

IMPACT OF COVID-19 ON MORTALITY AND HOSPITALIZATION IN OLDER ADULTS WITH HIP FRACTURE

IMPACTO DA COVID-19 NA MORTALIDADE E INTERNAÇÃO DE IDOSOS COM FRATURA DO QUADRIL

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ABSTRACT

Objective: To evaluate the impact of the COVID-19 pandemic on hospital admission and mortality indicators in older adults with fractures of the proximal femur. **Methods:** Observational and retrospective study that took place from June 2016 to 2020. Patients of both genders who underwent surgical treatment for fractures of the proximal end of the femur, aged over 60 years, were included. **Results:** The population consisted of 379 patients, treated before (group 1; N = 278; 73.35%) and during the pandemic (group 2; N = 101; 26.65%). Higher mortality was observed in group 2 (N = 24; 23.8%) versus group 1 (N = 10; 3.6%), $p < 0.001$. The highest proportion of deaths in group 2 was maintained in patients aged 70-79 years ($p = 0.011$), 80-89 years ($p \leq 0.001$) and > 90 years ($p \leq 0.001$). In addition, the preoperative time and hospital stay were longer in group 2 compared to group 1 ($p \leq 0.001$). **Conclusion:** The present study demonstrated that the pandemic period increased the mortality rate and the preoperative and hospitalization time in older patients with femur fractures. Thus, the pandemic has affected the care of fractures of the proximal femur in older adults, which reinforces the need to adopt measures to reduce complications and mortality. **Level of Evidence II, Retrospective Study.**

Keywords: COVID-19. Fractures, Bone. Aged. Hospitalization. Mortality. Femur.

RESUMO

Objetivo: Avaliar o impacto da pandemia de COVID-19 nos indicadores de internação e mortalidade hospitalar em idosos com fraturas do fêmur proximal. **Métodos:** Estudo observacional e retrospectivo, que ocorreu de junho de 2016 a 2020. Foram incluídos pacientes de ambos os sexos submetidos ao tratamento cirúrgico para fratura da extremidade proximal do fêmur, com idade acima de 60 anos. **Resultados:** A população foi composta por 379 pacientes, atendidos antes (grupo 1; N = 278; 73,35%) e durante a pandemia (grupo 2; N = 101; 26,65%). Foi verificada maior mortalidade no grupo 2 (N = 24; 23,8%) versus o grupo 1 (N = 10; 3,6%), $p < 0,001$. A maior proporção de óbitos no grupo 2 se manteve nos pacientes com 70-79 anos ($p = 0,011$), 80-89 anos ($p \leq 0,001$) e > 90 anos ($p \leq 0,001$). Os períodos pré-operatório e de permanência hospitalar foram maiores no grupo 2 em comparação ao grupo 1 ($p \leq 0,001$). **Conclusão:** Este estudo demonstrou que o período pandêmico aumentou a taxa de mortalidade e o tempo pré-operatório e de internação em pacientes idosos com fratura do fêmur. Dessa forma, a pandemia tem afetado o atendimento das fraturas do fêmur proximal em idosos, o que reforça a necessidade da adoção de medidas de redução de complicações e mortalidade. **Nível de Evidência II, Estudo Retrospectivo.**

Descritores: COVID-19. Fraturas Ósseas. Idoso. Hospitalização. Mortalidade. Fêmur.

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INTRODUCTION

The emergence of severe acute respiratory syndrome caused by the coronavirus (COVID-19) in China late 2019 has generated a global pandemic, which exposes the health and well-being of the entire population, especially of older adults.¹ According to the World Health Organization, COVID-19 has affected more than 216 countries, with 204,644,849 confirmed cases and 4,323,139 deaths.² Infection caused by COVID-19 can be easily transmitted through

the airways and has a wide clinical presentation ranging from a common cold to more severe respiratory syndromes.³ The highest mortality from COVID-19 occurs in older patients with multiple comorbidities, similar to the population at risk for the occurrence of fractures.⁴⁻⁶ In orthopedic care, most surgeries are intended for the treatment of femoral fractures, which are the most frequent cause of deficiency in patients over 65 years of age.¹

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The study was conducted at Department of Orthopedics and Traumatology of the Paulista School of Medicine of the Universidade Federal de São Paulo. Correspondence: Diego da Silva Santos. Rua Frei Caneca, 750, apt 3122, São Paulo, SP, Brazil, 01307000. diegos-santos@hotmail.com

