



Original Article

Mortality Increase after Hip Fracture in Aged Patients during the First 6 Months of the COVID-19 Epidemic

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SUMMARY

Background: The COVID-19 pandemic modified hospital functioning, social mobility and assistance to the elderly. These factors may alter hip fracture evolution.

Methods: Retrospective study of patients > 65 years suffering hip fracture from the 1st of March to the 31st of August of 2020, and compared with patients from the same period of 2019; 199 patients from 2019 (79.4% women) (mean age: 84.9 ± 7.72 years), and 203 patients from 2020 (69.5% women) (mean age: 85.37 ± 8.13 years). Extracapsular fractures were 57.3% in 2019, and 58.6% in 2020. Follow-up was made until death or 6 months after surgery.

Results: In 2019, 44 patients (22.1%) died in the six postoperative months, and 61 patients (30%) in 2020 (OR 1.513; 95% CI 0.96–2.37; $p = 0.199$). There were no significant differences in mortality during postfracture hospitalization (11.1% in 2019; 11.82% in 2020) and in the first postoperative month (16.6% in 2019; 22.66% in 2020). Four patients died during hip fracture hospitalization over 8 patients presenting PCR+. In 30 patients SARS-CoV-2 infection was diagnosed during the six months after hip fracture in 13 patients this was the cause of death (21.3% of causes). Dementia was associated with high mortality in patients with a SARS-CoV-2 diagnosis (6 out of 13 patients died with SARS-CoV-2 infection and dementia).

Conclusions: An increase in the 6 postoperative months mortality in 2020 compared with the same period in 2019 was observed. An important cause of death was SARS-CoV-2 infection.

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1. Introduction

The coronavirus disease 2019 (COVID-19) outbreak and associated lockdown measures have challenged healthcare. Medical care systems reached a state of collapse and public hospitals were totally overloaded. However, emergency department visits declined during the early COVID-19 pandemic.^{1,2} The government decreed a state of alarm on March 14th limiting citizens' free movement; strict confinement was decreasing from 28th April 2020. Trauma emergency attendances suffered an important reduction in absolute numbers and proportion exposed to road traffic accidents. In France, road traffic accidents (2017–2019) entailed 55.4% of total trauma admissions compared to 36.8% during 2020.³ A multicenter study of 43 hospitals in Hong Kong, showed a decrease of 44.7% in trauma emergency visits which fell by 44.7% from January 25 to March 27, 2020 compared with the previous four years.⁴ Nevertheless, the in-hospital observed mortality and predicted mortality during the pandemic period were not different compared to the non-pandemic years.³

Patients with hip fractures, due to their age and comorbidity,

were high-risk patients in this pandemic. The immune dysfunction associated with age⁵ may be added to the immunological alterations produced by surgery.⁶ These immune response impairments may predispose elderly people to complications after hip fracture in a period of SARS-CoV-2 epidemic.

The aim of the present article is to identify variations of incidence, evolution or mortality during hospitalization and the 6 postoperative months in senior patients suffering hip fracture during six months of the SARS-CoV-2 epidemic.

2. Patients and methods

We studied and compared hip fracture incidence and mortality from the 1st of March to the 31st of August of 2020, and the same period in 2019.

2.1. Participants

During the year 2019, 509 patients older than 65 years of age suffering from hip fracture were attended to in our hospital, and 481 patients during the year 2020. Research and figures follow rules of Ethical Committee, research was approved by the Ethical Committee (Comité de Proyectos de Investigación del Sector III - Hospital Clínico "Lozano Blesa"). Exclusion criteria were pathologic fractures and

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conservative treatment. Included were 199 patients older than 65 years operated from 01-03-2019 to 31-08-2019 (79.4% fractures in women) (mean age: 84.9 ± 7.72 years), and 203 patients during the same period of 2020 (69.5% fractures in women) (mean age: 85.37 ± 8.13 years). At the moment of fracture 22.6 % of the studied patients in 2019 were living in an assisted living residence, 23.6% in 2020. The proportion of extracapsular fractures was 57.3% in 2019, and 58.6% in 2020. Follow-up was made until death or 6 months after surgery.

