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FACTORS INFLUENCING THE SIX-MONTH MORTALITY RATE IN PATIENTS WITH A HIP FRACTURE

DEJAVNIKI, KI VPLIVAJO NA ŠESTMESEČNO STOPNJO UMRLJIVOSTI PRI BOLNIKIH Z ZLOMOM KOLKA

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ABSTRACT

Background. There are several potential risk factors in patients with a hip fracture for a higher rate of mortality that include: comorbid disorders, poor general health, age, male gender, poor mobility prior to injury, type of fracture, poor cognitive status, place of residence. The aim of this study was to assess the influence of potential risk factors for six-month mortality in hip fracture patients.

Methods. The study included all patients with a hip fracture older than 65 who had been admitted to the Clinic for orthopaedic surgery during one year. One hundred and ninety-two patients were included in the study.

Results. Six months after admission due to a hip fracture, 48 patients had died (6-month mortality rate was 25%). The deceased were statistically older than the patients who had survived. Univariate regression analysis indicated that six variables had a significant effect on hip fracture patients' survival: age, mobility prior to the fracture, poor cognitive status, activity of daily living, comorbidities and the place where they had fallen. Multivariate regression modelling showed that the following factors were independently associated with mortality at 6 months post fracture: poor cognitive status, poor mobility prior to the fracture, comorbid disease.

Conclusion. Poor cognitive status appeared to be the strongest mortality predictor. The employment of brief tests for cognitive status evaluation would enable orthopaedists to have good criteria for the choice of treatment for each patient screened.

Keywords:
cognitive status, comorbidity, poor cognitive status, hip fracture, six-month mortality

IZVLEČEK

Izhodišča. *Obstaja več možnih dejavnikov tveganja za višjo stopnjo umrljivosti, kot so spremljajoče bolezni, slabo splošno zdravstveno stanje, starost, moški spol, zmanjšana mobilnost pred poškodbo, tip zloma, slab kognitivni status, kraj bivanja. Cilj te študije je bil oceniti vpliv možnih dejavnikov tveganja na šestmesečno smrtnost pri bolnikih z zlomom kolka.*

Metode. *Študija je vključevala vse bolnike z zlomom kolka, starejše od 65 let, ki so bili sprejeti na Kliniko za ortopedsko kirurgijo in travmatologijo v enem letu. V raziskavo je bilo vključenih 192 bolnikov.*

Rezultati. *Šest mesecev po sprejemu zaradi zloma kolka je umrlo 48 bolnikov (šestmesečna smrtnost je bila 25%). Umrli so bili statistično starejši od bolnikov, ki so preživeli (p<0,001). Univariantna regresijska analiza je pokazala, da je šest spremenljivk pomembno vplivalo na preživetje bolnikov z zlomom kolka: starost, mobilnost pred zlomom, slab kognitivni status, vsakodnevne aktivnosti, komorbidnost in kraj, kjer so padli. Multivariantno regresijsko modeliranje je pokazalo, da so naslednji dejavniki bili neodvisno povezani z umrljivostjo šest mesecev po zlomu: slab kognitivni status, slaba mobilnost pred zlomom in komorbidne bolezni.*

Zaključek. *Zdi se, da je slabo kognitivno stanje najmočnejši napovedni dejavnik umrljivosti pri bolnikih z zlomom kolka. Uporaba kratkih testov za oceno kognitivnega stanja bi ortopedom omogočila dober kriterij za izbiro načina zdravljenja pri obravnavanem bolniku.*

Ključne besede:
kognitivni status, komorbidnost, slabo kognitivno stanje, zlom kolka, šestmesečna umrljivost

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1 INTRODUCTION

Mortality among patients with hip fractures is two or three times higher than that seen in the general population (1-3). Despite improvements in the treatment of hip fracture patients, only 60% recover all their previous functions. Between 7.9% and 26.9% die within three to six months, and 25% have levels of disability that require constant care (4-6).

A number of studies have looked at possible determinants or predictors of hip fracture mortality (7-10). Potential risk factors for a higher rate of mortality are comorbid disorders (11, 12), poor general health (11, 13), age (13-16), male gender (11, 12), poor mobility prior to the injury (13, 17), diabetes mellitus (13, 17), type of fracture (17), poor cognitive status (14) and place of residence (11). However, the exact roles and relative contributions of these factors have not been clearly determined.

It is indicated that a prognosis for survival of hip fracture patients may be given on the basis of the ability to walk and maintain an activity of daily living prior to the injury (7, 18), whereas the type of fracture, type of treatment and age of the patient seem not to be the main predictors of the ultimate outcome of treatment (8, 11). Studies have further indicated that the influence of poor cognitive status together with a chronic disease results in low survival rates (19).

