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ORIGINAL ARTICLE / ОРИГИНАЛНИ РАД

Influence of comorbidity on postoperative course and mortality in patients with hip fracture

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SUMMARY

Introduction/Objective Epidemiological research shows that we have a dramatic increase in the number of people with hip fractures, especially those over 65 years of age.
The objectives of this study are to assess the association between preoperative comorbidity and the risk of postoperative complications and mortality and postoperative worsening of comorbid conditions and their relationship to mortality within one year of hip fracture surgery.

Methods In this retrospective study, from January 2018 until January 2020, 64 patients with hip fractures were operated on at the Department of Orthopedic Surgery in Kosovska Mitrovica. We monitored the number of comorbidities and their significance on the preoperative risk and the course of concomitant diseases in the postoperative period and one-year mortality after surgery, in patients with hip fractures.

Results We collected data on patients from the moment of admission to discharge from the hospital accompanied by medical histories, and after discharge after follow-up examinations, six months and one year from discharge. Of the total number of subjects, 23 (35.9%) had one or two comorbidities, most often of cardiac and neurological nature, in 25 patients (39.1%) we had three concomitant diseases, and in 11 (17.2%) four and more comorbidities. The mean age of the patients was 72.51 years (69–92 years).

Conclusion Approximately 45–60% of men and women who suffer a hip fracture have three or more comorbid states. In older people with hip fractures, the presence of three or more comorbidities is the strongest preoperative risk factor.

Keywords: hip fracture; comorbidity; elderly; mortality

INTRODUCTION

Hip fractures present one of the biggest medical, social, and financial problems in the world, especially in the developed countries of the West. About 20% of all hospitalized orthopedic-traumatological patients are patients with hip fractures [1, 2, 3]. The number of hip fractures increases exponentially with age [2, 4]. It is a well-known fact that hip fractures, as a rule, lead to the worsening of existing chronic diseases from which the injured suffer, and which require the full engagement of doctors of other specialties. As one of the complications of osteoporosis, both due to its high incidence and due to the associated morbidity and mortality, hip fractures represent a significant problem in health, social, economic, and family terms [1, 5]. The basic precondition for the elderly to achieve "optimal physiological condition" to be able to perform the planned operation is the cooperative teamwork of orthopedists, anesthesiologists, and internists [3, 6]. All hip fractures are divided into: intracapsular (femoral neck fractures) and extracapsular (intertrochanteric and subtrochanteric fractures). The method of choice for patients with hip fractures is surgical treatment. In intra-articular fractures, hemiarthroplasty or total arthroplasty is used, and in extracapsular fractures, open repositioning and internal fixation of fractures are used [3, 4, 7]. Non-operative treatment is applied only in patients in whom the general condition is so bad that the risk of surgery is greater than the advantage of early fixation. Hip fractures have been considered one of the leading causes of death in the elderly population [1, 4]. McBride et al. [8] have shown that the state of mobility of the elderly and a small number of concomitant chronic diseases are very reliable prognostic indicators of the outcome of treatment of patients with hip fractures, while the type of fracture, type of implant, and age are not. In their study, Sterling et al. [6] show that survival in patients with chronic diseases is very low. He proved that the length of postoperative survival of patients after hip surgery is related to their activities in everyday life before fracture [5, 6]. Psychiatric diseases/delirium, depression and hip fractures are very common in elderly patients, so the outcome has a very poor prognosis [5, 9]. This study aimed to show the relationship between the health condition that the patient had before the hip fracture and the risk of postoperative complications and possibly mortality within one year of surgery. The impact of comorbidity and

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poor physical status on the development of postoperative complications and on mortality leads to the idea that the health condition reported by the patient at admission may be critical to predict the postoperative course. We were particularly interested in assessing the general status of patients with hip fractures immediately after injury, and monitoring comorbidities one year after surgery.

