

# The impact of preoperative cardiology consultation on the surgical treatment of patients with proximal femur fractures

Wpływ przedoperacyjnej konsultacji kardiologicznej na leczenie pacjentów ze złamaniami bliższego końca kości udowej

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## Abstract

**Introduction.** Proximal femur fractures are a common problem in the geriatric population. Moreover, due to numerous comorbidities, the choice of the appropriate form of treatment requires a cardiology consultation.

**Aim.** Therefore, the aim of this study is to analyze whether these consultations have a significant impact on the treatment of patients with proximal femoral fractures.

**Materials and methods.** A total number of 158 patients with a mean age of 81.3 (range, 56-98), treated for femoral neck and trochanteric fractures were enrolled in a retrospective study. Data from the patient's treatment history were used for the study, such as: age, hospital admission date, cardiological consultation date, surgery date, discharge date or date of death.

**Results.** Patients without cardiology consultation stayed in hospital on average 3.97 days shorter ( $p = 0.0011$ ) and had surgery on average 2.89 days earlier ( $p = 0.000001$ ) than patients with an arranged consultation. The percentage of deaths in both groups was similar: 6.1% and 7.1% ( $p = 0.70068$ ). Spinal anesthesia was mainly performed by anesthesiologists in the group with consultation (64.3%) and without consultation (83.8%) ( $p = 0.442$ ). More cases with a consultation were disqualified from surgery: 18.8% vs. 2.9% ( $p = 0.00357$ ). Among the patients with an ordered cardiological consultation, 53.6% had surgery > 48 hours after admission compared to 26.2% patients without consultation ( $p = 0.0002$ ).

**Conclusions.** Cardiological consultations extend the length of stay in hospital and delay surgical treatment, but do not affect the choice of anesthesia. However, consultation in some cases may help in the proper qualification and disqualification from surgery.

**Key words:** proximal femur fracture, delay in treatment, trochanter fracture, preoperative cardiology consultation.

## Streszczenie

**Wstęp.** Złamania bliższego końca kości udowej stanowią częsty problem w populacji geriatrycznej. Ponadto, ze względu na dużą liczbę chorób współistniejących, wybór metody leczenia operacyjnego wymaga niejednokrotnie konsultacji kardiologicznej.

**Cel.** W związku z powyższym, celem niniejszej pracy jest analiza, czy konsultacje mają istotny wpływ na proces leczenia pacjentów ze złamaniami bliższego odcinka kości udowej.

**Materiał i metody.** Do retrospektywnego badania zostało włączonych 158 pacjentów z średnią wieku 81,3 zakres, 56-98) lat, leczeni z powodu złamań części bliższej kości udowej. W badaniu wykorzystano dane z historii choroby: wiek, data przyjęcia do szpitala, data konsultacji kardiologicznej, data operacji oraz data wypisu ze szpitala lub zgonu.

**Wyniki.** Pacjenci, którzy nie byli konsultowani kardiologicznie przebywali w szpitalu średnio 3,97 dni krócej ( $p = 0,011$ ) i mieli operację średnio 2,89 dni wcześniej ( $p = 0,000001$ ), niż pacjenci ze zleconą konsultacją. Odsetek zgonów w obu grupach był zbliżony: 6,1% i 7,1% ( $p = 0,70068$ ). Anestezjologzy wybierali głównie znieczulenie podpajęczynówkowe zarówno u pacjentów z konsultacją (64,3%) jak i bez konsultacji (83,8%) ( $p = 0,442$ ). Więcej pacjentów z konsultacją zostało zdyskwalifikowanych z operacji: 18,8% vs 2,9% ( $p = 0,00357$ ). Wśród pacjentów, u których zlecono konsultację kardiologiczną, 53,6% przeszło operację > 48 godzin po przyjęciu w porównaniu z 26,2% pacjentami bez konsultacji ( $p = 0,0002$ ).

**Wnioski.** Konsultacje kardiologiczne wydłużają czas pobytu w szpitalu i opóźniają leczenie operacyjne, ale nie wpływają na wybór znieczulenia. Jednakże, konsultacja w niektórych przypadkach, może pomóc we właściwej kwalifikacji i dyskwalifikacji z leczenia operacyjnego.

