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Original article

Has the COVID lockdown altered the incidence and management of fragility fractures in older adults? Case-control study at a French University Hospital

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ABSTRACT

Introduction: In France, a national lockdown related to the COVID-19 pandemic was imposed from March 17 to May 11, 2020, drastically changing our professional and organizational practices. We were interested on the impact of the lockdown on fragility fractures in older adults (65 years and older). The primary objective of this study was to evaluate the incidence of peripheral and pelvic fragility fractures during the lockdown. The secondary objectives were to carry out an epidemiological analysis of the fractures, treatments and hospitalization data.

Hypothesis: The main hypothesis was that the number of peripheral and pelvic fragility fractures was lower during the lockdown in 2020 than in the same (non-lockdown) period in 2019.

Materials and methods: We retrospectively collected epidemiological (age, sex), clinical (type of fracture, treatment) and hospitalization data from patients 65 years and older who came to the emergency room because of a peripheral and/or pelvic fracture between March 17 and May 11 of the years 2019 and 2020.

Results: We included 192 patients in 2019 and 157 patients in 2020. The mean age and sex ratio were not statistically different. The number of peripheral and/or pelvic fragility fractures decreased by 16%. The share of patients treated surgically was similar in both years (46% in 2019; 51% in 2020 ($p=0.47$)). The number of proximal femur fractures dropped by 21%. The mean time to surgery for these fractures was shorter in 2020 ($p=0.02$) although the mean length of hospital stay was unchanged ($p=0.72$) The mortality rate of patients hospitalized for fragility fractures did not increase significantly ($p=0.51$).

Discussion: We observed a reduction in the number of peripheral and pelvic fragility fractures in patients 65 years and older during the lockdown. To ensure that we met our goals of optimal care for proximal femur fractures, a general reorganization of the operating room was necessary. The continued availability of fully functional technical facilities despite this health crisis was crucial to being able to treat these fractures and to prevent increased mortality.

Level of evidence: III, case-control study.

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1. Introduction

The SARS-CoV-2 virus responsible for the COVID-19 pandemic has drastically changed how health care services are provided throughout the world. In Europe, the epidemic started in January 2020 before an explosion in the number of cases led some national governments to impose lockdowns on their citizens. In France, a national lockdown was declared on March 17 until May 11,

2020. During this first COVID-19 wave, nearly 29,200 deaths were attributed directly to COVID-19 in France [1]. In our county, the INSEE (French national institute of economic and statistical information) estimated that mortality was 56% higher than in the same period in 2019 [2]. The High Level Committee on Public Health (HCSP) in France established a list of risk factors for developing severe SARS-CoV-2 infection [3]. One of these factors was being 65 years of age or older. The population in this age bracket was specifically targeted by public health authorities.

We were interested in the impact of the lockdown on fragility fractures in this age group (≥ 65 years). The primary objective of this study was to evaluate the incidence of fragility fractures (distal

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radius, proximal femur, pelvis, proximal humerus) in adults 65 years and older during the lockdown compared to a control period. The secondary objectives were to carry out an epidemiological analysis of all the fractures, treatments and hospitalization data. The main hypothesis was that the incidence of peripheral and pelvic fragility fractures was lower during the 2020 lockdown.

2. Materials and methods

This was a retrospective, single-center, comparative, epidemiological study carried out at an emergency trauma department of a University Hospital. We collected data on emergency consultations for fractures between March 17 and May 11 in the years 2019 (control) and 2020 (case). The following data were collected:

- standard epidemiological variables (age, sex);
- time-related (consultation date) and clinical parameters (reason for consultation, location and type of fracture, type of treatment [surgical, functional, immobilization]);
- information about the care provided (outpatient or inpatient, length of hospital stay, discharge destination [home, rehabilitation facility]);
- deaths while at the hospital.

Included were all peripheral and pelvic fractures in patients 65 years and older. Fragility fractures were defined as fractures occurring following a low-energy trauma (e.g., fall). These fractures included distal radius fractures, proximal femur fractures, proximal humerus fractures and pelvic fractures (acetabulum, ilio/ischial-pubic rami). Lower leg fractures, humeral and femoral midshaft fractures, peri-articular fractures of the intermediate segments (knee, elbow) were considered, arbitrarily, as fractures that occur with higher energy trauma. Excluded were patients younger than 65, trauma that did not lead to fracture, wounds, infections, burns, head injuries, consultations for ophthalmological reasons, along with spinal and facial fractures.

For the statistical analysis, the qualitative variables were described by their counts and percentages. The quantitative variables were described by the mean and standard deviation; normality was verified with the Shapiro-Wilk test. The qualitative variables were compared between groups using the Pearson's Chi² test or Fisher's exact test. For the quantitative variables, the non-parametric Wilcoxon test was used. A *p*-value of 0.05 or less was considered significant. These analyses were done using the software R version 3.6.3 (www.cran.r-project.org).