METHODS

The retrospective study included operated patients with hip fractures. The inclusion criteria were age over 65 years, and fracture of the proximal end of the femur. Patients with simultaneous bilateral fractures, periprosthetic and pathological fractures, patients younger than 65 years, and those who were not treated with operative methods were not included in the study. We started the preoperative preparation at the admission department, when, in addition to routine diagnostic procedures, we placed great emphasis on a well-taken anamnesis, whether the patient was physically active before the fracture and whether they had other concomitant diseases and which. A plan of consultative examinations was made, primarily for internist-cardiologists and anesthesiologists. We used a questionnaire that contained general data about the patient: sex, age, previous illnesses, and operations. The second part of the questionnaire referred to the level of physical activity before the fracture (IV levels), the mechanism of injury, the type of fracture, the existence of associated injuries, data on comorbidities. Appropriate therapy was administered at the ward. We performed complete medical, sanitary and psychological preparation for each patient. Each patient was informed of the treatment plan. In our paper, we used the Carlson comorbidity index (CCI). Depending on the type of variables and the normality of the distribution, the data description is shown as n (%), arithmetic mean ± standard deviation, or median (range, min–max). Among the methods for testing statistical hypotheses, the following were used: t-test, Mann–Whitney test, χ^2 test, and Fisher's test of exact probability. Logistic regression was used to analyze the relationship between binary outcomes and potential predictors. Statistical hypotheses were tested at the level of statistical significance (alpha level) of 0.05. All data were processed in the IBM SPSS Statistics 22 (IBM Corp., SPSS Statistics for Windows, Armonk, NY, USA) software package.

Committee for Ethical Topics of Health Center in Kosovska Mitrovica has approved the research before the beginning of this study.

RESULTS

The examined sample represents elderly patients who suffered a hip fracture. The study included 64 patients: 26 males (40.6%) and 38 females (59.4%). The youngest patient was 69 years old and the oldest is 92. There were 29 patients (45%) over the age of 80. The average age was 72.5 years. Many world studies classify sex as a very important factor influencing mortality after hip fractures.

In our study, long-term mortality was more common in females (70.8%) compared to males 29.2% (Table 1). Older age is one of the main risk factors for mortality in patients with hip fractures. People over the age of 85 have a high absolute mortality rate, especially when it comes to short-term mortality. The reasons are biological in nature, such as age, and certainly a higher number of comorbid conditions in the elderly. It has been proven that extracapsular fractures occur more often in the elderly than femoral neck fractures, but also that the median survival time was higher by about 10 months in patients with intertrochanteric fractures than for patients with intracapsular hip fractures.

Table 1. Distribution of hip fractures in relation to sex

Comorbidity			Yes	No	Total
Sex	male	Count	19	7	26
		% Comorbidity	47.5	29.2	40.6
	female	Count	21	17	38
		% Comorbidity	52.5	70.8	59.4
Total		Count	40	24	64
		% Comorbidity	100	100	100

In our paper, age, the type of fracture, as well as the mechanism of injury, were not statistically significant (Table 2). The strongest preoperative risk factor for the development of postoperative complications and mortality is the presence of comorbidities in persons with hip fractures. Less than 25% of elderly patients do not have a chronic disease (high blood pressure, anemia, ischemic heart disease, chronic obstructive pulmonary disease, metabolic diseases – diabetes and thyroid disease, dementia). Most patients have several concomitant diseases.

In our study, cardiovascular diseases were the most common comorbidities in 39 patients (60.9%), followed by anemia in 36 patients (56.3%), and respiratory diseases in 32.8% of subjects. However, we did not obtain statistical significance for any single disease (Table 3). Out of the total number, 42 patients had one or two so-called moderate concomitant diseases, while 22 patients had more severe comorbidities. In 11 subjects we had four or more

Table 2. Age in patients with hip fracture

/	Levene's Test for Equality of Variances		t-test for Equality of Means						
	F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
								Lower	Upper
Equal variances assumed	0.071	0.791	-2.065	62	0.043	-2.600	1.259	-5.117	-0.083
Equal variances not assumed	/	/	-2.040	46.765	0.047	-2.600	1.274	-5.164	-0.036

F – test statistics for ANOVA; Sig. – p-value in output SPSS Statistics; t – test statistic for t-test; df – number of free degrees