**Słowa kluczowe:** złamanie części bliższej kości udowej, opóźnienie w leczeniu, złamanie przezekrętarzowe, przedoperacyjna konsultacja kardiologiczna.

## Introduction

Proximal femur fractures are a common problem in orthopedics departments, especially in the geriatric population. In Poland, the average age of people who develop this type of injury is 72 years [1]. It is estimated that for every 100 000 people who have any type of fracture, 63 women and almost 28 men suffer from proximal femur fracture. In addition, it is estimated that the number of patients with fractures of the proximal femur may double by 2025 to 2.6 million patients worldwide and by 2050 to 4.5 million patients [2]. Most of them will occur as a result of a low-energy injury. Risk factors include old age, female, low estrogen level and also deficiencies in diet, especially of calcium and vitamin D [3,4]. Furthermore, a proximal femur fracture may lead to severe complications, such as high blood loss, infection, embolism, pneumonia and even death [4]. Therefore, these fractures require surgical treatment in most cases. There are several methods of surgical treatment. Femoral neck fractures are mainly treated in the geriatric population with hemiarthroplasty (bipolar endoprostheses), while intertrochanteric fractures can be treated surgically with an intramedullary nail or sliding compression hip screw and side plate [5].

Moreover, numerous comorbidities are common in the geriatric population. The most common diseases are: hypertension, coronary artery disease, chronic heart failure, myocardial infarction and heart arrhythmias - especially atrial fibrillation. In addition to cardiological disease, other conditions also often occur in the elderly population, such as: diabetes, dementia, atherosclerosis, osteoporosis, chronic pulmonary diseases and rheumatic diseases [6,7]. Patients' medical histories are usually unknown because they come to the orthopedic department directly from the emergency ward. Due to frequent chronic heart diseases in the elderly population, anesthesiologists ask for a cardiological consultation to choose the safest type of anesthesia for the patient. This, may lead to a delay in surgical treatment, which, on the other hand, may lead to complications due to bed-stay, such as urinary tract infections, pneumonia, pressure ulcers, thromboses and cardiovascular events [4,8,9]. In contrast, early surgical intervention may reduce the morbidity and mortality risk in elderly patients [4,10]. The purpose of the present study was to examine the impact of the cardiological consultation on the treatment path in elderly patients with proximal femur fractures. We hypothesized that cardiological consultation can lead to surgical delay and, as a consequence, prolong the stay in the hospital and affect mortality.

## Materials and methods

To the retrospective study, 158 patients (M = 38; F = 120) treated at the department of orthopedics and traumatology

in 2019-2020 due to displaced proximal femur fractures (femoral neck fracture or trochanteric fracture) were included. The mean age was 81.3 (range, 56-98) years. All patients, based on preoperative radiographs, were classified as III or IV according to the Garden classification, assessing the femoral neck fracture and as type 2 according to the Evans classification, assessing trochanter fracture [11,12]. Patients with any of the following criteria were excluded: a pathological fracture, reoperation for failure of previous fixation, and death before surgery. The minimum follow-up period for each patient was 6 months.

The research was performed in accordance with the Helsinki declaration. All patients or their relatives gave written informed consent to be included in scientific studies during hospital admission. As this analysis consists of anonymized clinical routine data, the Research Ethics Committee Approval was not necessary in our Institution.

Data from the patient's treatment history were used for the study, such as: age, hospital admission date, cardiological consultation date (if it was ordered), surgery date, hospital discharge date or date of death. In addition, the type of anesthesia performed was analyzed. Before the surgery, each patient had to complete a questionnaire together with the anesthesiologist. If patients reported periodic chest pain, palpitations (arrhythmias) or unjustified fainting, a cardiological consultation was ordered at the anesthesiologist's request. The aim of the consultation was to determine whether there are any cardiological contraindications for anesthesia and what method of anesthesia would be the safest for the patient. All patients included in the study were classified according to the ASA (American Society of Anesthesiologists) physical status classification system in group 2 or 3.

