original article

One-year postoperative mortality rate among the elderly with hip fractures at a single tertiary care center

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BACKGROUND: Hip fractures are one of the leading causes of disability and dependency among the elderly. The rate of hip fractures has been progressively increasing due to the continuing increase in average life expectancy. Surgical intervention is the mainstay of treatment, but with an increasing prevalence of comorbid conditions and decreased functional capacity in elderly patients, more patients are prone to postoperative complications.

OBJECTIVES: Assess the value of surgical intervention for hip fractures among the elderly by quantifying the 1-year mortality rate and assessing factors associated with mortality.

DESIGN: Medical record review.

SETTING: Tertiary care center.

PATIENTS AND METHODS: All patients 60 years of age or older who sustained a hip fracture between the period of 2008 to 2018 in a single tertiary healthcare center. Data was obtained from case files, using both electronic and paper files.

MAIN OUTCOME MEASURES: The 1-year mortality rate for hip fracture, postoperative complications and factors associated with mortality.

SAMPLE SIZE: 802 patients.

RESULTS: The majority of patients underwent surgical intervention (93%). Intra- and postoperative complications were 3% and 16%, respectively. Four percent of the sample died within 30 days, and 11% died within one year. In a multivariate analysis, an increased risk of 1-year mortality was associated with neck of femur fractures and postoperative complications (P=.034, <.001, respectively)

CONCLUSION: The 1-year mortality risk in our study reinforces the importance of aggressive surgical intervention for hip fractures.

LIMITATION: Single-centered study.

CONFLICT OF INTEREST: None.

Hip fractures are one of the leading causes of disability and dependency among the elderly.[1] They have been progressively increasing due to the continuing increase in average life expectancy among populations.[2] The estimated number of hip fractures in the United States is around 350 000 cases yearly.[3] By 2050, the worldwide incidence of hip fractures is projected to reach 6.26 million fractures annually.[4] Hip fractures can be classified into pertrochanteric, femoral neck, and subtrochanteric fractures.[5] Risk factors for hip fractures include female gender, osteoporosis, and older age.[6]

The elderly are at an increased risk of falls due to several factors including multiple comorbidities, polypharmacy, and decreased functional capacity.[7] As the consequences of falls are often devastating, several strategies have been employed to prevent them. However, falls remain the main cause of frailty and mortality.[8] Fractures are reported to be the most common serious injury related to falls. Lower limb fractures, in particular, are the most prevalent (60%).[8]

Although older patients have a higher risk of surgical complications compared to younger patients,[9] it has been shown that the 30-day mortality rate of patients older than 60 who have undergone surgical interventions for hip fractures is relatively low (>6%).[10] Moreover, research has shown that surgical intervention improves both mortality and functional outcome in lower limb fractures (hip and distal femur) in patients older than 65 years in comparison to those who were treated conservatively.[11] A recent study that compared surgical treatment versus conservative treatment concluded that conservative treatment is not superior to surgery in terms of complications.[12] Moreover, a systematic review and meta-analysis that evaluated the timing of surgery to the rate of morbidity and mortality found that earlier surgical intervention is associated with a reduced rate of mortality, fewer perioperative complications, and a 20% lower 1-year mortality rate.[13] Several recommendations have been developed regarding the optimal time for surgery. The UK National Health Service recommend prompt surgery, with an admission to surgery time of less than 48 hours.[14] Additionally, hip fractures require long-term surveillance and treatment due to the strong association with osteoporosis. Various models have sought to address postoperative programs by integrating an interdisciplinary team to prevent the recurrence of fracture.[15]

The aim of this study was to assess the value of surgical intervention for hip fractures among the elderly by quantifying the 1-year mortality rate and assessing its associated factors in a single tertiary care hospital.

PATIENTS AND METHODS

This retrospective chart review was conducted in a single tertiary care hospital with a level I trauma center. The targeted population was patients older than 60 years of age who sustained a hip fracture (intracapsular, neck of femur, intertrochanteric, and subtrochanteric) during the period from January 2008 to December 2018. The Institutional Review Board of King Abdullah International Medical Research Center, Riyadh, Saudi Arabia provided ethical approval for this study under protocol number RC18/283/R.

