ORIGINAL ARTICLE

DOI: 10.4274/hamidiyemedj.galenos.2025.06978

Hamidiye Med J 2025;6(2):119-123

Systemic Effects of Hip Fractures and Surgical Treatment

Kalça Kırıkları ve Cerrahi Tedavilerinin Sistemik Etkileri

Murat Gök[1], Sevan Sıvacıoğlu[2], Onur Çetin[3]

[1]*Balıkesir Atatürk City Hospital, Clinic of Orthopedics and Traumatology, Balıkesir, Türkiye*

[2]*Private Clinic, İstanbul, Türkiye*

[3]*Çamlıca Medipol University Hospital, Department of Orthopedics and Traumatology, İstanbul, Türkiye*

ABSTRACT

Background: Hip fractures are one of the common types of fractures observed in the elderly population, and various implants can be successfully used in their treatment. The aim of this study is to determine whether there is a significant difference in surgical stress and potential complications between osteosynthesis techniques and arthroplasty.

Materials and Methods: Seventy-nine patients who underwent surgery for hip fracture were included in the study. Age, gender, type of fracture, and the surgical procedure applied were recorded. The effects of hip fracture and the surgical method on the general systemic inflammation, muscle damage, the cardiovascular system, the kidney, and the liver were examined.

Results: Of the 79 patients included in our study, 28 (35%) were male, and 51 (65%) were female. Among these patients, 44 (56%) were treated with osteosynthesis, and 35 (44%) underwent hemiarthroplasty. When comparing the groups based on haemoglobin changes, it was not statistically significant (p=0.601), although there was a greater decrease in hemoglobin levels at the 6th postoperative hour in the hemiarthroplasty group. When patients were evaluated based on C-reactive protein values, the increase from preoperative levels in the hemiarthroplasty group was higher than that in the osteosynthesis group, but it was not statistically significant (p=0.816). Moreover, there was no significant difference between the two groups regarding creatine kinase, creatine kinase-MB isoenzyme, cardiac Troponin, aspartate aminotransferase, alanine aminotransferase, serum creatinine, and D-dimer values.

Conclusion: In the treatment of hip fractures, no significant difference was observed between hemiarthroplasty and osteosynthesis in terms of acute systemic effects.

Keywords: Intertrochanteric fractures, femoral neck fractures, hip replacement arthroplasty, osteosynthesis

ÖZ

Amaç: İleri yaştaki toplumda kalça kırıkları sık görülen kırık türlerinden biridir ve tedavisinde çeşitli implantlar başarı ile kullanılabilmektedir. Bu çalışmanın amacı; osteosentez teknikleri ve artroplasti arasında cerrahi stres ve olası komplikasyonlar açısından anlamlı bir farklılık olup olmadığının tespit edilmesidir.

Gereç ve Yöntemler: Kalça kırığı tanısı ile opere edilen 79 hasta çalışmaya dahil edildi. Kalça kırığının ve uygulunan cerrahi yöntemin; genel sistemik enflamasyon ve kas yıkımı, kardiyovasküler sistem, böbrek ve karaciğer üzerine etkileri incelendi. Bu amaçla ameliyat öncesi, ameliyat sonrası 6., 24. ve 72. saat hemogram, C-reaktif protein (CRP), kreatin kinaz, CK-MB, Troponin, aspartat aminotransferaz (AST), alanin aminotransferaz (ALT), kreatinin, D-dimer değerleri kontrol edildi.

Bulgular: Çalışmamıza dahil edilen 79 hastanın, 28'i (%35) erkek, 51'i (%65) kadındı. Bu hastalardan 44'üne (%56) tedavide osteosentez, 35'ine (%44) hemiartroplasti uygulanmıştı. Hemoglobin değişimine göre hasta grupları incelendiğinde; post operatif 6. saatteki hemoglobin düşüşü hemiartroplasti uygulanan grupta daha fazla olsa da istatiksel olarak anlamlı değildi (p=0,601). Hastalar CRP değerlerine göre değerlendirildiğinde hemiartroplasti grubunda pre-operatif değerlerle kıyaslandığında, CRP değerlerindeki artış osteosentez grubundan daha fazla olsa da istatiksel olarak anlamsız bulundu (p=0,816). Benzer şekilde CK, CK-MB, Troponin, AST, ALT, kreatinin ve D-dimer değerleri açısından incelendiğinde de hemiartroplasti grubu ile osteosentez grubu arasında anlamlı fark saptanmadı.

