 Acta Chir Orthop Traumatol Cech. 89, 2022, No. 3
p. 199–203

ORIGINAL PAPER
PŮVODNÍ PRÁCE

The Predictive Values of the Functional Status, Comorbidities, and the Types of Treatment on the Treatment Outcomes in Elderly Patients Following the Hip Fracture

Prediktivní hodnoty funkčního stavu, komorbidit a způsobu léčby na výsledky léčení u starších pacientů po zlomenině kyčle

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ABSTRACT

PURPOSE OF THE STUDY

The hip fracture is the leading cause of disability and deaths in elderly. If left untreated, the hip fracture results in inability to walk, and therefore the patient is dependent on the other's people help. The aim of this study was to determine the predictive values of the functional status, present comorbidities, and the types of treatment on the long-term functional status and mortality in patients with the hip fracture.

MATERIAL AND METHODS

We analyzed the data about the patients with the hip fractures treated in the period between 01.07.2006. and 01.07.2016., with the mean follow-up period between 34.3±4.9 months. The data included radiographs, age, comorbidities, functional status on admission, functional status on discharge, and follow-ups.

RESULTS

Female sex, increasing age, and poorer functional status upon admission, conservative treatment, trochanteric fracture, the presence of neurological or lung disease, diabetes, were all significant risk factors leading to poorer functional outcomes on the latest follow-up ($p < 0.05$). On the other hand, the patients who were mobile upon admission had a longer survival (38.1±3.51 months) as compared with the other patients (12.3±5.1 months; $\chi^2=25.202$, $p = 0.001$). Besides, the results of this study revealed that the direct, statistically significant relationship exists between the untreated internal and neurological diseases, and increased mortality and poorer functional outcomes on the latest follow-up.

CONCLUSIONS

These results are useful for the orthopedic and trauma surgeons, who are treating these patients, the physical medicine and rehabilitation specialists, who are performing the rehabilitation of these patients, but also the health policy makers, who may promote the programmes of healthy aging (treating the diseases, maintaining fitness, etc.)

Key words: hip fracture; comorbidity; mortality; functional status.

INTRODUCTION

Although the surgical and anesthetic techniques are significantly improved nowadays, the hip fractures in elderly are related to high mortality and complication rate. The patients with the hip fractures have significantly higher rates of mortality as compared with the general population of the same age. The most important risk factors for mortality in these patients are male sex, increasing age, malnutrition, physical disabilities, patients with dementia, and patients with cardiovascular diseases (12, 17, 24).

Many authors studied the potential determinants of treatment outcomes in patients with hip fractures with high sensitivity and specificity rates. The fracture type, the treatment type, and the patients age are not the leading predictors of the treatment outcomes. Moreover, mental functions and the patients' mobility reflect the general state of the patients and can be considered as a reliable indicators of the treatment outcomes. Age, cognitive dysfunction, the fracture type, and late rehabilitation are related to the poorer functional rehabilitation following the surgery. Therefore, it is very important to start the early rehabilitation in order to meet the functional rehabilitation following the surgery as soon as possible (5, 25, 29). Postoperative functions are closely related to postoperative mortality rates (9, 13).

The aim of this study was to determine the predictive values of the functional status, comorbidities, and treatment type on the mortality rates and the long-term functional status in patients with the hip fractures.

MATERIAL AND METHODS

Patients

In this retrospective-prospective study, we analyzed the data of all the patients with the hip fractures treated at the Department of orthopedic surgery and traumatology, during the ten-year period between 01.07.2006. and 01.07.2016. The data included the clinical reports and X-rays upon admission, discharge, and follow-ups.

In all the patients with the hip fractures, we followed the following parameters: I) age, time of the injury, sex; II) fracture type (trochanteric fractures, femoral neck fractures), surgery (yes, no); III) comorbidities, and for the patients treated conservatively, the reasons for non-operative treatment; IV) patients' mobility (ability and gait) before and after the injury and on the latest follow-up.

The mean follow-up was 34.3 ± 4.9 months (1.4–144 months). The patients with incomplete data, the patients younger than 65 years of age, and the patients with the previous history of hip fractures were excluded from the study. The data about the eventual deaths of analyzed patients were updated in collaboration with the Registrar's offices and the Federal office.

