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Analysis of surgically treated patients with hip fracture admitted to the Department of traumatoloy, UMC Ljubljana in 2016

Analiza operiranih poškodovancev z zlomom kolka, oskrbljenih na Kliničnem oddelku za travmatologijo UKC Ljubljana v letu 2016

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Abstract

Background: The incidence of hip fracture in developed countries is between 400/100000 to 1000/100000 in population over 65 years of age and the number is increasing due to population aging. Despite improvements in implant technology, surgical technique, anaesthesia and rehabilitation, the outcome for many patients remains poor with a one-year mortality rate of up to 35%. Approximately half of the patients are able to return to pre-injury mobility. Treatment outcome is related to pre-injury status with comorbidities and treatment protocol (timing and type of surgery, etc.). The purpose of our retrospective study is to analyze the results of hip fracture treatment at the Department of Traumatology, UMC Ljubljana.

Methods: We performed an observational retrospective cohort study of all patients with pertrochanteric and femoral neck fracture, who were admitted to the Department of Traumatology, UMC Ljubljana from 1 January 2016 to 31 December 2016. Data processing and statistical analysis were done with Rstudio (version 1.1.463, 2018) and Tidyverse and Survival libraries.

Results: In one-year period we treated 717 patients with hip fracture. Median age was 82 years. The majority of patients had ASA scoring 3 (56.5%). The survival analysis included 695 patients. We operated on 92.5% of patients and their one-year survival was 81.6%; 53.8% for those were treated conservatively. 79% of patients with pertrochanteric fractures and just 33% patients with femoral neck fracture were operated on in 48 hours after admission. The return to pre-injury mobility was achieved in 52% of surgically treated patients. The average hospitalization time was 12 days.

Conclusion: The results regarding survival rate and return to pre-injury mobility for the patients treated at our institution are at least comparable to those reported in the literature. In the future we have to decrease time from admission to surgery for femoral neck fracture patients (by organising special surgical facilities intended for these patients) and decrease hospitalization time (by enlarging outpatient nursing care facilities).

Izvleček

Izhodišča: V razvitem svetu je pojavnost zlomov kolka med 400/100.000 do 1.000/100.000 prebivalcev, starejših od 64 let; število starajočega prebivalstva pa narašča. Kljub razvoju vsadkov za učvrstitev zlomov, napredku kirurške tehnike, anestezije in rehabilitacije rezultati pri mnogih poškodovancih ostajajo slabi. Smrtnost znaša v prvem letu do 35 %. Le približno polovica poškodovancev se vrne k prejšnjim dejavnostim. Na končni izid zdravljenja vpliva splošno stanje

poškodovanca s pridruženimi boleznimi in način zdravljenja (čas operacija, tip operacije itd.). Z retrospektivno analizo smo ugotavljali rezultate zdravljenja zlomov kolka na Kliničnem oddelku za travmatologijo UKC Ljubljana.

Metode: Observacijska retrospektivna kohortna študija upošteva vse poškodovance, ki so bili sprejeti na naš oddelek zaradi poškodbe kolka med 1. 1. 2016 in 31. 12. 2016. Obdelavo podatkov in statistično analizo smo napravili s programom Rstudio (verzija 1.1.463, 2018) in s knjižnicama Tidyverse in Survival.

Rezultati: V enoletnem obdobju smo zdravili 717 poškodovancev z zlomom kolka. Mediana starost naših poškodovancev je bila 82 let. Večina poškodovancev je imela vrednost ASA 3 (56,5 %). V analizo preživetja smo vključili 695 oseb. Operirani poškodovanci so imeli enoletno preživetje 81,6 %, konzervativno zdravljeni 53,8 %. 79 % poškodovancev s pertrohanternim zlomom je bilo operiranih v okviru priporočenih 48 ur in le 33 % poškodovancev je imelo zlom vratu stegnenice. K prejšnjim dejavnostim glede pomičnosti se je vrnilo 52 % naših operiranih poškodovancev. Povprečna ležalna doba v bolnišnici je bila 12 dni.

