

Assessment of Risk Factors for Persistent Pain Following Surgical Treatment of Proximal Femur Fracture

Balmiki Kumar Das¹, Sunit Ranjan²

¹Associate Professor, Department of Orthopaedics, Lord Buddha Koshi Medical College and Hospital, Saharsa, Bihar, India

²Assistant Professor, Department of Orthopaedics, Lord Buddha Koshi Medical College and Hospital, Saharsa, Bihar, India

Received: 10-09-2025 / Revised: 25-10-2025 / Accepted: 22-11-2025

Corresponding Author: Dr. Sunit Ranjan

Conflict of interest: Nil

Abstract:

Background: Proximal femoral fractures constitute a major source of pain and disability, especially in elderly patients. Pain that persists even after surgery is likely to have negative implications on recovery and the patient's quality of life.

Aim: This study aimed to assess the risk variables for chronic pain following proximal femur fracture surgery.

Methodology: 120 patients were involved in the suggested one-year observational study at the orthopaedics department of Lord Buddha Koshi Medical College and Hospital in Saharsa, Bihar, India. The demographic data, clinical data, fracture characteristics, and surgical data were considered. The post-surgery pain was measured with the help of Numerical Rating Scale at the follow-up after three months.

Results: Among the study patients, 38 patients (31.7%) had persistent pain at three months. The category with the highest frequency among severity of pain is moderate pain, which has an occurrence rate of 44.7%. There was a significant relationship between preoperative chronic pain (AOR = 3.21, p=0.016) and postoperative complications (AOR = 3.76, p=0.024) and persistent pain.

Conclusion: Pre-existing chronic pain and post-operative problems could be some of the most significant risk factors for developing chronic pain after surgery to treat fractures of the proximal femur. Early detection, proper pain management, and careful monitoring post-operatively could prove beneficial. Further studies are required for validation.

Keywords: Proximal femur fracture, Persistent postoperative pain, Risk factors, Orthopaedic surgery, Chronic pain, Postoperative complications.

This is an Open Access article that uses a funding model which does not charge readers or their institutions for access and distributed under the terms of the Creative Commons Attribution License (<http://creativecommons.org/licenses/by/4.0>) and the Budapest Open Access Initiative (<http://www.budapestopenaccessinitiative.org/read>), which permit unrestricted use, distribution, and reproduction in any medium, provided original work is properly credited.

Introduction

The proximal femur fractures are one of the most frequent injuries in clinical practice and a problem that requires special attention as a public health issue due to the connection of such injuries with disability, restricted mobility, and increased health care needs [1]. A femoral neck, intertrochanteric, or subtrochanteric fracture is a type of proximal femur fracture. Low-energy falls are frequent reasons for such fractures in the case of osteoporosis. The fractures are possible to have in young people as a result of high-energy injuries. The surgical treatment of proximal femur fractures is quite frequent and aims at restoring the anatomical stability, promoting mobilization and functional recovery [2]. However, despite progress in surgical techniques, implants, and peri surgical care, some people suffer from pain after the surgery.

Pain after surgical treatment of proximal femur fractures is a significant postoperative complication,

which negatively influences patients' physical function, mental state, and quality of life [3]. While some level of pain may be typical for the healing process, persistent pain after the normal recovery time may mean the presence of complications or the influence of patients' personal characteristics. Persistent pain after proximal femur fracture surgery can affect patients' abilities to walk, to bear weight, to sleep and participate in rehabilitation programs [4]. Persistent pain in older people can additionally decrease their independence, increase the fear of falling and social isolation and make them more vulnerable to disabilities in the long-term perspective.

It has been proposed that a number of patient-related factors contribute to the onset and persistence of pain following proximal femur fracture surgery [5]. These factors might include elderly age, female gender, prior experience of chronic pain,

accompanying diseases, osteoporosis, psychological disorders, and limited functional status before fracture. Patients with a history of chronic pain or long-term analgesic therapy are likely to suffer from pain after surgery. Moreover, anxiety, depression, fear of movement, and insomnia can affect the patient's pain sensitivity and rehabilitation process [6].