Sonuç: Kalça kırıklarının tedavisinde tercih edilebilecek yöntemlerden hemiartroplasti ve osteosentez arasında akut dönemde sistemik etkiler açısından anlamlı fark saptanmamıştır.

Anahtar Kelimeler: İntertrokanterik kırıklar, femur boynu kırıkları, kalça replasman artroplasti, osteosentez

Address for Correspondence: Murat Gök, Balıkesir Atatürk City Hospital, Clinic of Orthopedics and Traumatology, Balıkesir, Türkiye
E-mail: dr.muratgok@yahoo.com **ORCID ID:** orcid.org/0000-0002-9435-0225

Received: 12.05.2025 **Accepted:** 30.06.2025 **Publication Date:** 04.07.2025

Cite this article as: Gök M, Sıvacıoğlu S, Çetin O. Systemic effects of hip fractures and surgical treatment. Hamidiye Med J. 2025;6(2):119-123

Copyright© 2025 The Author. Published by Galenos Publishing House on behalf of University of Health Sciences Türkiye, Hamidiye Faculty of Medicine. This is an open access article under the Creative Commons Attribution-NonCommercial-NoDerivatives 4.0 (CC BY-NC-ND) International License.

Introduction

Hip fractures are one of the most common types of fractures in the elderly population, and various implants can be used successfully in their treatment. These include Dynamic Hip Screw (DHS), Cannulated screws, plate-screw fixation, Proximal Femur Nail (PFN), hemiarthroplasty, and total arthroplasty. Studies and discussions about which treatment to choose for hip fractures are still ongoing. One of the factors affecting the choice is the surgical stress on the patient, including soft tissue damage during surgery, blood loss, and duration of surgery. Treatment can be divided into osteosynthesis and arthroplasty. In general, osteosynthesis techniques are less invasive than arthroplasty techniques, which are thought to cause less surgical stress on the patient (1). The hypothesis of this study is that there will be less surgical stress in hip fractures treated with osteosynthesis compared to hemiarthroplasty. Our aim in this study was to determine whether there is a significant difference between osteosynthesis techniques and arthroplasty regarding surgical stress and possible complications.

Materials and Methods

In this study, we retrospectively evaluated patients aged 65 years and older who were admitted to a tertiary care hospital with a hip fracture between 2018 and 2019. All patients underwent surgical treatment, had low-energy trauma (simple fall from the same level) as the fracture etiology and underwent surgery within the first 48 hours after the fracture. Patients under 65 years of age with subtrochanteric fractures with additional concomitant injuries with irregular follow-up with conservative follow-up who underwent revision surgery who died in the period who could not be operated on within the first 48 hours were excluded from the study.

The operations were performed by the same surgical team. A proximal femur nail was applied after closed reduction using a traction table for osteosynthesis. In the arthroplasty group, all patients underwent hemiarthroplasty using the Lateral Hardinge approach. Age, gender, fracture type, American Society Anesthesiologists (ASA) score, body mass index (BMI), and type of surgery performed were recorded. The effects of hip fracture and surgical method on general systemic inflammation, muscle destruction, the cardiovascular system, the kidney, and the liver were analysed. For this purpose, haemogram, C-reactive protein (CRP), creatine kinase (CK), creatine kinase-MB isoenzyme (CK-MB), cardiac Troponin (Troponin), aspartate aminotransferase (AST), alanine aminotransferase (ALT), serum creatinine (Creatinine), and D-dimer values were checked preoperatively, 6, 24, and 72 hours, postoperatively. Approval was received from the Ethics Committee of University of Health Sciences Türkiye, İzmir Bozyaka Training and Research Hospital, Clinical Research Ethics Committee (approval number: 2023/88, dated: 21.06.2023). Informed consent was obtained from the patients or their relatives.

