ABSTRACT

Objective: Hip fractures in young adults can cause poor functional capacity throughout life because of several complications. The purpose of this study was to prospectively evaluate 1-year mortality and functional outcomes for patients aged 60 years or younger with hip fracture. Methods: We prospectively obtained data for all consecutive patients aged 60 or younger with any type of hip fracture who were treated operatively between 2008 and 2014. After one year, patient outcomes were evaluated according to changes in pain severity, functional status (modified Barthel index), and mortality rate. Results: Of the total of 201 patients, 132 (65.7%) were men (mean age: 41.8 years) and 69 (34.3%) were women (mean age: 50.2 years) (p<0.001). Reduced pain severity was reported in 91.5% of the patients. The mean modified Barthel index was 22.3 in men and 18.6 in women (p<0.001). At the one-year follow-up, 39 cases (19.4%) were dependent on walking aids while only 17 patients (8.5%) used walking aids preoperatively (p<0.001). Seven patients (4 men and 3 women) died during the one-year follow-up period; 2 died in the hospital after surgery. Conclusion: Hip fractures in young adults have a low mortality rate, reduction in pain severity, and acceptable functional outcomes one year after surgery. Level of Evidence II, Prospective Comparative Study.

Keywords: Hip fractures. Morbidity. Mortality. Femoral neck fractures.

INTRODUCTION

Hip fracture is a major public health problem that has a significant financial impact on patients and health care systems. The incidence of hip fracture varies by age and sex; it is more common in older people. Hip fracture in elderly osteoporotic patients most often results from low-energy trauma such as falling down. On the other hand, high-energy trauma is the main mechanism of hip fracture in the young adult population.
Although several studies have dealt with the consequences and mortality of hip fractures in older people, only a few studies have reported the outcomes of hip fracture in the younger adult population.\textsuperscript{1,4-6,12} Several complications of hip fracture such as osteonecrosis, nonunion, implant failure, and shortening can cause life-long poor functional capacity and impede the adult population from returning to pre-fracture levels of activity.\textsuperscript{4,10-14} Moreover, the 1-year mortality rate for hip fracture is less than 10% in young patients, but it is approximately 20–30% in older patients.\textsuperscript{6,15} This prospective study presents epidemiologic data for young adults who were treated for hip fractures at our center and evaluates their 1-year mortality and functional outcomes.

**MATERIALS AND METHODS**

After the study was approved by the institutional review board (Ortho-shiraz.Med.Rec.1390.2), we selected all patients 60 years or younger referred to our hospital with hip fracture between March 2008 and February 2014. Patients who died within the first day of admission, patients with pathologic fractures or hip fracture dislocations, and non-surgically treated cases were excluded. After the patients signed the terms of informed consent, a trained researcher interviewed each patient and extracted data from the medical records, surgical log, and discharge orders using a data-gathering form. We followed the patients by telephone for one year after discharge and asked about their functional status and potential mortalities. Demographic data included age, sex, locomotion history of the patients prior to the fracture, and fracture risk factors such as body mass index (BMI), history of previous fracture, cigarette smoking, and comorbidities were recorded. Mechanism and type of fracture, surgical method, number of days from admission to surgery, and days from surgery to discharge were also recorded.

The main items used to measure patient outcome were pain severity and pain changes over time, functional status, and mortality rate. The functional status of the patients was measured using the modified Barthel index for activities of daily living, level of walking ability, sphincter control (bladder, bowel), and locomotion (walking with or without a walking aid or bedridden).\textsuperscript{16} Activities of daily living were measured with five items for feeding, bathing, dressing, toilet use, and transfer. Each was scored as follows: 0=patient unable to perform, 1=patient required help to perform, 2=patient could perform independently. Total possible scores for these five items ranged from 0 to 10. Level of walking ability was measured with seven items including meal preparation, shopping, housework, watering the garden, washing clothes, taking medication, and transportation. The total possible score range was 0–14. Descriptive statistics were analyzed using SPSS software version 18.0 for Windows (SPSS Inc, Chicago, IL, USA). Continuous variables are presented as mean values ± standard deviation (SD). Categorical variables are presented as absolute numbers and percentages. The differences were considered statistically significant when P was less than 0.05 for all analyses.