The functional status was approximately determined by dividing the patients in one of the four categories: M – mobile patients, A – mobile with the orthopedic aids' support, P – mobile with the other person's help, I – immobile. Furthermore, the reason for making these categories of the elderly patients was its practicality, exactness, and the wide use of the description of the mobility using these categories, not only in colloquial terms, but also the physician's records.

The patients were also divided by the presence of comorbidities into the following categories: W – no significant comorbidities, CV – the presence of the cardiovascular disease, L – the presence of pulmonary disease, M – the presence of malignant disease, DM – the presence of diabetes mellitus, N – neurological disease, O – other. The significant comorbidities were considered those affecting the quality of life and the ones requiring regular treatment.

According to the type of treatment, the patients were divided into: WS – without surgery, and S – those who underwent surgery. The later are further distributed into two subgroups: SP – with the prothesis installed and with SO – osteosynthesis.

Ultimately, each of the patients will have two numerical values (age, and life length after the hip fracture) and four parameter values (comorbid diagnosis W/CV/L/M/DM/N/O, the treatment type, functionality/ability to walk before the fracture and at the last check-up M/A/P/I).

Statistical methods

Hi-square test, Kruskal-Wallis H test, Man-Whitney U test were used to test the differences between individual groups. The Kaplan-Meier method was used to estimate survival time by testing for differences in estimated survival times used the Mal-Cox test.

RESULTS

A total of 622 patients with the hip fractures were treated in the period between 01.07.2006. and 01.07.2016. Among these 622 patients, 167 were males (26.8%) and 455 were females (73.2%). The mean age of the patients in this study was 78.2 ± 8.4 years (the ange range was 65–100 years of age). We followed-up the functional status of the 527 patients who survived longer than one month or survived the total follow-up period. The patients were followed-up during the period after the injury and was equal to the survival time.

According to the type of the hip fracture, 310 patients (58.8%) had the femoral neck fracture, while 217 patients (41.2%) had trochanteric fracture.

A total of 480 patients had some comorbidities. Among them, 409 died (85.2%), while 71 survived (14.8%) during the follow-up period. There were 47 healthy patients, among which 22 died (46.8%), and 25 survived (53.2%) the follow up period. The statistical analysis showed that there is a significant difference in mortality rates according to the presence of comorbidities (p = 0.001). (Table 1.).

Furthermore, the cardiovascular diseases, including primary hypertension, cardiomyopathy, angina pectoris, etc., were the most common among other comorbidities and were found in 383 patients (72.7%). The cardiovascular diseases are followed by the neurological diseases, found in 149 patients (28.3%), and included intracranial insult, Parkinson's disease, dementia, etc. The diabetes mellitus was found in 136 patients (15.6%), while the pulmonary diseases were found in 57 patients (6.5%) and included chronic obstructive pulmonary disease (COPD), pneumonia, asthma, etc. The least common comorbidities were malignant diseases, found in 23 patients (2.6%), and the other comorbidities were found in 126 patients (14.4%). We found the statistically significant difference in the presence of comorbidities as compared with the functional status before the hip fracture (p = 0.004).

The analysis of the functional status upon admission revealed that the 463 patients (87.9%) was mobile (M), while 64 patients were mobile with the orthopedic aids' support (A). However, there were no immobile patients, or patients who were mobile with the other person's

Table 1. The comorbidities and the survival rates

			Comorbidities		Total
			Present	Not present	
Fatal outcome	No	n	71	25	96
		%	14.8	53.2	18.2
	Yes	n	409	22	431
		%	85.2	46.8	81.8
Total		n	480	47	527
		%	100.0	100.0	100.0

Table 2. Functional status upon admission and the long term functional status

			Functional status upon admission				Total
			M	A	P	I	
Functional status on the latest follow-up	M‘	n	285	0	0	0	285
		%	61.6	–	–	–	54.1
	A‘	n	92	18	0	0	110
		%	19.9	28.1	–	–	20.9
	P‘	n	54	14	0	0	68
		%	11.7	21.9	–	–	12.9
	I‘	n	32	32	0	0	64
		%	6.9	50.0	–	–	12.1
Total		n	463	64	0	0	527
		%	100.0	100.0	–	–	100.0

M/M’ – independently mobile; A/A’ – mobile with the walking aid; P/ P’ – mobile with the help of another person; I/I’ – immobile.