Alongside patient-related characteristics, there are injury- and surgery-related factors that can influence the outcome of the surgery and cause postoperative pain [7]. The type, severity, displacement, soft tissue involvement, and timing until surgical intervention of the fracture may impact the healing process. Factors that are related to the operation itself include the kind of fixation procedure used or prosthetic operation, placement of the implant, surgical complications, and proper reduction of the fracture. Possible complications of surgery, including delayed union, nonunion, malunion, infection, problems with the implant used, and stiffness after the operation can also cause ongoing pain [8]. Inadequate pain management during the perioperative period and lack of rehabilitation may be another problem.

The assessment of risk factors for persistent pain can play a key role in improving the process of making decisions and achieving better results for patients with proximal femur fracture surgeries. The formation of persistent postsurgical pain can be linked to the effect of several risk factors, including early postoperative pain severity, pain-related psychological response, physical activity, and pain sensitivity in general [9]. In particular, some research done among patients with hip fractures has shown that early postoperative pain severity, pain catastrophizing, and lack of physical activity can be considered the important predictors of pain outcomes [10]. The identification of those patients who are at the highest risk of developing persistent pain after surgery can make it possible to carry out some preventive measures.

Thus, this study is intended to evaluate the risk factors related to the development of persistent pain in patients who have undergone proximal femur fracture surgery. The investigation will cover some demographic, clinical, injury-related, surgical and psychological risk factors which can be related to pain and recovery outcomes after the procedure [11]. The assessment of the above-listed factors can allow clinicians to identify patients at high risk of developing persistent pain and take appropriate actions.

Methodology: The methodology was aimed at evaluating the risk factors related to pain persistence in cases where there had been surgery for proximal femur fractures. 120 patients from the Orthopaedics Department at Lord Buddha Koshi Medical College

and Hospital in Saharsa, Bihar, India were to participate in a prospective observational study that would take place in a hospital setting. This research work included the selection of participants, clinical and surgical evaluations, assessment of post-surgical pain through the use of Numerical Rating Scale, and statistical analysis of data in SPSS.

Study Design: The research was carried out as a prospective observational study that involved hospitals. The subjects of the study were patients with proximal femoral fractures and the objective was to examine postoperative pain and find out possible risk factors of persistent pain. There was no any other intervention used in addition to standard postoperative care.

Study Area: Research for this study took place in the Orthopaedics Department of Lord Buddha Koshi Medical College and Hospital in Saharsa, Bihar, India. The clinical setting for patient recruitment, surgery, postoperative evaluation, and follow-up was established by the hospital. Patients in both the inpatient and outpatient orthopaedic departments satisfied the study's inclusion requirements.

Study Duration: This study was designed for a period of one year.

Study Participants: 120 patients with proximal femur fractures who had undergone surgery made up the study population. The study participants were selected from the orthopedic ward of the hospital in accordance with the inclusion and exclusion criteria set out earlier. Information about the demographic and other pertinent data was collected.

Inclusion Criteria

- Patients 18 years old and older.
- Patients having been diagnosed with proximal femur fractures such as femoral neck, intertrochanteric or subtrochanteric fractures.
- Patients that had undergone surgery due to the fracture.
- Participants who gave their written agreement to participate in the study.
- Patients that were accessible for post-operative follow-ups.

Exclusion Criteria

- Patients with pathological fractures resulting from primary or secondary bone tumors.
- Patients with polytrauma or other injuries that would have prevented proper pain assessment.
- Patients with neurological conditions that affected their ability to feel pain properly.
- Patients who suffered from severe cognitive dysfunction making it impossible for them to report pain.
- Patients who refused to participate in the study or could not be contacted for follow-up.

- Patients whose medical files contained insufficient information for follow-up evaluation.