**RESULT**

Over the six-year study period, a total of 230 patients aged 60 years or less were treated surgically for hip fracture. Only 201 patients (87.3%) completed the survey with a one-year follow-up interview. Of these, 132 (65.7%) were men with a mean age (±SD) of 41.8±13.1 years and 69 (34.3%) were women with a mean age of 50.2±11.9 years (p<0.001). The mean length of hospital stay was 7.3±3.3 days (injury to surgery interval: 3.4±2.9 days, surgery to discharge interval: 3.8±1.5 days). Other data are reported in Table 1. As shown in Table 2, right and left hip fractures are equal in frequency. Intertrochanteric fractures were most common, followed by femoral neck fractures and subtrochanteric fractures. Reduction and internal fixation was the most commonly used surgical management for hip fractures in our sample (96.5%). High-energy trauma including traffic accidents and falls from height caused 128 cases (63.7%). Most fractures occurred in the fall and winter seasons. One-year mortality and functional outcome for patients are displayed in Table 3. Reduction in pain severity was reported in 91.5% of all participants. The mean modified Barthel index was 22.3±3.9 in men and 18.6±7.3 in women (p<0.001). More than 90% of patients had bladder and bowel control after surgery. At the one-year follow-up, 39 patients (19.4%) were dependent on walking aids while only 17 (8.5%) had used walking aids prior to surgery (p<0.001). Of the total, 7 patients (4 men and 3 women) died during the one-year follow-up period. The mean age of the dead patients was 51.4±10.3 years. Fracture was the result of high-energy trauma in 5 patients. Intertrochanteric, subtrochanteric, and femoral neck fractures were seen in 4, 2, and 1 cases, respectively. The mean hospital stay was 10.5±5.7 days. Two patients (28.5%) died in the hospital after surgery: 1 (14.2%) died within the first three months after hip fracture surgery and 4 patients (57.1%) died between 3 and 12 months after surgery.

**Table 1. Baseline characteristics of patients with hip fracture.**

| Characteristic | No. (%) of men | No. (%) of women | Total |
|---------------|----------------|-----------------|-------|
| Age (Mean SD) | 41.8±13.1      | 50.2±11.9       | 44.7±13.3 |
| Smoking       | 73 (55.3)      | 12 (17.4)       | 85 (42.3) |
| Body Mass Index (Mean SD) | 22.5±3.2       | 22.8±3.8       | 22.6±3.4 |
| Length of hospital stay (Mean SD) | 3.4±2.9       | 3.6±2.7       | 3.5±2.5 |
| Injury-surgery interval | 3.5±2.9       | 3.3±2.9       | 3.4±2.9 |
| Surgery-discharge interval | 3.9±1.5       | 3.7±1.4       | 3.8±1.5 |
| Previous fracture |                  |                |       |
| Hip fracture  | 4 (3.0)        | 2 (2.9)         | 6 (3.0) |
| Wrist fracture | 3 (2.3)        | 1 (1.4)         | 4 (2.0) |
| Vertebra fracture | 3 (2.3)        | 1 (1.4)         | 4 (2.0) |
| Other fracture | 32 (24.2)      | 6 (8.7)         | 38 (18.9) |
| Locomotion |                  |                |       |
| Without walking aids | 123 (93.2)     | 61 (88.4)      | 184 (91.5) |
| With walking aids | 9 (6.8)        | 8 (11.4)       | 17 (8.5) |
| Comorbidity |                  |                |       |
| Hypertension | 2 (1.5)        | 1 (1.4)         | 3 (1.5) |
| Diabetes mellitus | 5 (3.8)        | 7 (10.1)       | 12 (6.0) |
| Heart disease | 3 (2.3)        | 4 (5.8)         | 7 (3.5) |
| Cerebrovascular disease | 0 (0.0)        | 2 (2.9)         | 2 (1.0) |
| Others | 24 (18.2)       | 24 (34.8)       | 48 (23.9) |