The number of poor cognitive status patients with a hip fracture proportionally increases with age, and cognitive disorders are pre-morbid conditions which are very frequently associated with an unsatisfactory outcome (1, 6, 8, 14, 20-24). A patient's mental function and mobility before the injury may be considered a good indicator of their general condition and may be useful in predicting the outcome.

The aim of this paper was to assess the influence of risk factors on six-month mortality in patients with a hip fracture.

2 MATERIALS AND METHODS

This study was conducted at the University hospital, which treats all patients with hip fractures in Sumadija Region (Central Serbia). The study included all patients with a hip fracture who were aged over 65 years and who were admitted to the Trauma and Orthopaedics Clinic between March 2008 and March 2009. All study parameters were assessed and recorded during the first 24 hours after admission.

Data were collected by way of a specifically designed questionnaire which recorded patients' personal details (gender, age, occupation and place of residence), circumstances and location of the injury as well as the status of the patient prior to the injury in terms of their ability to walk, their use of assistive devices and details of all previous injuries and fractures in the past few years.

Data relating to the injury were recorded by an orthopaedist when a patient was admitted. The assessment of the patient's general health was completed by an internist at the time of the admission. According to data thus obtained, all patients were divided into three groups, namely:

1. patients with mild comorbid diseases, such as mild hypertension, diabetes mellitus with good control by oral antidiabetic medication, benign prostatic hypertrophy;
2. patients with moderate comorbid deseases, such as compensated cardiomyopathy, insulin dependent diabetes mellitus with initial vascular complication (retinopathy, nephropathy), chronic obstructive pulmonary disease, occasional supraventricular arrhythmias; and
3. patients with severe comorbid deseases, such as acute myocardial infarctus, decompensated cardiomyopathy, poorly controlled insulin-dependent diabetes mellitus with a marked angiopathy (angina pectoris, gangrene of the extremities).

Mental status was assessed using the Short Portable Mental Status Questionnaire (SPMSQ), which is a modified version of the Blessed test (25, 26) and is administered quickly and easily (1, 8). The SPMSQ is a ten-item questionnaire for the assessment of cognitive function. It was administered within 24 hours of admission by the patient's orthopaedist. Ten parameters were recorded with a score of 0, 1, 2 or 3. The level of cognitive function was categorized according to the results of SPMSQ test: >7 correct answers (cognitive function was intact); 6 or 7 correct answers (cognitive function was mildly impaired); 3-5 correct answers (cognitive function was moderately impaired); <3 correct answers (cognitive function was severely impaired). In order to compare the outcome for patients with severe cognitive dysfunction (<3) and patients with cognitively intact, mild or moderate impairment (≥3), we have used the cut-off level fewer than 3 correct answers (26). An overall score of 3 or below indicates extremely poor cognitive function and corresponds with poor cognitive status (1, 8, 21, 25). All patients with the score of 3 or below were also examined by a psychiatrist.

The ADL index was used to evaluate the functional independence or dependence of patients with regard to bathing, dressing, going to the toilet, transferring, continence, and feeding. A score of '0' indicates that the patient is "dependent in all daily activities". Score 6 means that the patient is fully capable of maintaining all the mentioned activities by him/herself (27, 28).

All the patients were treated according to conventional protocols. Comorbidities were treated prior to surgery. Patients with a fracture of the neck of the femur received a partial hip replacement by prosthesis. Patients with a trochanteric fracture were treated with reduction and internal fixation of the fracture.

Follow-up of the cohort of hip-fracture patients was performed six months after the injury to determine survival status. The Central Death Register was used for all status checks when the status could not be confirmed by means of post-mortem records.

Statistical analyses were performed using IBMSPSS-Statistics, version 19. Continous variables were presented as mean values ± standard deviation. Categorical variables were presented as frequencies of exposure as a percentage. Univariate associations between potential risk factors and an outcome were tested using the chi-square test for categorical variables, and Student's t test for independent samples for continuous variables. The link between potential risk factors and the fatal outcome were tested by linear and multiple logistic regressions, whereas the strength of the link was expressed in values of odds ratio with 95% confidence interval. All analyses were assessed at the statistical significance level $p<0.05$. Informed consent was obtained from all the patients or their careers. The research has been approved by the Ethical Committee of the Clinical Centre "Kragujevac". Ethical approval: Principles of ICH Good Clinical Practice were strictly followed for the study protocol.

