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Research Article

Comparison of One-Year Mortality Rates in Patients with Peritrochantric Hip Fractures during and Prior to the COVID-19 Pandemic

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Abstract

Background: This study aimed to assess and follow up on patients who had peritrochantric hip fractures during the first wave of the coronavirus disease-2019 (COVID-19) outbreak in Iran. These patients were compared to patients from the previous year during the same period. Their prognosis and one-year mortality rates were also compared.
Methods: In this two-center, retrospective cohort study, patients aged over 60 years with a proximal femoral fracture admitted to the hospital between March 2019 and April 2020 were included. The primary outcome was one-year mortality.
Results: The patients counted 146, and we had access to all of them. Seventy-four were from the year 2019, and 72 were from the year 2020. There was no significant difference between the two groups regarding age, sex, type of fracture, or the American Society of Anesthesiology (ASA) score in the analytical investigation. Regarding patient mortality at this time, our one-year mortality rate in patients hospitalized before the COVID-19 era was 29.7%, compared to 51.5% in the COVID-19 period.
Conclusion: The one-year mortality rate for patients with hip fracture increased considerably during the COVID-19 pandemic. Comorbidity and ASA score were related to mortality in this patient population. This increase in mortality may be attributable to postoperative complications, including coagulopathy and proper health care limitation.

Keywords: Coronavirus; COVID-19; Mortality; Hip Fractures

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Background

The coronavirus disease-2019 (COVID-19) was officially reported in December 2019 for the first time (1), and since then, it has disrupted the world's routine. The COVID-19 pandemic significantly changed people's lifestyles and their usual way of life (1). This pandemic also significantly altered hospital arrangements; COVID wards were arranged for patient care in hospitals (2). In orthopedic wards, elective procedures were canceled, and the incidence of fractures and injuries decreased (3-5).

The incidence of unstable hip fractures, commonly found in the elderly, has remained unchanged during the COVID era (6, 7). Hip fractures are one of the main practical issues faced by orthopedists at this time. These fractures are among the risk factors for mortality, which increases with comorbidity and aging (8, 9). Furthermore, COVID-19 increases mortality rates in the elderly and those with underlying disorders (10). The one-month mortality rate of COVID-19-infected individuals with hip fractures has been reported to be 16.3%, 23%, and 35.3% in various studies (11-13).

Furthermore, the necessity of hospitalization, recurrent visits, and regular post-operative imaging, as well as the anticipated need for rehabilitation, all contribute to an increase in personal exposure (14-16). Moreover, it may increase the risk of acquired infection in the postoperative phase. As a result, patients with hip fractures are far more prone to COVID-19 (17).

Despite these considerations, operative surgery for a peritrochantric fracture is still preferred over non-surgical therapy. In addition to guidelines for managing trauma patients in the COVID-19 epidemic (18-20), this large population has received particular attention (21, 22). Lockdown was handled in Iran from March 1st to April 15th, 2020, in response to the breakout of COVID-19 in February 2020, to sufficiently prevent unnecessary gatherings and transportation, followed by a significant decrease in hospital admissions caused by trauma (23, 24).

During the COVID-19 pandemic and due to the presence of lockdown and the fear of infection among patients, they would come to the medical centers later than usual, which did not exhibit consistent findings in numerous research (25, 26). Because of this, there is a rational fear that delays in hospitalization are connected to more prominent mortality (25). The main aim of this study was to track patients with hip fractures during COVID-19 first wave and compare the patients' one-year outcome with patients with hip fractures during the same period in 2019.

Methods

Study Design and Data Source: This retrospective cohort study was done in two tertiary trauma hospitals (Shohada Tajrish Hospital, Tehran, Iran, and Taleghani Hospital, Kermanshah, Iran). Our data were meticulously acquired from our local limb fracture registry. Patients over 60 with peritrochantric hip fractures (femoral neck and intertrochanteric fractures) were eligible. Exclusion criteria included patients with pathological fractures,

active malignancies, and lost follow-up. The assessor reviewed their medical records retrospectively.

