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ORIGINAL ARTICLES

Factors affecting in-hospital Mortality in Patients with Hip Fracture.

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Abstract

Background. The prevalence of hip fractures is steadily increasing, as the population ages. These fractures are associated with significant morbidity and mortality. Most of these fractures are treated surgically. Factors related to surgical intervention can play a significant role in the outcome.

This study examines the association of in-hospital mortality with the timing of surgery, sex, and age of patients treated surgically due to a hip fracture at Clinical Hospital Shtip in a 2-year long period.

Material and Methods. A total of 348 patients admitted with a diagnosis of hip fracture who were treated surgically were identified. Data about sex and age were collected. The outcome was assessed for groups treated within 24, 48, 72, and more than 72 hours after admission. Descriptive statistical methods, chi-square test, t-test for independent samples, and odds - ratio with 95% confidence interval (CI) were used in statistical analysis.

Results. The delay of surgical treatment beyond 24 hours did not increase the risk of death (OR=0.65, 95%CI=0.23-1.73). Delays beyond 48h and 72h increased the risk of death progressively (OR=1.17, 95%CI=0.50-2.75, and OR=1.65, 95%CI=0.69-3.95 respectively). Mortality was significantly higher in the 76-85-years age group.

Conclusions. Association between surgical delay and in-hospital mortality in hip fracture patients is disputed. Confounding factors such as age, sex, comorbidities, and type of treatment determine the outcome. Patients with hip fractures, without any additional disease, should be operated on as soon as possible after admission to the hospital. Delay beyond 48 hours may increase the risk for in-hospital mortality.

Keywords: In-hospital mortality, hip fracture, comorbidities, trauma

Introduction

As the population ages, the prevalence of hip fractures is steadily increasing. It is estimated that it was 1.26 million worldwide in 1990 and is expected to grow to 6.4 million by 2050. [1]

These fractures are associated with significant morbidity and mortality. Up to 50% of patients with such fractures do not return to pre-fracture functional level, and mortality in the first year is 30%. [2, 3]

There are several factors that affect the outcome in a patient with a hip fracture. Since most of these fractures are treated surgically, factors related to surgical intervention can play a significant role in the functional outcome. Surgical delay as a factor has been the subject of intense study for the last two decades. Patients admitted to hospital with a hip fracture are among the most moribund patients, and the reasons for delaying the intervention can range from the need to stabilize such a patient to the unavailability of an operating room to conduct treatment. Whatever the reasons, the delay extends the patient's hospital stay, immobility, and preoperative starvation. Many studies show a link between delayed intervention on one hand and morbidity and mortality on the other. [4-7] But there are a number of

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studies that have shown that mortality is not associated with delayed surgery and that further research is needed on the effects of delayed functional outcome. [8, 9]

In this study, we investigated the association between delayed surgical intervention, gender, and age in patients admitted with hip fracture and mortality during their hospital stay using inpatient data.

Materials and methods

We reviewed the hospital diaries for admitted, discharged and operated patients in PHI Clinical Hospital Shtip, Department of Orthopedics and Traumatology, for 2-year long period. Data was obtained for patients admitted with a primary diagnosis of hip fracture (diagnoses S72.0 to S72.2 according to ICD10) and surgical treatment of the fracture. Patients who were transferred to another institution or treated conservatively were excluded.

For these patients, we analysed data on gender, age, time from admission to surgery, and outcome (discharged versus death outcome). We divided the age groups into 10-year intervals. We divided the time from admission to surgery into: patients operated on within 24 hours after admission, patients operated on after 25-48 hours, patients operated on after 49-72 hours and patients operated on with a delay of more than 72 hours.

Descriptive statistical methods, chi-square test, t - test for independent samples and odds - ratio with 95% confidence interval (CI) were used in statistical analysis.

Results

A total of 348 patients admitted with a diagnosis of hip fracture who were treated surgically were identified. Of these, 223 (64.1%) were women. The mean age of the patients was 75.3 years. Hospital mortality was 6.6%.