Data were collected using both electronic medical records (Saudi Korean Health Informatics Company. Released 2009, BestCare 2.0 for Windows, Version 2. Riyadh, Riyadh, Saudi Arabia) and from the paper file-based system (the BestCare system was introduced to the hospital in 2017). The inclusion criteria included all trauma patients 60 years or older who sustained one of the fractures denoted above (older age is defined, according to the World Health Organization, as people above the age of ≤60).[16] Pathological fractures, non-traumatic fracture, and patients younger than the age of 60 were excluded. The following variables were gathered: Age, gender, weight, height, comorbidities, length of stay, admission to operation time, type of fractures, type of surgery, preoperative medication, physical status, intraoperative complications (defined as any event deemed by the surgeon as a complication in the medical report; such as, a femoral head fracture with screw insertion), postoperative complications (infections, cerebrovascular events, acute coronary syndromes, deep vein thrombosis/pulmonary embolism, acute kidney injury, electrolytes abnormalities, revision of surgery, stress ulcers), and 1-year mortality rate.

The data were compiled on a Microsoft Excel sheet and then uploaded into Stata statistical software (StataCorp. 2017. Stata Statistical Software: Release 15. College Station, TX: StataCorp LLC.) which was used for data analysis. Descriptive analysis was carried out by calculating the frequencies and percentages for categorical variables, means and medians were used as appropriate to describe data. The chi-square test was used to test differences between patients that waited for more than 48 hours and patients that did not in relation to the 1-year mortality. A *P* value of ≤.05 was used for significance. The chi-square test was also used to test the relationship between independent variables and the 1-year mortality (dependent variable); the 30-day mortality, length of hospital stay and surgery wait time were also tested separately (using the same independent variables) as dependent variables. Bonferroni correction was done to control for false positive occur-

rence due to the high number of variables. A significant *P* value was deemed to be ≤.002 after correction. The Shapiro–Wilk test was performed to assess the normal distribution of the sample. Finally, we conducted two separate multivariate analyses using logistic regression with 1-year mortality and 30 day-mortality as the dependent variables and significant and clinically important independent variables.

RESULTS

Over the study period from January 2008 to December 2018, 1142 cases admitted with a diagnosis of hip fracture were screened, and 802 patients met the inclusion criteria. All of the patients were between 60 and 118 years old. **Table 1** summarizes demographic data and the types of fractures and surgeries. Hypertension was the most prevalent chronic disease (73%), followed by diabetes mellitus (56%), and dyslipidemia (24%) (**Figure 1**). Anticoagulants were not used in 369 (46%) of cases, while 152 (19%) were using aspirin and 56 (7%) were using heparin, warfarin, or enoxaparin. (**Figure 2**). Intra- and postoperative complications occurred in 25 (3%) and 126 (16%) patients, respectively (**Table 2**). Thirty patients (4%) died within 30 days, and 66 (11%) died within one year. Forty-three percent (n=346) patients stayed in the hospital for 7-14 days following hip surgery while 162 (22%) stayed for 1-7 days or less.

Patients that underwent surgical intervention within 48 hours constituted 332 (41.3%) of the sample. The median admission to operation time was 3 days. A wait of more than 48 hours for surgery was significantly associated with increased mortality at 1 year using Pearson's chi-square test (*P*=.047). The high average length of wait time for surgical intervention prompted further analysis of the data to assess possible factors affecting length of hospital stay and surgical wait time. Chi-square analysis of hypertension and myocardial infarction as independent factors showed a significant as-

Table 1. Demographic and clinical characteristics of study group (n=802).

Gender	
Male	423 (53)
Female	379 (47)
Age group	
60-79	547 (68)
≥80	255 (32)
Body mass index category[a]	
Underweight	63 (10)
Normal weight	244 (39)
Overweight	175 (28)
Obese	145 (23)
Physical activity[a]	
Independent	228 (52)
Partially dependent	133 (30)
Totally dependent	76 (17)
Area of fracture	
Intertrochanteric	378 (47)
Neck of femur	320 (40)
Subtrochanteric	25 (3)
Other	79 (11)
Modality of treatment	
Non-operative	57 (7)
Operative	745 (93)
Name of surgery	
Closed reduction with internal fixation	451 (60)
Bipolar hemiarthroplasty	236 (32)
Closed reduction with compression screws	42 (6)
Other	16 (2)
American Society of Anesthesiologists score[a]	
1	8 (1)
2	168 (23)
3	396 (54)
4	162 (22)
Length of hospital stay at the hospital	
1-7 days	174 (22)
8-14 days	346 (43)
15-21 days	159 (20)
22-28 days	55 (7)
>28 days	68 (9)

Data are number (%). [a]Some variables were unattainable from medical records and were not involved in the analysis.

sociation after correction (*P*=.001 and .001, respectively) with length of hospital stay. However, other factors (including other relevant cardiac comorbidities: coronary artery bypass surgery, cardiac catheterization, and heart failure (*P*=.007, .022, and .039, respectively) did not yield significant results (with Bonferroni correction, <.002 statistically significant). Use of heparin or warfarin were not significantly associated with increased hospital stay after surgery using the same test (*P*=.008 and .025, respectively) (with Bonferroni correction, <.002 statistically significant). No factors were associated with wait time for surgery.

