications", Clin. Orthop. Relat. Res., vol. 186, **(1984)**, pp. 45-56.
[7] E. David, F. L. Longnecker and L. D. Murphy, "Introduction to anesthesia", 9th ed., WB Saunders Co., vol. 9, **(1996)**, pp. 18-19.
[8] J. D. Zuckerman, "Hip fracture", N Engl J Med., vol. 334, **(1996)**, pp. 1519-1525.
[9] S. R. Cummings, J. L. Kelsey, M. C. Nevitt and K. J. O'Dowd, "Epidemiology of osteoporosis and osteoporotic fractures", Epidemiol Rev., vol. 7, **(1985)**, pp. 178-208.
[10] E. L. Hannan, J. Magaziner, J. J. Wang, E. A. Eastwood, S. B. Silberzweig, M. Gilbert, R. S. Morrison, M. A. McLaughlin, G. M. Orosz and A. L. Siu, "Mortality and locomotion 6 months after hospitalization for hip fracture: risk factors and risk-adjusted hospital outcomes", JAMA. vol. 285, **(2001)**, pp. 2736-2742.
[11] E. S. Fisher, J. A. Baron, D. J. Malenka, J. A. Barrett, W. D. Kniffin, F. S. Whaley and T. A. Bubolz, "Hip fracture incidence and mortality in New England", Epidemiology, vol. 2, **(1991)**, pp. 116-122.
[12] W. C. Graafmans, M. E. Ooms, H. M. Hofstee, P. D. Bezemer, L. M. Bouter and P. Lips, "Falls in the elderly: a prospective study of risk factors and risk profiles", Am J Epidemiol., vol. 143, **(1996)**, pp. 1129-1136.

[13] H. Mnif, M. Koubaa, M. Zrig, R. Trabelsi and A. Abid, "Elderly patient's mortality and mobidity following trochanteric fracture", A prospective study of 100 cases", Rev Chir Orthop Traumatol., vol. 95, **(2009)**, pp. 609-615.
[14] K. A. Lefaivre, S. A. Macadam, D. J. Davidson, R. Gandhi, H. Chan and H. M. Broekhuyse, "Length of stay, mortality, morbidity and delay to surgery in hip fractures", J Bone Joint Surg Br., vol. 91, **(2009)**, pp. 922-927.
[15] J. A. Aldrete, H. S. Davis and R. A. Hingson, "Anesthesia factors in the surgical management of hip fractures", J Trauma., vol. 7, **(1967)**, pp. 818-826.
[16] P. H. Lorhan and E. A. Shelby, "Factors influencing mortality in hip fractures", Anesth Analg., vol. 43, **(1964)**, pp. 539-543.
[17] J. P. Grimes, P. M. Gregory, H. Noveck, M. S. Butler and J. L. Carson, "The effects of time-to-surgery on mortality and morbidity in patients following hip fracture", Am J Med., vol. 112, **(2002)**, pp. 702-709.
[18] M. J. Parker and G. A. Pryor, "The timing of surgery for proximal femoral fractures", J Bone Joint Surg Br., vol. 74, **(1992)**, pp. 203-205.
[19] T. Dolk, "Operation in hip fracture patients: analysis of the time factor", Injury, vol. 21, **(1990)**, pp. 369-372.
[20] I. Weller, E. K. Wai, S. Jaglal and H. J. Kreder, "The effect of hospital type and surgical delay on mortality after surgery for hip fracture", J Bone Joint Surg Br., vol. 87, **(2005)**, pp. 361-366.
[21] K. J. McGuire, J. Bernstein, D. Polsky and J. H. Silber, "Delays until surgery after hip fracture increases mortality", Clin Orthop Relat Res., vol. 428, **(2004)**, pp. 294-301.
[22] C. Bredahl, B. Nyholm, K. B. Hindsholm, J. S. Mortensen and A. S. Olesen, "Mortality after hip fracture: results of operation within 12 h of admission", Injury, vol. 23, **(1992)**, pp. 83-86.
[23] J. Magaziner, E. M. Simonsick, T. M. Kashner, J. R. Hebel and J. E. Kenzora, "Survival experience of aged hip fracture patients", Am J Public Health, vol. 79, **(1989)**, pp. 274-278.
[24] G. T. Hardin, "Timing of fracture fixation: a review", Orthop Rev., vol. 19, **(1990)**, pp. 861-867.
[25] V. Ho, B. H. Hamilton and L. L. Roos, "Multiple approaches to assessing the effects of delays for hip fracture patients in the United States and Canada", Health Serv Res., vol. 34, **(2000)**, pp. 1499-1518.
[26] F. B. Regers, S. R. Shackford and M. S. Keller, "Early fixation reduces morbidity and mortality in elderly patients with hip fractures for low-impact falls", J Trauma., vol. 39, **(1995)**, pp. 261-265.