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Have mortality rates in elderly patients with hip fractures changed during pandemic?

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Abstract. – OBJECTIVE: The mortality rates of patients over 65 years suffering from hip fractures were compared with/without infection related to SARS-CoV-2 virus during the 3 years of the pandemic.

PATIENTS AND METHODS: Patients with femoral proximal region fracture (Type A-B) over 65 years were searched between January 2019 and February 2021 retrospectively. 487 patients met the inclusion criteria and were classified as Group I for surgery before and Group 2 for surgery during the pandemic. Demographic characteristics of the groups, hospitalization time before surgery, hospitalization total time, post-operative time until death and mortality rates were analyzed.

RESULTS: The survival rate of hip fracture patients over 65 was higher for the surgeries performed during the pandemic compared to Group I (p=0.032). Patients with 2, 3 or 4 comorbidities in Group I had higher mortality rates (p<0.05). According to fracture type, the mortality rates were higher in Group I (patients with femoral neck fractures) (p=0.005), in contrast mortality rate for trochanteric fractures (p>0.05) remained the same. Mortality rates of Group I and II did not differ according to either time from admission to operation, or time to surgery for fracture types. The mortality rates at 1, 4, 12, and 24 months were determined to be 8.83%, 20.14%, 36.75%, and 45.22%, respectively in Group I, and 8.86%, 23.15%, 32.51%, and 33.49% in Group II with no difference.

CONCLUSIONS: The approaches taken in extraordinary circumstances such as a pandemic can change the course or outcomes of a disease. These changes may emerge as different mortality rates between periods of time. Further studies to lower mortality rates depending on hip fracture are warranted especially for patients over 65.

Key Words:
Hip fractures, Geriatric patient, COVID-19, SARS-CoV-2 negative, Mortality.

Introduction

The first victim in Turkey was identified in March, while the World Health Organization (WHO) announced COVID-19 as a global epidemic 11th of March, 2020 and advised on many precautions and implementations of severe restrictions to social life[1,2]. Turkish Ministry of Health stopped non-emergency operations on March 20, 2020 due to high risk during the global pandemic, thus routine orthopedic surgeries and practices have become quite different compared to the regular ones before the pandemic period[3]. Thus, the diagnosis and treatment processes of patients were interrupted undesirably[4-9], affecting especially elderly who experience hip fractures frequently in their late lifespan.

Comorbidities of patients with hip fracture such as diabetes, cerebrovascular diseases, mainly due to hypertension, chronic pulmonary and cardiovascular diseases increase the risk of mortality[10-12]. Not only comorbidities, but also SARS-CoV-2 infections caused an incline in mortality rates[13,14], especially for a delay in the surgery date of more than 48 hours for elderly patients with hip fractures. Early intervention within the first 24 hours is of great importance in the treatment of hip fractures, even for patients in good general condition[11,15-19]. Although adverse effects of COVID-19 infection are known to increase mortality in elderly patients with hip fractures[20-22], there is only limited knowledge about the mortality rate of non-infective elderly patients who experienced a hip fracture[23].

The aim of the study was to evaluate the factors affecting the mortality of elderly patients with hip fractures without infection of SARS-CoV-2 during the pandemic and to identify alternative measures that could improve the prognosis during the pandemic period by comparing outcomes of surgeries before and during the pandemic of elderly patients with hip fractures.

Patients and Methods

Data of patients being operated due to intracapsular or extracapsular femoral proximal

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region fracture (Type A-B) between January 2019 and February 2021 were obtained. Patients having negative result for Polymerase Chain Reaction (PCR) test and aged over 65 years with a 2- year of regular follow-up due to unilateral hip fracture surgery were included to the retrospective study.

Exclusion criteria were set as pathological and multiple fractures, fracture history in the same region, femoral shaft or distal fracture, high-energy trauma or concomitant systemic trauma in addition to positive results for PCR testing. Patients were classified as either Group I (before; January 2019-December 2019, n=283) and Group II (during the pandemic, March 2020-February 2021, n=204) based on their surgery date. Demographic data, time from admission to surgery, hospitalization period, 2-year mortality rates, surgical procedures, comorbidities, intensive care admissions and ASA scores of both groups were evaluated and compared statistically.