Statistical Analysis

Statistical analyses were performed using IBM SPSS 20.0 (IBM Corp., Armonk, NY, USA). Mean, standard deviation, and median values were used for descriptive analyses. Chi-square, t-test, and non-parametric tests were used to analyse numerical data. The normal distribution was evaluated using the Kolmogorov-Smirnov.

Results

Of the 79 patients included in our study, 28 (35%) were male and 51 (65%) were female. The mean age was 76.63±10.17 (65-93) years. Osteosynthesis and hemiarthroplasty were performed in 44 (56%) and 35 (44%) of these patients. Twenty-nine patients (37%) had AO A2 type fractures (Table 1). When analyzed according to fracture type progression from A1 to B2, more patients underwent hemiarthroplasty, and the difference in surgical method according to fracture type was significant (p=0.001). The mean age of the patients who underwent osteosynthesis was 73.32±12.0, while the mean age of those who underwent hemiarthroplasty was 80.77±7.3. A significant difference was found between the two groups in terms of age (p=0.001). When the decrease in hemoglobin (Hb) was analyzed based on fracture types, it was found that Hb decrease was significantly higher in patients with type B fractures than in patients with type A fractures (p=0.001). The mean ASA score was 2.61±0.72 in the osteosynthesis group and 2.63±0.54 in the hemiarthroplasty group (p=0.920). The mean BMI was 27.65±3.14 in the osteosynthesis group and 26.61±3.79 in the hemiarthroplasty group (p=0.736).

In all patients, the mean preoperative Hb was 11.7±0.1, the mean postoperative Hb at the 6th hour was 10.17±1.49, the mean Hb at the 24th hour was 9.6±0.12, and the mean Hb at the 72nd hour was 9.16±1.35. The postoperative Hb decrease was found to be significant regardless of the

Table 1: Distribution according to fracture type

Fracture type	Number (n)	Percentage (%)
A1	17	21.5
A2	29	36.7
A3	6	7.6
B1	7	8.9
B2	20	25.5
Total	79	100

surgical method (p=0.001) (Table 2). When the patient groups were analysed according to haemoglobin change, the mean post-operative Hb decrease at the sixth hour was 1.77±1.54 in the hemiarthroplasty group and 1.46±1.15 in the osteosynthesis group. Although the Hb decrease at the 6th post-operative hour was higher in the hemiarthroplasty group, it was not statistically significant (p=0.601). When the two groups were analysed according to the Hb decrease at the 24th post-operative hour the haemoglobin decrease in the hemiarthroplasty group (2.30±2.12) was higher than in the osteosynthesis group (2.08±1.48), but it was not statistically significant (p=0.787). The decrease in Hb at 72 hours postoperatively was 2.61±1.53 in the hemiarthroplasty group and 2.44±1.21 in the osteosynthesis group, with no statistically significant difference (p=0.836) (Table 3).

When the postoperative CRP changes were analysed according to the preoperative CRP values of the patients, the preoperative CRP mean was 57.75±42.34 in the general patient group; it was 94.60±58.0 at the 6th postoperative hour, 146.51±50.88 at the 24th postoperative hour, and 201.24±71.60 at the 72nd postoperative hour. When the preoperative CRP mean was compared with the 6th hour (p=0.001), 24th hour (p=0.001), and 72nd hour (p=0.001), CRP means, a significant difference was found in all three groups. The mean CRP increased significantly as the postoperative period progressed (p=0.001). In all three evaluations, while the increase in CRP values was higher in the hemiarthroplasty group compared to the preoperative values than in the osteosynthesis group, it was not statistically significant.

In the general patient group, the mean pre-operative CK levels were 144.63±174.27, 450.25±448.72 at 6 hours post-operative, 610.87±177.02, at 24 hours post-operative, and 230.78±210.95 at 72 hours post-operative. Regardless of the surgical method, preoperative CK values and CK

Table 2. Preoperative and postoperative mean laboratory values and statistical analysis of preoperative and postoperative values in general patient population

