



One-year mortality rate of patients operated for hip fracture during COVID-19 pandemic compared to pre-COVID-19 period

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Abstract

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Aim: This study aims to investigate the effects of the COVID-19 pandemic on the outcomes of patients operated for hip fractures, to determine the effect on mortality in the first postoperative year, and to compare it with the pre-pandemic period.

Materials and Methods: This retrospectively designed study includes 291 patients who are operated on for hip fractures. The patients are divided into two groups: 134 patients admitted between 11 March-31 December 2019 (pre-COVID-19 period) and 157 patients admitted between 11 March-31 December 2020 (COVID-19 period). Age, gender, fracture type, an implant used, smoking habits, operation waiting time, postoperative intensive care hospitalization, length of hospital stay, COVID-19 status, Charlson comorbidity index scores, and mortality rates are evaluated based on the data from hospital records.

Results: Although there has been an increase in mortality rates in the COVID-19 period, both in the postoperative one-year one year and in the postoperative 30-day period, there is no statistically significant difference ($p>0.05$). Although the mortality rate of COVID-19 positive patients is higher in one-year postoperatively than negative patients, it is demonstrated that this difference is not statistically significant ($p>0.05$). In addition, it is determined that the mortality rates of COVID-19 positive patients in the postoperative 30-day period has increased significantly compared to COVID-19 negatives ($p=0.035$).

Conclusion: Mortality rates similar to those before the COVID-19 period are found considering the one-year mortality rates in patients operated for hip fracture. However, there is a strong correlation between COVID-19 positivity and high mortality outcomes, especially in the postoperative 30-day period.



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Introduction

Hip fractures are serious orthopedic injuries frequently seen in patients over 60 years of age, and their incidence is expected to increase with the aging population [1]. Patients with hip fractures are generally elderly and have multiple comorbidities [2]. This situation causes an increase in the risk of postoperative mortality in patients [3]. Studies have shown that mortality rates within the first year after surgery are between 14-36%, despite advances in multidisciplinary care, implant designs, and advanced rehabilitation protocols [4]. On the other hand, survivors have difficulties in returning to their pre-fracture mobility [3]. Therefore, as a basic principle in the treatment of hip fractures, the adoption of early surgical treatment after the patient is prepared for surgery is important in terms of minimizing the rates of complications, mortality, and morbidity in the postoperative period [5]. The

coronavirus disease (COVID-19), first detected in China in December 2019, has become a global epidemic in a short time, causing it to be declared a pandemic in March 2020 [6]. The epidemic has given rise to unprecedented damage to the national health services of countries. Most of the human and physical resources in hospitals are used to respond to the rapidly increasing number of COVID-19 patients due to the epidemic. Human and physical resources such as anesthesiologists, operating room personnel, operating rooms, and post-anesthesia care units are used in the fight against the epidemic. As a result, non-emergency orthopedic surgeries have been delayed [7]. Although the quarantine measures mandated by the governments of the countries to prevent the epidemic have caused a decrease in hospitalizations due to trauma in general, they do not change the incidence of hip fractures in the elderly population [8]. These patients are typically elderly and have multiple comorbidities and have an increased risk of mortality due to COVID-19 [9]. For these reasons, COVID-19 infection is not a reason to cancel or delay emergency surgery

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a for hip fracture. This study aims to determine the effect of the COVID-19 pandemic on mortality in the postoperative first year of patients operated for hip fracture and to compare it with the pre-pandemic period.

