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Retrospective Analysis of Extracapsular Hip Fracture Outcomes Before and During the Pandemic: A Comparative Cohort Study

Pandemi Öncesi ve Pandemi Sırasında Ekstrakapsüller Kalça Kırıkları Sonuçlarının Retrospektif Analizi: Karşılaştırmalı Kohort Çalışma

Mehmet Can GEZER[a], Kezban Sanem ÇAKIR TURHAN[b], Volkan BAYTAŞ[b], Mahmut KALEM[c]

[a]Mamak State Hospital, Clinic of Orthopedics and Traumatology, Ankara, Türkiye
[b]Ankara University Faculty of Medicine, Department of Anaesthesiology and Reanimation, Ankara, Türkiye
[c]Ankara University Faculty of Medicine, Department of Orthopedics and Traumatology, Ankara, Türkiye

ABSTRACT Objective: On March 11, 2020, coronavirus disease-2019 (COVID-19) was first reported in Türkiye. In response, measures were quickly implemented that completely transformed the healthcare system and daily life. As a result of these changes, the priorities for hospitalization and treatment plans have shifted. This study aims to retrospectively evaluate and compare the outcomes of geriatric patients who underwent surgery for anextracapsular hip fracture during the one year pre-pandemic and pandemic periods. **Material and Methods:** Only those who underwent surgery for extracapsular hip fracture were included in the study to ensure surgical standardization. We obtained patient data from the hospital's digital archive and assessed demographic characteristics, location of the trauma, anesthesia method, postoperative outcomes, length of hospital stay, and intensive care requirements. **Results:** 191 patients underwent surgery for an extracapsular hip fracture indication during the specified time intervals. Out of these, 71 (were male and 120 were female. Among the patients, 117 were in Group 1 (surgery before the pandemic) and 74 were in Group 2 (surgery during the pandemic). Although Group 2 had a larger number of patients with American Society of Anesthesiologists III and diabetes, there were no significant differences between the two groups in terms of postoperative complications and mortality. Group 2 patients were more likely to have sustained trauma outdoors. Additionally, it was observed that Group-1 patients had a higher preoperative hospitalization period, received more spinal anesthesia applications, and had a higher rate of pulmonary insufficiency. **Conclusion:** The study highlights how the pandemic has affected the lives of both patients and healthcare professionals and how it continues to do so.

Keywords: Hip fractures; COVID-19; pandemics; morbidity

ÖZET Amaç: Türkiye'de 11 Mart 2020 tarihinde ilk koronavirüs hastalığı-2019 [coronavirus disease-2019 (COVID-19)] vakasının görülmesinden sonra hızla alınan tedbirler, genel sağlık sistemi ve toplumsal yaşamı tümüyle değiştirmiş, buna bağlı olarak da hastaneye yatış ve tedavi planlarının önceliği de değişmiştir. Buradan yola çıkılarak bu çalışmada, ekstrakapsüler kalça kırığı endikasyonuyla opere olan geriatrik hastaların sonuçları; pandemi öncesi 1 yılın ve pandemi dönemindeki 1 yıla göre retrospektif olarak değerlendirilmesi ve karşılaştırılması amacıyla planlanmıştır. **Gereç ve Yöntemler:** Hastane dijital arşivinin taranmasıyla hasta verilerine ulaşıldı. Hastalar; demografik özellikleri, travmanın gerçekleştiği mekân, uygulanan anestezi yöntemi, postoperatif hasta sonuçları, hastanede yatış süreleri ve yoğun bakım gereksinimleri açısından değerlendirildi. **Bulgular:** Çalışma verilerine göre belirtilen zaman aralıklarında 71'i erkek, 120'si kadın olmak üzere 191 hastanın ekstrakapsüler kalça kırığı endikasyonuyla opere olduğu saptandı. Hastaların 117'si Grup 1 (pandemi öncesinde ameliyat edilen), 74'ü ise Grup 2 (pandemi sırasında ameliyat edilen) de yer alıyordu. Grup 2'de Amerikan Anestezistler Derneği III ve diyabetik hasta sayısı fazla olsa da postoperatif komplikasyonlar ve mortalite açısından gruplar arasında fark yoktu. Travma yerinin ise Grup 2'de daha fazla olmak üzere, daha çok ev dışı mekânlar olduğu saptandı. Ayrıca hastaların ameliyat öncesi hastanede yatış süresi, spinal anestezi uygulama sayısı ve pulmoner yetersizlik oranlarının Grup 1'de daha yüksek olduğu gözlendi. **Sonuç:** Bu çalışma, pandeminin hem hastaların hem de hekimlerin hayatlarını değiştirdiğini ve değiştirmeye devam ettiğini göstermektedir.