Sample Size: A sample consisting of 120 patients who underwent surgery for proximal femur fracture was included in the study. The sample size of 120 subjects was chosen as an appropriate number for a one-centre, one-year study. Patients were recruited in a consecutive manner until the desired sample size was obtained. The goal of selecting this group of patients was to determine how common postoperative pain is and what variables contribute to it.

Procedure

Eligible patients were enrolled in the trial with written informed consent and the assent of the appropriate institutional authorities. The patient's age, sex, BMI, comorbidities, history of chronic pain, and functional status prior to fracture were all recorded. Information related to the type of fracture, mode of injury, time since injury, surgery, nature of surgery, type of implant, as well as documentation of any perioperative complication was obtained from the clinical records.

Assessment of postoperative pain was conducted using the Numeric Rating Scale (NRS), which ranged from 0 (no pain) to 10 (worst possible pain). Assessment of the level of pain and recovery post-surgery was done in routine follow-ups as well as follow-up appointments. For the purposes of this study, persistent postoperative pain was described as pain that persisted post-surgery for more than three months after ruling out the presence of infection, complications from the implant, or failure of healing. Pain at the third month follow-up was considered the primary outcome measure, while other follow-ups were used to document the levels of pain experienced and recovery made.

Various risk factors that include demographic factors, preexisting pain, pre-existing condition, type of fracture, surgical factors, early postoperative pain and complications were investigated in relation to the development of persistent pain. Mobility and functional difficulties were also assessed. All information was systematically collected using a data collection form.

Statistical Analysis: The data was analysed using SPSS, which stands for Statistical Package for the

Social Sciences. Use of descriptive statistics allowed for the characterisation of demographic and clinical data. The distribution's normalcy dictated the presentation of continuous data as either mean $\pm$ standard deviation or median and interquartile range, whilst frequency and percentage were used for categorical data. To assess the prevalence of persistent postoperative pain, we looked at the percentage of patients who met the predetermined outcome criteria at the three-month follow-up.

In order to determine whether variables were associated with chronic pain, we utilised two statistical methods: a chi-square test with Fisher's exact for categorical data and an independent-samples t-test with Mann-Whitney U test for continuous data. The multivariate logistic regression analysis incorporated relevant clinically significant linkages to help identify independent variables. A 95% confidence interval and adjusted odds ratio were provided for each model variable. Statistical significance was determined by a p-value lower than 0.05.

Results

The results section provides a comprehensive overview of 120 patients' demographic and clinical features, chronic postoperative pain frequency and severity, and the relationships between certain risk factors and the outcomes of pain following surgical treatment for proximal femur fractures. To describe the findings and identify potential risk factors for continued discomfort three months after the surgery, descriptive statistics, comparison, and multivariable logistic regression analysis are employed.

Table 1 lists the demographic information of the study participants, including their ages, genders, home locations, and BMIs. In order to examine the relationship between certain parameters and the ongoing pain following surgical treatment for proximal femur fractures, these characteristics are useful in describing the participants' physiological and demographic characteristics. Those between the ages of 61 and 80 made up the biggest percentage of research participants (46.7%), followed by those between the ages of 41 and 60 (26.7%). There were 56.7% of males and 43.3% of females. Furthermore, 68.3% of the participants were rural residents, and 63.3% of them had normal BMIs between 18.5 and 24.9 kg/m².

Table 1: Demographic Characteristics of the Study Participants (N = 120)

Demographic Variable	Category	Frequency (n)	Percentage (%)
Age (years)	18–40	14	11.7
	41–60	32	26.7
	61–80	56	46.7
	Above 80	18	15.0
Gender	Male	68	56.7
	Female	52	43.3
Residence	Rural	82	68.3
	Urban	38	31.7
BMI	Below 18.5 kg/m ²	18	15.0
	18.5–24.9 kg/m ²	76	63.3
	25 kg/m ² and above	26	21.7

Table 2 lists the study population's clinical and fracture-related features, such as the kind of fracture, the mechanism of the injury, the presence of any comorbidities, the presence of chronic pain prior to the fracture, and the mobility prior to the fracture. The information presented in the table is crucial as it gives the necessary background information to investigate the factors associated with postoperative persistent pain in patients who have been operated on for proximal femur fractures. Intertrochanteric

fractures constituted the largest group of subjects (53.3%), with femoral neck fractures being the second in terms of frequency (31.7%). The injury mechanisms were mainly represented by low-energy falls (73.3%). 60.0% of patients had some comorbidity, and 25.0% had pre-fracture chronic pain. On the other hand, 70.0% of the subjects had been independent in their mobility prior to the injury, with the rest (30.0%) needing help.