No patients presented fractures in both hips during the studied period. Follow-up was made until death or a minimum of 6 months. We contacted all patients during the studied period after hospitalization. The study was carried out entirely in a hospital belonging to the public health system. This survey had no financial sponsorship.

The most common underlying comorbid conditions or antecedents in the studied patients are presented in Table 1.

Extracapsular hip fractures were operated by means of trochanteric Gamma® 3 nail (Stryker), intracapsular hip fractures were operated by means of Furlong® cemented hemi-arthroplasty (Jri Orthopaedics). Subcutaneous enoxaparin every 24 hours was administered as antithrombotic prophylaxis. From admission until 48 hours after surgery the patients received intravenous Metamizole 2 g/24 hours and oral Omeprazole 40 mg/24 hours. Intravenous Cefuroxime (1500 mg) was administered 30 minutes before surgery and 750 mg every 8 hours for 24 hours after surgery; in allergic patients Clindamycin (600 mg) was administered in the same way. Teicoplanin 800 mg previous to surgery and 400 mg 12 hours after surgery was administered in patients from residential communities. Patients received 200 mg of intravenous Venofer® (iron sucrose) on the first hospitalization day and 48 hours after this. Epoetin Alfa (40,000 units) was injected subcutaneously in patients when hemoglobin was less than 13 g/dL in peripheral blood before surgery.

2.2. Variables

The following data were collected from patients' clinical history and stored in electronic databases: fracture side, month of the year, associated traumatic injuries, patient age, gender, own living at home or in an assisted living residence, body mass index at the time of surgery (obesity was defined as a body mass index greater than 30), pre-fracture bladder and bowel continence, presence of comorbidities, previous pathology, chronic drug treatments, American Society of Anesthesiologists score, anesthesia type, duration of surgery, antimicrobial prophylaxis, duration of hospitalization before and after surgery, and number of transfused erythrocyte concentrate units, patients' walking competence, date and cause of the death. The Katz index was used pre- and postoperatively to evaluate independence in basic activities of daily living.⁷

SARS-CoV-2 presence in patients was studied by means of PCR analysis in samples collected from all incoming patients at the moment of hospitalization since April 2020. In March 2020 SARS-CoV-2 presence was analyzed at the moment of hospital incoming in 20 out of 38 patients. PCR analysis was repeated if any suspicious symptom appeared or in cases of contact with any positive case, and prior to the return to the assisted living residence. The first patient was diagnosed with SARS-CoV-2 pneumonia in our hospital on March 4th.

2.4. Statistical analysis

Statistical analysis was performed using Statview-Statgraphics 5.0.1 software (SAS Institute Inc., Cary, North Carolina, USA), and Epidat 3.1 (Organización Panamericana de la Salud-OMS) for logistic regression. Basic descriptive analysis and elaborate analysis of va-

riance were performed. Categorical data were tested using chi-square or Fisher exact tests. Analysis of variance and Kruskal-Wallis tests were employed for quantitative data. All data are presented as means, and the deviations are presented as standard deviations. Correlation coefficient (values of 0.7 or greater were taken as a high correlation) was used to study linear correlation between variables showing a significant value using the Spearman's test and Pearson's test. p value of 0.05 or less was considered to be significant for all tests. The bivariate analysis results identified the variables associated with mortality. Only those variables with an adjusted p value ≤ 0.05 were included in the final model. All the variables thus selected were introduced into a logistic regression multifactorial model which takes into account the effect of each factor after adjustment for all the other factors. The results of these analyses were presented in the form of odds ratios (OR) with 95% confidence intervals (CIs).

3. Results

From March 2020 to August 2020 the number of incoming hip fractures did not show significant differences compared with the same months of 2019. Clinical data from all the patients were located for follow-up. No significant differences in the studied comorbid conditions or antecedents were found when comparing the 2019 and 2020 studied patients. There were no differences in the proportion of patients receiving anticoagulants or antiplatelet between the studied years (Figure 1).