In a univariate analysis, hypertension was significantly associated with increased risk of 1-year mortality (*P*=.002). Likewise, chronic obstructive pulmonary disease and renal disease significantly increased the risk of 1-year-mortality after hip fractures (*P*=.019, and <.002, respectively). Increasing class of ASA score increased the risk of 1-year mortality (*P*<.002) as well as having intraoperative and post-operative complications (*P*=.001, <.002, respectively). Two factors were significantly associated with increased 30-day mortality rate in univariate comparisons (heart failure and postoperative complications). Heart failure was the only comorbid condition that affected 30-day mortality (*P*<.002), and postoperative complications had a significant 30-day mortality risk (*P*<.002). Multiple logistic regression yielded no significant associations with 30-day mortality as the dependent variable, but neck of femur fractures and postoperative complications were significantly associated with 1-year mortality as the dependent variable (**Table 3**).

DISCUSSION

The noticeable increase of life expectancy in the general population has been associated with an increased need for surgical intervention in the elderly.[17] This can lead to formidable challenges to practicing clinicians. Hip fractures are not uncommon in elderly patients, and surgical intervention is needed in most cases.[18] However, the potential for complications and even death has been a major concern in this age group. Some studies of non-operative approaches for severely ill patients have shown acceptable outcomes.[19-21] However, surgery remains the mainstay of treatment.[19] The majority of patients in this study had surgical interventions with a rate of intra- and postoperative complications of 3% and 16%, respectively. These figures differ from the 20% and 32% postoperative complications figures cited in the literature.[22] Additionally, the 30-day mortality of 4% in our study was slightly lower than numbers reported in the literature but similar to many single center studies.[10,23-34]

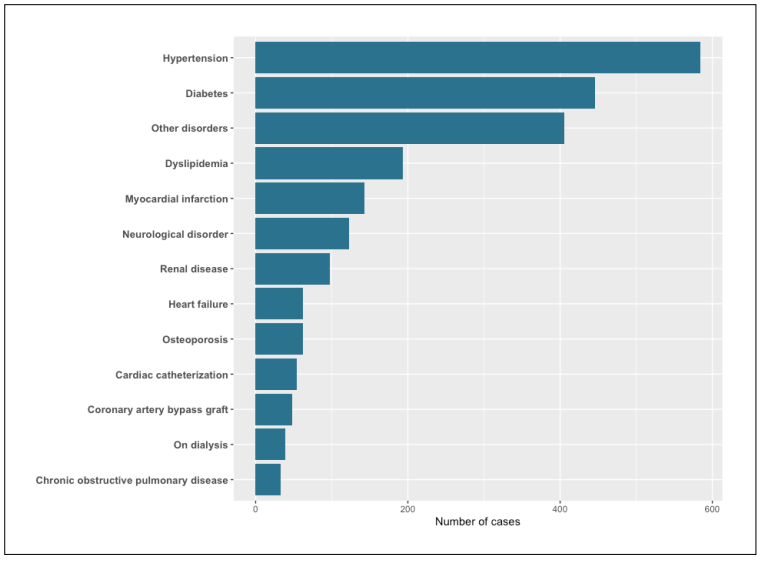

Figure 1. Clinical and comorbid disease characteristics among the study group of elderly patients with hip fracture (n=802).

