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In-hospital mortality analysis in patients with proximal femoral fracture operatively treated by hip arthroplasty procedure

Analiza bolničke smrtnosti kod bolesnika sa prelomom proksimalnog dela femura operativno lečenog metodama artroplastike kuka

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Abstract

Background/Aim. Hip fracture remains the leading cause of death in trauma among elderly population and is a great burden to national health services. In-patient death analysis is important to evaluate risk factors, make appropriate selection and perform adequate treatment of infections for patients to be operated. The aim of this study was to analyze in-hospital mortality in proximal femoral fracture patients operatively treated with hip arthroplasty procedure. **Methods.** We followed 622 consecutive patients, and collected data about age, gender, the presence of infection preoperatively and postoperatively, American Society of Anesthesiologists (ASA) score, diabetes mellitus and the type of surgical procedure. Postoperative infections included pneumonia, urinary tract infections, surgical site infections and sepsis. **Results.** We found a statistically significant influence of preoperative and postoperative infection presence for in-patient mortality with relative risk for lethal outcome of 4.53 (95% CI: 1.44–14.22) for patients with preoperative infection and 7.5 (95% CI: 1.90–29.48) for patients with postoperative infection. We did not confirm a statistically significant influence of age, gender, ASA score, diabetes mellitus or the type of surgical procedure for increased mortality rate. **Conclusion.** Adequate preoperative selection, risk evaluation and adequate treatment of infections are of the key importance for lowering the risk of death in patients operated due to proximal femoral fracture and treated by hip arthroplasty procedures. Special attention is to be paid for the presence of preoperative and postoperative infections in patients operatively treated due to the risk for increased in-hospital mortality.

Key words:
femoral fractures; aged; arthroplasty; cross infection; mortality; risk factors.

Apstrakt

Uvod/Cilj. Fraktura proksimalnog dela femura je vodeći uzrok smrti od povreda kod starijih bolesnika, kao i veliko opterećenje za nacionalne zdravstvene službe. Analiza bolničke smrtnosti je važna da bi se ustanovili faktori rizika, napravila adekvatna selekcija bolesnika, i sprovelo adekvatno lečenje pre- i postoperativnih infekcija. Cilj ove studije bio je analiza bolničke smrtnosti kod bolesnika operativno lečenih artroplastikom kuka zbog preloma proksimalnog femura. **Metode.** Pratili smo 622 uzastopna bolesnika sa prelomom proksimalnog dela femura i analizirali starost, pol, prisustvo preoperativne i postoperativne infekcije, skor Američkog udruženja anesteziologa (ASA), prisustvu dijabetes melitusa i vrstu operativne metode. Postoperativne infekcije uključivale su pneumoniju, urinarnu infekciju, infekciju operativnog mesta (IOM) i sepsu. **Rezultati.** Našli smo statistički značajan uticaj preoperativnog i postoperativnog postojanja infekcije na hospitalnu smrtnost sa relativnim rizikom od smrtnog ishoda 4,53 (95% CI: 1,44–14,22) kod bolesnika sa preoperativnom infekcijom i 7,5 (95% CI: 1,90–29,48) kod bolesnika sa postoperativnom infekcijom. Nije registrovan statistički značajan uticaj starosti, pola, ASA skora, dijabetesa melitusa ili vrste operativne metode na povećanje mortaliteta u toku hospitalizacije. **Zaključak.** Adekvatna preoperativna selekcija, procena rizika i preduzimanje adekvatnih terapijskih mera u cilju lečenja infekcija od ključnog su značaja za smanjenje rizika smrtnog ishoda u toku hospitalizacije kod bolesnika operisanih zbog preloma proksimalnog femura metodama artroplastike kuka. Posebnu pažnju potrebno je obratiti na prisustvo preoperativne i postoperativne infekcije kod operisanih zbog povećanog rizika od smrtnog ishoda u toku hospitalizacije.

Ključne reči:
femur, prelomi; stare osobe; artroplastika; infekcija, intrahospitalna; mortalitet; faktori rizika.

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Introduction

Hip is defined as the region of proximal femur from articular cartilage proximal, to the extent of 5 cm below the lesser trochanter. Hip fracture remains the leading cause of death in trauma among elderly population and is a great burden to national health services. There is about 300 000 hip fractures in the USA yearly [1]. The fact that the population mostly exposed to this injury is elderly, suggests that comorbidities and complications are common. In-patient death rate varies from 2.3% [2] to the range from 5% to even 50% according to various studies [3]. In-patient death analysis is important to evaluate risk factors, make appropriate selection and perform adequate treatment of infections for patients to be operated on.

Methods

The population of 622 consecutive patients, with proximal femoral fracture (PFF), treated with hip arthroplasty procedure were included in this study. Hemiarthroplasty was performed in 393 patients (group 1) and total hip arthroplasty in 229 cases (group 2). Data was collected about age, gender, American Society of Anesthesiologists (ASA) score, the presence of diabetes mellitus (DM), the presence of infection preoperatively and postoperatively and the type of surgical procedure. Postoperative infections included pneumonia, urinary tract infections, surgical site infections (SSI) and sepsis. Regarding postoperative infection we used the criteria established by the USA Center for Disease Control and Prevention [4].