Table 3. Prevalence of individual comorbidities in patients with hip fracture

Comorbidity n (%)	Total	Mortality	Living	p
Anemia	36 (56.3)	19 (79.2)	17 (42.5)	0.004
Cardiovascular disease	39 (60.9)	17 (70.8)	22 (55)	0.209
Respiratory disease	21 (32.8)	11 (45.8)	10 (25)	0.086
Neurological	20 (31.3)	7 (29.2)	13 (32.5)	0.781
Psychiatric	16 (25)	8 (33.3)	8 (20)	0.233
Endocrine system	18 (28.1)	8 (33.3)	10 (25)	0.473
Gastrointestinal tract	4 (6.3)	0 (0)	4 (10)	0.288
Urinary tract	9 (14.1)	3 (12.5)	6 (15)	1.000

comorbidities. Four patients with severe comorbidities who also developed surgical complications (two deep infections and one cut-out complication) died at the hospital. During the first postoperative year, another 16 patients with severe comorbidities and four patients with moderate comorbidities died. Comorbidity was monitored based on the CCI. We opted for CCI, primarily because CCI in a large number of studies has produced a predicted probability of mortality with a small degree of variation (Table 4).

Table 4. Presence of multiple comorbidities in subjects with hip fracture

Comorbidity			Mortality.ALL		Total
			No	Yes	
Number of comorbidities	0	Count	5	0	5
		% Within Mortality.ALL	12.5	0	7.8
	1	Count	2	0	2
		% Within Mortality.ALL	5	0	3.1
	2	Count	16	5	21
		% Within Mortality.ALL	40	20.8	32.8
	3	Count	12	13	25
		% Within Mortality.ALL	30	54.2	39.1
	4	Count	5	6	11
		% Within Mortality.ALL	12.5	25	17.2
Total		Count	40	24	64
		% Within Mortality.ALL	100%	100%	100%

Table 5. Overview of the significance of worsening of concomitant diseases on one-year mortality after surgical treatment of hip fractures

Independent variable	B	p	OR	95% confidence interval	
				Lower limit	Upper limit
Age	0.013	0.870	1.01	0.86	1.19
Existence of surgical complications during the operation	1.840	0.096	6.30	0.72	55.09
Worsening of comorbidity after surgery	4.272	**< 0.001**	**71.67**	7.82	657.06

B – gradient coefficient in the regression mode; p – value; OR – odds ratio

About 15–30% of bedridden patients with a hip fracture had serious complications during the acute phase of the fracture. The main medical complications of these fractures are pain, anemia, respiratory and cardiovascular complications (pneumonia, respiratory infections, myocardial infarction, stroke), urinary tract infections, delirium, decubitus ulcers, and therefore – from the moment of hospitalization of these patients should begin thromboembolic prophylaxis with complete diagnosis by treating different comorbidities. In the multivariant logistic regression model, a statistically significant predictor of death within one year of surgery was worsening of comorbidity after surgery (B = 4.272; p < 0.001), whose odds ratio was OR = 71.67. This shows that subjects with worsening comorbidities after surgery have over 70 times a higher chance of death, with control of all other factors in the model (Table 5).

DISCUSSION

A large number of papers have been published in the world literature which try to find the factors that influence the prognosis of hip fractures, both in the physical recovery of the patient and in their survival [1, 3, 7, 9]. Knowing the predictors of mortality is very useful because of the treatment plan for each patient individually, and in that way, the risk of death would be reduced [4, 6, 8]. Factors affecting mortality after hip fracture are: age, sex, poor mobility of the patient before fracture, poor mental status, dementia or cognitive impairment, diabetes, heart disease, cancer, comorbidities, higher ASA score, type of fracture, operative delay [5, 10]. The mortality rate during a hospital stay (intrahospital mortality) for patients with hip fracture in persons older than 70 years is 2–20% [7, 10, 11]. It usually ranges 5–7%, although in some studies it is significantly higher and is most often associated with the effects of acute trauma on the patient, length of hospital stay in the postoperative period, worsening of existing comorbidities, and possible surgical postoperative complications [4, 5, 11]. In our study, intrahospital-short-term mortality occurred in four patients and amounted to 6.25%. Mortality after discharge from the hospital – post-hospital mortality, can be determined at three, six, 12 months after discharge and later. The highest mortality rate is in the first three months after the fracture because patients in this period have to overcome physical and mental trauma caused by the fracture, which imposes functional and mental limitations associated with accompanying diseases that are characteristic of this life period [5, 9, 12]. Mortality in the first year after fracture is long-term mortality and it ranges around 25–30% [9, 13, 14]. However, most patients do not regain their previous functional results even after the first year of surgery and are not independent to perform basic life tasks, so they need the help of another person or require accommodation in special rehabilitation centers. It is estimated that only one-fifth of patients who walked independently before the fracture do so six months after surgery [5, 6, 15]. Age in patients with hip fractures is one of the main predictors of mortality. People with hip fractures older than 85 have an absolutely high mortality rate [4, 7, 11]. The mortality rate increases exponentially with age, while in persons under 75 it is about 7% per year, in persons over 85 it is about 33% in the first postoperative year [7, 16]. Life expectancy is estimated to be reduced by