Anahtar Kelimeler: Kalça kırıkları; COVID-19; pandemik; morbidite

Correspondence: Mehmet Can GEZER
Mamak State Hospital, Clinic of Orthopedics and Traumatology, Ankara, Türkiye
E-mail: mehmetcangezer9121@gmail.com

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The "coronavirus disease-2019 or (COVID-19)", is a disease that can lead to severe acute respiratory syndrome. It first appeared in the city of Wuhan in the Hubei province of the People's Republic of China. Since then, it has spread globally, causing harm, closing borders, and posing a significant health problem.[1]

Due to the virus's high pathogenicity and a 2-14 day incubation period, asymptomatic individuals can rapidly spread the virus.[1,2] The first case of COVID-19 in Türkiye was reported on March 11, 2020 and the World Health Organization (WHO) declared the outbreak of COVID-19 a pandemic on the same day. As a result, several measures were implemented to curb the spread of the virus, such as mask-wearing, social distancing, hygiene rules, and online education, imposing travel restrictions, closing borders, and addressing its significant impact on public health. Outdoor activities were restricted for those aged 65 and over and under 20, and crowded places were closed. Hospitals suspended routine practices, and elective cases were canceled. As a result, sedentary behavior and frailty susceptibility increased, especially in older age groups, who were forced to stay at home. Hospital visits were postponed, and underlying comorbidities were neglected.

Hip fractures remain a significant concern for healthcare systems worldwide due to the aging population. Elderly patients with comorbidities are particularly at risk during hip fracture repair. There are general principles that should be followed for hip fracture care, which include a thorough preoperative assessment for healthy recovery regardless of age, rapid optimization of overall health status, and determining the optimal time for surgery as early as possible to reduce postoperative complications and mortality.

Hip fractures are becoming an increasingly significant health issue due to the aging population. Hip fractures are critical and prevalent, especially in the elderly. Interest in the course of this issue has grown during the pandemic. Several reports have been published that conducted country- or hospital-specific evaluations regarding hip fractures during the pandemic.[1,3,4]

While the pandemic was controlled mainly by the development of vaccines and over 158.5 million infected individuals and more than 3.2 million deaths by May 11, 2021, were reported, according to the WHO, Türkiye reported more than 5 million infected individuals and 43,029 deaths during the same period.[5-7] Assuming there is no change in the age- and gender-specific incidences of hip fractures in our country, we estimate that the number of cases will reach approximately 64,000 by 2035.[8]

In the elderly patient group, where extracapsular fractures are common, and comorbidities are prevalent, the presence of COVID-19 naturally emerges as an important factor that increases mortality and morbidity. It has been shown that postoperative morbidity and mortality are higher in hip fracture patients with concomitant COVID-19 pneumonia.[9,10] Similarly, in another study, pulmonary complications were more common in all elderly patients with COVID-19 during the pandemic.[11]

This retrospective study examines the outcomes of geriatric patients with extracapsular fractures during the COVID-19 pandemic. The obtained data was compared with patient outcomes from a non-pandemic period. The aim was to contribute to current clinical understanding and provide insights for future planning.

MATERIAL AND METHODS

Our retrospective study, which was approved by the Ankara University Human Research Ethics Committee (date: June 16, 2021; No: 2021/144). The study was conducted in accordance with the principles of the Declaration of Helsinki. Focused on patients who presented with trauma and hip pain to our orthopedic and traumatology clinic between March 1, 2019, and 2020, and March 11, 2020, and 2021. We analyzed the data from our hospital's digital archive using the International Classification of Diseases and Related Health Problems 10 fracture codes, with a specific focus on per trochanteric and subtrochanteric fractures (OTA/AO 31A1, A2, A3), identified by the codes S72.1, S72.10, S72.2, S72.20.

Patients with additional diagnoses, under 60 years old, returning with the same fracture, mistak-

enly coded with a fracture diagnosis, with high-energy trauma, periprosthetic fractures, pathological fractures, and undergoing revision surgery due to a previous hip fracture, were excluded from the study. We confirmed the remaining patient group by reviewing standard radiographs of the affected hip.

All patients included in the study were operated on by the same surgical team for an extracapsular fracture indication, using the same surgical technique with intramedullary nails and similar equipment. Patients were divided into two groups: Group 1 during the pre-pandemic period (March 1, 2019-2020) and Group 2 during the pandemic period (March 11, 2020-2021).