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Femoral fractures are considered an important public health problem due to the long period of recovery and the possible emergence of complications that affect the quality of life of the patient with high economic and social impact.⁴ In Brazil, femoral fractures have a trend of progressive increase in the number of cases. In the period from 2008 to 2018, femoral fractures in older adults were responsible for 478,274 hospitalizations and the expenditure of BRL 99.7 million annually to the Brazilian Unified Health System (SUS).⁵ The pandemic scenario drastically affects the usual treatments and protocols of elective and emergency services, including the care of femoral fractures, which is imposing the creation of plans for the reallocation of health resources to face pandemic demands.⁶ Despite this change in the routine of health services, patients with femoral fractures still require emergency care.⁶⁻⁸ In the context of the pandemic, several studies have reported an increase in serious complications and mortality in patients with femoral fractures diagnosed with COVID-19.^{1,7,9} However, few studies focused on investigating the impact of the pandemic on the epidemiology and clinical outcome of patients with femoral fractures, especially at the national level. Due to the scarcity of studies on the influence of COVID-19 on hospitalization indicators and clinical outcome, this study aimed to evaluate the impact of the COVID-19 pandemic on hospitalization and mortality indicators in older adults with proximal femoral fractures.

METHODS

Type of study

This is an observational and retrospective study, which was conducted in the Department of Orthopedics and Traumatology, Hospital São Paulo, Universidade Federal de São Paulo – Unifesp (EPM), São Paulo, Brazil. The study took place from July 2016 to February 2021, following the methodology guided by the STROBE (Strengthening the Reporting of Observational Studies in Epidemiology) initiative, a reference guide for observational studies.¹⁰ This study was submitted to and approved by the Research Ethics Committee Unifesp/EPM (No. 1,890,165).

Inclusion and exclusion criteria

Inclusion factors were: patients of both sexes, over 60 years of age, who presented fracture of the proximal extremity of the femur (femoral neck and transtrochanteric) and underwent surgical treatment performed by specialized orthopedists, with more than 5 years of experience in the area. Patients who presented incomplete data, who did not undergo surgical treatment and those who could not be contacted and lost outpatient follow-up were not included.

Data collection

Data collection was carried out at two times: pre-pandemic period (July 6, 2016 to March 17, 2020) and during the pandemic (March 18, 2020 to February 17, 2021). The demographic characteristics of the cases were recorded. The number of cases, types of fractures, preoperative time, duration of hospitalization and postoperative clinical outcome were obtained through electronic medical records, telephone contact or via obituaries. Confirmation of infection with COVID-19 was obtained through the result of registered PCR, and the information was compiled for the approach of these patients. Data were obtained by preserving the identity of patients and reducing the leakage of information from medical records.

Management of fractures of the proximal femur

The anatomical classification of the fracture was performed in the emergency room by an orthopedist specialist and confirmed by the orthopedist coordinator at the surgical hospital. In the period before the pandemic, older patients were subjected to the management of fractures of the proximal femur prepared by the institution in 2016, which

aims to optimize the surgical treatment within 48 hours of the patient's entry to obtain better outcomes and early hospital discharge. For surgical treatment, patients were subjected to cardiological evaluation in a separate room for surgical release. In the postoperative period, the clinical and orthopedic team offered follow-up aimed at the early discharge of the patient. However, during the pandemic, this flow was changed after the hospital was framed in the preferential care of COVID-19. Thus, the cardiological evaluation was relocated to the ICU and the clinical team was overloaded in the COVID-19 wards.

Statistical analysis

Descriptive statistics were presented in frequency, percentage, mean values and standard deviation. The chi-square test was used to evaluate the difference between proportions and the differences between continuous variables were obtained using the Mann-Whitney test. The results were analyzed by jamovi software (version 1.6.18.0) (Software Inc., USA), considering the significance level of 5% ($p < 0.05$) as statistically significant.

RESULTS

This study included data from 379 patients treated with surgical treatment for femoral fractures, which were grouped into two groups: patients treated before (group 1; $N = 278$; 73.35%) and during the pandemic (group 2; $N = 101$; 26.65%). The sample was characterized by having a higher proportion of female patients ($N = 251$; 66.23%), aged between 80-89 years ($N = 153$; 40.37%) presenting transtrochanteric fracture ($N = 327$; 86.28%). Regarding the type of fracture, a higher proportion of patients with neck fractures was observed in group 2 ($N = 33$; 32.70%) compared to group 1 ($N = 19$; 6.90%), with $p \leq 0.001$. However, no differences were observed regarding gender and age group (Table 1).