3 RESULTS

There were 192 hip fracture patients in total (59 (30.7%) males and 133 (69.3%) females). The mean age was 76.9 (age range from 65 to 91). Forty-seven (35.6%) patients were older than 80 years of age. There were no deaths during surgery.

Six months after admission for a hip fracture 48 patients died, accounting for the six-month mortality rate 25%. The deceased patients were significantly older than the patients who survived ($p<0.001$) (Table 1). Fourteen of the deceased patients were male and thirty-four female. There was no statistical difference between the rate of mortality in women (25.56%) and men (23.76%) ($p=0.786$).

Forty patients had a cognitive status score of 3 or lower (20.8%). The remaining 152 patients (79.2%) had scores higher than 3. The surviving patients were significantly more likely to have a SPMSQ value above 3 ($p<0.001$). One hundred and ten patients (57.3%) had fallen at home and eighty-two (42.7%) outside their home. It was found that there was a considerably higher rate of mortality in patients who had suffered a fracture at home ($p=0.0024$). Prior to the hip fracture, 170 patients (88.5%) could walk independently, whereas twenty-two patients (11.5%) could not. Only four bedridden patients survived the period of six months after the fracture. A considerably higher rate of mortality was found in patients who could not walk independently before the injury ($p<0.001$).

Table 1. Basic characteristics of the patients with hip fractures.

Variable	Deaths (n=48)	Surviving (n=144)	Statistically significant
Age	80.23±6.60	75.43±6.00	p<0.001
Gender			
Male	14 (29.2%)	45 (31.3%)	p=0.786
Female	34 (70.8%)	99 (68.7%)	
SPMSQ			
≤3	28 (58.3%)	12 (8.3%)	p<0.001
>3	20 (41.7%)	132 (91.7%)	
Ability to walk			
tied to bed	18 (37.5%)	4 (2.8%)	
use of assistive devices	21 (43.7%)	64 (44.4%)	p<0.001
without assistive devices	9 (18.8%)	76 (52.8%)	
Place of the injury			
in the home	37 (77.1%)	73 (50.7%)	p=0.0024
out of the home	11 (22.9%)	71 (49.3%)	
ADL	2.25±0.54	2.84±0.39	p<0.001
Comorbidities			
mild diseases	15 (31.3%)	80 (55.5%)	
moderate diseases	17 (35.4%)	56 (38.9%)	p<0.001
severe diseases	16 (33.3%)	8 (5.6%)	

SPMSQ- The Short Portable Mental Status Questionnaire
ADL- Activities of Daily Living index

Out of twenty-four patients with very severe comorbidities, eight (33.3%) survived the period of six months after the fracture. A considerably lower rate of survival was found in patients with a serious comorbidity in contrast to those without one ($p<0.001$).

The analysis of the seven variables listed in Table 2, by univariate regression analysis, showed that six of them significantly influenced the survival in the patients with a hip fracture: age, mobility prior to the fracture (walking), poor cognitive status (SPMSQ), ADL, comorbidities and the place where the fall occurred.

These six variables were entered into a multivariate regression model. Poor cognitive status, mobility prior

to the fracture and comorbidities were found to be independently associated with survival at 6 months following the hip fracture (Table 2).

Table 2. The univariate and multivariate logistic regression with the outcome (deaths/ surviving) as the dependent variable.

Variable	Crude OR (95% CI)	p	Adjusted OR (95% CI)	p
Age	0.88 (0.84-0.94)	<0.001*	0.95 (0.88-1.02)	0.153
Gender	1.10 (0.54-2.26)	0.786	-	-
SPMSQ (≤3)	15.40 (6.76-35.10)	<0.001*	4.88 (1.74-13.66)	0.003*
Ability to walk	5.36 (2.93-9.82)	<0.001*	2.73 (1.32-5.66)	0.007*
Place of the injury	3.27 (1.55-6.91)	0.002*	1.14 (0.43-3.02)	0.797
ADL	1.24 (1.12-1.37)	<0.001*	1.08 (0.93-1.24)	0.315
Comorbidities	0.34 (0.21-0.56)	<0.001*	0.51 (0.26-0.98)	0.043*

SPMSQ- The Short Portable Mental Status Questionnaire
ADL- Activities of Daily Living index
OR- odds ratio
CI- confidence interval
p- statistically significant
*- significant difference (p<0.05)

4 DISCUSSION

The six-month mortality rate recorded in this study is similar to that recorded in previous studies (4-6, 20). We found that the mortality rate was considerably higher in female patients, which is in contrast to some previous work (11, 15, 19, 22, 29, 30). Nevertheless, gender did not prove to be a significant prognostic indicator of mortality in hip fracture patients, which is in line with the results of some studies (11), but in contrast to other research (6, 11, 14, 19, 22, 29). The type of a fracture suffered did not influence mortality rate in our sample.