In 2019, 44 of the patients (22.1%) died in the course of the six postoperative months, and 61 patients (30%) in 2020 (OR 1.513; 95% CI 0.96–2.37; $p = 0.199$). There were no significant differences in mortality during postfracture hospitalization (11.1% in 2019; 11.82% in 2020) (OR 1.079, 95% CI 0.58–1.99) and in the first postoperative month (16.6% in 2019; 22.66% in 2020) (OR 1.47, 95% CI 0.90–2.42).

Sex, residence, surgery before 48 hours, fracture type, pre-fracture antiaggregant or anticoagulant treatment, dementia, diabetes, heart arrhythmia, or ischemic cardiopathy did not appear related to intrahospitalary mortality in 2019 or 2020. In 2019 heart insufficiency (10 patients died out of 35 diagnosed; in the non heart insufficiency group 12 patients died out of 164 diagnosed) (year 2019 OR = 5.07, 95% CI 1.98–12.97, $p < 0.0001$) and chronic respiratory disease (9 patients died out of 38 diagnosed; in the non respiratory disease group 13 patients died out of 161 diagnosed) increased intrahospitalary mortality in 2019 patients (OR = 3.533, 95% CI 1.382–9.031, $p < 0.01$). In 2020 patients with chronic renal disease presented significant differences in intrahospitalary mortality (9 patients died out of 40 diagnosed; in the non kidney insufficiency group 16 patients died out of 163 diagnosed) (OR = 2.667, 95% CI 1.080–6.586, $p < 0.05$).

Table 1
Comorbid conditions or antecedents % of the studied patients.

Year	2019	2020
Included patients	199	203
Mean age (years)	84.9 ± 7.7	85.4 ± 8.1
Female, %	79.4%	69.5%
Assisted living residence	22.6%	23.6%
Extracapsular fractures	57.3%	58.6%
Dementia	14.6%	15.2%
Diabetes mellitus	20.1%	24%
Atrial fibrillation	14.1%	16.2%
Congestive heart failure	17.6%	17.2%
Renal insufficiency	18.6%	19.6%
Chronic obstructive pulmonary	19.1%	15.2%
Ischemic cardiopathy	7%	4.9%

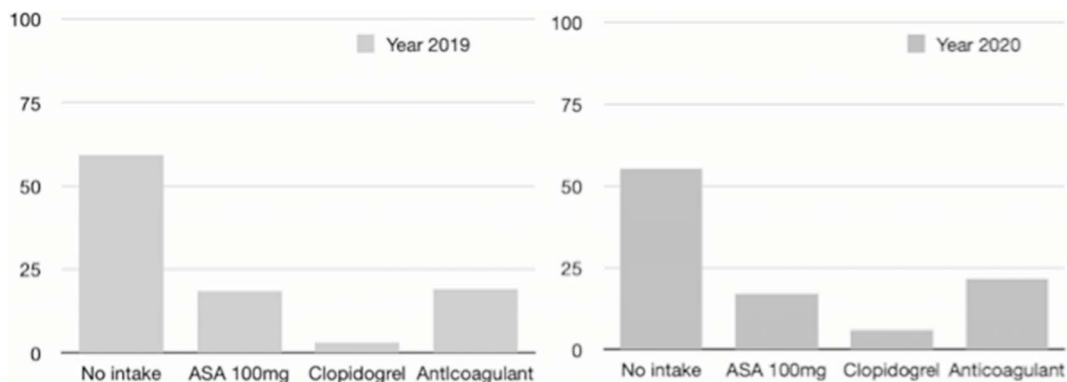


Figure 1. Percentage of patients receiving anticoagulants or antiplatelet treatment at hospital admission. ASA: acetylsalicylic acid.

Considering mortality in the six first months after hip surgery, men presented significantly different mortality (26 out of 62 men died) than women (35 out of 141 women died) in 2020 (OR = 2.187, 95% CI 1.16–4.12, $p < 0.05$). There was no significant difference in 2019.