Mortality by sex and age

For women, the mortality rate was 6.73%. In men, the mortality rate is 6.40%. The difference in mortality between the sexes is not statistically significant for $p < 0.05$. Although on average women with hip fractures were 3.4 years older than men, which was statistically significant ($p = 0.00098$), there was no statistically significant difference between the age of male and female patients who died ($p = 0.24$).

The distribution of mortality by age groups is shown in Table Nº. 1. Significantly higher mortality of 9.7% was found in the age group of 76 to 85 years. In this group the probability of death was 2.7 times higher than the other groups. For this group, additional analyses were performed on the probability of fatal outcome in relation to the time of the operation. Table Nº2 shows the probability of mortality in one age group compared to the others.

Mortality depending on the time of surgery

The distribution of mortality by groups according to the time of surgery is shown in Table Nº. 3. The probability of

Table No1: Distribution of mortality by age groups

Age groups	**Death outcome**		**Total**
	no	**yes**	
<56 years	17	0	17
56-65	29	0	29
66-75	91 (94,8%)	5 (5,2%)	96
76-85	149 (90,3%)	16 (9,7%)	165
>85	39 (95,1%)	2 (4,9%)	41
Total	325	23	348

Table No2: Odds ratio (95% confidence interval) for in-hospital mortality for sex, age and delay of surgical treatment

Factors and category	**Number (%)**	**Death in hospital – odds ratio (95% CI)***
Gender:		
male	125 (35,9%)	0,95 (0,39-2,30)
female	223 (64,1%)	1
Age:		
<66 years	46 (13,2%)	0,13 (0,01-2,14)
66-75	96 (27,6%)	0,71 (0,26-1,98)
76-85	165 (47,4%)	2,70 (1,08-6,74)
>85	41 (11,8%)	0,70 (0,16-3,09)
Time from admission to surgery:		
in the first 24 hours	67 (19,3%)	1,53 (0,58-4,04)
25-48 hours	97 (27,9%)	0,53 (0,17-1,59)
49-72 hours	84 (24,1%)	0,64 (0,21-1,95)
> 72 hours	100 (28,7%)	1,65 (0,69-3,95)
** odds ratio in relation to other groups, except for gender*		

Table No3: Distribution of mortality according to the time of surgery

Time from admission to surgery	**Death outcome**		**Total**
	no	**yes**	
in the first 24 hours	61 (91,0%)	6 (9,0%)	67
25-48 hours	93 (95,9%)	4 (4,1%)	97
49-72 hours	80 (95,2%)	4 (4,8%)	84
> 72 hours	91 (91%)	9 (9%)	100
Total	325	23	348

mortality is higher in the group of patients operated in the first 24 hours and those with a delay of more than 72 hours, but statistical significance of the differences was not shown ($p = 0.39$, $p = 0.26$ respectively) - Table No 2.

Mortality in the age group from 76 to 85 years

Mortality in the age group of 76-85 years, in which there was a significantly higher mortality was considered separately in terms of the time of surgery. The distribution by time of operation and sex is shown in Table Nº4. In this age group, surgical intervention in the period of 25-72 hours carries a significantly lower risk of death compared to early intervention (odds ratio 0.2, 95% CI 0.05-0.78). The risk then increases again with a delay of more than 72 hours (odds ratio 1.53, 95% CI 0.53-4.47).

Although men have a lower risk of mortality, the difference is not statistically significant (odds ratio 0.72, 95% CI 0.22-2.36, p = 0.59).

Table No4: Mortality distribution by sex and time of surgery for the age group from 76 to 85 years

Gender	Death outcome		Total
	no	yes	
male	47 (92,2%)	4 (7,8%)	51
female	102 (89,5%)	12 (10,5%)	114
Time from admission to surgery			
in the first 24 hours	25 (80,7%)	6 (19,3%)	31
25-48 hours	43 (95,6%)	2 (4,4%)	45
49-72 hours	39 (95,1%)	2 (4,9%)	41
> 72 hours	42 (87,5%)	6 (12,5%)	48
Total	149	16	165

Discussion

This study examines the association of in-hospital mortality with the timing of surgery, sex and age of 348 patients treated surgically due to a hip fracture at the PHI Clinical Hospital Shtip in 2-year long period.