	Pre-operative	Post-operative 6th hour		Post-operative 24th hour		Post-operative 72nd hour	
	Mean	Mean	p-value	Mean	p-value	Mean	p-value
Hemoglobin	11.76	10.17	0.001	9.61	0.001	9.16	0.001
Creatinine	1.13	1.17	0.506	1.14	0.887	1.26	0.404
CRP	57.76	96.75	0.001	143.22	0.001	196.38	0.001
CK	165.73	452.41	0.002	606.93	0.046	231.38	0.105
D-dimer	2242.09	4276.12	0.004	1489.23	0.205	1327.31	0.080
AST	27.46	38.70	0.004	46.55	0.017	32.47	0.218
ALT	17.82	26.16	0.004	25.22	0.028	21.76	0.199
Troponin I	0.02	0.03	0.338	0.08	0.098	0.04	0.001
CK-MB	2.38	5.97	0.001	6.89	0.028	3.14	0.401
Fibrinogen	478.75	497.25	0.403	516.60	0.011	714.51	0.001

CRP: C-reactive protein, CK: Creatine kinase, AST: Aspartate aminotransferase, ALT: Alanine aminotransferase, CK-MB: Creatine kinase myocardial band

Table 3: Preoperative and postoperative 6th, 24th and 72nd hour laboratory value averages and statistical comparison of osteosynthesis and hemiarthroplasty groups

	Post-operative 6th hour			Post-operative 24th hour			Post-operative 72nd hour		
	Osteosynthesis	Arthroplasty	p-value	Osteosynthesis	Arthroplasty	p-value	Osteosynthesis	Arthroplasty	p-value
Hemoglobin	9.97	10.13	0.601	9.47	9.59	0.787	9.07	9.28	0.836
Creatinine	1.15	1.19	0.113	1.11	1.17	0.173	1.23	29.53	0.443
CRP	85.76	110.95	0.816	130.56	163.78	0.461	178.88	217.04	0.080
CK	388.92	543.84	0.059	718.86	500.09	0.637	199.14	269.00	0.064
D-dimer	3887.33	4837.70	0.724	1504.81	1469.28	0.764	1591.06	986.62	0.705
AST	38.87	38.48	0.686	52.00	39.53	0.353	32.81	32.10	0.623
ALT	27.74	24.06	0.265	29.28	20.00	0.095	25.71	17.39	0.067
Troponin I	0.01	0.05	0.141	0.02	0.16	0.102	0.03	0.06	0.073
CK-MB	5.12	7.35	0.954	6.90	6.87	0.579	2.11	4.28	0.093
Fibrinogen	510.92	476.73	0.377	510.06	524.96	0.107	721.97	704.87	0.615

CRP: C-reactive protein, CK: Creatine kinase, AST: Aspartate aminotransferase, ALT: Alanine aminotransferase, CK-MB: Creatine kinase myocardial band)

increases at 6 hours postoperative (p=0.002) and 24 hours postoperative (p=0.046) were found to be significant, but CK values decreased at 72 hours postoperative to approach preoperative values (p=0.105). Although the CK increase in the first 6 hours was higher in the hemiarthroplasty group, it was not statistically significant (p=0.059) when a comparison was made in terms of CK levels.

When the D-dimer values of the patients were analysed, it was found that the preoperative mean D-dimer level was 2267.50±500.30, while the postoperative mean D-dimer level was 4983.25±726.04 at the 6th postoperative hour. D-dimer levels increased significantly at the 6th postoperative hour, when compared with the preoperative mean (p=0.004). However, it was found that the mean D-dimer level decreased at the 24th hour postoperatively compared to the 6th hour, and this decrease continued at the 72nd hour compared to the 24th hour. There was no statistically significant difference between postoperative 24-hour and 72-hour. D-dimer values compared to pre-operative levels (p=0.205 and p=0.08, respectively). When the patient groups were analysed in terms of surgical techniques, no significant difference was found between the two groups regarding the increase in D-dimer levels compared to preoperative values (p=0.724).

According to the creatinine values obtained at the 6th and 24th postoperative hours, no significant difference was found between the two groups in terms of creatinine increase (p=0.113, p=0.173). When AST values at postoperative 6th and 24th hours were analysed, no significant difference was found between the two groups (p=0.693 and p=0.353).

When CK-MB values were controlled, a significant difference was found between the preoperative mean and the mean values at the 6th and 24th hours postoperatively (p=0.001). There was no significant difference between surgical techniques in CK-MB values.