Patients who were living in assisted living residences presented significantly higher mortality in the six first months after hip surgery in 2019 (18 patients died/45 patients living in residences) (OR = 3.282, 95% CI 1.58–6.81, $p < 0.05$) and in 2020 (24 patients died/48 patients living in residences) (OR = 3.189, 95% CI 1.62–6.27, $p < 0.001$).

Heart insufficiency patients did not present significantly more mortality in the first six months after hip surgery in 2019 than patients with no heart insufficiency diagnosed at the moment of incoming fracture hospitalization (10 out of 35 patients presenting heart insufficiency died) (OR = 1.529, 95% CI 1.67–3.49, $p = 0.313$). However, in 2020 patients with heart insufficiency diagnosed at the moment of incoming fracture hospitalization presented higher mortality (16 out of 35 died) (OR = 2.302, 95% CI 1.09–4.486, $p < 0.05$).

Average delay for surgery was lower than 48 hours in 48.7% of cases in 2019, and in 46.3% of cases in 2020. Hospitalization duration since surgery was lower than 72 hours in 17.6% of cases in 2019 and 36% in 2020, greater than 6 days in 42.7% in 2019, and 33% in 2020. Mortality depending on the postoperative hospital stay is presented in Table 2.

From March to August SARS-CoV-2 infection was diagnosed in seven patients at the moment of incoming hip fracture hospitalization (Table 3), one patient, who died during hospitalization, presented a negative PCR at the incoming hospitalization moment and changed to positive during the hip fracture hospitalization. In 30 pa-

Table 2 Mortality depending on the postoperative hospital (PO) stay.

	Mortality 2019		Mortality 2020	
	1 month	6 months	1 month	6 months
PO stay < 72 hours	9.1%	12.11%	11.6%	24.6%
PO stay 4–5 days	2.9%	13.2%	10.2%	13.6%
PO stay 6 or more	7.9%	11.8%	16%	28%

Table 3 Mortality and PCR+ for SARS-CoV-2 during hospitalization after incoming hip fracture. One more patient, who died, presented PCR+ during hip fracture hospitalization.

In-hospital mortality	PCR– at admission	PCR+ at admission
No	174	4
Yes	22	3

$p < 0.012$

tients SARS-CoV-2 infection was diagnosed during the six months after hip fracture (13 of them died), these patients did not present higher mortality than the 173 non-COVID patients during the six postoperative months (49 of them died). Dementia was associated with high mortality in patients with SARS-CoV-2 diagnosis in the six post-hip fracture months (6 out of 13 patients with SARS-CoV-2 infection and dementia died).

Causes of death in patients who suffered hip fracture in the year 2020 are presented in Table 4. None of the five patients with unknown cause of death died during hip fracture hospitalization. Four of them died after hip hospitalization and before one month post-hospitalization (mean age 92.25 ± 2.28 years), and the fifth patient (94 years old) died before 6 months post-hip fracture hospitalization. All of them presented several concomitant pathologies.

4. Discussion

No significant differences were found between 2019 and 2020 groups in regard to the age, sex, or type fracture, so the 2019 group can be used as control group. We have not found differences in hip fracture incidence in 2020 compared with 2019. Minarro et al.⁸ found in a Spanish hospital in Cordoba a decrease of almost half of the diagnosed hip fractures during the first month of confinement. Other studies in our country showed no differences in incidence of

Table 4 Causes of mortality in patients who suffered hip fracture in the year 2020.

Death causes	Intrahospital	After hip fracture hospitalization and before 1 month post fracture	Between 1 and 6 months after hip fracture
COVID	4	5	4
Heart failure	6	4	0
Ischemic heart disease	2	0	1
Lung cancer	0	2	1
Multiple myeloma	1	0	0
Urinary infection	2	3	6
Pulmonary embolism PCR (–)	1	0	0
Cachexia-dementia	0	0	1
Mesenteric ischemia	2	1	0
Abdominal sepsis	1	0	0
Renal insufficiency	2	2	0
Arrhythmia	1	0	0
Anemia	1	0	0
Respiratory insufficiency	0	1	0
Pneumonia PCR (–)	1	0	0
Bronchial aspiration	0	0	1
Unknown	0	4	1