up to seven years in people over 80 after a hip fracture. Many studies indicate that the mortality rate after hip fractures is higher in males and that hip fractures are more common in women. Men have a higher mortality rate especially when it comes to long-term mortality after five years [4, 6, 14]. This difference in sex has no specific explanation. It is considered that the causes of the sex difference are that in men we have more bad habits (alcohol consumption, smoking), and then a higher number of comorbidities compared to females of the same age [14, 17]. In our study, mortality was more common in females at 70.8% compared to males at 29.2%. Patient mobility before hip fracture (walking distance, ability to go shopping, use of walking aids) plays a very important role in predicting mortality in the first year after surgery. Research has shown that mobility in itself is a more important factor than where the fracture itself occurred (indoors or outdoors) [7, 18]. However, the problem is that to date there is no generally accepted method of assessing mobility. Vestergaard et al. [9] described a significant association between poorer mobility (inability to walk / walk only indoors) and increased risk of early mortality. The presence of preoperative comorbidities and the risk of developing postoperative complications and mortality is the strongest postoperative risk factor [4, 7, 19]. Almost three-quarters of patients with hip fractures have a disease noted on admission (heart failure, anemia, dementia, diabetes mellitus, thyroid dysfunction, etc.). In most patients, we have the presence of three or more accompanying chronic diseases, which greatly complicate the complete recovery of patients with hip fractures. The mental status of a person who has suffered a hip fracture plays a significant role in the choice of treatment method and the final result of [17, 20]. Some studies show a persistently increased mortality of [5, 21], while others suggest either no long-term increased mortality [7, 17] or only moderately increased long-term mortality compared to that expected in the elderly [3, 6, 22]. In many studies, mortality appears to be attributed to the hip fracture itself, ignoring the fact that these are patients with an already increased risk of death from other causes [18, 21, 23]. In a meta-analysis, Brauer et al. [5] show that mortality is 5–8 times higher during the first three months after a hip fracture than in patients of the same age who did not have fractures. However, in the same study, they also compared with a control group of patients who did not have hip fractures but matched by age, sex, and who were of similar functional status and with similar comorbid conditions, long-term mortality (after two years) did not show differences between groups [5]. Mortality in the first year of surgery, the so-called long-term mortality, in our study was 31.25%. Meunier et al. [11] showed that as many as 78% of hip fracture patients who underwent surgery had a higher one-year survival rate. The cause of death among conservatively treated patients is mainly attributed to worsening of existing comorbidities, which is not the case with surgically treated patients [8, 20, 24]. In the first 30 days after the fracture, the most common causes of death are related to the worsening of the existing disease, and not to the appearance of postoperative complications. There are also opinions that the rate of 30-day postoperative mortality is the basic indicator of the quality of hospital operative treatment of hip fractures [1, 3, 14]. Within three weeks after the fracture, 7.6% of these patients die, reaching 8.3% at the end of the month. During the next three months after the fracture, the highest mortality rates occur [10, 19, 25]. Precisely because in this period, patients have to overcome psychological and physical traumas caused by a fracture that imposes functional and mental limitations associated with pathologies characteristic of this life period [3, 4, 5, 22]. Six months following the fracture, we encounter medium-term mortality of patients whose general condition has worsened and, in most cases, failed to reach the functional status from before the fracture [11, 26]. There is evidence that about 20–30% of elderly patients with hip fractures die in the first year after fracture, that about 30% of these patients require placement in special rehabilitation centers, while only 30–40% of patients regain their previous functional independence [5, 7, 16]. Most patients have a residual disability that leads to loss of ability to live independently after a fracture. It is estimated that only one-fifth of patients who walked independently before the fracture do so six months after the fracture [19, 27]. About 78.4% of patients with proximal femoral fracture treated with a surgical technique had a higher one-year survival rate (72%) than those treated conservatively (50%) [19, 28]. Numerous studies show that delaying surgery after 72 hours of fracture approximately doubles the risk of death before the end of the first year after surgery and is a very important risk factor for mortality [12–16, 27]. Saul et al. [22] have described in a meta-analysis that delay in surgery was associated with a significant increase in the risk of death and recommended that most patients with hip fractures should be operated on within 48 hours of fracture. In addition, early fracture fixation and mobilization of these patients reduce the economic burden because it can reduce the total length of stay and thus the total cost [13, 18, 29].