## Statistical analyses

Data from the patient's medical history was analyzed statistically. The Shapiro-Wilk test was performed to check the normal distribution of variables. Continuous variables (Age; Length of hospital stay; Number of days from admission to surgery) were compared between the groups using the U-Mann Whitney test. Finally, univariate variables (gender, fracture type, surgery type, death, disqualification from surgery, anesthesia type) were compared using the Chi2 test or Fisher's exact test. Statistical calculations were performed in the Statistica 13.0.2 program. Statistical significance was accepted as significant at  $p < 0.05$ .

## Results

Patients spent, on average, 6.84 (range, 1-45) days in hospital. A trochanteric fracture was diagnosed in 80 patients (50.6%) and a femoral neck fracture in 78 patients (49.4%). The time from admission to hospital to surgery was, on average, 2.45 (range, 0-10) days. All patients with a trochanteric fracture qualified for surgery (n=71, 44.9%), had per-

formed stabilization with an intramedullary nail (IMN). Thirty-eight patients (24.1%) with a fractured femoral neck underwent hemiarthroplasty (HA), while 31 patients (19.6%) had total hip arthroplasty (THA) (Tab. 1). Eighteen patients (11.4%) were disqualified from surgery and 7 of these patients (38.9%) had ordered a preoperative cardiological consultation. General anesthesia was performed in 13 cases (8.2%), while regional (spinal) anesthesia during surgery was performed in 127 cases (80.4%). In 10 cases (6.3%) the patients died before leaving the hospital.

**Table 1. The group with the ordered cardiological consultation (Group I) compared with the group without this consultation (Group II) in terms of gender, fracture type and surgery type. The Chi2 test was used for comparison.**

	Group I (n = 130)	Group II (n = 28)	P Value
<b>Gender:</b>			
- Female	98 (75.4%)	22 (78.6%)	0.72042
- Male	32 (24.6%)	6 (21.4%)	
<b>Fracture Type:</b>			
- Femoral Neck	62 (47.7%)	16 (57.2%)	0.36426
- Trochanter	68 (52.3%)	12 (42.8%)	
<b>Surgery Type:</b>			
- THA	29 (22.3%)	2 (7.1%)	0.20175
- IMN	62 (47.7%)	9 (32.1%)	
- HA	30 (23.1%)	8 (28.6%)	

THA - Total Hip Arthroplasty; IMN - Intramedullary nail; HA - Hemiarthroplasty

Cardiological consultations were ordered in 28 cases (17.7%). The mean time from admission to hospital to cardiological consultation was 2.93 (range, 0-9) days. The patients were divided into two groups - Group I (patients without cardiological consultation); Group II (patients with an arranged cardiological consultation). The average age in Group I was 83.5 (range, 56-98), while in Group II it was 81.8 (range, 66-95) ( $p = 0.868$ ). Comparing the number of days of hospitalization, the patients from Group I stayed in hospital on average 3.97 days shorter than the patients from Group II ( $p = 0.0011$ ). Moreover, patients without a cardiological consultation had surgery on average 2.89 days earlier compared to the group where a cardiological consultation was arranged ( $p = 0.000001$ ). In Group II there were more cases disqualified from surgery compared to Group I: 18.8% vs. 2.9% ( $p = 0.00357$ ). The cardiology consultations contributed directly to disqualification from surgery in two out of nine cases (22.2%). The percentage of deaths in both groups was similar: 6.1% (Group I) and 7.1% (Group II) ( $p = 0.70068$ ). In the Group, where a cardiological consultation were not arranged, spinal anesthesia was mainly performed by anesthesiologists ( $n = 109$ ; 83.8%) compared to general anesthesia ( $n = 1$ ; 9.2%). Regional anesthesia was also the most commonly used in the group with cardiological consultation ( $n=18$ ; 64.3%) compared to general anesthesia ( $n = 1$ ; 3.6%). However, there were no statistically significant differences in the choice of anesthesia between both groups ( $p = 0.43446$ ) (Tab. 2).

