

MANAGEMENT OF PROXIMAL FEMORAL FRACTURES

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Proximal femoral fractures are typical injuries in the elderly population. We conducted a retrospective study to estimate postoperative mortality and risk factors affecting patient outcomes at Tartu University Hospital. We retrospectively evaluated patients who were hospitalised in 2017 with a proximal femoral fracture diagnosis and who were operated (osteosynthesis, partial and total hip replacement). In the study we included 313 patients of 361 (219 women and 94 men). We did not find statistically significant difference between the choice of anaesthesia and mortality or between the time getting to the OR and mortality. Cognitive impairment and postoperative delirium were significantly associated with increased one-year mortality was 37% ($p < 0.05$). In the group of the patients who did not have postoperative delirium the overall mortality was 15%. 23% of the patients had preoperatively cognitive impairment, and 45.8% of them died in the first year after the operation ($p < 0.001$). Mortality of patients who did not have cognitive impairment was 14%. As the sample group of patients included in the study was small, further investigation should encompass a larger group in the future.

Keywords: cognitive impairment, delirium, mortality, survival, risk factor.

INTRODUCTION

Patients with proximal femoral fractures are one of the populations who most often need emergency hospitalisation and operation. A typical reason for fractures is falling. According to fracture risk factors and osteoporosis prevalence, the most threatened are elderly women (Parker and Johansen, 2016). Patient outcome depends on several factors that can be divided into modifiable and non-modifiable factors. Non-modifiable factors are gender, age, weight, comorbidities etc. Modifiable factors are time to hospitalisation, method of anaesthesia and operation, operation technique, time from hospitalisation to operation, deep vein thrombosis prophylaxis, rehabilitation and others (Parker and Johansen, 2016).

Postoperative 30-day mortality has been estimated to be 8% and one-year mortality up to 30%, and these proportions have not changed in the last 40 years despite developments in medicine (Parker and Johansen, 2016; Dawe, 2017). One-third of the deaths are only directly associated with proximal femoral fractures. Over 10% patients are not able to return home and most of the patients will have pain issues or disability (Parker and Johansen, 2016).

According to the literature, surgery conducted over 24 hours from the trauma is associated with higher risk for complications and mortality (Simunovic *et al.*, 2010; Chang *et al.*, 2018). There are more wound infections, reoperations and recurrent fractures, if the surgeon is less experienced (Browne *et al.*, 2009). Wound infections can be reduced by

using perioperative antibiotic prophylaxis (Souhtwell-Keely *et al.*, 2004). Using peripheral nerve blocks reduces postoperative pneumonia prevalence, pain and guarantees earlier patient mobilisation (Guay *et al.*, 2017). Deep vein thrombosis prophylaxis (non-pharmacological and pharmacological) reduces thromboembolic events, and pharmacological prophylaxis increases bleeding complications (Barrera *et al.*, 2010).

There have been large studies for choice of anaesthesia and intraoperative management, but unfortunately none of them have shown relevant lower of mortality or morbidity (Dawe, 2017; Van Waesberghe *et al.*, 2017).

Multidisciplinary team involvement has a positive effect on hospital stay and functional outcome (Halbert *et al.*, 2007). A retrospective population-based cohort study in Estonia showed that the mortality is comparable with other countries. According to results of the study data, the highest mortality risk was 3–6 months after the trauma and most threatened were elderly people and men (Jürisson *et al.*, 2017). Unfortunately, the study did not analyse the above-mentioned risks (time to surgery, method of anaesthesia, etc.) to patient outcomes. The aim of our conducted retrospective cohort study was to estimate postoperative mortality and risk factors associated with poor outcome of patients at the Tartu University Hospital.

MATERIALS AND METHODS

An electronic database search of medical records (EMR) was performed using ICD-10 codes S72.0–S72.2 for all patients hospitalised in 2017. The following data were manually retrieved from obtained records: patients demographic data, anaesthesia details, operation mode, time of surgery, length of hospital stay, comorbidities (hypertension, atrial fibrillation, valvular disease, diabetes, pulmonary disease, osteoporosis, and cognitive function), postoperative complications (delirium, cerebral and myocardial infarction, cardiovascular problems, wound infections, pneumonia, thromboembolic complications, hospitalisation to ICU), medication (antiplatelets, anticoagulants, beta blockers, antihypertensive drugs), and pre- and postoperative analyses (including haemoglobin). Mortality data were obtained from the population registry.

Statistical analysis was performed using Stata 14 software, Statacorp, USA.

Unadjusted survival data were compared using the log-rank test. Mortality was adjusted for age and gender using the Cox proportional hazard model when the log-rank test indicated association with survival ($p < 0.25$); hazard ratio and 95% confidence intervals were calculated. Cox model assumptions were tested using Schoenfeld residuals.