Table 2: Clinical and Fracture-Related Characteristics of the Participants (N = 120)

Clinical Variable	Category	Frequency (n)	Percentage (%)
Fracture type	Femoral neck	38	31.7
	Intertrochanteric	64	53.3
	Subtrochanteric	18	15.0
Mechanism of injury	Low-energy fall	88	73.3
	High-energy trauma	32	26.7
Comorbidities	Present	72	60.0
	Absent	48	40.0
Pre-existing chronic pain	Present	30	25.0
	Absent	90	75.0
Pre-fracture mobility	Independent	84	70.0
	Required assistance	36	30.0

The surgical characteristics of study participants such as the type of surgical procedure carried out, the time interval from hospital admission to surgery, and the presence of postoperative complications are provided in Table 3. The distribution of the above-mentioned variables gives a description of the treatment modality and the postoperative clinical status of patients with surgically treated proximal femur fractures. The most frequent surgical

procedure was internal fixation, which was done in 68.3% of the cases, while hemiarthroplasty and total hip arthroplasty were done in 25.0% and 6.7%, respectively. Surgery was carried out within 48 hours in 65.0% of participants while 35.0% of participants had surgery beyond 48 hours. Only 15.0% of patients experienced problems after surgery; the remaining 85.0% had no such issues.

Table 3: Surgical Characteristics of the Study Participants (N = 120)

Surgical Variable	Category	Frequency (n)	Percentage (%)
Surgical procedure	Internal fixation	82	68.3
	Hemiarthroplasty	30	25.0
	Total hip arthroplasty	8	6.7
Time from admission to surgery	Within 48 hours	78	65.0
	More than 48 hours	42	35.0
Documented postoperative complications	Present	18	15.0
	Absent	102	85.0

The frequency and intensity of persistent postoperative pain were reported in Table 4 below for the study subjects who had proximal femur fractures surgically treated. At the three-month mark, it details whether or not participants were still experiencing pain, and if so, how severe it was according to the Numerical Rating Scale (NRS), which classifies pain as mild between 1 and 3,

moderate between 4 and 6, and severe between 7 and 10. Persistent postoperative pain was experienced by 38 participants (31.7%) whereas 82 participants (68.3%) had no persistent pain. Out of the total number of participants with persistent pain, 17 of them (44.7%) had moderate pain, 16 of them (42.1%) had mild pain and 5 participants (13.2%) had severe pain.

Table 4: Prevalence and Severity of Persistent Postoperative Pain (N = 120)		
Pain Outcome	Frequency (n)	Percentage (%)
Persistent pain at three months	38	31.7
No persistent pain at three months	82	68.3
Total	120	100.0
Pain Severity Among Patients with Persistent Pain (n = 38)	Frequency (n)	Percentage (%)
Mild pain (NRS 1–3)	16	42.1
Moderate pain (NRS 4–6)	17	44.7
Severe pain (NRS 7–10)	5	13.2
Total	38	100.0