The study analyzed patients' demographic information, such as age, gender, body mass index, ASA classification, location of the trauma, time from hospital admission to surgery, length of hospital stay, and readmission rates. Their pre-existing medical conditions, such as smoking, diabetes mellitus, hypertension, chronic obstructive pulmonary disease, congestive heart failure, and need for dialysis were also evaluated. The study examined severe acute respiratory syndrome-coronavirus-2 polymerase chain reaction (PCR) test results to detect COVID-19 infection, anesthesia method, intraoperative transfusion requirements, confusion and intubation requirements beyond 48 hours, cerebrovascular events/stroke, thromboembolic events (deep vein thrombosis or pulmonary embolism), history of cardiac arrest, acute renal failure, sepsis/septic shock, organ failure, surgical site infection, and other postoperative complications.

STATISTICAL ANALYSIS

The SPSS 20.0 software (IBM®, Armonk, NY, USA) was used for assessments. $p<0.05$ was considered statistically significant. Descriptive statistics for continuous data included mean, standard deviation, median, minimum, maximum values, and percentage values for categorical data. To determine the normal distribution of data, the Shapiro-Wilk test was utilized, and the chi-square test was used for group comparisons of nominal variables. Mann-Whitney U or Student's t-tests were used for pairwise comparisons of groups depending on the normal distribution results.

RESULTS

Our study included 191 patients who underwent surgery for an extracapsular hip fracture indication. Of these patients, 71 (37.18%) were male and 120 (62.82%) were female. Out of the 191 patients, 117 were in Group 1, and 74 were in Group 2. In Group 2, only two patients (1.48%) tested positive for the PCR test, while 71 (95.94%) tested negative. One patient (0.74%) was operated on without undergoing a preoperative PCR test, as it was not mandatory at the time of surgery.

When analyzing ASA scores, 23.08% of patients in Group 1 had ASA III, while this percentage was higher, with a rate of 45.95% in Group 2. This difference between the groups was statistically significant ($p=0.011$). In the pre-pandemic period, 38 (32.48%) patients had diabetes, whereas in the pandemic period, the number of patients with diabetes was 35 (47.30%). This difference was statistically significant ($p=0.040$). No statistically significant differences were observed among other demographic characteristics and evaluated parameters, as shown in Table 1.

The patients were assessed based on where they experienced the trauma. In Group 1, a total of 95 (81.20%) patients fell at home, while 22 (18.80%) patients fell outside the home from the same level (while standing). In Group 2, 44 (59.46%) patients fell at home, and 30 patients (40.54%) fell outside the home from the same level. The groups showed a statistically significant difference ($p=0.001$).

The study evaluated the time elapsed from the moment of fracture occurrence to admission to the hospital and surgery. The results showed that Group 1 had an average time of 2.22 days, while Group 2 had an average time of 3.08 days. The difference between the two groups was statistically significant ($p=0.034$).

When comparing the anesthesia method between the two groups, 10 patients (8.55%) in Group 1 and only one patient (1.35%) in Group 2 underwent surgery under general anesthesia. This difference was statistically significant ($p=0.019$).

The study also observed the development of postoperative pulmonary insufficiency. Only one pa-

TABLE 1: Comparison of groups in terms of demographic characteristics and comorbidities before and during the pandemic.

	Group 1, n (%) 117, (61)	Group 2, n (%) 74 (39)	Total, n (%) n=191	p value
Age, (years) Median (minimum-maximum)	79.56 (62-104)	76.19 (67-97)	78.26 (19-104)	0.089
Gender, n (%)				
Male	48 (41.02)	23 (31.09)	71 (37.18)	0.166
Female	69 (58.98)	51 (68.91)	120 (62.82)	
BMI (kg m-2) Median (minimum-maximum)	28.69 (17.3-41.6)	28.42 (17.3-38)	29.1 (18.7-41.6)	0.237
Smoking, n (%)	28 (23.93)	24 (32.43)	52 (27.23)	0.199
ASA, n (%)				
1	12 (10.26)	4 (5.41)	16 (8.38)	**0.011****
2	66 (56.41)	31 (41.89)	97 (50.79)	
3	27 (23.08)	34 (45.95)	61 (31.94)	
4	12 (10.26)	5 (6.76)	17 (8.90)	
DM, n (%)	38 (32.48)	35 (47.30)	73 (38.22)	**0.040***
HT, n (%)	88 (75.21)	56 (75.68)	144 (75.39)	0.942
COPD, n (%)	9 (7.69)	8 (10.81)	17 (8.90)	0.461
CHF, n (%)	36 (30.77)	28 (37.84)	64 (33.51)	0.313
Dialysis need, n (%)	7 (5.98)	4 (5.41)	11 (5.76)	0.867

*Values considered significant with p<0.05; **A statistical comparison of mean ASA scores of patients before the pandemic and during the pandemic; BMI: Body mass index; DM: Diabetes mellitus; HT: Hypertension; COPD: Chronic obstructive pulmonary disease; CHF: Congestive heart failure.

tient (0.85%) in Group 1 experienced it, while seven patients (9.46%) in Group 2 did. The difference was statistically significant (p=0.004).