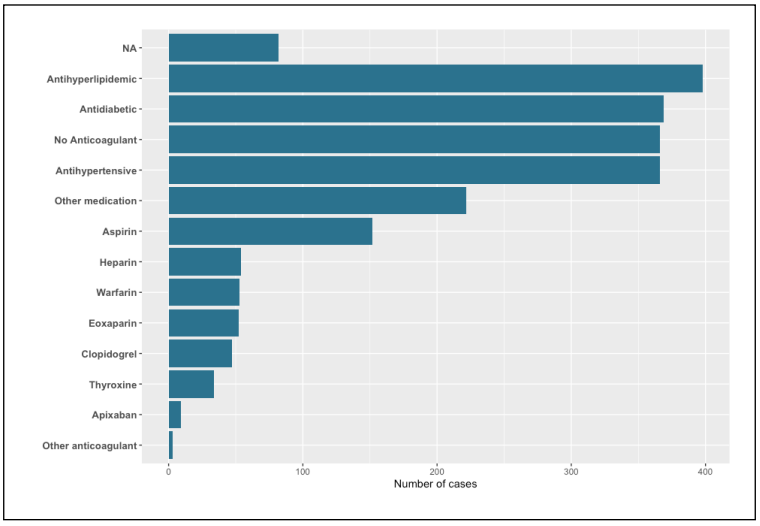

Figure 2. Medication use among the study group of elderly patients with hip fracture (n=802). (NA: data not available)

Table 2. Complications and one-year mortality rate after surgery.

Intraoperative complications	25 (3%)
Postoperative complications	126 (16%)
Postoperative 30-day mortality	30 (4%)
1-year mortality	66 (11%)

Data are number (%) .

Table 3. Multiple logistic regression analysis with 1-year mortality as dependent variable.

Variable	Odds Ratio	95% CI	*P* value
Diabetes	1.685086	0.909734-3.121259	.097
Hypertension	1.794137	0.760723-4.231405	.182
Chronic obstructive lung disease	2.374143	0.868823-6.487575	.092
Fracture name			
Intertrochanteric	0.316407	0.099356-1.007623	.052
Neck of femur	0.274117	0.083009-0.905211	**.034**
Subtrochanteric	0.895564	0.183503-4.370689	.892
Transcervical	0.291956	0.027997-3.044591	.303
Pelvis	0.292615	0.04559-1.878121	.195
Other	0.519545	0.080591-3.349358	.491
ASA Score			
2	0.134344	0.012774-1.412845	.095
3	0.27084	0.028755-2.551055	.254
4	0.542073	0.056347-5.214918	.596
Intraoperative complications	2.584487	0.816828-8.177452	.106
Postoperative complications	2.696537	1.493953-4.867159	**<.001**
Kidney disease	1.648881	0.820034-3.315484	.161
Constant	0.281514	0.024879-3.185446	.306

Model fit measures: Log likelihood = -192.77378, pseudo R squared= 0.1214

Hip fractures were historically considered "a death sentence" for the elderly. In the literature, the reported 1-year mortality rate reaches up to 30%. In contrast, recent studies have shown a decline in 1-year mortality (16%, 13.9%, and 14%).[35-37] Moreover, a recent systematic review reported a global reduction of 1-year mortality after hip fractures across 36 countries.[37] The 1-year mortality of 11% in our study is consistent with international averages. The slightly lower percentage presented here can be attributed to the nature of the study being a single tertiary-care center as opposed to nationwide studies that introduce multiple additional variables. However, a direct comparison cannot be drawn.

Variables previously recognized as risk factors for 1-year mortality following a hip fracture include gender, physical status, comorbidities, and others. It has been proposed that men are more likely to die following a hip fracture,[38] but our data failed to demonstrate that. Surprisingly, age was not a risk factor. Medical comorbidities such as chronic obstructive pulmonary disease, renal disease, hypertension and diabetes have been linked with increased 1-year mortality rate.[39,40] Data from this study showed similar results. Additionally, a high ASA Score was strongly associated with mortality as expected.[41] Furthermore, the data did not demonstrate a statistical difference between the type of surgery performed in terms of mortality rates.[42-44] However, the type of fracture sustained, in this case neck of femur fractures, showed a significant association with 1-year mortality.[45] The effects of surgical delay on mortality is a well-studied topic in the literature. Several studies have reported that early intervention is associated with reduced mortality.[13,46,47] In our study, a wait of more than 48 hours for surgery was significantly associated with increased mortality at 1 year.

A prolonged hospital stay has major economic and psychosocial impacts on patients, their relatives and the society at large, as well as being a contributor to early mortality. The majority of patients in this study stayed in the hospital for 7-14 days (43%) following hip surgery while 22% of patients stayed for 7 days or less. Multiple studies in the literature reported similar lengths of stay (11.4, 8.1 days).[44,48]

This study highlights the need for accurate national databases to adequately assess and predict mortality after surgical interventions. The reported mortality percentages at 1-year postoperatively portray one side of the story only, with more complex predictive risk models requiring more expansive datasets. We acknowledge the limitation of this work as being done in a single center. However, we believe that aggressive surgical intervention for hip fracture is associated with an acceptable 1-year mortality.

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