In-hospital mortality in patients with hip fractures ranges between 4% and 10%, with a number of studies consistently reporting higher mortality in men than in women. [3, 7, 10, 11]

In this study, the total in-hospital mortality was 6.6%. Mortality was higher in women than in men in general and in the age group 76-85, although the difference in mortality was not significant. There was no difference in the timing of the operative intervention between these two groups.

The term in-hospital mortality is defined as number of patients with hip fracture that die during their hospital stay multiplied by 100 and divided by the total number of patients with hip fracture. According to Spanish National Healthcare System it is inpatient quality indicator for hospitals and that's why reducing this indicator as much as possible should be a primary objective. [12, 13]

A number of studies have analysed mortality for intracapsular and extracapsular fractures of the proximal femur separately, with some reporting higher mortality rates for femoral neck fractures and others for intertrochanteric fractures. [14, 15]

However, most of them do not show a difference in the type of fracture. [16, 17] For these reasons, we did not make separate analysis according to the type of fracture.

The advanced age of patients has been accepted as an independent factor influencing mortality in most studies. [7, 18]

In the literature the advanced age of the patients and male sex are related to in-hospital mortality. According to the research of Frost there is a rate ratio of 2.06 for each +10 years of age and of 2.31 for males for in-hospital mortality. [19] Chatterton found that male gender (OR 2.0, 95% CI 1.3 to 3.0), increasing age (age ≥ 91; OR 4.1, 95% CI 1.4 to 12.2) and comorbidity (American Society of Anaesthesiologists (ASA) grades 3 to 5; OR 4.2, 95% CI 2.0 to 8.7) were independently and significantly associated with increased odds of in-hospital mortality. [20]

The results from various studies suggest that comorbidities at admission are strongly associated with in-hospital mortality and they have been very dissimilar as to which of them has the strongest influence. Belmont considers dialysis the best predictor of in-hospital mortality, with an OR>6. [21]

Frost indicates that number of comorbidities equal to or greater than 1, has risk ratio of 2.3 for in-hospital mortality compared to no comorbidities. [19]

Chatterton suggests that the greater the number of comorbidities, the greater the risk of in-hospital mortality. [20]

Association between surgical delay and mortality is disputed. Several studies establish a relationship between a surgical delay of more than 2 days and mortality. [20, 22]

Chatterton indicates greater in-hospital mortality in patients with delay of more than 2 days, although without statistical significance. [20] Belmont on the other hand, does not find association, although there are more complications in patients with greater delay. [21]

Factors which are associated with 30-day mortality can be divided into modifiable and non-modifiable, the first being patient-related: age, sex, comorbidities and type of fracture, while modifiable are correlated with treatment, such as the type of surgery, anaesthesia and surgical delay. [23-25] However, preoperative treatment of certain comorbidities, such as active, high risk cardiac conditions (unstable coronary syndrome, decompensated heart failure) may significantly improve outcomes.[26]

In our study we did not find any significant difference between sexes regarding timing of surgery or in-hospital mortality. Mortality was significantly higher for the age group of 76-85 years, but was lower for patients older than 85. In addition, patients aged 76-85 years had highest mortality when operated in the first 24 hours. Considering the fact this age group is more likely to have comorbidities compared to younger patients, they would probably benefit from medical interventions prior to surgery. Overall mortality was lowest when patients were operated in the 24-72 - hour window, suggesting that a certain subset of patients does not benefit from early operation and larger delays increase risk of complications. Further analysis of comorbidities and reasons for death is needed in order to clarify these issues. In our study we were not able to analyse comorbidities or ASA status, which could give additional insight in differences in mortality for age groups and different surgery timings.

Decreased hospital-wide nurse staffing l evels are associated with increased in-hospital mortality. [27]

Browne suggests that hospital volume is not correlated with decreased mortality in the treatment of these injuries. [28] Various scales that represent the hospital quality are reported, but more studies are needed to clarify the link between the hospital quality and hip fracture mortality.

Conclusion

Surgical delay beyond 48 hours may have direct impact on the mortality of hip fracture patients. Confounding factors such as age, sex, comorbidities, severity of illness and type of the treatment determine the outcome. Patients with hip fractures, without comorbid conditions that can be efficiently improved prior to surgery, should be operated on as soon as possible after admission to hospital. However, medically decompensated patients that can benefit from quick medical optimization should be stabilized prior to surgery.