Materials and Methods

This retrospective cohort study is initiated after obtaining institutional ethics committee approval (decision date: 14/12/2021, decision no: 2021/10-17). Patients who are operated for hip fracture between 11 March 2019 and 31 December 2019 as the pre-COVID-19 period and between 11 March 2020 and 31 December 2020 as the COVID-19 period are included. The reason for choosing the date of March 11, 2020, is that the first case of COVID-19 was detected within the borders of Turkey on this date, and then a series of restrictions were taken by the national government to prevent the epidemic. The hip fracture types included in the study are intertrochanteric (OTA/AO 31A), femoral neck (OTA/AO 31B), and subtrochanteric (32(A, B,C)) fractures according to the OTA/AO hip fracture classification [10]. Patients under 65 years of age, periprosthetic fractures, and pathological fractures are excluded from the study. After examining the hospital's digital records and removing the patients with exclusion criteria, 134 patients from the pre-COVID-19 period and 157 patients from the COVID-19 period are identified. As a result of the examination of hospital records, age, gender, injury type, injury date, operation date, fracture type, surgical procedure, reason for the delay in surgery, American Society of Anesthesiologists (ASA) score, postoperative intensive care unit admission, anesthesia type, discharge time, postoperative mortality data on rates and mortality dates are collected [11]. In addition, the results of the COVID-19 patients are obtained. The scores of the patients obtained according to the Charlson Comorbidity Index are documented [12]. Based on clinical findings such as cough, fever, and myalgia that indicate infection, a clinical diagnosis compatible with COVID-19 infection are made [13]. The sample taken from the oro-nasopharyngeal swab is studied in a quantitative real-time polymerase chain reaction (RT-PCR) device. Detection of viral RNA is accepted as a positive laboratory indicator (13). The radiological diagnosis is made after the thoracic computed tomography (CT) result, which is taken after appropriate protocols are evaluated by the radiologists and the findings that would raise the suspicion of COVID-19 are detected [14]. All patients suspected clinically or radiologically are subsequently tested RT-PCR for the detection of COVID-19. RT-PCR test is not performed on patients who have not had clinical symptoms or radiological findings due to insufficient laboratory test capacity in the initial period of the epidemic. Patients considered to be at high risk according to clinical or radiological findings are operated in specially designed COVID-19 operating rooms. Asymptomatic and RT-PCR test-negative patients are considered low infection risk and operated in normal operating rooms using standard protocols as in the pre-COVID-19 period. During the operation, regional anesthesia techniques are implemented rather than general anesthesia. Regardless of the risk status of patients, appropriate protective equipment against COVID-19 is used by surgeons and operating room personnel.

Statistical analysis

Statistical analyzes are performed with IBM SPSS 23.0 software (IBM Corp., Armonk, NY, USA). Power analysis was performed to determine the minimum sample size. The power of the performed tests for the sample size of 291 was calculated as %96 which is greater than the generally accepted at least power of %80. The Mann Whitney U Test is used for the two groups to compare data that have not demonstrated normal distribution, and the Pearson Chi-square independence tests are applied to test the independence between the two categorical variables. $p < 0.05$ results are considered statistically significant.

Results

As a result of the analyzes made, it is determined that 157 patients (99 (63.06%) female, 58 (36.94%) male, mean age: 80.31 ± 9.62 years) in the period of COVID-19 and 134 patients (78 (58.21%) female, 56 (41.79%) male, mean age = 79.6 ± 8.60) in the pre-COVID-19 period have been operated for hip fractures. Information on the variables for which comparisons are made between groups is summarized in Table 1. According to these results, a statistically significant difference are detected in terms of smoking habits, fracture mechanism, fracture type, and type of anesthesia applied ($p < 0.05$). It is observed that cigarette use have decreased significantly during the COVID-19 period ($p = 0.035$). As a mechanism of fracture formation, it can be said that fracture formation with high-energy trauma has decreased significantly in the COVID-19 period compared to the previous period ($p = 0.001$). It becomes obvious that the fracture type is reversed with the COVID-19 period, while intertrochanteric fractures are more common in the pre-COVID-19 period, collum femoris fractures became dominant in the COVID-19 period ($p = 0.028$). It has been shown that general anesthesia is significantly less preferred as the type of anesthesia applied during the COVID-19 period ($p = 0.034$). Table 2 shows the data on the comparison of mortality rates of the patients in the postoperative 30-day and postoperative one-year period. Accordingly, although there is an increase in mortality rates during the COVID-19 period, there has been no statistically significant difference in mortality rates in both one-year postoperative period and the postoperative 30-day period ($p > 0.05$). The relationship between the postoperative 30-day and postoperative one-year mortality rates and COVID-19 positivity are shown in Table 3. Although the mortality rate at one year postoperatively in COVID-19 positive patients is higher than in negative patients, this difference is not shown to be statistically significant. In addition, it is concluded that the mortality rates of COVID-19 positive patients in the postoperative 30-day period has increased significantly compared to COVID-19 negatives ($p = 0.035$).