Table 3. The influence of the independent variables on the mortality rates

	OR	95% CI for OR	p
Group	0.5096	0.0969–2.6800	0.4260
Gender	0.6317	0.3270–1.2205	0.1716
Age	1.0993	1.0576–1.1426	0.0001
Hip fracture type	0.7307	0.4257–1.2543	0.2551
Comorbid diseases	0.5118	0.1564–1.6751	0.2682
N	0.3523	0.1496–0.8298	0.0170
CV	1.9826	0.8431–4.6625	0.1167
L	0.9672	0.3228–2.8982	0.9525
M	0.7621	0.1786–3.2509	0.7135
DM	0.7267	0.3548–1.4886	0.3829
Functional status at the admission	0.0000	0.35258–2.8992	0.9995
Functional status at the last check-up	0.1138	0.0384–0.3373	0.0001

N – neurological condition; CV – the existence of the cardiovascular condition; L – lung conditions; M – malignant disease; DM – diabetes mellitus.

help. The mean survival time in the studied sample was 34.3 ± 4.96 months. The patients who were mobile prior to injury had higher survival time, i.e., 38.1 ± 3.51 months, while the patients who required the orthopedic

Table 4. The influence of the independent variables on the long-term functional status

	OR	95% CI for OR	p
Group	1.4569	1.254–3.254	0.0001
Gender	0.1387	0.095–1.527	0.0455
Age	0.0228	0.001–0.524	0.0001
Hip fracture type	0.1676	0.002–0.195	0.0072
Comorbid diseases	0.0816	0.086–5.247	0.5861
N	0.3264	0.025–0.574	0.0001
CV	0.1666	0.248–5.257	0.0491
L	0.2560	0.142–0.385	0.0063
M	0.1478	1.257–5.873	0.6379
DM	0.1203	0.027–0.852	0.0996
O	0.0509	2.357–5.387	0.4931
Functional status at the admission	0.8727	0.085–2.742	0.0001

N – neurological condition; CV – the existence of the cardiovascular condition; L – lung conditions; M – malignant disease; DM – diabetes mellitus; O – other conditions.

aids’ support had significantly lower survival time, i.e., 12.3 ± 5.1 months. There was a statistically significant difference in the survival times as compared with the functional status prior to hip fracture (F = 31.830; $p = 0.001$).

Furthermore, by analyzing the functional status on the latest follow-up, we found that 285 patients (61.6%) among the 463 patients in the M group remained mobile. From the patients in the group A among 64 patients, 32 (50.0%) became immobile after the hip fracture – I’, 14 patients remained mobile with the help of the other person – P’, while 18 patients (28.1%) remained mobile with the support of the orthopedic aids’. The statistical analysis showed the significant difference, as the mobility following the hip fracture is highly dependent on the functional status prior to fracture ($p = 0.001$). (Table 2).

During the total follow-up period, the mortality rate was higher in patients who were treated conservatively (126 patients; 96.2%), as compared with the surgically treated patients (305; 77.0%) ($p < 0.05$). The logistic regression analysis showed that the age, neurological diseases, and the functional status have statistically significant impact on the mortality rates ($p < 0.05$). (Table 3).

The multivariate regression analysis revealed that the patients of the female sex, of the increasing age, with poorer functional status upon admission, treated conservatively, with the trochanteric fracture, having neurological, or pulmonary disease, or diabetes mellitus, have higher probability to be immobile ($p < 0.05$). (Table 4).

DISCUSSION

The hip fracture represents a significant disability, related to the high morbidity and mortality rates, higher expenses for the health system, and the relatively uncertain and long-term clinical/functional results. Taking into consideration the ageing of the population and longer life span, the increase in socio-economical loads due to the hip fracture is expected in the future. Therefore, the hip fracture is nowadays considered, not only medical, but also the issue of the entire community (1, 6, 7, 8, 18).