There were no significant differences observed among the groups in terms of comorbidities, intraoperative transfusion requirements, surgical site infections, hospital stay duration, readmission rates, and mortality rates. All the evaluations during the period from trauma occurrence to the postoperative period, including any complications, are summarized in Table 2.

DISCUSSION

In this study, the demographic characteristics, postoperative complications, duration of hospitalization, readmissions, and morbidity and mortality rates of elderly patients with extracapsular hip fractures who were operated on by the same surgical team in a single center were examined for one year before the pandemic (2019-2020) and during the pandemic (2020-2021). As a result, the characteristics of patients in the elderly population were similar before and during the pandemic. During the pandemic, patients were more frail, had more pulmonary complications, and falls mainly occurred inside the home environment, suggesting that leaving the comfort zone facilitated falls.

After analyzing the patient data, we observed a decrease in the number of patients with extracapsular hip fractures during the pandemic period compared to the pre-pandemic period. The possible reasons for this decrease include the public's fear due to the pandemic, the measures taken to prevent the spread of the virus or the restriction of going out. Similar studies in the literature have reported similar results.[12-14]

During the pandemic period, an increase in health problems was observed in the elderly population, as indicated by an increase in the number of patients with significantly higher ASA scores compared to the pre-pandemic period. In a multicenter study published in The Lancet, which involved 1,128 patients, the 30-day mortality rate for all hip fractures was 23.8%, with mortality being associated with ASA III-IV and male gender.[15] Despite the majority of patients during the pandemic being in the ASA III group, our study found no significant difference in mortality rates between the groups (p=0.285), and this may be because 68.91% of our extracapsular hip fracture patients during the pandemic were female.

TABLE 2: Comparison of operation process and postoperative complications among groups before and during the pandemic.

	Total, n (%) n=191	Group 1, n (%) 117 (61)	Group 2, n (%) 74 (39)	p value
Location of trauma, n (%)				
At home	139 (72.77)	95 (81.20)	44 (59.46)	0.001* (at home)
Outside	52 (27.23)	22 (18.80)	30 (40.54)	
Average time between admission and surgery (days), $\bar{X}$±SD	2.55±4.70	2.22±2.57	3.08±6.82	0.0346*
Anesthesia method, n (%)				
General anesthesia	11 (5.75)	10 (8.55)	1 (1.35)	0.019*
Spinal anesthesia	180 (94.25)	107 (91.45)	73 (98.65)	
Unplanned intubation, n (%)	2 (1.05)	2 (1.71)	0 (0)	0.258
Intubation >48hr, n (%)	5 (2.63)	2 (1.72)	3 (4.05)	0.328
Coma >48 hr, n (%)	2 (1.05)	1 (0.85)	1 (1.35)	0.743
CVA, n (%)	4 (2.09)	4 (3.42)	0 (0)	0.108
DVT/PE, n (%)	1 (0.52)	1 (0.85)	0 (0)	0.425
Cardiac arrest, n (%)	5 (2.62)	1 (0.85)	4 (5.41)	0.055
ARF, n (%)	20 (10.47)	13 (10.11)	7 (9.46)	0.814
Pulmonary failure, n (%)	8 (4.19)	1 (0.85)	7 (9.46)	0.004*
Intraoperative transfusion requirement, n (%)	3 (1.57)	2 (1.71)	1 (51.35)	0.846
Sepsis/septic shock, n (%)	2 (1.05)	1 (0.85)	1 (1.35)	0.743
Surgical site infection, n (%)	4 (2.09)	4 (3.42)	0 (0)	0.108
Time after hospitalization (day), n (%)	1.18±0.55	1.15±0.55	1.17±0.55	0.459
Rehospitalization, n (%)	25 (13.09)	13 (11.11)	12 (13.09)	0.308
Mortality, n (%)				
No	183 (95.81)	114 (97.44)	69 (93.24)	0.285
<30 day	4 (2.09)	2 (1.71)	2 (1.71)	
>30 day	4 (2.09)	1 (0.85)	3 (54.95)	

*p<0.05, considered significant; SD: Standard deviation; CVA: Cerebro vascular accidents; DVT: Deep vein thrombosis; PE: Pulmonary embolism; ARF: Acute renal failure.