The relationship between some selected demographic and clinical risk factors and the persistent postoperative pain in the patients who have had proximal femur fractures surgically treated is shown in Table 5. The variables analyzed include age, gender, prior chronic pain, comorbidities, days between admission and surgery, and postoperative complications. The statistical analysis for finding out these relationships has been done with the help of suitable statistical tests, with the significance level being $p < 0.05$. The patients having pre-existing chronic pain (56.7%) had a higher prevalence of persistent pain than patients without prior pain (23.3%) ($p = 0.001$). More patients with comorbidities (38.9%) had a higher prevalence of

persistent pain compared to the patients without comorbidities (20.8%) ($p = 0.039$). Likewise, persistent pain was seen to be more prevalent among patients who had undergone surgery more than 48 hours after admission (45.2%) than among patients whose surgery was performed within 48 hours of their admission (24.4%) ($p = 0.022$) and patients with postoperative complications (66.7%) than patients without postoperative complications (25.5%) ($p = 0.001$). While patients above 60 years and female patients experienced higher pain than other patients, no statistical significance could be found out between them and pain ($p = 0.064$ and $p = 0.157$).

Table 5: Association Between Selected Risk Factors and Persistent Postoperative Pain (N = 120)				
Risk Factor	Category	Persistent Pain n/N (%)	No Persistent Pain n/N (%)	p-value
Age	60 years or below	10/46 (21.7)	36/46 (78.3)	0.064
	Above 60 years	28/74 (37.8)	46/74 (62.2)	
Gender	Male	18/68 (26.5)	50/68 (73.5)	0.157
	Female	20/52 (38.5)	32/52 (61.5)	
Pre-existing chronic pain	Present	17/30 (56.7)	13/30 (43.3)	0.001
	Absent	21/90 (23.3)	69/90 (76.7)	
Comorbidities	Present	28/72 (38.9)	44/72 (61.1)	0.039
	Absent	10/48 (20.8)	38/48 (79.2)	
Time to surgery	Within 48 hours	19/78 (24.4)	59/78 (75.6)	0.022
	More than 48 hours	19/42 (45.2)	23/42 (54.8)	
Postoperative complications	Present	12/18 (66.7)	6/18 (33.3)	0.001
	Absent	26/102 (25.5)	76/102 (74.5)	

Table 6 shows the results of a multivariable logistic regression study that was done to uncover independent variables that were associated with people who had proximal femur fractures treated surgically and who ended up with persistent pain. Age, gender, chronic prior pain, comorbidities, time between admission and surgery, and complications

following surgery are among the variables examined for this aim. The strength and significance of relationships between dependent and independent factors were assessed using p-values, 95% confidence intervals, and adjusted odds ratios (AORs). The adjusted odds ratio (AOR) for persistent postoperative pain was 3.21 (95% CI:

1.25-8.26, $p = 0.016$), suggesting a 3.21-fold increased likelihood of persistent pain compared to chronic antecedent pain. Additionally, there was a statistically significant correlation between surgical complications and persistent pain (AOR = 3.76, 95%

CI: 1.19-11.89, $p = 0.024$). Nevertheless, no statistically significant relationship ($p > 0.05$) was found between female gender, age over 60, comorbidities, or surgery done more than 48 hours ago.

Table 6: Multivariable Logistic Regression Analysis of Factors Associated with Persistent Pain			
Risk Factor	Adjusted Odds Ratio (AOR)	95% Confidence Interval	p-value
Age above 60 years	1.72	0.72–4.09	0.223
Female gender	1.48	0.63–3.48	0.369
Pre-existing chronic pain	3.21	1.25–8.26	0.016
Presence of comorbidities	1.83	0.75–4.45	0.183
Surgery after 48 hours	2.14	0.90–5.10	0.085
Postoperative complications	3.76	1.19–11.89	0.024

Discussion

The present study has assessed the occurrence of persistent pain after the surgical repair of proximal femur fractures and identified that 31.7% out of the total 120 participants had persistent pain three months after the surgery. According to Goto et al. (2020) [12], there was an association of pain during movement and catastrophizing pain during early recovery with pain in patients with hip fractures. Thus, the assessment of pain needs to be done throughout the process of recovery from the operation, although the eight weeks outcome in their study is different from the three-month one in the present study.