As in previous studies (17), poor mobility levels prior to the injury had an important impact on the six-month mortality rate in patients with a hip fracture; it was independently associated with mortality. This is not surprising, as mobility prior to the injury reflects both the patients' general health as well as their cognitive status (22). Comorbidities in our research, as in many previous studies (11, 19, 22, 31), have been shown to be an important prognostic factor for mortality following a hip fracture. Whilst it is true that all methods of categorization of comorbidities have insufficiently clear criteria, subjectivity and/or insufficiently high sensitivity, certain conditions are important prognostic indicators in their own right (e.g. metastatic disease, de-compensated heart failure, chronic lung diseases and others) (19).

We could not demonstrate that the age of the patient played a significant role in the prediction of mortality after a hip fracture, which was the case with other studies (11, 32). However, we did find that a poor cognitive status was a significant predictive factor and this has also been shown in previous work (22, 29, 33). We found that older, mentally stable patients had a better ultimate outcome after a fracture, regardless of other observed factors, than younger patients with serious cognitive disorders. Younger patients with a hip fracture and severe cognitive disorders had a poor prognosis. This presents an important new perspective on the influence of age on the outcome in patients with a hip fracture. Cognitive functioning may therefore be regarded as the most sensitive indicator of physiological ageing. Based on this study, it seems reasonable to conclude that taking age as an isolated predicting factor may lead to wrong treatment and rehabilitation of elderly patients after a hip fracture.

There are inherent study limitations when looking into the relationship between existing cognitive function and mortality among hip fracture patients. These include recognising symptoms similar to poor cognitive status, keeping a detailed record of cognitive disorders in medical records, and recognising initial and mild symptoms of poor cognitive status. We were particularly interested in hip fracture patients' evaluation of cognitive status immediately after the injury, when an orthopaedist makes an important decision about the treatment (1, 21, 24, 34). Orthopaedists obtain many pieces of information about cognition through an interview (35), and special instruments for the detection of cognitive disorders are useful for, and complementary to, the general evaluation of the patient after a hip fracture. The scale for detection of poor cognitive status, according to Blessed (25), is widely used and recognised as a tool for assessing cognitive status among hip fracture patients. Nevertheless, both orthopaedists and psychiatrists have explored other instruments in an attempt to find a more suitable tool for this evaluation (1, 8, 14, 21, 22, 25).

In spite of the fact that poor cognitive functioning has already been highlighted as an important prognostic factor of mortality in hip fracture patients (1, 6, 8, 11, 21, 22, 30), it was not featured in treatment protocols for patients with a hip fracture. Poor cognitive status in

elderly hip fracture patients could be determined by an orthopaedist within the first 24 hours after admission, and then this information could be used to define the course of treatment irrespective of the patient's calendar age. Psychiatrists can be invited in as temporary members of a multidisciplinary team who will look after the patients with a complex hip fracture (36). Regardless of the recorded results, scales for quick assessment of cognitive status are still rarely employed in the routine work of an orthopaedist.

In the course of the study it was found that the majority of the observed risk factors did not operate independently of one another. In contrast to age and place where a fracture occurred, which have an impact only as clustered factors, it has been shown that poor cognitive status, comorbidity and mobility prior to the fracture have a significant and independent role in predicting six-month mortality in elderly patients with a hip fracture (37).

This study makes a good prognostic tool for the estimation of survival of patients after hip fracture.

4.1 Limitations of the Study

Not all risk factors that may be associated with the cause of mortality were taken into consideration (type of fracture, type of fixation, osteoporosis, waiting time for surgery, etc.). The follow up period may have been short, so in a future study, we could prolong that period.

5 CONCLUSIONS

Cognitive disorders are the strongest predictors of mortality in hip fracture patients. The employment of brief tests for the evaluation of cognitive status enables an orthopaedist to have a good 24-hour direction as regards the choice of the treatment for each patient screened. The methodological issues concerning the evaluation of patients' mobility prior to the fracture and complex evaluations about the severity of somatic conditions (comorbidities) also warrant further work.

CONFLICTS OF INTEREST

The authors declare that no conflicts of interest exist.

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ETHICAL APPROVAL

The research has been approved by the Ethical Committee of the Clinical Centre "Kragujevac".

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