**Table 2. The group with the arranged cardiological consultation (Group I) compared with the group without this consultation (Group II) in terms of: age; length of hospital stay; time from admission to surgery; number of disqualifications from surgical treatment; number of deaths; anesthesia type. The first three variables were compared using the U-Mann Whitney test; other variables were compared with the use of the Chi2 test.**

	Group I (n = 130)	Group II (n = 28)	P Value
<b>Age [years]</b>	83.5 (range, 56-98)	81.8 (range, 66-95)	0.86897
<b>Length of hospital stay [days]</b>	6.25 (range, 1-45)	10.22 (range, 1-26)	0.00114
<b>Time from admission to surgery [days]</b>	2.06 (range, 0-7)	4.95 (range, 1-10)	0.00002
<b>Number of disqualifications (%)</b>	9 (6.9%)	9 (32.1%)	0.00014
<b>Number of deaths (%)</b>	8 (6.1%)	2 (7.1%)	0.55809
<b>General anesthesia (%)</b>	12 (9.2%)	1 (3.6%)	0.44227
<b>Spinal anesthesia (%)</b>	109 (83.8%)	18 (64.3%)	

The patients were also divided into two other groups, in terms of the length from admission to surgery: Group I' - Surgery performed within 48 hours from admission ( $n = 91$ ) and Group II' - surgery performed more than 48 hours after admission ( $n = 45$ ). In Group I' one case of death (1.1%) was reported, while in Group II' 4 deaths (8.9%) ( $p = 0.0581$ ). Among patients with an arranged cardiological consultation, 15 patients (53.6%) underwent surgery more than 48 hours after admission, while 4 patients (14.3%) were operated within 48 hours. For comparison, in the group without consultation, 87 patients (66.9%) were operated within 48h from admission, and 34 patients (26.2%) above this period. The difference between the patients with cardiological consultation and the non-consulted patients, in terms of the length from admission to surgery, was statistically significant ( $p = 0.0002$ ) (Fig. 1).

## Discussion

In our study, cardiological consultations significantly prolonged the length of hospital stay as well as the delay in surgical treatment. Moreover, patients were more often disqualified from surgery when a cardiological consultation was arranged, of which consultations had a direct impact on disqualification in two out of nine cases. However, we did not observe that cardiological consultations influenced the mortality of patients and the choice of anesthesia type. Referring to the delay time of the surgery, as early as 1992, Bredhal et al. showed a lower mortality rate in patients who underwent the surgical treatment of a hip fracture within 12 hours of admission (25.5% vs. 34.5%) [13]. However, Grimes et al. in his work, showed no increased mortality in proximal femur fractures when surgery was performed more than 24h after admission [14]. Hamlet reports that the time of admission to the operating room