This cohort prospective study was designed to analyze risk factors for in-hospital death for the study population.

Complete statistical analysis of data was done with the statistical software package, SPSS Statistics 17 (Chicago, IL, USA). Most of the variables were presented as the frequency of certain categories, while statistical significance of differences was tested with the χ^2 test.

In case of continuous data, the variables were presented as the mean value ± standard deviation (SD) and the statistical significance of differences was tested by *t*-test.

Calculations of odds ratios and their 95% confidence intervals (CI) were done to determine the association between risk factors and outcomes (survival). For that purpose, the most promising independent variables as a single risk factor were incorporated into binary logistic regression analyses. All the analyses were estimated at $p < 0.05$ level of statistical significance.

Results

During the period January 1, 2006 till December 31, 2010 a total number of 622 patients were operatively treated by hip arthroplasty procedure due to the PFF. The overall death rate was 27 patients that was 4.3% of the total study population (Table1).

Hemiarthroplasty was performed in 393 and total hip arthroplasty in 229 cases. A total of 16 (4.1%) patients in the hemiarthroplasty group and 11 (4.8%) in the group treated by total arthroplasty died. There was no significant statistical difference in mortality rate between the groups ($p = 0.819$) (Table1).

Table 1
Most important basic characteristics of the patients

Parameters	Value
Age of patients (years), $\bar{x} \pm SD$	75.79 ± 10.36
Sex, n (%)	
male	202 (32.5)
female	420 (67.5)
Total	622 (100.0)
Type of arthroplasty (%)	
total	229 (36.8)
partial	393 (63.2)
Diabetes, n (%)	
yes	107 (17.2)
no	515 (82.8)
BMI (kg/m^2), $\bar{x} \pm SD$	25.22 ± 3.75
ASA score, $\bar{x} \pm SD$	2.60 ± 0.62
Clinical outcome, n (%)	
non-survivors	27 (4.3)
survivors	595 (95.7)
Total	622 (100.0)

BMI – body mass index; ASA – American Sociaty of Anesthesiologists.

The patients were grouped into 3 categories according to age: up to 65 (93 patients), from 65.1 to 75 years (142 patients) and older than 75 (387 patients). A total number of 4 (4.3%) patients in the category 1, 4 (2.8%) in the category 2 and 19 (4.9%) in the category 3 died. There was no significant statistical difference in the mortality among the categories ($p = 0.578$) (Tables 1 and 2).

According to the ASA score (physical status classification system) the patients were classified as ASA-1 (11 patients had zero mortality), in ASA-2 group (n = 265 patients) 9 (3.4%) died, in ASA-3 group (n = 310 patients) 14 (4.5%) died and in ASA-4 group (n = 36 patients) 4 (11.1%) patients died.

Table 2
Distribution of in-hospital deaths according to the age group

Age category (years)	Outcome, n (%)		Total
	non-survivors	survivors	
≤ 65	4 (4.3)	89 (95.7)	93 (100.0)
66–75	4 (2.8)	138 (97.2)	142 (100.0)
> 75	19 (4.9)	368 (95.1)	387 (100.0)
Total	27 (4.3)	595 (95.7)	622 (100.0)
χ^2 test	$\chi^2 = 1.09$; $p = 0.578$		

Comparing mortality for all ASA classes there was no significant difference in the mortality ($p = 0.167$) (Tables 1 and 3).

Considering the patients with diabetes mellitus there were 107 patients out of which 7 (6.5%) died, that was without statistical significance ($p = 0.33$) (Table1).

The presence of preoperative and postoperative infection showed a statistically important influence on in-patient mortality ($p = 0.02$ and $p = 0.007$ respectively). Regarding preoperative infection 4 (15.4%) out of 26 patients died (Table 4). Regarding postoperative infection 3 (25%) out of 12 patients died (Table 5). By logistic regression we calculated the relative risk of 4.53 for patients with preoperative infection for lethal outcome and 7.5 for patients with postoperative infection (Tables 2, 4 and 6).

Discussion

Age is a very important risk factor concerning orthopedic surgical treatment of PFF by hip arthroplasties and final outcome. Generaly, elderly population sustains these kinds of injury mostly, according to available data. Older patients with PFF operatively treated by orthopaedic surgery methods, commonly have comorbidities that can increase the risk of postoperative complications, including mortality [1, 2, 5]. The influence of age on in-hospital mortality of these patients varies from study to study. In our study, concerning the age we confirmed no statistical difference. Our results are similar to some other ones [6], but opposite to findings in some other studies [7, 8].