Statistical Analysis

Descriptive statistics of nominal variables were reported using mean±sd (min-max) and categoric variables were presented using numbers (n) and percentages (%), depending on data distribution analyzed by SPSS software version 22, (IBM Corp., Armonk, NY, USA). Numerical variable data distributed normally were tested with Student *t*-test, whereas data that failed to be normal according to Kolmogorov-Smirnov test, were compared using the Mann-Whitney U test. 2×2 comparisons based on group and ratio were performed with the Chi-square test, whereas Fisher's exact test was used for comparisons above 2×2. Survival curves were compared with the long rank test and Kaplan-Meier analysis. $p<.05$ was considered statistically significant.

Results

The data of 487 patients were analyzed, comprising 283 (58.1%) in Group I, operated on pre-pandemic, and 204 (41.9%) in Group II, operated during the pandemic. The mean age of the sample, which consisted of 281 (57.7%) women and 206 (42.3%) men, was 81.59±8.33 (65-100). ICU admission dependent on hip surgery was required for 348 (71.5%) patients and the duration in ICU was longer than 2 days for 139 (28.5%) patients. The surgery was performed under neuraxial anesthesia for 414 (85%) cases, whereas 73 (15%) patients received general anesthesia. Type of the implants were hemiarthroplasty for 200 (41.1%) patients and proximal femoral nail (PFN) for 287 (58.9%) patients without any complication for 427 (87.7%) patients.

Hospitalization time was significantly longer for Group I compared to Group II ($p<.001$), while age, gender, affected side, ICU admission, anesthesia, implant type, and complication variables did not differ significantly between groups ($p>.05$) (Table I).

Mortality developed in a total of 196 (40.24%) patients; 128 (45.22%) in Group I and 68 (33.49%) in Group II. The survival time of patients after surgery was 492.5 days (95% CI: 458.7-526.2 days) for Group I and 524 days (95% CI: 483.2-564.8 days) for Group II, thus survival time was significantly longer during the pandemic compared to pre-pandemic period (Log Rank, $p=.032$). Moreover, fewer deaths were registered in patients with hip fracture surgery during the pandemic which can be seen in the Kaplan-Meier survival curves in Figure 1.

Mortality rates of patients with 2, 3 or 4 comorbidities independent of hip fracture were significantly higher for Group I compared to Group II ($p=.023$, $p=.014$, $p=.009$ respectively). Although mortality rates for cases with trochanteric fractures ($p>.05$) did not differ between groups, mortality rate for femoral neck fractures ($p=.005$) was significantly higher for Group I compared to Group II. Patients with and without comorbidity were similar for both groups. ($p>.05$) (Table II).

According to the time from hospitalization to surgery, Group I and Group II did not differ significantly ($p>.05$) as seen in Table III. Group I compared to Group II did not show any significant difference neither for the time to surgery, nor for the mortality rates within 1, 4, and 12-months ($p>.05$), whereas mortality rates for 24-months were higher in Group I for patients operated after 24-48 hours ($p=.047$) (Table IV).

Discussion

The pandemic created serious changes not only in the planning stage of orthopedic operations, but also in operation times and priorities compared to the pre-pandemic period[4,5,9]. Studies[24,25] conducted in 2019 including both pre-pandemic and pandemic period revealed a 70% decline in the volume of orthopedic surgical procedures.

Table I. Comparison of demographic and clinical characteristics between research groups.