CONCLUSION

Most studies point out that preoperative health is the most effective criterion for predicting postoperative mortality in hip fractures. It can be said that older men, with more chronic diseases (heart failure, chronic obstructive pulmonary disease, diabetes) and with a higher degree of dependence in daily activities are at the highest risk of dying during the first year of the fracture. Analysis of comorbidities and causes of death is extremely important for identifying risk factors, predicting the course of the disease, and timely prevention of complications. Usually, patients in orthopedic wards and clinics around the world receive "faster" help: preparation, anesthesia, surgery, and short-term rehabilitation. However, there are opinions that with a little additional engagement, organizing additional multidisciplinary specialist programs to support surgically treated patients with hip fractures, where the introduction of orthogeriatric specialists is possible, provides

the potential to improve functional outcomes and reduce mortality. Patients with hip fractures have a significantly higher mortality rate than the rest of the population of the same age. We are witnesses that almost one-quarter of patients with hip fractures require lifelong home care and the help of another person, and only half regain all the functions they had before the fall. In older people with a hip fracture, the presence of three or more comorbidities is the strongest factor influencing long-term comorbidity. Complications on the organs of the respiratory system and heart failure are the most common postoperative complications that lead to increased mortality. During the research, we proved that the worsening of comorbidities (primarily cardiovascular and respiratory diseases) after hip surgery increases the possibility of death in the first postoperative year by as much as 70 times. Although it is well known that mortality is increased after hip fractures, there is still controversy about the extent to which mortality can be reduced by hip fracture prevention, as those with the highest risk of hip fractures are weak and older and already have an increased risk of mortality. Lifestyle changes, calcium and vitamin D supplementation, smoking cessation, regular exercise, and reduced alcohol intake can all contribute to reducing the incidence of hip fractures. In short, although it is possible to prevent early deaths, reducing long-term mortality is likely to be very difficult. Some research shows that prevention of falls with the use of certain safety measures (e.g., protective clothing) may have limited benefits in prolonging overall life expectancy due to the multiple risks faced by weak older people.

Conflict of interest: None declared.

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Утицај коморбидитета на постоперативни ток и морталитет код пацијената са преломом кука

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САЖЕТАК

Увод/Циљ Епидемиолошка истраживања показују да имамо драматичан пораст броја особа са преломом кука, посебно оних старијих од 65 година.

Главни циљеви ове студије су да се процени повезаност преоперативног коморбидитета и ризика од постоперативних компликација и морталитета и постоперативног погоршања коморбидних стања и њиховог односа са морталитетом у току једне године од операције прелома кука.

Методе У овој ретроспективној студији, у периоду од јануара 2018. до јануара 2020. године на Одељењу ортопедске хирургије у Косовској Митровици, оперисали смо 64 пацијента са преломом кука. Код пацијената са преломом кука пратили смо број коморбидитета, њихов значај на преоперативни ризик и ток пратећих болести у постоперативном периоду и једногодишњи морталитет од операције.

Резултати Прикупили смо податке о пацијентима од момента пријема до отпуста из болнице и после контролних прегледа, шест месеци и годину дана након отпуста. Од укупног броја испитаника, 23 (35,9%) испитаника су имала један или два коморбидитета, најчешће кардиолошке и неуролошке природе, код 25 пацијената (39,1%) имали смо три пратећа обољења, а код 11 (17,2%) четири и више коморбидитета. Просечна старост пацијената била је 72,51 година (69–92 године).

Закључак Око 45–60% мушкараца и жена са преломом кука имају три или више коморбидних стања. Код старијих особа са преломом кука присуство три или више коморбидитета је најјачи преоперативни фактор ризика.

Кључне речи: прелом кука; коморбидитет; старије особе; морталитет