Competing interests - The authors declare that they have no known competing financial i nterests o r personal relationships that could have appeared to influence the work reported in this paper.
The study has not been presented elsewhere!

Author Contributions
DP. conceived and designed the analysis, collected the data, treatment of all the patients in the article, observed the patients, IH, AA, RD, contributed the data and analyses tools, performed the analysis and Interpretations, literature search, wrote the paper, other contributions (take the pictures), supervisor of the project, critical reviewer. TT, KGj, SK TD, KU, SS conceived and designed the analysis, collected the data, treatment of all the patients in the article, wrote the paper, other contributions, critical reviewer, literature search.

Ethics approval and consent to participate – all the patients/ their parents have signed informed consent. Clinical trial registration information provided – not applicable. We confirm that the manuscript, including related data, figures and tables has not been previously published and that the manuscript is not under consideration elsewhere.

References

1. Gullberg B, Johnell O, Kanis JA. World-wide projections for hip fracture. *Osteoporos Int*. 1997;7(5):407-413. doi:10.1007/PL00004148
2. Sernbo I, Johnell O. Consequences of a hip fracture: A prospective study over 1 year. *Osteoporos Int*. 1993;3(3):148-153. doi:10.1007/BF01623276
3. Jiang HX, Majumdar SR, Dick DA, et al. 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. doi:10.1359/JBMR.041133
4. Moja L, Piatti A, Pecoraro V, et al. Timing Matters in Hip Fracture Surgery: Patients Operated within 48 Hours Have Better Outcomes. A Meta-Analysis and Meta-Regression of over 190,000 Patients. *PLoS One*. 2012;7(10). doi:10.1371/journal.pone.0046175
5. Bottle A, Aylin P. Mortality associated with delay in operation after hip fracture: Observational study. *Br Med J*. 2006;332(7547):947-950. doi:10.1136/bmj.38790.468519.55
6. Novack V, Jotkowitz A, Etzion O, Porath A. Does delay in surgery after hip fracture lead to worse outcomes? A multicenter survey. *Int J Qual Heal Care*. 2007;19(3):170-176. doi:10.1093/intqhc/mzm003
7. Daugaard CL, Jorgensen HL, Riis T, Lauritzen JB, Duus BR, Van Der Mark S. Is mortality after hip fracture associated with surgical delay or admission during weekends and public holidays? A retrospective study of 38,020 patients. *Acta Orthop*. 2012;83(6):609-613. doi:10.3109/17453674.2012.747926
8. Bergeron E, Lavoie A, Moore L, et al. Is the delay to surgery for isolated hip fracture predictive of outcome in efficient systems? *J Trauma - Inj Infect Crit Care*. 2006;60(4):753-757. doi:10.1097/01.ta.0000214649.53190.2a
9. Grimes JP, Gregory PM, Noveck H, Butler MS, Carson JL. The effects of time-to-surgery on mortality and morbidity in patients following hip fracture. *Am J Med*. 2002;112(9):702-709. doi:10.1016/S0002-9343(02)01119-1
10. Alzahrani K, Gandhi R, Davis A, Mahomed N. In-hospital mortality following hip fracture care in southern Ontario. *Can J Surg*. 2010;53(5):294-298. https://pubmed.ncbi.nlm.nih.gov/20858372/. Accessed May 17, 2021.
11. Weller I, Wai EK, Jaglal S, Kreder HJ. The effect of hospital type and surgical delay on mortality after surgery for hip fracture. *J Bone Jt Surg - Ser B*. 2005;87(3):361-366. doi:10.1302/0301-620X.87B3.15300
12. *INDICADORES DE CALIDAD PARA HOSPITALES DEL SISTEMA NACIONAL DE SALUD*.; 2012. www.calidadasistencial.es. Accessed May 17, 2021.
13. *AHRQ Quality Indicators Guide to Inpatient Quality Indicators: Quality of Care in Hospitals-Volume, Mortality, and Utilization*.; 2002. http://www.qualityindicators.ahrq.gov. Accessed May 17, 2021.
14. Cornwall R, Gilbert MS, Koval KJ, Strauss E, Siu AL. Functional outcomes and mortality vary among different types of hip fractures: A function of patient characteristics. In: *Clinical Orthopaedics and Related Research*. Lippincott Williams and Wilkins; 2004:64-71. doi:10.1097/01.blo.0000132406.37763.b3