Zaključek: Rezultati oskrbe zlomov kolka pri nas so glede preživetja in pomičnosti po poškodbi vsaj primerljivi z rezultati v literaturi. Potrebno pa bo skrajšati čas pred operacijo, ki je potrebna za oskrbo zlomov vratu stegnenice tako, da se posebej organizirajo operacije, namenjene tem poškodovancem, ležalno dobo pa tako, da se omogoči oskrba in negovanje zunaj bolnišnice.

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1 Introduction

Fracture of the proximal part of the femur is one of the most serious consequences of osteoporosis and the most frequent reason for admittance and operation due to injury in the elderly. Hip fracture is usually the result of a low energy accident in osteoporothic patient (1). The number of these injuries in the developed world has been growing (2). In 2009, the incidence of hip fracture in Slovenia was roughly 550/100,000 inhabitants above the age of 64, while in Europe it is between 400/100,000 in Switzerland, and up to 1,000/100,000 in Scandinavia (3). It is the most frequent cause for long-term hospitalization and high fatality rate resulting from a fall (4). In Slovenia, the probability that an elderly person between 65 and 75 will injure their hip is estimated at 10–30% (5). Despite improvements in implant technology, i.e. osteosynthesis (OS), improved surgical technique, anaesthesia and rehabilitation, the outcome for many patients remains poor (2). In the first year after injury, 35% of people still die, with 10% in the first month, and only about a half manage to obtain the preinjury levels of mobility (6). A British study from 2013 showed that the complete medical treatment of a hip fracture of a patient costs GBP 64,000, i.e. EUR 76,160 (7).

In Slovenia, patients with hip injury are generally admitted to surgical departments for treatment. Therapy for hip fracture (the proximal part of the femur) is surgical. We rarely opt for conservative therapy. The reasons for conservative therapy are either general (the general condi-

tion of the injured person is too weak, so an operation would be exceptionally risky, the person was already immobile before the injury, etc.), or local (undisplaced fracture of the femoral neck, chronic wounds on the skin above the hip) (8,9).

After preparation, which for those with comorbidities means a fast optimization of basic diseases, the injured receive surgery. The time from admittance to operation must be as short as possible, as numerous studies have shown that extending the time before the procedure has a negative impact on the survival rate, complications, and restoration of previous activities. It currently stands that those with a hip injury should wait no more than 48 hours for operation, and according to some guidelines, only 36 hours (10-13).

Pertrochanteric femoral fractures are generally operated with internal fixation, either using an intramedullary nail or dynamic hip screw fixation (DHS). The type of fixation is selected on the basis of the fracture's stability. For younger patients, fractures of the femoral neck are fixated using DHS or paralell screws, while with older people, a partial or a total hip prosthetic is made (14-18).

The day after surgery, patients can already begin to stand and walk with support.

Patients are supposed to be released from the hospital when there is no further indication for hospital therapy (the wound is healing without any problems, and the general health condition supports the discharge from the hospital).

The objective of our retrospective study is to establish our success rate with therapy of these injuries, to recognize any shortcomings and to find solutions.

2 Methods

This is an observational retrospective cohort study. We included all fractures of femoral neck and the pertrochanteric femoral fractures of patients who were admitted to the Ljubljana University Medical Centre and the Clinical Department of Traumatology between 1 January 2016 and 31 December 2016.

Table 1: Description of individual grades according to ASA classification.

ASA grade	Description
Grade I	Normal healthy patient.
Grade II	A patient with mild systemic disease.
Grade III	A patient with severe systemic disease.
Grade IV	A patient with severe systemic disease that is a constant threat to life.
Grade V	A moribund patient who is not expected to survive without the operation.
Grade VI	A moribund patient who is not expected to survive without the operation.

ASA (American Society of Anesthesiologists)

Table 2: Description of the whole sample (operated and not-operated hip fractures).