**Table 2. Fracture characteristics among young adults.**

| Fracture | No. (%) of men | No. (%) of women | Total |
|----------|----------------|-----------------|-------|
| Side of fracture |                  |                |       |
| Left     | 69 (52.3)      | 30 (43.5)       | 99 (49.3) |
| Right    | 62 (47.0)      | 39 (56.5)       | 101 (50.2) |
| Bilateral | 1 (0.8)        | 0 (0.0)         | 1 (0.5) |
| Type of fracture |                  |                |       |
| Intertrochanteric | 78 (59.1)      | 27 (39.1)       | 105 (52.2) |
| Subtrochanteric | 16 (12.1)      | 3 (4.3)         | 19 (9.5) |
| Femoral neck | 38 (28.8)      | 39 (56.5)       | 77 (38.3) |
| Mechanism of fracture |                  |                |       |
| High-energy trauma | 98 (74.2)      | 30 (43.6)       | 128 (63.7) |
| Low-energy trauma | 34 (25.8)      | 39 (56.5)       | 73 (36.3) |
| Method of fixation |                  |                |       |
| Internal fixation | 131 (99.2)     | 63 (91.3)       | 194 (96.5) |
| Arthroplasty | 1 (0.8)        | 6 (8.7)         | 7 (3.5) |
| Season of fracture |                  |                |       |
| Spring    | 30 (22.7)      | 15 (21.7)       | 45 (22.4) |
| Summer    | 30 (22.7)      | 11 (15.9)       | 41 (20.4) |
| Fall      | 36 (27.3)      | 23 (33.3)       | 59 (29.4) |
| Winter    | 36 (27.3)      | 20 (29.0)       | 56 (27.9) |
Morbidity and mortality among elderly patients after hip fracture have been well described in the literature. In young adults, prolonged morbidity after hip fracture as a major public health concern requires significant attention to reduce the economic burden on society. The morbidities are the result of complications such as nonunion, malunion, implant failure, femoral shortening, osteonecrosis, arthritis, and stiffness of joint motions. To the best of our knowledge, many studies in the literature describe complications of surgically-treated hip fractures (especially femoral neck type) in young adults, but limited research has been carried out on functional outcomes. In this study we showed that pain levels were reduced, activities of daily living increased, and patients were able to move about unaided after one year in most cases. The survival rate for hip fracture among young adults exceeds 90%. Duckworth et al. reported a mortality rate of 2.6% and complications of about 32% in adults <60 years with surgically-treated hip fractures.

In this study we showed that pain severity, and acceptable functional outcomes one year after surgery.

DISCUSSION

Hip fractures in young adults have a low mortality rate, reduction in pain severity, and acceptable functional outcomes one year after surgery.

AUTHORS’ CONTRIBUTIONS: Each author made significant individual contributions to this manuscript. BP (0000-0002-6118-8938)*, MJE (0000-0001-6598-0968)*, ARV (0000-0002-6118-8938)* designed the study and directed the research. ARV and ZK (0000-0003-0431-179X)* followed patients and gathered clinical data. BP and HM (0000-0002-9988-1200)* evaluated the data for the statistical analysis. MJE, ARV, and HM performed the literature search, reviewed the manuscript, and contributed to the intellectual concept of the study. All authors participated in drafting the article, critically reviewed the manuscript, and approved the final manuscript as submitted. *ORCID (Open Researcher and Contributor ID).