Discussion

In this study, postoperative one-year mortality changes in patients who are operated on for hip fractures during the COVID-19 pandemic are investigated. The most important result is that there is no difference in the postoperative one-year mortality rates of the patients between the period of COVID-19 and before, but the mortality rates

Table 1. Distribution of patient variables in pre-COVID-19 and COVID-19 periods.

Variables	pre-COVID-19 period	COVID-19 period	p-value
Gender, (n)			0.234 ^a
Male	56	58	
Female	78	99	
Age (mean ± SD)	79.6 ± 8.60	80.31 ± 8.62	0.275 ^b
ASA, (n)			0.593 ^a
ASA-1	0	0	
ASA-2	15	24	
ASA-3	73	82	
ASA-4	46	51	
Smoking, (n)			0.035 ^a
Yes	32	22	
No	102	135	
Operation Waiting Time (days) (mean ± SD)	3.35 ± 2.67	3.56 ± 2.6	0.486 ^b
Postoperative Hospitalization (days) (mean ± SD)	2.88 ± 0.9	3.39 ± 2.32	0.692 ^b
Fracture Mechanism, (n)			0.001 ^a
Low energy trauma	89	142	
High energy trauma	45	15	
Fracture Type, (n)			0.028 ^a
Intertrochanteric Fracture	81	70	
Collum Femoris Fracture	49	80	
Subtrochanteric Fracture	4	7	
Implant used, (n)			0.099 ^a
PFN	71	66	
Hemiarthroplasty	63	91	
Anesthesia Type, (n)			0.034 ^a
Regional Anaesthesia	118	149	
General Anaesthesia	16	8	
Postoperative Intensive Care Hospitalization, (n)			0.630 ^a
Yes	49	62	
No	85	95	
Charlson Comorbidity Indeks (median (min-max))	4 (1-15)	5 (1-17)	0.194 ^b

a: Chi-square Test of Independence, b: Mann-Whitney U Test.

in the postoperative 30-day period increase in the period of COVID-19. Another important result is that the type of fracture in the patients has changed with the period of COVID-19, while intertrochanteric fractures are more common in the pre-COVID-19 period, collum femoris fractures has become more dominant in the period of COVID-19. Hip fractures are an important public health problem due to their high mortality and morbidity rates [15]. It is estimated that this problem will grow exponentially with

the increase in the average age of people. Some studies suggest that the incidence of hip fracture tends to decrease over the years [16]. It is thought that developments in the diagnosis and treatment of osteoporosis play an important role in this decrease [17]. However, there are also studies in which an increase in the incidence of hip fracture are found [18]. Various restriction decisions are implemented by the country's governments during the pandemic have reduced social movement and have increased the time people spend

Table 2. Distribution of patients who survived and died before and during the pre-COVID-19 periods.

Variables	pre-COVID-19 period	COVID-19 period	p-value
Postoperative first one-year period, (n)			
Number of living patients	95	106	0.611 ^a
Number of patients with Ex	39	51	
Postoperative 30-day period, (n)			
Number of living patients	128	146	0.452 ^a
Number of patients with Ex	6	11	

a: Chi-square Test of Independence.

Table 3. Distribution of death rates of patients with and without COVID-19 during the COVID-19 period.