A study conducted by Lim et al. found that the sociological decisions made during the pandemic resulted in inactivity and obesity among all types of patients. Obesity, in turn, can increase the risk of complications such as diabetes and cardiovascular diseases.[16] Similarly, in our study, we found that patients with extracapsular hip fractures were more likely to have diabetes during the pandemic (p=0.040).

Based on a survey conducted by Aksu et al. during the pandemic, regional anesthesia was the preferred method for 52.1% of patients, while 47.6% opted for general anesthesia, and only 0.3% chose sedation.[17] Our study results showed that spinal anesthesia was the most commonly performed procedure among the anesthesia methods used with 73 patients.

In a study conducted by Ricci et al., the duration between admission and surgery for patients admitted to the service after a hip fracture was evaluated. The study revealed that patients underwent surgery between 2.2 and 2.7 days after admission.[18] The period was affected by the day of admission to the service, the ASA score, and the need for preoperative cardiac tests. Our study results indicate that the average time for patients to undergo surgery before the pandemic was 2.2 days, which is consistent with the literature.[18,19] During the pandemic, this duration increased to an average of 3.08 days. This difference could be attributed to factors such as mandatory preoperative PCR testing during the pandemic, consultation of infectious diseases, longer cleaning times for operating rooms, and the use of personal protective equipment before surgery.

Our study shows that the incidence of pulmonary insufficiency in patients significantly increased during the pandemic period compared to the pre-pandemic period. Before the pandemic, only one patient had pulmonary insufficiency, but seven patients developed pulmonary insufficiency after surgery during the pandemic (p=0.004). Only two of these patients were PCR-positive for COVID-19. We believe that factors such as the viral disease itself, increased inactivity due to pandemic restrictions, weight gain, reluctance to go to healthcare centers, increased cardiovascular morbidity, decreased morale and increased depression due to bad news might adversely affect pulmonary functions.

Previous studies in the literature have reported high mortality rates during the COVID-19 pandemic. However, these studies did not examine mortality rates during the pre-pandemic period, nor did they compare patient groups affected and not affected by COVID-19 during the pandemic.[19,20] On the other hand, our study focused on examining the effect of the pandemic period on hip fractures rather than the biological effect of the virus. We only included two patients who were confirmed to have contracted COVID-19 through positive PCR. Unlike other studies, we selected our patient group based on similar hip fractures (extracapsular fractures) and patients undergoing similar surgeries by the same surgical team, and this is one of the reasons why our study reported a low mortality rate.[20,21]

Our study has several limitations that need to be considered. Firstly, it was planned retrospectively, which can affect the accuracy of the results. Secondly, the number of patients in the pre-pandemic group is higher than the number of patients in the pandemic period, which may skew the findings.[22]

CONCLUSION

In this study, the patient profile and surgical outcomes of patients with extracapsular hip fractures operated on in our center during the pandemic period were mainly similar to the pre-pandemic period. During the pandemic period, there were significant changes observed in the number of patients, the time until surgery, and the type of anesthesia used. This study highlights that the pandemic has resulted in a shift in the workload of patients and healthcare professionals, which continues to impact them.

Source of Finance

During this study, no financial or spiritual support was received neither from any pharmaceutical company that has a direct connection with the research subject, nor from a company that provides or produces medical instruments and materials which may negatively affect the evaluation process of this study.

Conflict of Interest

No conflicts of interest between the authors and / or family members of the scientific and medical committee members or members of the potential conflicts of interest, counseling, expertise, working conditions, share holding and similar situations in any firm.

Authorship Contributions

Idea/Concept: *Mahmut Kalem, Mehmet Can Gezer;* ***Design:*** *Kezban Sanem Çakır Turhan, Volkan Baytaş, Mehmet Can Gezer;* ***Control/Supervision:*** *Mahmut Kalem;* ***Data Collection and/or Processing:*** *Mehmet Can Gezer, Kezban Sanem Çakır Turhan;* ***Analysis and/or Interpretation:*** *Mehmet Can Gezer, Kezban Sanem Çakır Turhan;* ***Literature Review:*** *Volkan Baytaş;* ***Writing the Article:*** *Mehmet Can Gezer, Volkan Baytaş, Kezban Sanem Çakır Turhan;* ***Critical Review:*** *Mahmut Kalem;* ***References and Fundings:*** *Mahmut Kalem, Mehmet Can Gezer;* ***Materials:*** *Mahmut Kalem, Mehmet Can Gezer.*

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