		Group I (n = 283) mean ± SD	Group II (n = 204) mean ± SD	*p*-value
Age (years)		82.09 ± 7.92	80.90 ± 8.84	.120[c]
Hospital stays time (day)		9.34 ± 4.953	7.58 ± 4.735	< **.001**[d]
		N (%)	**N (%)**	
Gender	Male	120 (42.4)	86 (42.2)	.957[a]
	Female	163 (57.6)	118 (57.8)	
Side	Right	134 (47.3)	96 (47.1)	.949[a]
	Left	149 (52.7)	108 (52.9)	
Intensive care	No	199 (70.3)	149 (73)	.512[a]
	Yes	84 (29.7)	55 (27)	
Anesthesia	Neuraxial	234 (82.7)	180 (88.2)	.091[a]
	General	49 (17.3)	24 (11.8)	
Implant	Hemiarthroplasty	117 (41.3)	83 (40.7)	.884[a]
	PFN	166 (58.7)	121 (59.3)	
Complication	No	246 (86.9)	181 (88.7)	.188[b]
	DVT	21 (7.4)	17 (8.3)	
	PTE	0	1 (0.5)	
	Wound problem	16 (5.7)	5 (2.5)	

[a]Chi-square test with n (%); [b]Fisher exact test n (%); [c]Student's *t*-test with mean ± SD (standard deviation); DVT: Deep Vein Thrombosis; PTE: Pulmonary Thromboembolism; PFN: Proximal Femoral Nail.

According to Turgut et al[26], frequency of fractures in Turkey decreased of approximately one third during the pandemic. Routine hospital practices and operations had been delayed; however, the number of trauma and emergency cases did not change significantly during the pandemic process[27-30] as the incidence of hip fractures which was stated as 8.6%-18.6%[29]. According to preventive measures during the pandemic in Turkey, individuals over the age of 65 were restricted to go out and were therefore exposed to less trauma, thus hip fracture incidence for patients over 65 decreased 27.9% during the pandemic.

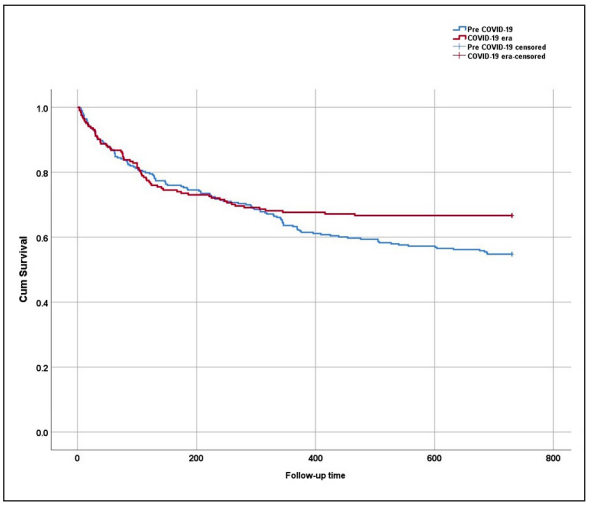

Figure 1. Kaplan-Meier survival curves for hospitalization time.

Femoral neck fractures, periprosthetic fractures and acute infections are low-frequency conditions that require primarily treatment and should be operated without delay[31]. A delay of 48 hours for surgery increased the 30-day and 1-year mortality rates during the pandemic, especially for hip fractures experienced by elderly[32]. For a patient with a hip fracture, surgery is recommended within 48 hours if the patient's consent is given and clinical contraindication does not exsist[11,33,34]. A previous study[35] stated that the mortality rate within one month increased by 50% in patients being operated on after 48 hours of hip fracture. The same study reported a 30-day mortality rate of 9.45%, whereas the mortality rate of 1 year was 31.5%. Findings of the current study showed that 1-month mortality rate was 10.7% for patients operated on between 0 and 48 hours, and 17.7% for those operated on after 48 hours. The corresponding 1-year mortality rates for surgery within 48 hours and after 48 hours were found as 32.1% and 43.5% respectively. On the other hand, mortality rates for patients who underwent hip fracture surgery during the pandemic were lower compared to patients who were operated

Table II. Comparison of mortality rates among research groups.

