COVER LETTER

Type of Manuscript: Original Research Article

Title of Manuscript: Predictive Factors of Mortality After Surgical Management of Proximal Femoral Fractures in Elderly Patients

Objective: Proximal femur fractures are quite common and dangerous in elderly patients because of high mortality rates post-surgery. This has been a major problem globally and its mechanism remains uncertain. The present study has been conducted to evaluate the predictive factors of mortality in elderly patients of age 60 years or more with proximal femur fracture undergoing surgical management.

All the authors of the manuscript confirmation that the manuscript has not been published elsewhere and is not under consideration for publication by any other journal.

All authors have given their approval for submission of the manuscript to the journal.

Abstract:

Objective: Proximal femur fractures are quite common and dangerous in elderly patients because of high mortality rates post-surgery. This has been a major problem globally and its mechanism remains uncertain. The present study has been conducted to evaluate the predictive factors of mortality in elderly patients of age 60 years or more with proximal femur fracture undergoing surgical management.

Method: The present study is an observational retrospective study with a follow up of 1 year. A total of 50 patients were included after applying the inclusion and exclusion criteria. All the patients were operated by the same orthopaedics surgeon and under uniform conditions.

Results: The overall mortality rate was 34% at 1 year follow-up. There was no statistical difference between male and female patients but there was a 3 fold increase in mortality rates in patients of age more than 80 as compared to patients between 60-80 years. Similarly, statistical difference was observed in patients who were operated within 72 hours of admission to the hospital than those operated after 72 hours of admission. Likewise, a 3 fold increase in mortality was observed in patients with more than 2 comorbidities as compared to patients with less than 2 comorbidities.

Conclusion: Patients older than 80 years with reduced post-operative mobility score and having more than 2 comorbidities have a statistically significant higher mortality rate following surgical management of proximal femur fracture.

Key words: mortality, operative management, osteoporotic fracture, proximal femur fracture, risk factor.

Introduction:

Proximal femur fractures are most commonly seen in elderly patients and they are a significant cause of mortality and morbidity [1-2]. With a higher incidence in elderly patients, the load of proximal femur fractures will increase even more on the society in the future [3,4]. It is a well-known fact that low-energy trauma that results in proximal femur fractures in the elderly is frequently linked to conditions like osteoporosis, malnutrition, poor visual acuity, and cognitive impairment [5].

It is estimated that one-third of elderly over 65 years of age and half of these over 85 years of age had a fall at least once per year [6].

There is a 12% to 36% one-year mortality rates after having proximal femur fracture and the highest rates reported is within the first month after fracture [7-9]. Elderly patients of proximal femur fracture with comorbidities have a negative impact on post-operative survival rates [10]. Few factors have shown a clear correlation with the increased mortality in proximal femur fracture patients such as age, cognitive decline, time elapsed between fracture and surgery, pre fracture mobility capacity, and previous comorbidities [11,12]. Diseases like liver, cardiovascular, and pulmonary have shown to affect mortality rate [10,13-14].

The present study aims to evaluate the factors related to the mortality of elderly patients of age 60 years or more submitted to surgical management of proximal femur fractures and followed-up for 1 year.

Material and Methods

It is an observational, retrospective study which included medical records of 50 patients of age 60 years or more with proximal femur fracture who underwent surgical treatment.

Proximal femoral fractures included femur neck fracture, inter-trochanteric fracture and sub-trochanteric fracture. The treatment of inter-trochanteric fractures was performed with either a proximal femoral nail or a dynamic hip screw whereas fracture neck femur was treated by hip arthroplasty. For statistical purposes, the selected implant for the treatment of each case were not considered.

Inclusion Criteria included patients of age more than or equal to 60 years, patients operated by the same surgeon and patients whose medical records could be retrieved.

Exclusion Criteria were patients less than 60 years of age, patients with pathological fracture due to neoplasm, patients with multiple fractures and patients loss to follow up within 1 year.

Outcome Measure and Risk factors

Primary outcome measures in the study were cumulative mortality and proportional survival following fracture surgery at 1, 6 and 12 months. The risk factors that were included are:

Age. Review of literature proves the relationship between increasing age and the risk of sustaining hip fracture. As the age increases, there is an increase risk of sustaining a hip fracture and its associated mortality [15].

Sex. Many studies have proven that risk of developing a hip fracture is higher in woman, although mortality rates are higher in men. The reason behind this is not clear yet [14,16].

Number of Comorbidities. Each patient's previous 2 years medical records were examined to determine the number of comorbidities. The following comorbidities that were taken into consideration diabetes mellitus, chronic nephropathy, chronic obstructive pulmonary disease, obesity, hypertension, cerebrovascular diseases, vascular diseases.

Total Hospital Stay. An average hospital stay in United States after fracturing the hip was 7 days in 2003 [17]. The length of hospital stay was counted from the day of admission to the day of discharge.

Surgical Delay. Surgical delay is defined as the time from hospital admission to surgery. In accordance with current British guidelines, patient should preferably be operated upon within 24 hours after trauma; however, this has not always been possible [18].