Mortality among patients treated before and during the COVID-19 pandemic

Regarding mortality before and during the pandemic, there was a higher mortality in group 2 ($N = 24$; 23.8%) compared to group 1 ($N = 10$; 3.6%), with $p < 0.001$ (Table 2). The same profile of increased mortality was observed considering the stratification of sex: male ($p < 0.001$) and female ($p < 0.001$).

In the analysis of mortality considering the age group (Table 3), a higher proportion of deaths was observed in patients treated during the pandemic in all age groups analyzed, 70-79 years (group 1,

Table 1. Demographic characteristics of patients undergoing surgical treatment for femoral fractures before and during the COVID-19 pandemic.

Variables	Group 1		Group 2		Total		p
	N	%	N	%	N	%	
Age	78.98	SD:9.55	78.87	SD:10.23	78.95	9.728	0.9927#
Sex							0.9023*
Male	93	33.50	35	35.00	128	33.77%	
Female	185	66.50	66	65.00	251	66.23%	
Age group							0.488*
60-69 years	55	19.80	25	24.80	80	21.11%	
70-79 years	73	26.30	23	22.80	96	25.33%	
80-89 years	116	41.70	37	36.60	153	40.37%	
> 90 years	34	12.20	16	15.80	50	13.19%	
Type of Fracture							< 0.001*
Transtrochanteric	259	93.10	68	67.30	327	86.28%	
Fracture of neck	19	6.90	33	32.70	52	13.72%	

Group 1: patients treated before the COVID-19 pandemic; Group 2: patients treated during the pandemic; #: Mann-Whitney test; *: chi-square test; N: sample number; SD: standard deviation.

Table 2. Mortality of patients undergoing surgical treatment for femoral fractures before and during the COVID-19 pandemic according to gender.

	Death	Group 1		Group 2		p
		N	%	N	%	
Sex		278	73.35	101	26.65	
Male						< 0.001
	No	92	98.92	26	74.29	
	Yes	1	1.08	9	25.71	
	Total	93	100.00	35	68.63	
Female						< 0.001
	No	176	95.14	51	77.27	
	Yes	9	4.86	15	22.73	
	Total	185	100.00	66	100.00	
Total						< 0.001
	No	268	96.40	77	76.24	
	Yes	10	3.60	24	23.76	
	Total	278	100.00	101	100.00	

Group 1: patients treated before the COVID-19 pandemic; Group 2: patients treated during the pandemic; chi-square test; N: sample size; p < 0.05: statistical significance.

N = 2; 2.7% versus group 2, N = 4; 17.39%, p = 0.011), 80-89 years (group 1, N = 27; 19.57% versus group 2, N = 10; 66.67%, p < 0.001) and > 90 years (group 1, N = 2; 5.88% versus group 2, N = 7, p < 0.001). However, considering the age group from 60 to 69 years (group 1, N = 1; 1.82% versus group 2, N = 3; 12.00%, p = 0.053), no significant differences were observed.

Regarding the time of care, group 2 had a longer preoperative time (4.97 days) and hospital stay (12.7 days), compared to group 1, which was verified 4.97 days and 12.7 days, respectively, with p ≤ 0.001 (Table 4).

The causes of mortality were verified, and it was observed that in group 1 the main causes were: cardiorespiratory arrest (CRP) secondary to hydroelectrolytic disorder (17.6%), sepsis of urinary focus (17.6%), CRP of undetermined cause (17.6%), sepsis of pulmonary focus (14.7%) and other causes (32%). In group 2, the causes of death were: CRP of undetermined cause (36%); sepsis

Table 3. Mortality of patients undergoing surgical treatment for femoral fractures before and during the COVID-19 pandemic according to age group.