Ethical Consideration: The Institutional Review Board of Shahid Beheshti University of Medical Sciences, Tehran, approved this multicenter retrospective cohort study (code: IR.SBMU.RETECH.REC.1399.1094).

Data Collection: The assessors who retrieved the data from the patient's hospital medical records and those who contacted and inspected them had no involvement in the patient's care or treatment. Electronic forms were used to collect all of the data. In addition, the surgeon who treated the patients was not involved in any part of the analysis.

Patients were divided into two groups: those admitted to the hospital between March 1st and June 15th, 2019, in the "pre-COVID" group, and those admitted between March 1st and June 15th, 2020, in the "COVID-era" group. Age, sex, fracture type (31B, 31A) (27), time from injury to hospitalization, time from hospitalization to surgery, type of surgery, type of anesthesia, American Society of Anesthesiology (ASA) score (28), COVID-19 status at the time of hospitalization, family members living with them, complications, and one-year mortality rates were all retrieved from the patients' records.

Medical comorbidities, including cardiovascular diseases, cerebrovascular pathologies (e.g., history of stroke), chronic respiratory disorders, renal pathologies, diabetes, dyslipidemia, and neurocognitive disorders (e.g., Alzheimer's) were recorded as < 2 or ≥2.

In our article, the COVID status is described as follows. "No" indicates neither the patient nor his/her family acquired documented COVID-19, "self" means the patient got it his/herself, and "family" implies that the family members got COVID-19.

Statistical Analysis: The mean and standard deviation (SD) index was used for descriptive statistics, and frequency and percentage were used for nominal data. The unpaired t-test and Pearson chi-square test or Fischer's exact test for nominal data analyzed variables. The independent variables were age, gender, type of fracture, time from admission to surgery, time from surgery to discharge, and ASA score. Covariates that were different between pre-pandemic patients and pandemic patients at P < 0.20 were assessed for confounding. Categorical variables were presented as frequencies and percentages, and a comparison was made using Fisher's exact test between survival and non-survival groups at one-year post-fracture diagnosis. The Kaplan-Meier survival analysis was used to evaluate the likelihood of survival at a given period after the fracture (one month and one year). The Cox proportional hazard models were used to identify mortality predictors. For each variable, crude and adjusted hazard ratios with 95% confidence intervals (CI) were determined. Age, gender, Association of Osteosynthesis (AO) type of fracture, time from injury to admission, time from admission to surgery, time from surgery to discharge, comorbidity, ASA score, and COVID-19 status were all independent variables in the model. A two-sided P-value ≤0.05 was considered statistically significant. The calculated power for this study was 74.09% in post-hoc power analysis. All analyses were carried out with the SPSS software for Windows (version 25.0, IBM Corporation, Armonk, NY, USA). G*Power 3.1.9.4 was used for post-hoc power analysis.

Results

One hundred forty-six patients were included. Seventy-four had hip fractures in 2019, and 72 were during the COVID-19 pandemic. Peritrochantric hip fracture incidence among those over 60 years of age was 31.2% in 2019 and 33.43% in 2020. There was no significant difference between the two groups regarding age, sex, type of fracture, or ASA score. The pre-COVID group had a mean time from injury to hospitalization of 22.64 ± 11.41 hours, while the COVID-era group had a mean time of 23.32 ± 11.20, which was not statistically different (P = 0.431). In addition, five patients in the pre-COVID group had a delay of more than three days (Table 1).

The pre-COVID group spent 26.36 ± 10.12 hours in the hospital before surgery, whereas the COVID-era group spent 24.51 ± 7.98 hours. Moreover, the pre-COVID group took 35.42 ± 10.03 hours from surgery to discharge, while the COVID-era group took 39.50 ± 9.88 hours. In 2020 patients, one had COVID-19 at admission, and nine became infected with COVID-19 throughout the trial.

The one-year mortality rate among patients hospitalized before the COVID pandemic was 29.7%, compared to 51.5% in the pandemic. In the COVID-era group, "comorbidity above 2" was significantly correlated with mortality (Tables 2 and 3).