		Group I (n = 283) N (%)	Group II (n = 204) N (%)	*p*-value
Number of additional diseases				
0	Survival	49 (72.1)	39 (72.2)	.984[a]
	Exitus	19 (27.9)	15 (27.8)	
1	Survival	35 (72.9)	19 (70.4)	.814[a]
	Exitus	13 (27.1)	8 (29.6)	
2	Survival	63 (45.7)	60 (60.6)	**.023**[a]
	Exitus	75 (54.3)	39 (39.4)	
3	Survival	6 (35.3)	8 (88.9)	**.014**[b]
	Exitus	11 (64.7)	1 (11.1)	
4	Survival	2 (16.7)	10 (66.7)	**.009**[a]
	Exitus	10 (83.3)	5 (33.3)	
Fracture type				
Neck (IC)	Survival	43 (47.3)	43 (70.5)	**.005**[a]
	Exitus	48 (52.7)	18 (29.5)	
Trochanteric (EC)	Survival	112 (58.3)	93 (65)	.213[a]
	Exitus	80 (41.7)	50 (35)	

[a]Chi-square test with n (%); [b]Fisher exact test n (%).

on before the pandemic. The lowest mortality rate was identified in the 1-year and 2-year follow-up periods for patients being operated on between 24 and 48 hours, 26.8% and 27.8%, respectively. The findings of the study show that the most suitable time for surgery of hip fractures for the elderly might be 24-48 hours, as accepted for damage-control surgery.

Consistent with previous literature, the findings of this study showed that hospitalization time for elderly patients with hip fractures decreased significantly during the pandemic which might be due to the limited bed numbers available for patients without COVID-19 infections. The hospitalization period during pandemic was shortened to ensure patient circulation so that intervention for emergency orthopedic patients was performed on proper time. The mean time spent for patients having a surgery due to femoral neck fracture has been reported[35] as 11 days. It has been reported[36] that COVID-19 positive patients with hip fractures, especially having comorbidities, have a longer hospitalization time and higher mortality rates than negative patients. Another study[37], focused on the effect of hospitalization time on the mortality rates, showed that a hospitalization time shorter than 10 days increased the 1-year mortality rate to 21.7%, whereas the mortality rate declined to 12.4%-15.2% for a hospitalization time longer than 10 days. Findings of the study showed that the mean time spent on the service in hospital was 9.3 days for the patients having hip fracture surgery, and 7.5 days for patients having surgery during the pandemic, however hospitalization time and mortality rates did not show any significant correlation.

Mortality rates and postoperative complications in patients over 65 years of age with hip fractures are associated with comorbidities[38,39]. It has been stated[40] that COVID-19 infection worsens the clinical status of elderly patients with hip fracture having comorbidities. It has been reported[41] that patients positive for

Table III. Comparison of mortality rates according to the time intervals until the operation.

Time from hospitalization to surgery		Group I (n = 283) N (%)	Group II (n = 204) N (%)	*p*-value
Exitus	0-24 h	32 (25)	26 (38.2)	.121
	24-48 h	39 (30.5)	20 (29.4)	
	48-72 h	17 (13.3)	10 (14.7)	
	> 72 h	40 (31.3)	12 (17.6)	

Chi-square test with n (%). $p < .05$.

Table IV. Comparison of mortality time, time to operation and mortality rates between groups.

Time between fracture and death (months)	Time from hospitalization to surgery		Group I N (%)	Group II N (%)	*p*-values
0-1 m	0-24 h	Survival	43 (89.6)	53 (86.9)	.666[a]
		Exitus	5 (10.4)	8 (13.1)	
	24-48 h	Survival	52 (89.7)	52 (91.2)	.774[a]
		Exitus	6 (10.3)	5 (8.8)	
	48-72 h	Survival	24 (85.7)	13 (86.7)	1.000[b]
		Exitus	4 (14.3)	2 (13.3)	
	> 72 h	Survival	36 (78.3)	18 (85.7)	.740[b]
		Exitus	10 (21.7)	3 (14.3)	
0-4 m	0-24 h	Survival	43 (76.8)	53 (76.8)	.997[a]
		Exitus	13 (23.2)	16 (23.2)	
	24-48 h	Survival	52 (74.3)	52 (78.8)	.536[a]
		Exitus	18 (25.7)	14 (21.2)	
	48-72 h	Survival	24 (77.4)	13 (65)	.332[a]
		Exitus	7 (22.6)	7 (35)	
	>72 h	Survival	36 (65.5)	18 (64.3)	.916[a]
		Exitus	19 (34.5)	10 (35.7)	
0-12 m	0-24 h	Survival	43 (63.2)	53 (67.9)	.549[a]
		Exitus	25 (36.8)	25 (32.1)	
	24-48 h	Survival	52 (63.4)	52 (73.2)	.194[a]
		Exitus	30 (36.6)	19 (26.8)	
	48-72 h	Survival	24 (61.5)	13 (56.5)	.697[a]
		Exitus	15 (38.5)	10 (43.5)	
	> 72 h	Survival	36 (51.4)	18 (60)	.431[a]
		Exitus	34 (48.6)	12 (40)	
0-24 m	0-24 h	Survival	43 (57.3)	53 (67.1)	.212[a]
		Exitus	32 (42.7)	26 (32.9)	
	24-48 h	Survival	52 (57.1)	52 (72.2)	.047[a]
		Exitus	39 (42.9)	20 (27.8)	
	48-72 h	Survival	24 (58.5)	13 (56.5)	.876[a]
		Exitus	17 (41.5)	10 (43.5)	
	> 72 h	Survival	36 (47.4)	18 (60)	.241[a]
		Exitus	40 (52.6)	12 (40)	