Variables	pre-COVID-19 period	COVID-19 period	p-value
Postoperative first one-year period, (n)			
Number of living patients	41	105	0.035 ^a
Number of patients with Ex	7	4	
Postoperative 30-day period, (n)			
Number of living patients	30	76	0.459 ^a
Number of patients with Ex	18	33	

a: Chi-square Test of Independence.

at home. For this reason, there has been a significant decrease in the cases of orthopedic trauma, especially due to accidents and high-energy trauma [19]. However, recent studies demonstrate that these restriction decisions do not cause a change in the incidence of hip fractures in the elderly [20]. In this study, it is revealed that there has been an increase in the number of hip fractures in the COVID-19 period compared to the previous period, but this increase is not at a significant level in the statistical analysis. The COVID-19 pandemic period has caused serious changes in people's lifestyles. Especially the restriction rules during the pandemic period further have increased the activity restriction in the elderly population. We think that this situation affects bone quality negatively and is effective in the increase in the number of hip fractures during the pandemic period. Many studies evaluate hip fractures as homogeneous [21]. However, hip fractures consist of different types of fractures, primarily intertrochanteric fractures, femoral neck fractures and subtrochanteric fractures [2]. Studies have shown that intertrochanteric fractures and femoral neck fractures account for more than 90% of hip fractures and are seen at almost equal rates [22]. There are few studies examining hip fractures during the COVID-19 period, and changes in hip fracture types are examined in these studies, and no statistically significant difference are revealed between fracture types [5,14]. One of the important results of our study is that the type of fracture in patients have altered with the period of COVID-19. While the rate of intertrochanteric fractures is higher in patients admitted to the hospital due to hip fractures in the pre-COVID-19 period, it is found that collum femoris fractures have become statistically significantly more dominant in the COVID-19 period. In addition, a significant decrease has been observed in the number of hip fractures due to high-energy traumas during the COVID-19 period. We believe that the decrease in social movement due to the

restriction rules causes a decrease in the number of high-energy trauma, and this situation causes collum femoris fractures to be seen more frequently. The most important complication after hip fracture in the elderly is the increase in mortality rates [5,23]. The mortality rate after hip fracture is 9-10% in the first 30 days after surgery, and 15-30% in the first year [24]. There are few studies examining the changes in mortality due to hip fracture during the COVID-19 pandemic period. In the study conducted by Thakrar et al., they calculate the mortality rate as 16.3% in the postoperative 30-day period and claim that it has increased significantly during the pandemic period [8]. In addition, they come up with a strong correlation between COVID-19 positivity and increased death rates in the patients they have evaluated. While Munoz et al. determine the mortality rate after hip fracture to be 9.6%, they state that this rate has increased to 30.4% in COVID-19 positive patients [25]. In their meta-analysis of 28 articles, Clement et al. find the mortality rate to be 35% in patients with COVID-19 positive and hip fracture [26]. In our study, postoperative one-year and 30-day mortality rates due to hip fracture in COVID-19 and before are examined. In the statistical analysis, it is observed that there has been an increase in both one-year and 30-day mortality rates during the COVID-19 period, but this increase is not at a significant level. During this period, the 30-day and one-year mortality rates of patients who are positive and negative for COVID-19 are compared. In the analyzes made, it is verified that the mortality rates are statistically significantly higher in the 30 days in COVID-19 positive patients. There is an increased risk of venous thromboembolism and intravascular coagulation in COVID-19 [9]. We think that decreased mobility, especially in patients who undergo surgery for hip fracture, increases the risk of coagulation in patients with COVID-19 and leads to an increase in mortality in the first 30 days. This study has

some limitations, though. In particular, the study is designed retrospectively. In addition, it has a single-center and small sample size. At the beginning of the pandemic period, the lack of standardized guides in determining the positive case of COVID-19 and the lack of adequate laboratory testing have caused difficulties in case detection. The fact that COVID-19 positive patients could not be detected adequately due to this situation can be considered as another limitation of the study.

Conclusion

In conclusion, in the COVID-19 period, the incidence of hip fracture has increased compared to the previous period. This shows that hip fracture is an important type of orthopedic injury, even during the pandemic period with restrictions. During the pandemic period, there has not been an increase in both one-year and 30-day mortality rates compared to the previous period. However, a significant increase in mortality rates are observed in the 30-day postoperative period of patients with COVID-19.

Ethics approval

Ethical approval was obtained for our study from Adiyaman University Non-Invasive Clinical Research Ethics Committee (decision date: 14/12/2021, decision no: 2021/10-17).

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