Factor	N (%)
All	695 (100%)
Age, median (IQR)	82 (14)
Type of fracture	
Pertrochanteric fractures	331 (47,6%)
Femoral neck	364 (52,4%)
Type of treatment	
operative	643 (92,5%)
conservative	52 (7,5%)
ASA	
5	0 (0%)
4	19 (2,7%)
3	393 (56,5%)
2	266 (38, 3%)
1	17 (2,4%)

ASA (American Society of Anesthesiologists)

The list of these people was obtained from the Birpis database and reviewed using the Birpis application and the archives of the Traumatology Clinical Department. We collected age, ASA physical status (Table 1), fracture and operation type, time of injury, time from admittance to operation and duration of hospitalization. Death and time of death were established for patients up until 13 June 2018, according to the record of health insurance state using the Birpis application. Individual patients were assessed after the final control examination if it took place at least three months after the operation.

We unified the collected data and converted them into an appropriate type. We made the statistics of the sample using histograms and tables. We made the inferential statistics using the chi square test, a bilateral, unpaired Student's t-test, bilateral exact binomial test and the Mann-Whitney U test. We calculated the survival statistics using the log-rank test and the Cox proportional-hazards regression model. The limit of the statistical significance was set at $\alpha = 0{,}01$. We conducted data processing and a statistical analysis using the R programme (version 3.5.2) and the Tidyverse and Survival libraries.

3 Results

In the examinated period, we treated 717 patients with femoral neck or pertrochanteric femoral fractures at the Traumatology Clinical Department of the Ljubljana University Medical Centre.

Because there was no information on death, we excluded 22 patients from the analysis (Table 2). This data was not available because these patients were insured abroad and have a permanent residence outside of Slovenia. The analysis therefore included 695 patients.

No type of fracture was statistically dominant ($p = 0.20$, bilateral exact binomial test). We treated 44 femoral neck fractures and 8 pertrochanteric femoral fractures conservatively. The reason for conservative therapy with 31 patients (59% of all conservatively treated) was poor general health condition. In all pertrochanteric fractures the reason for conservative treatment was poor general condition. In 20 patients the reason for conservative treatment was fracture in good position (all patients had impacted femoral neck fracture); and with one patient we were not able to establish the reason from the documentation.

Table 3: Comparison of operated and conservatively treated patients by survival rate and ASA grade.

	Operated	Conservatively treated	p-value
1-month survival rate 95% 95% trust interval (TI)	94,9% [93.0–96.5]	84,6% [75.4–95.0]	< 0,0001
1-year survival rate, 95 % TI	81,5% [78.6–84.6]	53,8% [41.9–69.2]	< 0,0001
ASA grade (share, number)			0,001
ASA 1	3% (17)	0	
ASA 2	40% (257)	18% (10)	
ASA 3	55% (352)	75% (41)	
ASA 4	2% (15)	7% (4)	
Age, median (median, IQR)	82(14)	83 (12)	0,1