[a]Chi-square test with n (%); [b]Fisher exact test n (%).

COVID-19 have a higher risk of postoperative complications, admission to the ICU, and prolonged hospitalization time. In contrast, it has also been found[41] that COVID-19 positive patients have less early complications and shorter hospitalization times as a result of being operated earlier than COVID-19 negative patients. The postoperative rate of admission to ICU following hip fracture surgery has been reported[12] as 26.8%, which was found similar in the patient groups without or with only one comorbidity in our study. In contrast, the mortality rate of patients with 2, 3 or 4 comorbidities were lower for patients having surgery during the pandemic as hypothesized earlier such that interventions were made earlier, and hospitalization time was reduced due to the pandemic. The need for intensive care and rate of complication was similar for both groups, whereas admission to ICU was determined as 29.7% for patients being operated on before and 27% for patients operated on during the pandemic.

The 1-year mortality rate of hip fracture patients older than 65 has been reported[39] as 27.3%. The 30-day mortality rates of patients operated for hip fractures have been reported[28,29,42,43] as 30-35% for COVID-19 positive cases and 10% for negative patients. The 120-day mortality rate has been reported[42] as 63% in patients with positive COVID-19 and 46% in negative patients. In the period before the pandemic, the 120-day mortality rate was reported[44-46] as 12.5-20.1%, and the rate for one-year mortality as 20-25%. However, in the current study, the 1, 4, 12, and 24-month mortality rates were determined as 8.83%, 20.14%, 36.75%, and 45.22%,

respectively before the pandemic, and 8.86%, 23.15%, 32.51%, and 33.49%, respectively, for the COVID-19 negative patients.

Limitations

As the data of the patients are obtained from a single center and the population is limited to a single center, it is our limitation to evaluate the efficacy of additional diseases on mortality separately. Another limitation is the application of surgical procedures by different surgeons. Although there are small interindividual differences, we think that it will not have an effect on mortality because the surgeons have similar experience and standard surgical approaches are applied in our clinic.

Conclusions

Fractures developing around the hip are a health problem causing severe mortality rates in the elderly population. The approaches taken in extraordinary circumstances such as in a pandemic, can change the course and outcomes of a disease. These changes can be seen as different mortality rates between periods of time. Therefore, it is extremely important that mortality studies are conducted for practices which could reduce the mortality rates of elderly patients with hip fracture. From the experience gained during the pandemic, it can be concluded that the ideal time for operation of hip fractures is 24-48 hours.

Conflict of Interest

The Authors declare that they have no conflict of interests.

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Ethics Approval

This study was approved by the Hitit University Ethics Committee (approval number: 2021.03; 409).

Informed Consent

Not applicable.

Availability of Data and Materials

The data supporting this study's findings are available from the corresponding author, [T.A], upon reasonable request.

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Authors' Contribution

TA: project supervision, writing-reviewing and editing.
TA, SZ: data collection, data checking, data entry and analysis.

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