	Death	Group 1		Group 2		p
		N	%	N	%	
Age group		278	73.35	101	26.65	
60-69 years						0.053
	No	54	98.18	22	88.00	
	Yes	1	1.82	3	12.00	
	Total	55	100.00	25	100.00	
70-79 years						0.011
	No	71	97.26	19	82.61	
	Yes	2	2.74	4	17.39	
	Total	73	100.00	23	100.00	
80-89 years						< 0.001
	No	111	80.43	5	33.33	
	Yes	27	19.57	10	66.67	
	Total	138	100.00	15	33.33	
> 90 years						< 0.001
	No	32	94.12	9	56.25	
	Yes	2	5.88	7	43.75	
	Total	34	100.00	16	100.00	

Group 1: patients treated before the COVID-19 pandemic; Group 2: patients treated during the pandemic; chi-square test; N: sample size; p < 0.05: statistical significance.

Table 4. Mortality of patients undergoing surgical treatment for femoral fractures according to the Polymerase Chain Reaction test for COVID-19.

	Group 1			Group 2			p
	N	%	SD	N	%	SD	
Time (days)	278	73.35		101	26.65		
Preoperative	0.76	0.12	2.70	4.92	3.45	4.55	< 0.001
Hospital stay	4.97	2.5	6.14	12.7	9.31	10.5	< 0.001

Group 1: patients treated before the COVID-19 pandemic; Group 2: patients treated during the pandemic; Mann-Whitney test; N: sample number; SD: standard deviation; p < 0.05: statistical significance.

of pulmonary focus (24%); sepsis of undetermined focus (12%) and CRP secondary to hydroelectrolytic disorder (12%). Regarding the reasons found for the delay in surgical care, we found that in group 1 this was justified mainly due to the waiting for clinical stabilization (70%) and waiting for evaluation by a cardiologist (20%). In group 2, the main reasons for delay were: waiting for evaluation by a cardiologist (46.40%), waiting for clinical stabilization (32.10%) and delay in the arrival of material (14.20%) (Table 5).

Among the 79 patients tested in group 2, the results of the CRP test showed that 16 (20.25%) of the patients were COVID-19 positive. However, regarding mortality, no significant differences were observed (Table 6).

Table 5. Causes of mortality and increased length of stay of patients undergoing surgical treatment for femoral fractures before and during the COVID-19 pandemic.

	Group 1		Group 2	
	N	%	N	%
Causes of death	278	73.35	101	
CRP secondary to hydroelectrolytic disorder	2	17.60	3	12.00
CRP of undetermined cause	2	17.60	8	36.00
CRP secondary to upper gastrointestinal bleeding	0	0.00	2	8.00
Urinary focal sepsis	2	17.60	0	0.00
Pulmonary focal sepsis	1	14.70	6	24.00
Sepsis; focus, indeterminate	0	0.00	3	12.00
IRA secondary to COVID	0	0.00	2	8.00
Other causes*	3	32.00	0	0.00
Causes of the increase in hospitalization time				
Waiting until clinical stabilization	194	70.00	32	32.10
Waiting for cardiologist evaluation	55	20.00	47	46.40
Delay for material arrival	0	0.00	14	14.20
Lack of ICU	2	0.90	4	3.60
Waiting for exam	0	0.00	3	3.50
Other causes#	27	10.00	0	0.00

CRP: cardiorespiratory arrest; Other causes*: acute respiratory failure (IRA), pulmonary thromboembolism, cerebrovascular accident, unspecified sepsis, arrhythmia, atrial fibrillation, bronchoaspiration and CRP secondary to anesthetic induction; Other causes#: obtaining social discharge, delay to vacancy in the CC, delay to clinical examination.

Table 6. Mortality of patients undergoing surgical treatment for femoral fractures according to the Polymerase Chain Reaction test for COVID-19.

	COVID-19 CRP						p
	Negative		Positive		Total		
	N	%	N	%	N	%	
Death							1.000
No	60	80.00	3	75.00	63	79.75	
Yes	15	20.00	1	25.00	16	20.25	
Total	75	100.00	4	100.00	79	100.00	

X2: chi-square test; N: sample size; PCR: Polymerase Chain Reaction; p < 0.05 statistical significance.

DISCUSSION

In this retrospective observational study, we investigated the clinical outcome of femoral fracture patients who were admitted and surgically treated in a quaternary hospital in the city of São Paulo, Brazil, before and during the COVID-19 pandemic, in a vulnerable population over 60 years of age. We observed that during the pandemic, patients with proximal fracture of the femur presented higher mortality and length of hospital stay.