Once the patient fractures the hip, a significant change in the lifestyle occurs; the patient depends on the family's and community's care. Furthermore, the patient's course of the recovery depends on the proper assessment of the patient's general condition, and the appropriate treatment. Some patients cannot be surgically treated, or the surgical treatment is delayed, due to the poor general condition. Frequently, these patients have slower recovery, are more prone to complications, and have uncertain treatment outcomes. Therefore, the primary goal of the surgical treatment is recovery, which is achieved primarily by early mobilization. This lowers the probability of complications which could occur due to poorer functional ability following the hip fracture (14, 20, 26, 27, 33). Because of that, the surgery should be performed as early as possible.

Most of the fatal outcomes in patients with hip fracture is related with comorbidities and the fact that the hip fracture increases the risk of mortality from other diseases. Therefore, the question arises whether the patients with serious comorbidities benefit from the delay of the surgical treatment until the stabilization of the general condition, or the urgent surgery should be preferred. Furthermore, we found that 51 patients (9.7%) had no comorbidities, 185 patients (35.1%) had one comorbidity, 212 patients (40.2%) had two comorbidities, while 79 patients (14.9%) had three or more comorbidities. The analysis of the preoperative condition of elderly patients in similar studies revealed that more than 50% of patients had at least one comorbidity, while approximately 30% had two or more comorbidities (11, 15, 19, 21, 22, 31).

Surgical treatment of the hip fractures is usually not considered as urgent treatment; however, any delay may cause the worsening of the condition, or lead to other complications related to the patient's immobility. Moreover, the demand for urgent surgical treatment in patients with comorbidities who have increased surgical risk may be justified, as the surgical treatment for the hip fracture is the most effective treatment for the pain relief and, generally, the patients' care (2, 23). The analysis of the number and types of comorbidities in elderly patients with hip fracture in our study is similar and in accordance with the results of the most relevant studies published (16, 28, 34).

Significantly longer survival time was noted in the group of patients without comorbidities as compared with the patients with comorbidities. The statistical analysis revealed significant difference, meaning that the presence of comorbidities significantly affects the survival time ($p = 0.005$). The good assessment of the cognitive disorders, e.g., dementia, could be very useful in choosing the appropriate treatment type in patients with the hip fracture (3, 10). In almost all cases, the hip fracture causes exacerbation of the existing comorbidities. Therefore, the complications may arise, leading to decrease in functioning of locomotor apparatus, and other organ systems, which could result in the fatal outcome. The complete assessment of the physical and mental health is the most important factor in the prediction of the treatment outcomes in elderly patients with hip fracture.

Patients who were mobile had longer survival time, while the patients from the group A had significantly shorter survival time. The results in the study by Mariano et al. also showed that the functional status significantly affects the mortality (10).

During the total follow-up time, the mortality rates were higher in the patients who were treated conservatively, as compared with the patients who were surgically treated, this was shown in other studies (35). Furthermore, our study showed that the age, neurological diseases, and functional status have significant influence on mortality rates ($p < 0.05$), which is in the study by Suzanne et al. also showen (4). Further analysis revealed that the patients of the female sex, increasing age, poorer functional status upon admission, treated conservatively with the trochanteric fracture who suffer from neurological disease, pulmonary disease, or have diabetes mellitus, have greater probability to be immobile on the latest follow-up. Sheehan et al. identified the same factors affecting the long-term functional status following the hip fracture in their meta-analysis (32).

CONCLUSIONS

The poor functional status upon admission, the presence of comorbidities, especially neurological and internal diseases, conservative treatment, are all negative factors influencing the long-term functional status and the mortality rates in patients with hip fractures.

It is very important that the elderly are under medical supervision for the prevention and treatment of chronic diseases, in order to have the best possible result after hip fracture.

The proper assessment of the patients' physical and mental condition, early surgical treatment, and fast functional recovery are the factors allowing the patients to regain the function and mobility. Furthermore, the patients' independence and mobility affects the long-term functional status, as well as the quality and the longevity of life. That is important for the medical professionals, patients' families, and society.

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