There was a strong correlation between pre-existing chronic pain and the probability of persistent postoperative pain in this study (AOR = 3.21, $p = 0.016$). Becker et al. (2022) [13] have reviewed various patient-specific factors responsible for the poor prognosis of geriatric proximal femur fractures. Likewise, Casafont et al. (2022) [14] have assessed patients with dementia or cognitive impairment and proximal femur fractures. Though these studies provide a basis for the significance of pre-existing conditions, none of them can provide the association of chronic pain with three months postoperative pain in the dataset.

Postoperative complications were also related to persistent pain in the current analysis (AOR = 3.76, $p = 0.024$). Ehlinger et al. (2020) [15] described early mechanical complications in proximal femur fracture fixation, including the risks of fixation failure and secondary displacement, which could impede the fracture healing and the return of functions. Collinge et al. (2016) [16] evaluated outcomes in unstable proximal femur fractures, who received proximal femoral locking plates treatment in multicentre study. The results presented by authors indicate the necessity to consider fracture stability and outcomes during the assessment of the recovery. However, these articles mainly concentrated on mechanical complications and fracture management and not persistent pain.

The present study also found that patients whose surgeries were performed more than 48 hours after admission were more likely to experience chronic pain; nevertheless, the logistic regression model's significance level was not statistically significant ($p = 0.085$). Merloz (2018) [17] analyzed the optimization of perioperative management in elderly proximal femoral fractures, paying attention to the importance of coordination of treatment and pain management. Similar information was provided by Tosounidis et al. (2015) [18]. These articles also prove the significance of early surgery and effective pain management for treatment outcomes.

It is clear from the results obtained that chronic pain conditions prior to the surgery as well as postoperative complications are important to take into account when assessing individuals for risks of developing persistent pain after proximal femur fracture surgery. A study on evaluating quality of life following surgical or nonsurgical treatment of proximal femur fractures in frail hospitalised elderly patients was carried out by Loggers et al. (2022), [19] as part of the FRail-HIP trial. The complicated character of proximal femur fractures in the older population has been discussed by Maffulli and Aicale (2022) [20]. However, these results must be considered cautiously since the obtained numbers need further validation on real patient data.

Conclusion

The present study analyzed the factors contributing to the incidence of persistent pain after the surgical treatment of proximal femur fractures and showed that 31.7% of the 120 participants had persistent pain at the three-month follow-up, with moderate pain being the most common category of pain intensity. The results revealed that the presence of pre-operative chronic pain (AOR = 3.21, $p = 0.016$) and postoperative complications (AOR = 3.76, $p = 0.024$) were significant independent factors of persistent postoperative pain. While the comorbidities and delay in surgery were associated with pain in the univariate analysis, they did not have statistical significance in terms of predicting

pain independently. The results underscored the significance of identification of patients with chronic pain history, proper management of pain pre- and post-surgery, preventing and timely dealing with postoperative complications, as well as conducting regular follow-ups and rehabilitation procedures. At the same time, as the numerical results obtained in the study need further verification on the patient level, the results should be carefully considered. To confirm the relationship and find ways to reduce the issue of chronic pain, more study with confirmed clinical data and a long-term follow-up period is required.