ASA – American Society of Anaesthesiologists; IQR – interquartile range

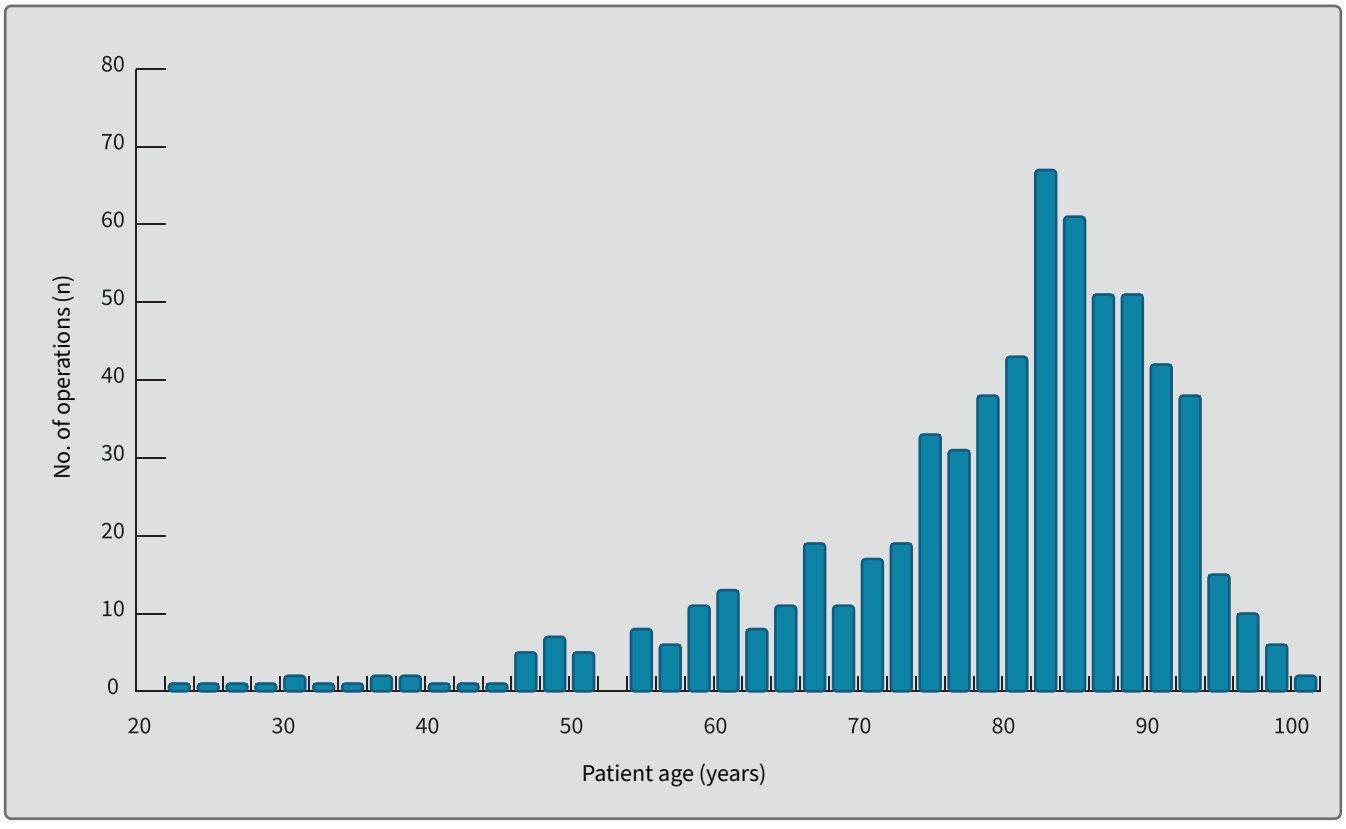

Figure 1: Distribution by age of patients with hip fracture surgery at the Ljubljana University Medical Centre in 2016. The youngest person was aged 22, the oldest 100.

4 Discussion

Hip fractures are injuries of an older population, which is also evident from our casuistry. Most injured people were older than 80 years (median of 82 years) (Figure 1). Similar results were obtained by the studies of Krušič et al. (50% of patients aged between 80 and 89), Lawrence et al. (median age 85), Mosk et al. (median age 84), and Schnell et al. (median age 85) (3,19-21). An ageing population will additionally increase the incidence of hip fractures in developed countries, including Slovenia (5,22). Epidemiological studies show that the number of hip fractures will double by 2050 (6), which mean the need for increased staffing, infrastructional and financial resources for the healthcare and social system. Already in 2016, the share of operations related to hip fractures at the Ljubljana University Medical Centre was 16% of all major traumatological operations (4,095), without taking into account the procedure conducted with local anaesthesia. This is a major burden on operation rooms and beds of the departments.