In Italian study, there is no evidence of significant reduction in mortality rates after hip fractures in elderly, in the last 20 years [6]. The question is if there is any possibility to reduce mortality after PFF and optimize the outcome of operative treatment of these injuries. Pioli et al. [6] have found an unexpected results in their study with no statisticaly significant correlation between age and mortality after hip fractures. The possible explanation for this is exclusion of patients under 70 and only 1-year follow-up period. There is the possibility that rate of mortality after hip fractures may not be influenced only by age but also by increased degree of frailty in this population of patients [6]. According to Diaman-

Table 3

Distribution of in-hospital deaths according to the American Society of Anesthesiologists (ASA) score

ASA score	Outcome, n (%)		Total
	non-survivors	survivors	
1	0 (0.0)	11 (100.0)	11 (100.0)
2	9 (3.4)	256 (96.6)	265 (100.0)
3	14 (4.5)	296 (95.5)	310 (100.0)
4	4 (11.1)	32 (88.9)	36 (100.0)
Total	27 (4.3)	595 (95.7)	622 (100.0)
χ^2 test	$\chi^2 = 5.06$ $p = 0.167$		

Table 4

Distribution of in-hospital deaths according to preoperative infections

Preoperative infections	Outcome, n (%)		Total
	non-survivors	survivors	
Yes	4 (15.4)	22 (84.6)	26 (100.0)
No	23 (3.9)	573 (96.1)	596 (100.0)
Total	27 (4.3)	595 (95.7)	622 (100.0)
χ^2 test	$\chi^2 = 5.43$ $p = 0.02$		

Table 5

Distribution of in-hospital deaths according to postoperative infections

Postoperative infections	Outcome, n (%)		Total
	non-survivors	survivors	
Yes	3 (25.0)	9 (75.0)	12 (100.0)
No	24 (4.3)	540 (95.7)	564 (100.0)
Total	27 (4.7)	549 (95.3)	576 (100.0)
χ^2 test	$\chi^2 = 7.15$ $p = 0.007$		

Table 6

Unadjusted risk factors (OR) that predict lethal outcome

Infections	Odds ratio (OR)	95% confidence interval		Probability
		lower	upper	
Preoperative				
yes	4.53	1.44	14.22	$p = 0.01$
no	1			$p = 1.00$
Postoperative				
yes	7.50	1.90	29.48	$p = 0.004$
no	1			$p = 1.00$

topoulos et al. [7] older age is an independent risk factor of increasing mortality after hip fracture in males and females (OR – 5.74 : 6.95, respectively).

Clague et al. [8] in their research found older age as one of the factors predicting in-hospital mortality in patients sustained hip fractures. According to the authors, increased age also has a significant effect on increasing the length of total hospital stay.

Relatively low mortality was found in our study among the oldest patient category over the age of 75 (4.9%), comparing the youngest patient category with the age ≤ 65 (4.3%). Similar mortality between the youngest and the oldest categories suggests that fracture itself has the risk of lethal outcome [9].

Although increased ASA score among elderly should suggest greater risk [10] that was not confirmed in our study. Kapicioglu et al. [10] researched risk factors for postoperative complications and mortality in extremely old patients (> 90 years) following hip fracture surgery. The authors have found significantly high incidence of postoperative complications and mortality in the group with ASA score 3 comparing to ASA score 1 ($p = 0.041$; $p = 0.022$). There was no significant correlation between gender and mortality ($p = 0.11$). Similar results can be found in a study by Vidan et al. [11]. The influence of high ASA score values on increasing in-hospital mortality explained that medical comorbidities were associated with surgical delay in patients with hip fracture. "Late surgery" in those cases is an important cause of increased in-hospital mortality ($p = 0.002$).

Regarding the ASA score most patients in our study were within the ASA 3 group (62%) but the mortality was 4.5% that is lower than in the study of Giversen [12]. The reason for lower mortality is probably due to the fact that we counted only in-patient mortality and that the study took into consideration in-patient mortality within 30 days. We find the ASA score as general, not precisely defining the nature of comorbidities [13]. Our findings of the similar mortality between the genders differs from those in some other studies [12, 14, 15] in which increased mortality was found with male predomination. Kapicioglu et al. [10] showed no difference in mortality rates between males and females ($p = 0.11$), similarly to our results. According to a research by Dorotka et al. [16] diabetic patients belong to the group of patients with higher risk of mortality and morbidity, following operative treatment of hip fractures. Medical condition in these patients can be optimized through adequate preoperative and postoperative measures under control of endocrinologist. Considering our results, we confirmed no significant correlation between DM and a higher mortality incidence.

The overall in-hospital mortality in our study (4.3%) is within the range of many studies and is closer to the lower boundaries [17]. Adequate preoperative evaluation, optimizing health status and active surveillance are of the key importance to survival rate improvement [4]. It means that predominantly cardiological and anesthesiological adequate preoperative estimation was effective in lowering the mortality risk. Preoperative and postoperative infection was the key risk factor in our study. Other papers also showed higher mortality rate due to postoperative chest infection in limb and hip trauma. Postoperative infection is a significant contributor to mortality [18–20].

Conclusion

Adequate preoperative selection, risk evaluation and adequate treatment of infections are of the key importance for lowering the risk of death for those operated on due to proximal femoral fracture treated by hip arthroplasty procedures. Special attention should be paid to the presence of preoperative and postoperative infections in patients operatively treated due to the risk for increased in-hospital mortality.

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