Multiple logistic regression analysis was performed to test effect of preoperative factors on probability of delayed operation. The odds ratio and 95% confidence interval statistics were calculated. Goodness of fit of the final model was

tested using the Hosmer-Lemeshow test. All factors associated with delay ($p < 0.25$ in univariable logistic regression) were included in final model.

Permission from the Ethics Committee was received, protocol number 282/T-25 (signed 21.05.2018).

RESULTS

A total of 361 patients were found using EMR search and of these 313 patients were selected (219 women and 94 men). Forty-eight patients were excluded because they were not operated on during the hospitalisation. Before mortality adjustment, men were ten years younger than women. Characteristics of the patients are given in Table 1.

Table 1. Patient data

Characteristic	All patients (n = 313)
Gender	
Men, n (%)	94 (30.0)
Women, n (%)	219 (70.0)
Age, years (median)	80 (71–87)
Weight, kg mean (median)	67 (67)
Body Mass Index, kg/m ² mean (median)	22.8 (23.1)
Height, cm mean (median)	169.5 (169.5)
Preoperative haemoglobin, g/l mean (SD)	128.2 (17.5)
Comorbidities	
Arterial hypertension, n (%)	211 (67.4)
Atrial fibrillation, n (%)	58 (18.5)
Valvular disease (aortic valve stenosis, aortic valve insufficiency, other), n (%)	16 (5.1)
Pulmonary disease, n (%)	30 (9.6)
Diabetes (type I and II, n (%))	49 (15.7)
Medications	
Anticoagulants, n (%)	38 (12.1)
Antiplatelets, n (%)	34 (10.9)
Preoperative cognitive dysfunction, n (%)	72 (23.0)
Anaesthesia method	
Neuraxial (NA), n (%)	271 (86.6)
General (GA), n (%)	34 (10.9)
GA+NA, n (%)	7 (2.2)
No data, n (%)	2 (0.6)
Time to surgery	
≤ 24 h, n (%)	169 (54.0)
24–48 h, n (%)	82 (26.2)
> 48 h, n (%)	62 (19.8)
Postoperative complications	
Delirium, n	82
Myocardial infarction, n	1
Cerebral infarction, n	1
Cardiovascular problems, n	37
Wound infections, n	0
Pneumonia, n	12
Thromboembolic complications, n	2
Hospitalisation to ICU, n	6
Unadjusted mortality	
In hospital, n (%)	8 (3.2)
30-days, n (%)	22 (7.0)
90-days, n (%)	37 (11.8)
180-days, n (%)	49 (15.7)
1-year, n (%)	68 (21.7)

SD, standard deviation; ICU, intensive care unit

Multiple logistic regression found no effect of choice of anaesthesia (general vs neuraxial anaesthesia) on mortality ($p = 0.75$, Fig. 1), and no effect of time to surgery (≤ 24 h vs > 24 h and ≤ 48 h vs > 48 h) on mortality ($p = 0.63$ and $p = 0.57$, Figs. 2 and 3). Mortality was associated with pre-operative cognitive impairment (HR, 95% CI; 3.33, 2.05–5.42; $p < 0.001$, Fig. 4), and postoperative delirium (HR, 95% CI; 2.03, 1.25–3.31; $p = 0.004$, Fig. 5)

After adjustment for age and gender, anticoagulation was found to be a significant risk factor associated with delayed operation, OR 3.26 (1.54–6.89); $p = 0.002$ and 4.3 (2.06–8.96); $p < 0.001$ for 24 h or 48 h delay, respectively. Arterial hypertension was significantly associated with delayed operation only for 24 h delay, OR 2.27 (1.02–5.06) $p = 0.046$.

DISCUSSION

The main finding of the present study was that one-year mortality amongst women ($n = 219$) was 21.9 % and amongst men ($n = 94$) 21.3%. These results are comparable with those of other studies, which estimated one-year mortality as up to 30% (Parker and Johansen, 2006; Dawe,

2017; Lo *et al.*, 2015). It was also found that 60-days mortality was similar in general and neuraxial anaesthesia groups — 3.9% vs 4.1% (RR, 0.97; 95% CI, 0.59–1.57) (Neuman *et al.*, 2021). In our study, we did not also did not find any significant difference in mortality between the general and neuraxial anaesthesia groups.