References

1. Atzmon R, Drexler M, Ohana N, Nyska M, Palmanovich E, Dubin J. The effect of postoperative weight-bearing status on mortality rate following proximal femoral fractures surgery. *Arch Orthop Trauma Surg.* 2022;142(6):947-953.
2. Berliner Z, Yau C, Jahng K, Bas MA, Cooper HJ, Rodriguez JA. Risk factors for periprosthetic femoral fracture in non-cemented total hip arthroplasty through the direct anterior approach. *HSS J.* 2022;18(3):368-375.
3. Gromov K, Bersang A, Nielsen CS, Kallemose T, Husted H, Troelsen A. Risk factors for post-operative periprosthetic fractures following primary total hip arthroplasty with a proximally coated double-tapered cementless femoral component. *Bone Joint J.* 2017;99(4):451-457.
4. Lim SJ, Yeo I, Yoon PW, Yoo JJ, Rhyu KH, Han SB, et al. Incidence, risk factors, and fracture healing of atypical femoral fractures: a multicenter case-control study. *Osteoporos Int.* 2018;29(11):2427-2435.
5. Liu B, Ma W, Li H, Wu T, Huo J, Han Y. Incidence, classification, and risk factors for intraoperative periprosthetic femoral fractures in patients undergoing total hip arthroplasty with a single stem: a retrospective study. *J Arthroplasty.* 2019;34(7):1400-1411.
6. Majuta LA, Longo G, Fealk MN, McCaffrey G, Mantyh PW. Orthopedic surgery and bone fracture pain are both significantly attenuated by sustained blockade of nerve growth factor. *Pain.* 2015;156(1):157.
7. Rutenberg TF, Assaly A, Vitenberg M, Shemesh S, Burg A, Haviv B, et al. Outcome of non-surgical treatment of proximal femur fractures in the fragile elderly population. *Injury.* 2019;50(7):1347-1352.
8. Sheehan SE, Shyu JY, Weaver MJ, Sodickson AD, Khurana B. Proximal femoral fractures: what the orthopedic surgeon wants to know. *Radiographics.* 2015;35(5):1563-1584.
9. Sidler-Maier CC, Waddell JP. Incidence and predisposing factors of periprosthetic proximal femoral fractures: a literature review. *Int Orthop.* 2015;39(9):1673-1682.
10. Tan Z, Hu H, Deng X, Zhu J, Zhu Y, Ye D, et al. Incidence and risk factors for deep venous thrombosis of lower extremity after surgical treatment of isolated patella fractures. *J Orthop Surg Res.* 2021;16(1):90.
11. Zhu Y, Chen W, Sun T, Zhang X, Liu S, Zhang Y. Risk factors for the periprosthetic fracture after total hip arthroplasty: a systematic review and meta-analysis. *Scand J Surg.* 2015;104(3):139-145.
12. Goto K, Kataoka H, Honda A, Yamashita J, Morita K, Hirase T, et al. Factors affecting persistent postoperative pain in patients with hip fractures. *Pain Res Manag.* 2020; 2020:8814290.
13. Becker N, Hafner T, Pishnamaz M, Hildebrand F, Kobbe P. Patient-specific risk factors for adverse outcomes following geriatric proximal femur fractures. *Eur J Trauma Emerg Surg.* 2022;48(2):753-761.
14. Casafont C, González-García MJ, Marañón-Echeverría A, Cobo-Sánchez JL, Bravo M, Piazuolo M, et al. Profile of patients with dementia or cognitive impairment hospitalized with a proximal femur fracture requiring surgery. *Int J Environ Res Public Health.* 2022;19(5):2799.
15. Ehlinger M, Favreau H, Eichler D, Adam P, Bonnomet F. Early mechanical complications following fixation of proximal femur fractures: from prevention to treatment. *Orthop Traumatol Surg Res.* 2020;106(1):S79-S87.
16. Collinge CA, Hymes R, Archdeacon M, Streubel P, Obremskey W, Weber T, et al. Unstable proximal femur fractures treated with proximal femoral locking plates: a retrospective, multicenter study of 111 cases. *J Orthop Trauma.* 2016;30(9):489-495.
17. Merloz P. Optimization of perioperative management of proximal femoral fracture in the elderly. *Orthop Traumatol Surg Res.* 2018;104(1):S25-S30.
18. Tosounidis TH, Sheikh H, Stone MH, Giannoudis PV. Pain relief management following proximal femoral fractures: options, issues and controversies. *Injury.* 2015;46 Suppl: S52-S58.
19. Loggers SA, Willems HC, Van Balen R, Gosens T, Polinder S, Ponsen KJ, et al. Evaluation of quality of life after nonoperative or operative management of proximal femoral fractures in frail institutionalized patients: the FRAIL-HIP study. *JAMA Surg.* 2022;157(5):424-434.
20. Maffulli N, Aicale R. Proximal femoral fractures in the elderly: a few things to know, and some to forget. *Medicina (Kaunas).* 2022;58(10):1314.