Our study did not detect a statistically significant difference in the frequency between the pertrochanteric fracture and the femoral neck fracture. Literature did not verify the statistic characteristic; however, a trend has emerged showing that fractures in the femoral neck are more frequent. With older injured people, the type of fracture affects the type of operation. With femoral neck fracture, we opt for an endoprosthesis, which means that active people receive a total hip prosthetic, while less active ones a partial one. In the younger population (60–65 years), we generally also opt for a retentive operation even with

femoral neck fracture, and reduce and fixate the fracture (17,18). Pertrochanteric fractures are generally treated with bone reduction and fixation, regardless of the patient's age (Figure 2). Significant differences between these two types of operations are in the duration of the procedure and blood loss. Prosthetic care is longer and blood loss is higher. Staffing needs for assistants is also greater in most cases with prosthetics. Because of a heavy workload with other injuries, we strive to schedule a large part of hip fractures outside regular work hours, when only a limited number of on-call staff members are available. This also results in the statistically significant difference between the share of injured people operated on within 48 hours for both types of fractures. It has been established that with two thirds of cases, the reason for postponed therapy is of a systemic nature, and only for a third it is because of the need for additional optimization of the patient's condition (2). Considering that there is no statistical significant difference in the ASA grades in our study between one and the other group, and the statistically significant difference between the shares of those operated within 48 hours in the group with pertrochanteric fractures and femoral neck fractures (79% versus 33%), we assume that the differences in the time elapsed between the admittance and operation are of systemic origin. This pertains to the disproportion between the number of all injured people requiring surgical care and the number of surgical teams to treat them.

We ascertained that more than a half (58.2%) of our patients have at least one serious systemic disease (ASA grade of 3). The higher ASA grade is often related to a more advanced age. Because the diseases that lead to a hip fracture (osteoporosis and diseases that result in falling) are age-related, it is understandable that we will notice a higher ASA grade with a group with a fractured hip (23). In the Slo-

Table 4: Comparison between operated pertrochanteric and femoral neck fractures.

	Pertrochanteric fractures	Femoral neck fractures	p-value
1-month survival rate, 95% TI	93,1% [90.4–96.0]	96,6% [94.6–98.6]	0,4
1-year survival rate, 95% TI	78% [74.1–83.1]	85% [80.9–88.8]	0,4
Time from admittance to operation (median, IQR) (hours)	33,7 (17)	92,8 (82)	< 0.0001
Operated < 48h	79%	33%	< 0,0001
Age (median, IQR) (years)	83 (13)	81 (15)	0,08
ASA grade (share, number)			0,4
ASA 1	3% (11)	2% (7)	
ASA 2	42% (135)	27% (124)	
ASA 3	52% (170)	59% (194)	
ASA 4	2% (8)	2% (7)	
Hospitalisation duration (average, SD) (days)	11,6 (5,7)	13,2 (6,1)	< 0,0001
Same level of mobility	51,1% (128)	52,4% (141)	0,49

ASA (American Society of Anesthesiologists); IQR – interquartile range; SD – standard deviation