When analysis was conducted according to Troponin values, no significant difference was found between preoperative and postoperative 6 and 24 h Troponin values in the general patient group (p=0.338; p=0.098, respectively), whereas the increase in Troponin value at 72 h was significant (p=0.001).

Discussion

Wu et al. (2) reported that 190 of 213 patients (89%) operated for hip fracture had post-operative anaemia. In our study, a significant decrease in haemoglobin postoperatively was observed in patients operated on for hip fracture, independent of the surgical method, when compared with the preoperative values.

In a meta-analysis by Bhandari et al. (3), it was found that patients who underwent arthroplasty for hip fracture had more blood loss than patients who underwent internal fixation. In our study, although blood loss was numerically higher in the hemiarthroplasty group, the difference was not statistically significant between the two groups.

Neumaier et al. (1) studied 580 patients with proximal femur fracture and investigated the effect of osteosynthesis and arthroplasty on CRP levels in the treatment of hip fracture. It was found that CRP increase was higher in the arthroplasty group than in the osteosynthesis group. In this study, although there was no statistical difference between the two groups, CRP increased more in the hemiarthroplasty group. The highest CRP values were found at 72 hours.

Alagöz et al. (4) investigated the relationship between hip fracture and renal function and found that 47 of 238 patients had postoperative deterioration in renal function. Our patients were evaluated in terms of renal function using preoperative and postoperative creatinine values. No significant change was found in these values. Similarly, no difference was found between the surgical methods in terms of creatinine values.

Although AST and ALT are clinically used in the diagnosis and follow-up of liver diseases, both enzymes are also present in striated muscle tissue, with AST being more abundant, and both enzymes are increased in muscle damage or muscle tissue diseases (5,6). It is known that AST increases more than ALT in muscle tissue-related increases (7). In our study, for this purpose, AST and ALT values were monitored before and after surgery, and a significant increase was found in both values after surgery. No significant difference was found according to the surgical method.

CK is found in muscle tissue and is used in clinical practice as an indicator of muscle destruction and muscle ischaemia (8). Although there is no study in the literature comparing hemiarthroplasty and osteosynthesis in terms of CK values in patients with hip fracture, Wagman et al. included 359 patients who underwent surgery for intertrochanteric fracture and underwent proximal femoral nail or dynamic hip screw and investigated soft tissue damage according to the type of surgery. It was reported that CK value increased more in patients who underwent DHS compared to patients who underwent PFN (9). Similarly, Hong et al. (10) reported that there was no difference in CK values and soft tissue damage between the two groups in their study, in which they compared patients who underwent PFN and DHS for intertrochanteric fracture. In our study, no significant difference was found between hemiarthroplasty and osteosynthesis groups in terms of postoperative CK increase.

Since D-dimer is an indicator of endogenous fibrinolysis, it is used as a screening test for deep vein thrombosis and pulmonary thromboembolism. It is also a positive acute phase reactant and increases in conditions such as inflammation, infection and trauma (11,12). In a study conducted by Chen et al. (13) with 32 patients with hip

fracture, it was reported that there was a significant increase in postoperative D-dimer values and it returned to normal values within 1 week. In our study, D-dimer values increased significantly at the 6th postoperative hour and started to decrease at the 24th postoperative hour regardless of the surgical method. When surgical methods were compared, no significant difference was found between hemiarthroplasty and osteosynthesis groups in terms of D-dimer increase.

Troponin and CK-MB are biomarkers used as indicators of cardiac injury. CK-MB is also increased in skeletal muscle damage, and Troponin-I is a more specific indicator of cardiac damage. In our study, both CK-MB and Troponin-I values were monitored to determine the effect of hip fractures on the cardiac system. In the postoperative period, the mean CK-MB values were significantly higher than in the preoperative period, whereas no significant change was found in Troponin-I values. This suggests that the increase in CK-MB values may be due to muscle damage. When both values were compared according to surgical methods, no significant difference was found.

This study provides information on hip fractures, surgical treatments, and their systemic effects. The study's limitations include being a single-centre study, the failure to ensure homogeneity of fracture subtypes, the limited number of patients, and the lack of sufficient numbers of each fracture subtype.