Table 1. Baseline characteristics of patients with hip fractures of the pre-COVID group and COVID-era group

Index		Pre-COVID group (n = 74)	COVID-era group (n = 72)	Total (n = 146)	P-value*
Sex (men) [n (%)]		35 (47.29)	29 (40.27)	64 (43.83)	0.730
Age (year) (mean ± SD)		78.09 ± 8.98	77.65 ± 8.82	77.87 ± 8.87	0.765
Injury mechanism (low energy) [n (%)]		70 (94.59)	68 (94.44)	138 (94.52)	0.625
Place of injury [n (%)]	In-home	42 (56.70)	58 (80.04)	100 (68.49)	0.001
	In-house	14 (18.90)	12 (16.56)	26 (17.80)	
	Outdoor	18 (24.30)	2 (2.76)	20 (13.69)	
Comorbidities (no.), [n (%)]	< 2	47 (63.45)	46 (63.48)	93 (63.67)	0.550
	≥2	27 (36.45)	26 (35.88)	53 (36.30)	
ASA score [n (%)]	1, 2	56 (75.60)	45 (62.10)	101 (70.20)	0.723
	3, 4	18 (24.30)	27 (37.26)	45 (30.80)	
Walking ability [n (%)]	Independent	62 (83.70)	57 (78.66)	119 (81.51)	0.623
	Dependent	10 (13.50)	13 (17.94)	23 (15.75)	
	Bedridden	2 (2.70)	2 (2.76)	4 (2.73)	
Living alone [n (%)]	Yes	14 (18.90)	21 (28.98)	35 (23.97)	0.104
	No	60 (81.08)	51 (70.38)	111 (76.03)	
COVID status [n (%)]	No	69 (93.15)	56 (77.28)	125 (85.62)	0.008
	Self	4 (5.40)	5 (6.90)	9 (6.16)	
	Family	1 (1.35)	11 (15.18)	12 (8.21)	
Fracture type (AO/OTA) [n (%)]	31A	61 (82.35)	61 (84.18)	122 (83.56)	0.441
	31B	13 (17.55)	11 (15.18)	24 (16.43)	
Admission delay (> 3 days) [n (%)]	Yes	5 (6.75)	6 (8.28)	11 (7.53)	0.232
	No	69 (93.15)	66 (91.08)	135 (92.46)	

*Between-group comparison

ASA: American Society of Anesthesiologists; COVID: Coronavirus disease; AO/OAT: AO Foundation/Orthopedic Trauma Association; SD: Standard deviation

Table 2. Changes in mortality rate (between groups)

Mortality rate	Pre-COVID group (n = 74)	COVID-era group (n = 72)	Total (n = 146)	P-value
30-day [n (%)]	8 (10.81)	8 (11.11)	16 (0.11)	0.641
1-year [n (%)]	22 (29.73)	37 (51.38)	58 (0.40)	0.006

COVID: Coronavirus disease

In survival analysis using the Kaplan-Meier model, the incidence of mortality following proximal femoral fracture in the COVID-19 era was 12.11 ± 1.63 months in the pre-COVID group and 2.97 ± 0.62 months in the COVID-era group, which meant it was statistically significant (Logrank = 0.001).

In the analysis of the influence of covariates on survival analysis using the Cox regression approach, living alone with an elevated risk of mortality was the only condition of individual life (Table 4, Figure 1).

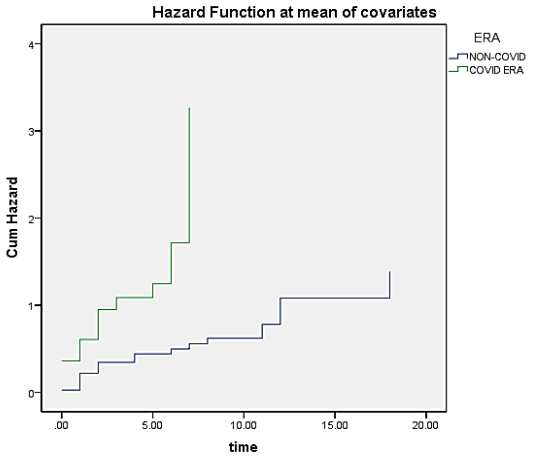

Figure 1. One-year mortality; hazard analysis at the mean of covariates

Discussion

One of the orthopedic issues in the COVID-19 pandemic is unstable hip fractures (6).