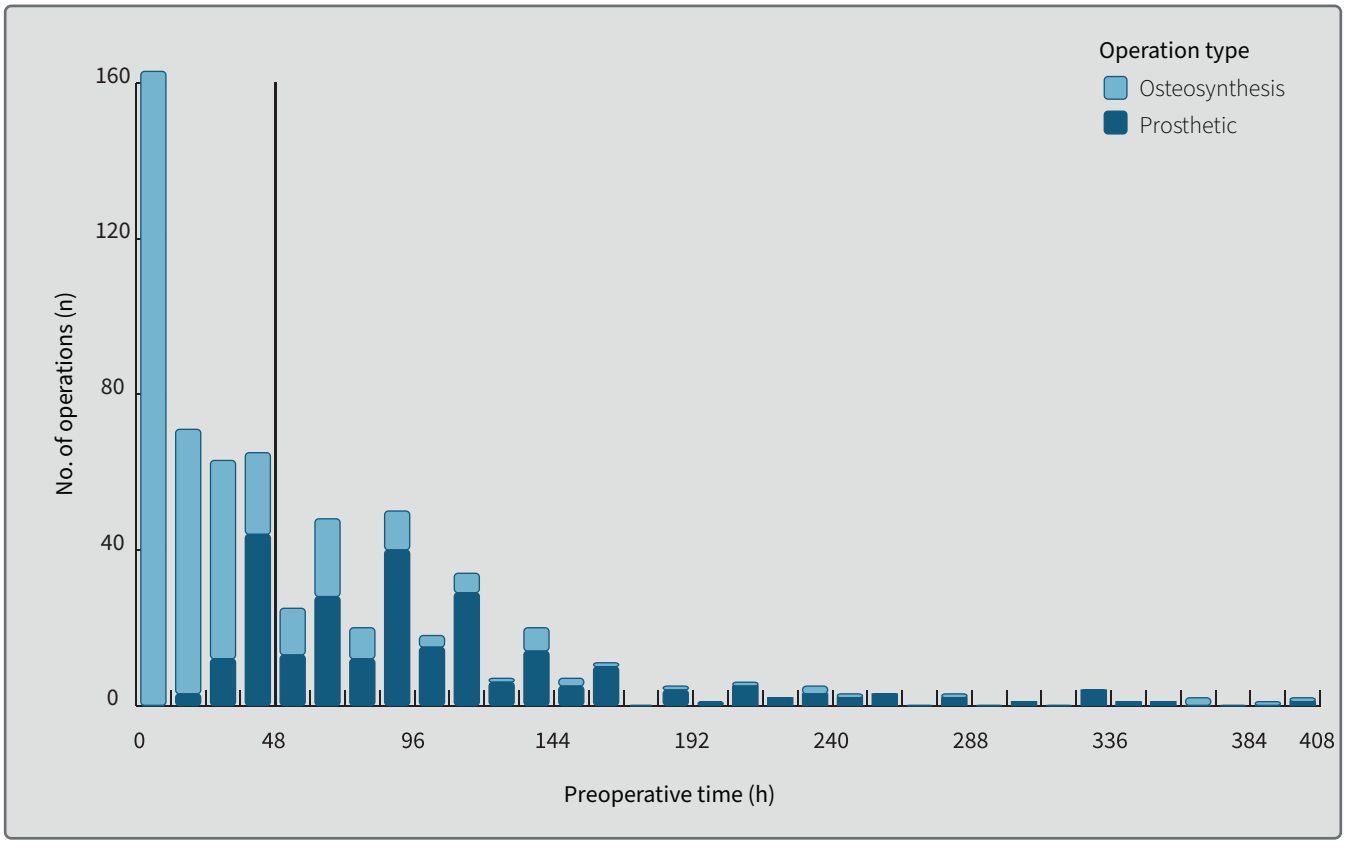

Figure 2: Distribution of time from admittance to surgery by type of surgery. The black line shows 48 hours (p-value <0.0001, Mann-Whitney U-test).

venian study published in 2016, more than 80% of patients had an ASA grade of 3 or above (3). The Lawrence et al. and Mosk et al. studies noted ASA grades of 2 or 3 with 87% to 91% of patients, while more than a half had an ASA grade of 3 (19,20). Elderly people with a broken hip require stabilization of their primary serious systemic disease before the procedure (13).

The sample of injured people with a broken hip, who were admitted and operated on in the Ljubljana University Medical Centre in 2016, the 1-month mortality rate was 5.1%, and the 1-year mortality rate was 18.4%. The Slovenian study from 2016 established that the mortality rate at the hospital was 5.4%, and the 1-month mortality rate was 10.1% (3). The Swedish study from 2018 noted a 1-month mortality rate of 8.2% and 23.6% rate for 1-year mortality (24). Other European studies put the 1-month mortality rate between 7% and 10%, and the 1-year rate between 16% and 38% (Table 3) (4).