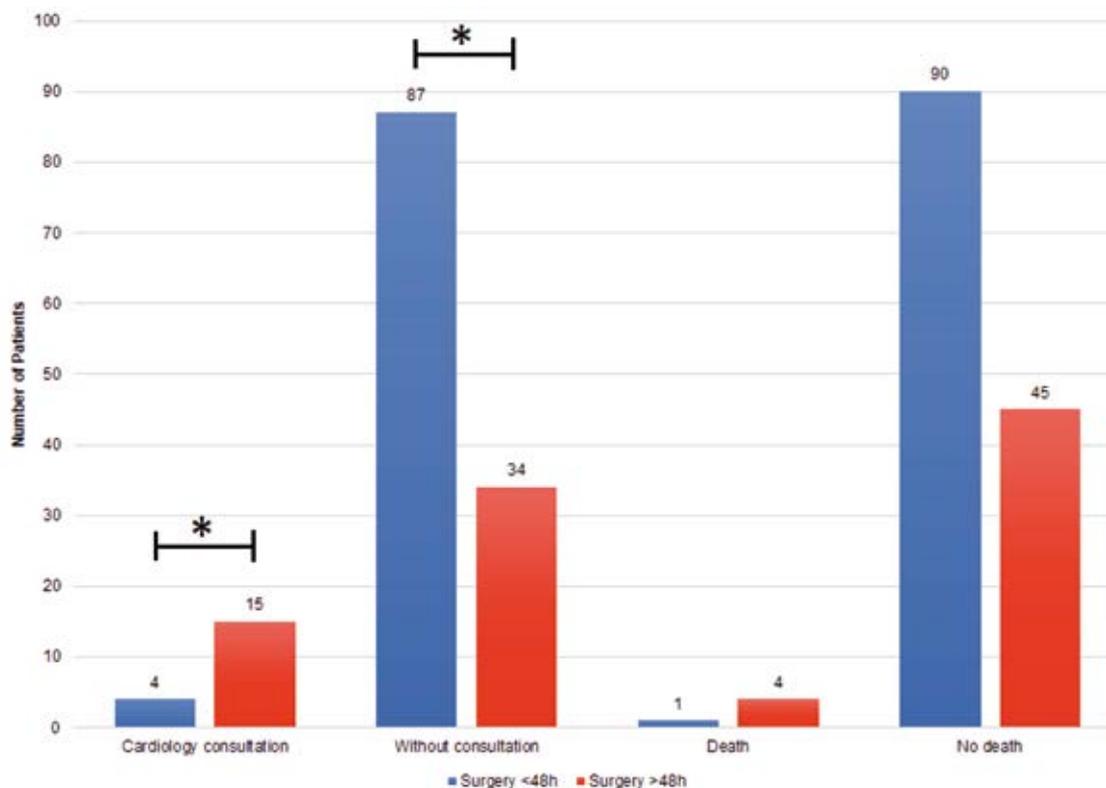


Fig. 1. Comparison of patients in terms of the length from admission to surgery (Group I, and Group II). Using Fisher's exact test, the groups were compared in terms of number of deaths and number of cardiological consultations.

\* Statistically significant difference.

from the moment of injury was the main factor differentiating mortality among his patients. Patients who had surgery performed within the first 24 hours of the fracture had a significantly lower mortality (20%) than patients whose surgery was performed after this time (50%), despite their state of health before surgery [15]. However, as the 2018 metanalysis by Klestil et al. shows, patients operated due to proximal femur fracture within 48 hours have a 20% lower mortality rate within 12 months. Moreover, earlier surgery also reduced the complication rate (8% vs. 17%) [4]. Interesting conclusions are also presented by Orosz et al., who prove that a shorter waiting time for surgery reduces the intensity and duration of pain after surgery [8]. In another study, Ferre et al. show that 57% of deaths within 30 days after proximal femur fracture are preventable by appropriate preoperative management. The authors emphasize not to delay surgery due to unnecessary consultations. In addition, they point out that regional anesthesia does not significantly affect the function of the cardiovascular system, so it can be used safely even in patients with multiple cardiological burdens [16]. In our study, we did not show an increased mortality rate, despite the fact that patients with a cardiological consultation had surgery performed almost 5 days after hospital admission. It is worth noting that, in our study, a greater number of deaths was recorded in patients operated 48 hours after admission, where the difference was at the border of statistical significance. This

trend is also proved in studies with a larger number of patients, such as the study by Schneider et al. carried out on a group of over 9 thousand geriatric patients, where it is shown that, in the case of patients with a fracture of the proximal femur, extending the delay of performing surgery beyond 48 hours significantly increases the mortality rate within 30 days after surgery [17]. This is also confirmed by Hamish's in his study where the delay of surgery beyond 48 hours was associated with an increase in 30-day mortality after hip fracture from 5.8% to 9.4% [18]. Analyzing the delay of surgical treatment, we referred the results to other orthopedic centers in Poland. While, in our study, the average waiting time for surgery was, 2 days for patients without consultation and less than 5 days for patients with a consultation, in the study performed by Glazer et al., the time from admission to surgery was, on average, 4 days. Moreover, the authors showed a longer delay in surgical treatment in a group of men ( $p < 0.007$ ) [19]. However, we were unable to confirm a similar relationship in our study.