15. Richmond J, Aharonoff GB, Zuckerman JD, Koval KJ. Morality risk after hip fracture. *J Orthop Trauma*. 2003;17(1):53-56. doi:10.1097/00005131-200301000-00008

16. Giversen IM. Time trends of mortality after first hip fractures. *Osteoporos Int*. 2007;18(6):721-732. doi:10.1007/s00198-006-0300-1

17. Meyer HE, Tverdal A, Falch JA, Pedersen JI. Factors associated with mortality after hip fracture. *Osteoporos Int*. 2000;11(3):228-232. doi:10.1007/s001980050285

18. Diamantopoulos AP, Hoff M, Hochberg M, Haugeberg G. Predictors of short- and long-term mortality in males and females with hip fracture - a prospective observational cohort study. *PLoS One*. 2013;8(10). doi:10.1371/journal.pone.0078169

19. Frost SA, Nguyen ND, Black DA, Eisman JA, Nguyen T V. Risk factors for in-hospital post-hip fracture mortality. *Bone*. 2011;49(3):553-558. doi:10.1016/j.bone.2011.06.002

20. Chatterton BD, Moores TS, Ahmad S, Cattell A, Roberts PJ. Cause of death and factors associated with early in-hospital mortality after hip fracture. *Bone Jt J*. 2015;97-B(2):246-251. doi:10.1302/0301-620X.97B2.35248

21. Belmont PJ, Garcia EJ, Romano D, Bader JO, Nelson KJ, Schoenfeld AJ. Risk factors for complications and in-hospital mortality following hip fractures: A study using the National Trauma Data Bank. *Arch Orthop Trauma Surg*. 2014;134(5):597-604. doi:10.1007/s00402-014-1959-y

22. Trpeski S, Kaftandziev I, Kjaev A. The effects of time-to-surgery on mortality in elderly patients following hip fractures. *Pril (Makedonska Akad na Nauk i Umet Oddelenie za Med Nauk*. 2013;34(2):115-121. http://www.ncbi.nlm.nih.gov/pubmed/24280786.

23. Panula J, Pihlajamäki H, Mattila VM, et al. Mortality and cause of death in hip fracture patients aged 65 or older - A population-based study. *BMC Musculoskelet Disord*. 2011;12. doi:10.1186/1471-2474-12-105

24. Smith T, Pelpola K, Ball M, Ong A, Myint PK. Pre-operative indicators for mortality following hip fracture surgery: A systematic review and meta-analysis. *Age Ageing*. 2014;43(4):464-471. doi:10.1093/ageing/afu065

25. Hu F, Jiang C, Shen J, Tang P, Wang Y. Preoperative predictors for mortality following hip fracture surgery: A systematic review and meta-analysis. *Injury*. 2012;43(6):676-685. doi:10.1016/j.injury.2011.05.017

26. Fleisher LA, Beckman JA, Brown KA, et al. ACC/AHA 2007 Guidelines on Perioperative Cardiovascular Evaluation and Care for Noncardiac Surgery: Executive Summary: A Report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines (Writing Committee to Revise the 2002 Guidelines on Perioperative Cardiovascular Evaluation for Noncardiac Surgery).(...). *J Am Coll Cardiol*. 2007;50(17):1707-1732. doi:10.1016/j.jacc.2007.09.001

27. Schilling P, Goulet JA, Dougherty PJ. Do higher hospital-wide nurse staffing levels reduce in-hospital mortality in elderly patients with hip fractures: A pilot study. *Clin Orthop Relat Res*. 2011;469(10):2932-2940. doi:10.1007/s11999-011-1917-8

28. Browne JA, Pietrobon R, Olson SA. Hip fracture outcomes: Does surgeon or hospital volume really matter? *J Trauma - Inj Infect Crit Care*. 2009;66(3):809-814. doi:10.1097/TA.0b013e31816166bb