One problem is that the incidence of this type of fracture has not reduced over time, and in published research, they account for a considerable number of emergency department patients (6, 29). There is also concern about providing an environment for these individuals in the event of a pandemic, making the lowest possible risk of acquired infection, time to surgery, and appropriate discharge and rehabilitation concerns (18).

This issue derives from the fact that patients with hip fractures are more sensitive to COVID-19 infection, with a prevalence of 13 percent in this group (17). Besides, in various reviews, a positive COVID-19 status is associated with a three-fold increased mortality risk in patients with hip fractures, and hospital-acquired infection may account for half of all COVID-19 cases within 30 days of admission (30, 31).

To our knowledge, the one-year mortality of patients with peritrochanteric hip fractures during the COVID-19 outbreak has not been published as of November 2021. There are multiple articles about hip fractures, COVID-19, and patient mortality and outcomes. The mortality rate in patients with COVID-19 who experienced a peritrochantric fracture ranged from 15% to 35.3%; these studies were conducted mainly on a one-month mortality rate (13, 28, 32). Moreover, the rate was 0.9%-2.7% in people who did not have COVID-19 symptoms or confirmation (32).

In our study, one-year mortality was 51.5% during the COVID-19 era, compared to 29.7% before the COVID-19 period. In our data, we hoped to find a rationale for the increase in mortality. As a result, we looked at the patient's comorbidity, surgery, and discharge times, and patients' and families' COVID-19 status. This statistical difference was significant in those with comorbidity ≥2 diseases and ASA scores of 3, 4.

Our data did not reveal why there was an increase in mortality in our patients at this time. To be clear, the possibilities we give are that the COVID-19 tests for our patients and their families were erroneous at the time of our cases' assessment or that these patients' therapies were still in the trial-and-error stage. For their family members, the same potential existed. This statistical disparity could be due to a lack of staff and facilities and the unavoidable transfer of human and non-human resources to COVID-19 treatment wards.

Another point that can be highlighted is the individual's activity level following the fracture, and the time it takes to recover to their pre-fracture status (acceptable percentage). Fear of leaving the house, regular doctor visits, and, importantly, a lack of access to physiotherapy and rehabilitation are some challenges we face during the COVID-19 era. During this time, the study showed that these cases had a negative impact on patients' outcomes (21, 33).

Table 3. Comparing risk factors for mortality (between groups)

Index		One-year mortality (n = 59)	Alive (n = 87)	Total (n = 146)	P-value
Sex (men) [n (%)]		23 (39.10)	41 (45.10)	64 (43.52)	0.211
Age (year) (mean ± SD)		78.88 ± 8.76	77.19 ± 8.93	77.87 ± 8.87	0.262
Era [n (%)]	Pre-COVID	22 (37.40)	52 (57.20)	74 (50.32)	0.006
	COVID-era	37 (62.90)	35 (38.50)	72 (48.96)	
Place of injury [n (%)]	In-home	43 (73.10)	57 (62.70)	100 (68.00)	0.543
	In-house	10 (17.00)	16 (17.60)	26 (17.68)	
	Outdoor	6 (102.00)	14 (15.40)	20 (13.60)	
Comorbidities (no.) [n (%)]	< 2	21 (35.70)	72 (79.20)	93 (63.24)	0.001
	≥2	38 (64.60)	15 (16.50)	53 (36.04)	
ASA score [n (%)]	1, 2	38 (64.60)	67 (73.70)	105 (71.40)	0.003
	3, 4	21 (35.70)	20 (22.00)	41 (27.88)	
Walking ability	Independent	40 (68.00)	61 (67.10)	101 (68.68)	0.642
	Dependent	16 (27.20)	19 (20.90)	35 (23.80)	
	Bedridden	3 (5.10)	7 (7.70)	10 (6.80)	
Living alone [n (%)]	Yes	18 (30.60)	17 (18.70)	35 (23.80)	0.093
	No	41 (69.70)	70 (77.00)	111 (75.48)	
COVID status [n (%)]	No	50 (85.00)	75 (82.50)	125 (85.00)	0.721
	Self	3 (5.10)	6 (6.60)	9 (6.12)	
	Family	6 (10.20)	6 (6.60)	12 (8.16)	
Fracture type (AO/OTA) [n (%)]	31A	48 (81.60)	74 (81.40)	122 (82.96)	0.355
	31B	11 (18.70)	13 (14.30)	24 (16.32)	
Admission delay (> 3 days) [n (%)]	Yes	4 (6.80)	7 (7.70)	11 (7.48)	0.592
	No	55 (93.50)	80 (88.00)	135 (91.80)	