Conclusion

In conclusion, hip fractures in the elderly population should be considered not only, as a pathology affecting the bone but also as a major health problem with systemic effects. There was no significant difference between hemiarthroplasty and osteosynthesis in terms of systemic effects in the acute period.

Ethics

Ethics Committee Approval: Approval was received from the Ethics Committee of University of Health Sciences Türkiye, İzmir Bozyaka Training and Research Hospital, Clinical Research Ethics Committee (approval number: 2023/88, dated: 21.06.2023).

Informed Consent: Informed consent was obtained from the patients or their relatives.

Footnotes

Authorship Contributions

Surgical and Medical Practices: M.G., Concept: M.G., O.Ç., Design: S.S., O.Ç., Data Collection or Processing: M.G., S.S., Analysis or Interpretation: S.S., O.Ç., Literature Search: M.G., Writing: M.G., O.Ç.

Conflict of Interest: No conflict of interest was declared by the authors.

Financial Disclosure: The authors declared that this study received no financial support.

REFERENCES

1. Neumaier M, Metak G, Scherer MA. C-reactive protein as a parameter of surgical trauma: CRP response after different types of surgery in 349 hip fractures. Acta Orthop. 2006;77:788-790. [Crossref]
2. Wu XD, Liu JC, Li YJ, Wang JW, Qiu GX, Huang W. The necessity of routine postoperative laboratory tests after total hip arthroplasty for hip fracture in a semiurgent clinical setting. J Orthop Traumatol. 2020;21:1-10. [Crossref]
3. Bhandari M, Devereaux PJ, Swiontkowski MF, Tornetta P, Obremskey W, Koval KJ, et al. Internal fixation compared with arthroplasty for displaced fractures of the femoral neck: a metaanalysis. J Bone Joint Surg Am. 2003;85:1673-1681. [Crossref]
4. Alagöz S. Acute kidney injury after hip fracture surgery and its impact on mortality. Ankara Training and Research Hospital Med J. 2019;52:167-173. [Crossref]
5. Sherman KE. Alanine aminotransferase in clinical practice: a review. Arch Intern Med. 1991;151:260-265. [Crossref]
6. Bodansky O, Schwartz MK, Nisselbaum J. Isozymes of aspartate aminotransferase in tissues and blood of man. Adv Enzyme Regul. 1966;4:299-315. [Crossref]
7. Nathwani RA, Pais S, Reynolds TB, Kaplowitz N. Serum alanine aminotransferase in skeletal muscle diseases. Hepatology. 2005;41:380-382. [Crossref]
8. Newsholme EA, Beis I, Leech AR, Zammit V. The role of creatine kinase and arginine kinase in muscle. Biochem J. 1978;172:533-537. [Crossref]
9. Wagman Y, Segal O, Dudkiewicz I, Steinberg E. Markers of muscle damage for comparing soft tissue injury following proximal femoral nail and dynamic hip screw operations for intertrochanteric hip fractures. Injury. 2016;47:2764-2768. [Crossref]
10. Hong JY, Suh SW, Park JH, Shin YS, Yoon JR, Yang JH. Comparison of softtissue serum markers in stable intertrochanteric fracture: dynamic hip screw versus proximal femoral nail-a preliminary study. Injury. 2011;42:204-208. [Crossref]
11. Wells PS, Anderson DR, Rodger M, Forgie M, Kearon C, Dreyer J, et al. Evaluation of D-dimer in the diagnosis of suspected deepvein thrombosis. N Engl J Med. 2003;349:1227-1235. [Crossref]
12. Johna S, Cemaj S, O'Callaghan T, Catalano R. Effect of tissue injury on D-dimer levels: a prospective study in trauma patients. Med Sci Monit. 2002;8:CR5-CR8. [Crossref]
13. Chen Z, Xie L, Xu J, Lin X, Ye J, Shao R, et al. Changes in alkaline phosphatase, calcium, C-reactive protein, D-dimer, phosphorus and haemoglobin in elderly osteoporotic hip fracture patients. Palliat Med. 2021;10:1079-1088. [Crossref]