In 2016, we opted for conservative therapy with 7.5% of patients with hip injury. In most of the cases, this was the result of the assessment that a patient is not suitable for operation because of their general poor health condition. Those patients who received conservative therapy had statistically significantly higher ASA grades than those who were operated on. The patients receiving conservative therapy also had a statistically significantly higher mortality rate both after one month and after one year after their injury. Considering that, on the one hand, they were more ill than those who received surgery, and that on the other hand, their mobilisation after injury was significantly more difficult, if not impossible, we can deduce that both lead

to this poor result (Table 4) (25).

It has been proven in numerous foreign studies that groups with different ASA grades, i.e. a different health condition before the procedure, have statistically significantly different survival rates. The Boddaert et al. in Lau et al. studies have related this higher mortality rate of patients with broken hips with a poorer medical condition before the operation (26,27). Boddaert et al., Furlaneto et al., Mosk et al. and Schnell et al. presented the finding that mortality rate in the first year is not only affected by hospital treatment after hip fracture, but also the patient's basic characteristics: age, Charlson Comorbidity Index, whether they live in a nursing home, their mobility before the operation, KOPB, dementia and perioperative delirium (20,21,28,29).

Our finding that there is no statistically significantly difference between survival rates for the pertrochanteric fractures and the fractures of the femoral neck can also be interpreted using the study of Mundi et al. which shows the mortality of both fracture types between 1980 and 2010. She established that the mortality of the femoral neck fracture has been approximately 20% for three decades, while the mortality of pertrochanteric fractures has been declining consistently (with 34% three decades ago) (30). Most reviewed studies still proved a difference in the survival rates between the two types of fracture and the types of operation (19,31,32), which may change considering the projection of the Mundi et al. study (Table 5) (30).

A good half of our patients returned to their previous level of mobility, compared to before the injury, and other studies also reached similar results (2).

Hospitalisation duration for operated patients with a femoral neck fracture is statistically significantly longer than with patients with pertrochanteric fractures. The difference in waiting for operation is also similar, so we assume that these two differences are causally linked.

Relatively long hospitalisation, which is longer than in comparable studies, is in most cases systemic in nature, as most patients had been able to take care of themselves until the injury, and do not require care and help in day-to-day activities, while after the injury, most seniors are dependent on domestic assistance or at least temporary care in the nursing home, and access to such assistance is still poor in our country (33).

5 Conclusion

The population of patients with hip fracture treated at our facility is not significantly different from those described in other studies. Already today it encompasses a large share of all the patients we treat, and it will only increase in the future. Because we know that most elderly patients have comorbidities, the core diseases have to be resolved as soon as possible before the procedure, so they can be prepared for surgery. The presence of doctors of internal medicine (geriatrics) will have to be increased to assist in patient preparation together with the anaesthesiology team. This will increase the share of operated patients within 48 hours. Surgical teams and premises for treating these fractures have to be ensured, so that other operations do not have to wait for hip fracture operations to finish and vice-versa. Earlier operations

Table 5: Cox proportional hazards regression model shows the influence of the patient's characteristics on their survival rate in the first year after hip surgery.

	PH [95 % IZ]	p-value
Type of fracture	1.57 [1.04–2.40]	0,031
Type of fracture	0.99 [0.6–1.5]	0,95
Age	1.07 [1.04–1.10]	<0,001
ASA grade	1.88 [1.27–2.82]	0,002
Hospitalisation duration	1.01 [0.98–1.03]	0,49

ASA – American Society of Anesthesiologists; PH – proportional hazard; 95% TI – trust interval

will shorten the hospitalisation duration, and we have to also ensure additional facilities outside of hospitals for the care and rehabilitation of these patients in the early post-operative period.

In 2019, we began with a prospective analysis in which we wish to find additional factors that impact survival rates and post-injury mobility.

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