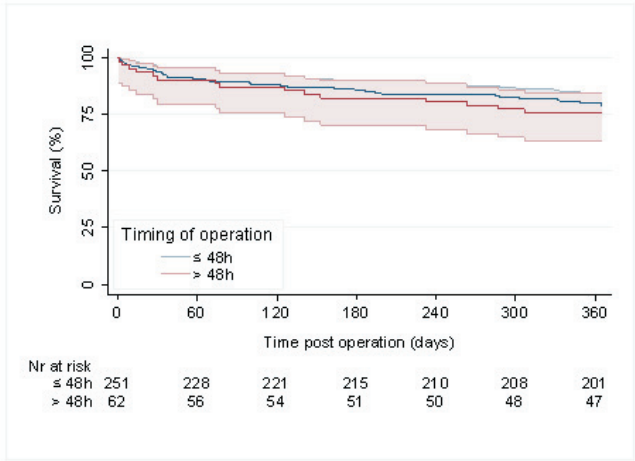


Fig. 3. Effect of time of operation (≤ 48 h vs > 48 h) on mortality.

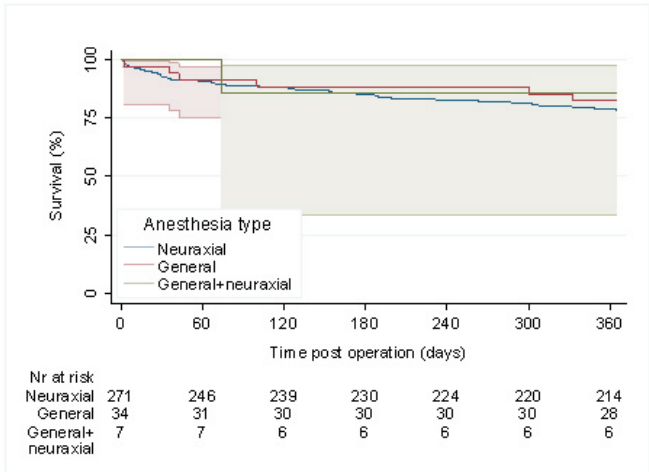


Fig. 1. Effect of choice of anaesthesia on mortality.

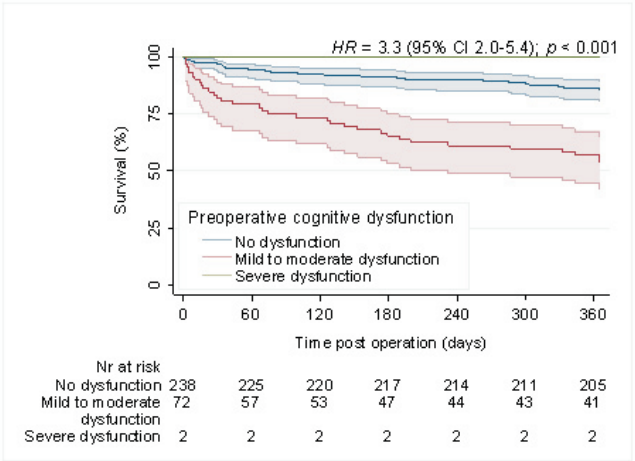


Fig. 4. Effect of preoperative cognitive dysfunction on mortality

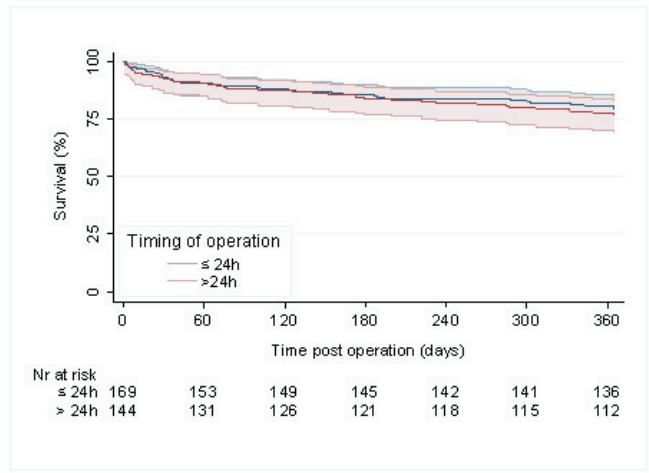


Fig. 2. Effect of time of operation (≤ 24 h vs > 24 h) on mortality.

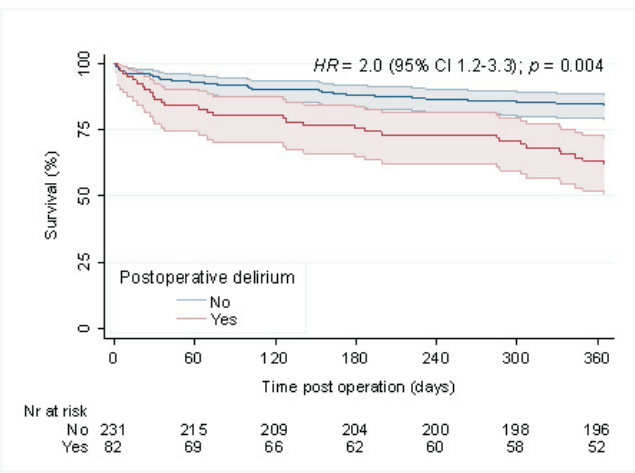


Fig. 5. Effect of postoperative delirium on mortality.