This study included 379 patients, who were treated before and during the pandemic. The sample was characterized by a higher proportion of female patients aged between 80 and 89 years. These results are consistent with the epidemiology of femoral fractures at the international and national levels, which report greater involvement of female patients,^{1,5,11,12} over 80 years of age^{1,5,7,11,12} suggesting that the results found can be applied in the epidemiological context of femoral fractures.

Regarding mortality, higher rates were observed in patients treated during the pandemic considering all patients and stratification according to sex. A study conducted in the United Kingdom compared the mortality associated with fractures of the proximal femur in patients treated in the month before the pandemic in relation to those treated one month during the pandemic. Similar to our results, the data presented showed an increase in mortality during the pandemic (22.0%) compared to the previous month (6.2%), which suggests a possible relationship of COVID-19 with mortality in this population.⁷

Several studies have shown that the risk of mortality from COVID-19 increases with age.^{7,13} Here we verified the increase in the number of deaths during the pandemic in all analyzed ranges similar to studies carried out in Italy,¹ England⁷ and Spain.¹⁴ This fact can be justified by the selection of patients over 60 years of age, who are considered to be at higher risk for the occurrence of COVID-19, which reflects in high mortality. However, recent studies^{15,16} reported a decrease in fracture cases at the beginning of the pandemic period, suggesting that there was reduced demand for health services due to fear of contamination and the possibility of late sequelae of COVID-19 infection.

In addition to the increase in the number of deaths, high rates of complications during hospitalization have been associated with COVID-19,^{12,15} here we observed that the most frequent causes of death were CRP of undetermined and secondary origin, hydroelectrolytic disorder and sepsis. Similar to our findings, studies have also related the occurrence of hospital complications, such as sepsis and electrolyte imbalance in patients with femoral fractures treated during the pandemic.^{1,12}

A possible justification for the increase in cases with unfavorable outcome and length of hospitalization in our reference center is based on the change in the care line of the institution that modified the flow of care and overloaded the care team,¹⁶ a reality also experienced in other health centers.^{14,15} Literature on the topic shows that the ideal time for surgical treatment of proximal femoral fractures should occur within 48 hours after the fracture episode,^{17,18} to reduce the length of hospital stay and mortality.¹⁹ Nevertheless, in this study we observed that the

changes in orthopedic care imposed by the pandemic impacted the preoperative increase and hospital stay, similar to what was reported by Segarra et al.²⁰

The pandemic period imposes several adaptations in hospital centers to improve the management of fractured patients during the pandemic that may have impacted the increase in hospitalization time, such as a reduction in the number of elective orthopedic surgeries, improvement in the perioperative management of older patients, deliberation of the appropriate time of surgery according to the risk and severity of COVID-19 and underlying medical condition, and use of universal pandemic containment precautions.^{16,20}

Regarding the reasons found for the delay in care, we found that during the pandemic, the main reasons for delay were: waiting for evaluation by a cardiologist, waiting for clinical stabilization and delay in the arrival of material. Similar findings were reported in hospitals that underwent redistribution of the surgical team.^{14,15}

In this study, we observed that the pandemic increased mortality regardless of whether the patient was infected with the virus at admission, since only 20.25% of patients were COVID-19 positive, with no differences in mortality, suggesting that other conditions of the pandemic may have interfered with the clinical outcome. However, unlike our findings, the study by Mamarelis et al.⁷ and Biarnés-Suñé et al.¹¹ found increased mortality in patients who tested COVID-19 positive.

Among the main findings of this study, we reinforce that mortality and length of stay in older patients with femoral fracture increased significantly in the pandemic period, findings consistent with those found by Biarnés-Suñé et al.¹¹ and Egol et al.¹² in more developed countries. Among the strengths of this study, we highlight the sample size, surgical care performed by an experienced team and evaluation of patients undergoing surgical treatment, characteristics little observed in previous studies. However, we highlight some limitations of the study, such as a retrospective data analysis model and the limited capacity of diagnostic tests during the first period of the pandemic, which limited patient testing.

Due to the pandemic, the world has faced difficulties with great social and economic impact, especially in poor and emerging countries that are affected by the lack of resources to meet the growth of demand from COVID-19. Increased demand for intensive care units, wards and resources such as respirators and medicines, has affected the care of other common causes of hospitalization such as fractures of the proximal femur in the older adults, which reinforces the need for greater attention to adopt measures to reduce complications and mortality.

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