ASA: American Society of Anesthesiologists; COVID: Coronavirus disease; AO/OAT: AO Foundation/Orthopedic Trauma Association; SD: Standard deviation

Table 4. One-year mortality covariate assessment (Cox regression model)

Covariate	P-value	Exp (B)	95% CI for Exp(B)	
			Lower	Upper
Sex	0.834	1.065	0.590	1.923
Age	0.665	0.993	0.963	1.024
Mechanism of injury	0.708	1.267	0.367	4.375
Place of injury	0.991	0.997	0.635	1.566
Comorbidity	0.503	0.819	0.458	1.467
Walking ability	0.561	0.868	0.539	1.398
Living alone	0.041*	0.507	0.265	0.972
COVID-19 status	0.204	1.370	0.843	2.227
Fracture type	0.469	1.305	0.634	2.687
Delay to hospitalization	0.624	0.720	0.194	2.677

*Statistically significant
COVID-19: Cornavirus disease-2019; CI: Confidence interval

Moreover, changes in the coagulation pathway balance in patients with hip fractures facing COVID-19 may also contribute to a difference in mortality rate. These changes were reported in the Tsantes et al. study, with increased clot strength and fibrinolysis shutdown increasing the rate of thrombotic events (34). According to studies, thrombotic events were about 12% in patients with COVID-19 who had a hip fracture and were on anticoagulant medications, while they were about 1.5% in patients without COVID-19 (13, 35).

In the COVID-19 era, changes in current protocols may be required to prevent thrombotic events in these patients, whether the change is an increase in dose, an extension of duration, or a change in antithrombotic pharmacological class (36-38). In our study, patients were given enoxaparin 40 mg subcutaneously daily for six weeks as prophylaxis, as per existing guidelines.

Our studies found an association between ASA score and one-year mortality, but no other covariates were found in our analyses. The care of the elderly in the hospitalization routine of patients over 60 years of age was why patients with COVID-19 had shorter hospital stays in our institution.

In addition, because of the lower rate of patient referrals, they were given unoccupied surgery rooms and a shorter operation schedule. Of course, due to cardiovascular assessment and anticoagulant problems, we were a few days late in some patients, but 93.05% of our patients were in the hospital for no more than 48 hours postoperatively.

The age and gender of the patients did not vary in our study compared to the previous year, which was also seen in Jarvis et al. (25) and Ojeda-Thies et al. (39) studies. The common occurrence of osteoporosis and inadequate care for the elderly are the reasons for this. As a result, steps should be taken to reduce the prevalence of osteoporosis in the elderly population, lowering the risk of fragility fractures in various situations.

One of our limits was the small number of patients; therefore, we combined the patients of two different trauma centers. Another limitation was the inability to check the status of COVID-19 testing definitively and the specific cause of death of patients. Another limitation we noticed after the study was the lack of investigation of patients' coagulation status, which can be investigated in a future prospective study. Larger studies and studies evaluating the effect of COVID-19 on the mortality of patients with other fractures can help us more accurately determine the COVID-19 effects on mortality. The strength of our study was the prospective patients in the COVID-19 era and measuring their one-year mortality rate, which was not mentioned in the literature.

Conclusion

Based on our findings, one-year mortality rates of patients with hip fractures increased dramatically during the COVID-19 pandemic. Comorbidity status and ASA score were related to mortality in this group of patients. This increase in mortality may be due to postoperative difficulties such as coagulopathy alterations and reduced postoperative mobility.

Conflict of Interest

The authors declare no conflict of interest in this study.

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