The only preoperative factor associated with higher one-year mortality was preoperative cognitive dysfunction. Our data is in concordance with earlier studies (Bai *et al.*, 2018; Menéndez-Colino *et al.*, 2018).

Postoperative delirium is a common postoperative complication that worsens several outcomes: increasing length of hospital stay, and lasting cognitive and functional failure (Parker and Griffiths, 2015; Schubert *et al.*, 2018). Postoperative delirium has multiple precipitating factors like infection, pain, myocardial and cerebral ischaemia, constipation and electrolyte abnormalities (Elie *et al.*, 2010). The development of delirium is a multifactorial process. Certain patient characteristics are thought to be the cause of the delirium. Pre-existing cognitive impairment is one of these causes (Zheng *et al.*, 2020). In our study, we also found that postoperative delirium has an association with higher mortality.

There is conflicting evidence about the effect of the time to surgery. A one-year follow up study (Huette *et al.*, 2020) showed that time to surgery over 48 hours is an independent factor for mortality (HR, 1.057; 95% CI, 1.007–1.108; $p = 0.024$). Chang *et al.* (2018) described a statistically significant association between increased time to surgery (> 2 days vs < 2 days; OR 1.91, 95% CI 1.14–3.18, $p = 0.013$) and mortality. In our study we did not find any association between delayed surgery (≤ 24 h vs > 24 h or ≤ 48 h vs > 48 h) and mortality.

Our study has several limitations. Firstly, as our study was single-centre and retrospective, some hidden confounding factors may exist. Secondly, the study group was small, limiting the generalisation of obtained data. Thirdly, the reporting of postoperative complications and problems can be physician dependent, which again questioned the validity of data. Hypoactive delirium (van Velthuisen *et al.*, 2018) is often underreported and is possible to speculate that associations could be even stronger.

CONCLUSIONS

One-year mortality after operated proximal femoral fractures occurred in approximately 20% of patients in the Tartu University Hospital cohort. Preoperative cognitive dysfunction and postoperative delirium are associated with a lower survival rate one year after operation.

AUTHORS' CONTRIBUTIONS

MV collected the data, wrote the paper; RJ, FV, IL, KK collected the data; AR, HK conceived and designed the analysis; KT contributed analysis tools and performed the statistical analysis; JK conceived and designed the analysis, contributed data/analysis tools, contributed to the final manuscript.

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AUGŠSTILBA KAULA PROKSIMĀLĀS DAĻAS LŪZUMU ĀRSTĒŠANA

Augšstilba kaula proksimālie lūzumi ir tipiski ievainojumi gados vecākiem cilvēkiem. Mēs veicām retrospektīvu pētījumu, lai noskaidrotu Tartu Universitātes slimnīcas pacientu pēcoperācijas mirstību un riska faktorus, kas ietekmē rezultātus. Retrospektīvi izvērtējām pacientus, kuri 2017. gadā tika hospitalizēti ar augšstilba kaula proksimālā lūzuma diagnozi un kuriem tika veikta operācija (osteosintēze, daļēja vai pilnīga gūžas locītavas endoprotezēšana). Pētījumā iekļāvām 313 pacientus no 361, no kuriem 219 bija sievietes un 94 vīrieši. Pētījumā nekonstatējām statistiski nozīmīgu atšķirību starp anestēzijas izvēli un mirstību vai starp nokļūšanu OR un mirstību. Kognitīvie traucējumi un pēcoperācijas delīrijs bija saistīti ar paaugstinātu mirstību. 26% pacientu bija delīrijs kā pēcoperācijas komplikācija, un kopējā mirstība viena gada laikā bija 37% ($p < 0,05$). Pacientu grupā, kam nebija pēcoperācijas delīrija, kopējā mirstība bija 15%. 23% pacientu bija pirmsoperācijas kognitīvie traucējumi, un 45,8% no viņiem nomira pirmajā gadā pēc operācijas ($p < 0,001$). Mirstība pacientiem, kuriem nebija kognitīvo traucējumu, bija 14%. Pētījumā iekļauto pacientu skaits bija neliels, tāpēc nākotnē būtu jārisina turpmāka izmeklēšana plašākā grupā.