REFERENCES

1. Brauer CA, Coca-Perraillon M, Cutler DM, Rosen AB. Incidence and mortality of hip fractures in the United States. JAMA. 2009;302(14):1573-9.
2. Jiang XX, Majumdar SR, Dick DA, Moreau M, Raso J, Otto DD. Development and initial validation of a risk score for predicting in-hospital and 1-year mortality in patients with hip fractures. J Bone Miner Res. 2005;20(3):494-500.
3. Forsh DA, Ferguson TA. Contemporary management of femoral neck fractures: the young and the old. Curr Rev Musculoskelet Med. 2012;5(3):214-21.
4. Veretkas DA, Galanis B, Kazakos K, Hatzilynnakis A, Kotsios E. Fractures of the proximal part of the femur in patients under 50 years of age. Injury. 2002;33(1):41-5.
5. Farooq MA, Orkazai SH, Okusanya O, Devitt AT. Intracapsular fractures of the femoral neck in younger adults. Injury. 2008;39(2):238-43.
6. Lin JC, Wu CC, Lo C, Liang WM, Cheng CF, Wang CB, et al. Mortality and complications of hip fracture in young adults: a nationwide population-based cohort study. BMC Musculoskelet Disord. 2014;15:362.
7. Karantana A, Boulton C, Bouliotis G, Shu KS, Scammell BE, Moran CG. Epidemiology and outcome of fracture of the hip in women aged 65 years and under: a cohort study. J Bone Joint Surg Br. 2011;93(5):658-64.
8. Butt MF, Dhar SA, Gani NU, Farooq M, Mir NF, Haider MA, et al. Delayed fixation of displaced femoral neck fractures in younger adults. Injury. 2008;39(3):238-43.
9. Della Rocca GJ. Gaps and opportunities in the management of the young femoral neck fracture. Injury. 2015;46(3):515-8.
10. Gautam VK, Anand S, Dhaon BK. Management of displaced femoral neck fractures in young adults (a group at risk). Injury. 1998;29(3):215-8.
11. Slobogean GP, Sprague SA, Scott T, McKee M, Bhandari M. Management of young femoral neck fractures: is there a consensus? Injury. 2015;46(3):435-40.
12. Sprague S, Slobogean GP, Scott T, Chahal M, Bhandari M. Young femoral neck fractures: are we measuring outcomes that matter? Injury. 2015;46(3):507-14.
13. Koot VC, Peeters PH, de Jong JR, Clevers GJ, van der Werken C. Functional results after treatment of hip fracture: a multicentre, prospective study in 215 patients. Eur J Surg. 2000;166(6):480-5.
14. Leibson CL, Testeson AN, Gabriel SE, Ransom JE, Melton LJ. Mortality, disability, and nursing home use for persons with and without hip fracture: a population-based study. J Am Geriatr Soc. 2002;50(10):1644-50.
15. Wu TY, Jen MH, Bottle A, Liaw CK, Aylin P, Majeed A. Admission rates and in-hospital mortality for hip fractures in England 1998 to 2009: time trends study. J Public Health (Oxf). 2011;33(2):284-91.
16. Wade DT, Collin C. The Barthel ADL Index: a standard measure of physical disability? Int Disabil Stud. 1988;10(2):64-7.
17. Mok JM, Durrani SK, Yamamoto A, Kim HT. Admitting service and morbidity and mortality in elderly patients after hip fracture: finding a threshold for medi-calversus orthopedic admission. Am J Orthop (Belle Mead NJ). 2010;39(2):80-7.
18. Pugely AJ, Martin CT, Gao Y, Klocke NF, Callaghan JJ, Marsh JL. A riskcalculator for short-term morbidity and mortality after hip fracture surgery. J Orthop Trauma. 2014;28(2):83-9.
19. Platzer P, Thalhammer G, Wozasek GE, Vécsei V. Femoral shortening after surgically treated trochanteric fractures in nongeriatric patients. J Trauma. 2008;64(4):982-9.
20. Robinson CM, Court-Brown CM, McQueen MM, Christie J. Hip fractures in adultsyounger than 50 years of age. Epidemiology and results. Clin Orthop Relat Res. 1995;(312):238-46.
21. Duckworth AD, Bennett SJ, Aderinto J, Keating JF. Fixation of intracapsular fractures of the femoral neck in young patients: risk factors for failure. J Bone Joint Surg Br. 2011;93(6):814-6.
22. Lin WP, Wen CJ, Jiang CC, Hou SM, Chen CY. Lin J. Risk factors for hip fracture sites and mortality in older adults. J Trauma. 2011;71(1):191-7.