Not a single study have shown that mortality get influenced by surgical delay after proximal femur fracture. Some studies have shown the mortality rate of patients who are operated early to be reduced significantly, some have shown an increase in mortality for surgical delays longer than 4 days while others have shown no significant effect [19-21].

Statistical Analysis

Statistical analysis was done using SPSS version 25 software.

The data was assessed for normal variation. In order to test for any significant differences between patients who died within 12 months and those who survived, each variable was compared between the 2 groups. Student's *t* test were used to assess continuous variables, and chi-square tests were used to assess categorical variables.

The Kaplan- Meier method was used for testing variables for survival difference and for constructing survival curves.

Results

The present study had 50 patients out of which 17 patients (34%) died within 1 year of surgery. Of the 17 patients that died, 9 patients (18%) died within 1 month of surgery while 5 patients (10%) died between 1-6 months post-surgery while rest 3 patients (6%) died between 6-12 months after surgery. (Table 1)

Out of 50 patients, 20 (40%) were male and remaining 30 (60%) were female. 7 male patients (35%) died within 1 year post-surgery out of which 4 patients died within 1 month of surgery and remaining 3 patients died between 6-12 months after surgery. Out of 30 female patients, 10 (33.3%) died within 1 year of surgery. (Table 1)

Out of 41 patients in the age range of 60 years to 80 years, 11 patients (26.8%) died within 1 year of surgery while 6 patients out of 9 (66.6%) in the age range of 81 years to 94 years died within 1 year after surgery. (Table 1)

Out of 25 patients with post-operative mobility score <= 5, 12 (48%) died within 1 year post-surgery while another 5 patients out of 25 patients (20%) with post-operative mobility score >5 died within 1 year after surgery. (Table 1)

The association between the categorical variables and the outcome (death) using the p- value and odds ratio as the risk measure was calculated. There was no significant difference between male and female patients who survived up to 1 year post surgery (p value of 0.90 with odds ratio of 1.08 and 95% CI of 0.33-3.55). (Table 2)

Mean age of patients who survived up to 1 year post-surgery was 70.3 years (SD 7.75) and those who died was 76.6 years (SD 10.03). There was a significant difference between the number of patients who survived in the age group of 60-80 years (73.2%) than the number

who survived in the age group of 81-94 years (33.3%) with a p value of 0.03 and odds ratio of 0.18 and 95% CI of 0.04-0.86. (Table 2)

Mean time from admission to surgery was 3.4 days (SD 2.1) for survived patients and was 4.8 days (SD 2) for patients who died within 1 year of surgery. A significant difference was observed in patients who were operated within 72 hours of admission and survived (91.7%) than those who were operated after 72 hours of admission (57.9%) with a p value of 0.05 and odds ratio of 0.13 with 95% CI of 0.02-1.07. (Table 2)

Mean hospital stay in days for patients who survived was 13.4 days (SD 4) as compared to those who died, in which it was 19.3 days (SD 8). (Table 2)

A significant difference was observed in patients with 2 or less comorbidities who survived (73.8%) than those with more than 2 comorbidities (25%) with p value of <0.05 and odds ratio of 0.12 and 95% CI of 0.02-0.67. (Table 2)

Figure 1 shows the overall survival on Kaplan- Meier curve

Figure 2 shows the curve stratified for the age group showed that the cumulative chance for survival for age group 60-80 was more than that the cumulative chance for survival for age group of more than 80 years of age.

Discussion

The mortality rate in the current study was 18% at 1 month and 34% at 1 year, which is nearly identical to the results of studies by Garcia et al. [22] and Guerra et al. [23], which found mortality rates of 30% and 24%, respectively, after 1 year follow-up.

Gender has no impact on the mortality rate (males has a mortality rate of 35% compared to females of 33.3% at 1 year follow-up). This result supports that of Van Laarhoven et al. [24] and Antes et al. [25]

In the present study the mortality rate was more than twice (66.6% vs 26.8%) in patients with age group 60-80 years than in patients with age group 61-94 years. This data agrees with those of a prospective study by Paksima et al.[26]

Out of 25 patients with post-operative mobility score of 5 or less, 12 (48%) died within 1 year of surgery as compared to just 5 (20%) with post-operative mobility score of more than 5. This is in concordance with the study by Parker MJ et al. [27] in which only 16% patients died within 1 year post surgery with post-operative mobility score of more than 5.

Review of literature by Lewis and Waddell [28] have shown the importance of reducing the time of surgery from admission to <72 hours to reduce excess mortality. The same holds good in the present study in which the mortality rate shoots from 8.3% to 42.1% if there is a surgical delay of >72 hours from admission to surgery.

According to research by Shebubakar et al. [29] and Campose et al. [30], having more than two comorbidities is linked to a higher risk of mortality and morbidity. The death rates for individuals with >2 comorbidities are 3 times higher (75% vs. 26.2%) in the current study than they are for patients with ≤ 2 comorbidities.