osteoporotic hip fractures in 2020 compared with years 2018 and 2019.⁹ Luceri et al.¹⁰ found a 73.8% decrease in overall patient flow in an Italian orthopedic trauma emergency department during the first month of lockdown comparing with 2019, with a marked reduction in the number of pediatric emergencies and in the group of sprains, contusions and back pain; however, proximal femoral fractures and the overall rate of fragility fractures in the elderly increased significantly. Nevertheless, these authors explain that “trauma was concentrated in regional hubs”. In our country the reference centers for trauma emergencies were not modified.

Average delay for hip fracture surgery did not change in 2020 in our hospital, it was lower than 48 hours in 48.7% of cases in 2019, and in 46.3% of cases in 2020. Extracapsular fractures are operated in a programmed surgery session in our hospital, the proportion of this type of fracture was 57.3% in 2019, and 58.6% in 2020. Despite organization problems during the first months of the pandemic, most of the operating rooms were closed and respirators were employed for intensive care patients, the delay in hip fracture surgery did not increase in 2020 in our hospital. In an Italian multicenter study¹¹ time to surgery in patients with hip fracture was 2.3 days in COVID + patients and 2.8 days in COVID – patients.

Another important issue to highlight is that the group of lower than 72 hours of postoperative hospitalization raised significantly from 17.6% in 2019 to 36% in 2020 in our hospital. Minarro et al.⁸ found a decrease in hospitalization stay in hip fractures. Fear of contamination during hospitalization and the need of beds for COVID patients may explain this decrease. Mortality during the six post hip fracture months increased in 2020 in the group of hospitalization stays lower than 72 hours compared to 2019 and in the group of more than 6 days of hospitalization.

In our study 22.1% of the patients died in the course of the 6 postoperative months in 2019, and 30% in 2020. We did not find any difference in mortality during postoperative hospitalization (11.1% in 2019; 11.82% in 2020). In the first postoperative month there was an increase but it was not statistically significant (16.6% in 2019; 22.6% in 2020). Tripathy et al.¹² examined eight studies and did not find a significant difference in 30 days mortality rate between the hip fracture patients treated during the pandemic (9.63%) and pre-pandemic periods (6.33%). Nevertheless, these authors found a mortality increase in COVID-19 positive compared with COVID-19 negative patients. In our study, from March to August eight patients exhibited SARS-CoV-2 infection during the hip fracture hospitalization and four died. Biarnés-Suñé et al.¹³ presented a 20% mortality during hospitalization in operated patients with PCR +, and a mortality of 40% in the first postoperative month versus 6.8% in non-infected patients. Kayani et al.¹⁴ developed a multicenter cohort study in nine hospitals in Greater London (United Kingdom), COVID-19-positive patients undergoing hip fracture surgery had increased postoperative mortality rates (30.5%) within a 30-day postoperative period compared to COVID-19-negative patients (10.3%).

In our study SARS-CoV-2 infection was diagnosed in 30 patients during the six months after hospitalization, these patients did not present higher mortality than non-COVID patients. In our study only dementia was associated with higher mortality in patients with SARS-CoV-2 diagnosis in the six post-hip fracture months. Considering overall mortality in the six first months after hip surgery, men presented significantly higher mortality than women in 2020. Patients who were living in assisted living residences presented non-significantly higher mortality in the six first months after hip surgery

in 2019 and 2020. Heart insufficiency patients exhibited elevated mortality in 2019 and 2020; in 2019 heart insufficiency patients who died represented 22.7% of all the deceased patients in the six first months after hip surgery, however, in 2020 heart insufficiency patients who died represented 26% of all the deceased patients, therefore heart insufficiency previously diagnosed was not the cause of the increase in mortality in 2020.

In conclusion, our study has revealed a significant increase in the 6 postoperative months mortality in operated patients suffering hip fracture in 2020 from March to August compared with the same months in 2019. An important cause of death was SARS-CoV-2 infection.

Declarations of interest

None.

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