Despite the fact that we did not check the complication rate in patients who had cardiological consultations, we managed to show that these patients not only undergo surgery later than patients without consultation, but also that they spend an average 3 days more in hospital (6 vs. 9 days). It has been shown, however, that a longer stay in hospital is not only associated with higher costs of treatment but also with a greater risk of complications, such

as pneumonia, embolism, urinary tract inflammation, etc. In the review written by Sicar et al., the authors prove that patients who underwent surgery within 48 hours had fewer complications (14.7%) than patients operated after 48h (33.3%) [20]. In addition, in a study on the prolonged length of stay in hospital, Rosman et al. report that the median time to the onset of any complications in patients was 6.2 days. The cumulative burden of any complications along the entire length ranged from 44% for 0-3 days stay to 100% for hospitalization over 11 days. Regardless of the reason for delaying discharge from hospital, an inadequate hospital stay is associated with an increased risk of infection and both short- and long-term mortality [21].

The ESC/ESA (European Society of Cardiology) European Society of Anesthesiology) Guidelines for Non-Cardiac Surgery 2014 discuss contraindications to proximal femur fractures. In patients with newfound severe systolic heart failure, it is recommended that non-urgent surgery should be postponed for  $\geq 3$  months to improve the patient's condition by conservative treatment. Poorly controlled blood pressure or new detected organ malfunction, as well as suspicion of secondary hypertension without an identifiable cause, can also be a reason for postponing non-cardiac surgery. In patients with 3 grades of hypertension, the potential benefits and risks of deferring surgery must be considered. With severe heart valve disease, a clinical assessment and echocardiography are recommended. If necessary, cardiological treatment before surgery should be considered. Arrhythmias such as atrial fibrillation (AF) and ventricular tachycardia (VT) are often the result of co-existing heart disease. The finding of an arrhythmia may result in delaying surgical intervention for a thorough cardiac evaluation [22]. On the other hand, Sonnese, in his study, showed that a cardiology consultation is usually unnecessary to perform orthopedic surgery [23]. There are claims that in patients with hip fractures, early surgical treatment is more important than having a cardiological consultation [24]. It extends the time before surgery, therefore, for patients with low and medium stages of cardiological disease, it is not advisable to wait for consultations [25]. Hence, it is important to consider whether delaying surgery due to cardiological consultations is justified.

Cardiological consultations help anesthesiologists in the process of qualifying the patient for surgery and in selecting the optimal form of anesthesia. However, it is worth emphasizing that the most frequently chosen type of anesthesia in the case of proximal femur fractures is spinal anesthesia. It shows many advantages, such as: shortened intraoperative time, improving the quality of recovery and lower healthcare costs via shorter hospitalization [26]. In addition, spinal anesthesia reduces the mortality rate in geriatric patients treated surgically for proximal femur fracture and also helps reduce persistent postoperative pain [27,28]. The European Society of Cardiology (ESC) guidelines indicate the consideration of spinal anesthesia

in patients with a long history of cardiovascular diseases. It reduces significant morbidity and mortality in those patients [29]. It is, therefore, not surprising that the vast majority of patients in our study underwent spinal anesthesia during surgery. Moreover, we showed that cardiological consultations had no effect on the type of performed anesthesia.

One of the limitations of our work is the relatively small number of patients and lack of information about postoperative complications. However, the main assumption of our study was to check whether cardiological consultations prolong the delay of surgery and length of stay in hospital. In addition, in our study, there is a trend that shows that cardiological consultations, although affecting the number of disqualifications from surgical treatment, do not affect the choice of anesthesia by anesthesiologists. Another limitation of our work is its retrospective nature. However, the collected data allowed to outline a trend that may help in future projects and prospective studies.

## Conclusion

Cardiological consultations in the geriatric population with a proximal femur fracture extend the length of stay in hospital and delay surgical treatment. At the same time, consultations do not affect the choice of anesthesia. However, in the case of patients with multiple cardiological diseases, the arranged consultation may help with appropriate qualification for surgical treatment and facilitate identifying patients who should be disqualified from surgery. On the other hand, the time of initiation of a surgical treatment is crucial, especially in the geriatric population. Therefore, the number of preoperative consultations should be reduced to a minimum or optimized in such a way that the consultation does not delay surgical treatment.

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