Conclusion

This study follows the epidemiological trend described in the literature about the mortality of elderly patients with proximal femur fractures following surgical treatment, including mean age, mean surgical delay in hours, number of comorbidities, and mean post-operative mobility score. In the present study, the same characteristics that are already known to be linked to higher mortality in this population—advanced age, a longer hospital stay, and the number of comorbidities—were also linked to higher mortality. Although there was no statistically significant difference in terms of mortality between the two sexes of proximal femur fracture managed surgically. A larger sample size may be appropriate to correlate the study's findings because the study's sample size is modest.

Financial Disclosure: Nil

Conflict of Interest: Nil

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TABLE-1

Time of Death

Characteristics	**No. of patients**	**No. of deaths**	**<1 month**	**1-6 months**	**>6–12 months**
Total	50	17	9 (18%)	5 (10%)	3 (6%)
Sex					
Male	20	7	4 (20%)	0 (0%)	3 (15%)
Female	30	10	5 (16.7%)	5 (16.7%)	0 (0%)
Age (Yrs)					
60-80	41	11	4 (9.75%)	4 (9.75%)	3 (7.3%)
81-94	9	6	5 (55.5%)	1 (11.1%)	0 (0%)
Post-operative Mobility Score					
<= 5	25	12	7 (28%)	3 (12%)	2 (8%)
>5	25	5	2 (8%)	2 (8%)	1 (4%)

TABLE-2

Patient Characteristics

Characteristics	Survived	Died	p value	OR (95% CI)
Sex, No. (%)				
Male	13 (65%)	7 (35%)	0.90	1.08
Female	20 (66.7%)	10 (33.3%)		(0.33– 3.55)
Mean Age in yrs (SD)	70.3 (7.75)	76.6 (10.03)		
Age range, No. (%)				
60-80 yrs	30 (73.2%)	11 (26.8%)	0.03*	0.18 (0.04-0.86)
81-94 yrs	3 (33.3%)	6 (66.7%)		
Mean time from admission to surgery in days (SD)	3.4 (1.5)	4.8 (2)		
Surgical delay in hrs, No (%)				
<72 hrs	11 (91.7%)	1 (8.3%)	0.05*	0.13
>72 hrs	22 (57.9%)	16 (42.1%)		(0.02-1.07)
Mean hospital stay in days (SD)	13.4 (4)	19.3 (8)		
No. of comorbidities, No (%)				
2 or less	31 (73.8%)	11 (26.2%)	0.016*	0.12
>2	2 (25%)	6 (75%)		(0.02-0.67)

Figure 1: Cumulative survival curve

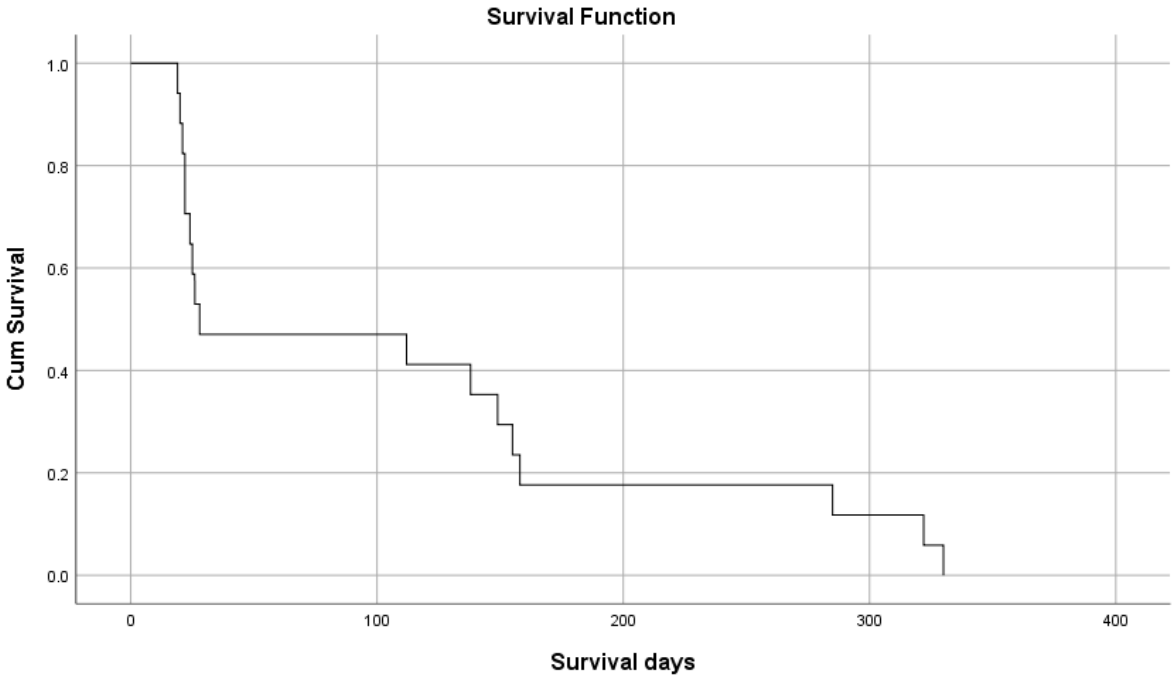

Figure 2: Age group related survival curve