3. Results

The analysis included 192 patients (6.3%) from the 3,046 emergency room visits in 2019 and 157 (11%) patients among the 1,428 visits in 2020 (*p* < 0.0001) (Fig. 1). There was no statistically significant difference in the sex ratio (*p* = 0.12) and the mean age (*p* = 0.85).

Table 1 summarizes the distribution of all the peripheral and pelvic fractures in the included subjects in 2019 and 2020, along with the percentage difference between the lockdown year and the control year. We diagnosed 135 (70%) peripheral or pelvic fragility fractures in 2019 versus 113 (72%) in 2020 (*p* = 0.73), a difference of -16%. Relative to all the emergency room visits in patients 65 years and older, fragility fractures were a 22% share in 2019 and a 26% share in 2020 (*p* = 0.13). Among these fractures, a surgical procedure was needed in 62 patients (46%) in 2019 versus 57 patients (51%) in 2020 (*p* = 0.47).

The number of proximal femur fractures (trochanter or femoral neck) in patients 65 years and older dropped by 21% in 2020 (Table 2). The share of these fractures among all fractures in patients

Table 1
 Distribution of the peripheral and pelvis fractures in patients 65 years and older by year.

Location	2019	2020	Variation (%)
	n (%)	n (%)	
Distal radius	38 (19.8)	29 (18.5)	-23.7%
Femoral neck	38 (19.8)	24 (15.3)	-36.8%
Trochanter	25 (13)	26 (16.6)	+4%
Proximal humerus	25 (13)	18 (11.5)	-28%
Pelvis	9 (4.7)	16 (10.2)	+77.8%
Ankle	9 (4.7)	15 (9.5)	+66.7%
Femur	7 (3.8)	5 (3.2)	-28.6%
Foot	8 (4.2)	3 (1.9)	-62.5%
Near hardware	5 (2.6)	5 (3.2)	-
Knee	5 (2.6)	3 (1.9)	-40%
Elbow	5 (2.6)	2 (1.3)	-60%
Clavicle	2 (1)	5 (3.2)	+150%
Humeral shaft	2 (1)	4 (2.5)	+100%
Lower leg	5 (2.6)	1 (0.6)	-80%
Multiple sites	5 (2.6)	1 (0.6)	-80%
Scapula	2 (1)	0 (0)	-
Finger	2 (1)	0 (0)	-
Total	192	157	-18.2%

Pelvis: includes acetabular and ilio/ischial pubic rami fracture. Fragility fractures are in bold.

65 years and older was comparable between the two periods: 63 (33%) in 2019 and 50 (32%) in 2020 (*p* = 0.85). More of these fractures required surgical care in 2020 (*p* = 0.03) (Fig. 2). A larger number of non-displaced fractures (garden I and II), which were treated functionally, was found in 2019 (24% versus 17% in 2020). The time to surgery averaged 3.3 ± 2.5 days in 2019 and 2.6 ± 3.1 days in 2020 (*p* = 0.02). Twenty-four fractures (12.5%) that occurred due to higher energy trauma (lower leg, humeral and femoral shaft, knee, elbow) were compiled in 2019 versus 15 (10%) in 2020, a -37.5% change.

In 2020, hospitalizations for fragility fractures were less frequent but not statistically different (*p* = 0.19) (Table 2). The mean length of hospital stay was comparable (*p* = 0.62). Upon leaving the hospital, a larger number of patients were discharged to a rehabilitation center in 2019, while more than half the patients were discharged to home in 2020. However, this difference was not statistically significant (*p* = 0.51). Higher intrahospital mortality was found in patients who had a fragility fracture in 2020-4 (5.9%) versus 3 (3.3%) in 2019 - with no significant difference (*p* = 0.51).

4. Discussion

During the first national lockdown in France, there was a 16% decrease in the incidence of peripheral and pelvic fragility fractures in patients 65 years and older at our university hospital center. In parallel, the share of these fractures in this population did not increase significantly in 2020.

These findings are comparable to recent published studies on this topic. Lv et al. found a 35% decrease in osteoporotic fractures during the lockdown at 11 hospitals in China [4]. But relative to the same period in 2019, the share of osteoporotic fractures was significantly higher during the lockdown. The authors attributed this finding to the lockdown having a larger impact on high-energy fractures (sports, motor vehicle accidents, etc.) than on low-energy fractures (fall from standing height, fall < 1 m). It is also possible that this increased share is due to a larger decrease in emergency room visits for more benign injuries during the lockdown (Fig. 1). In our study, the relative share of emergency room visits in patients 65 years and older increased in 2020. Moreover, during the lockdown, the included fragility fractures made up a larger share of the reasons for consultation in this age bracket while high-energy fractures (lower leg, humeral and femoral shaft, knee, elbow) and

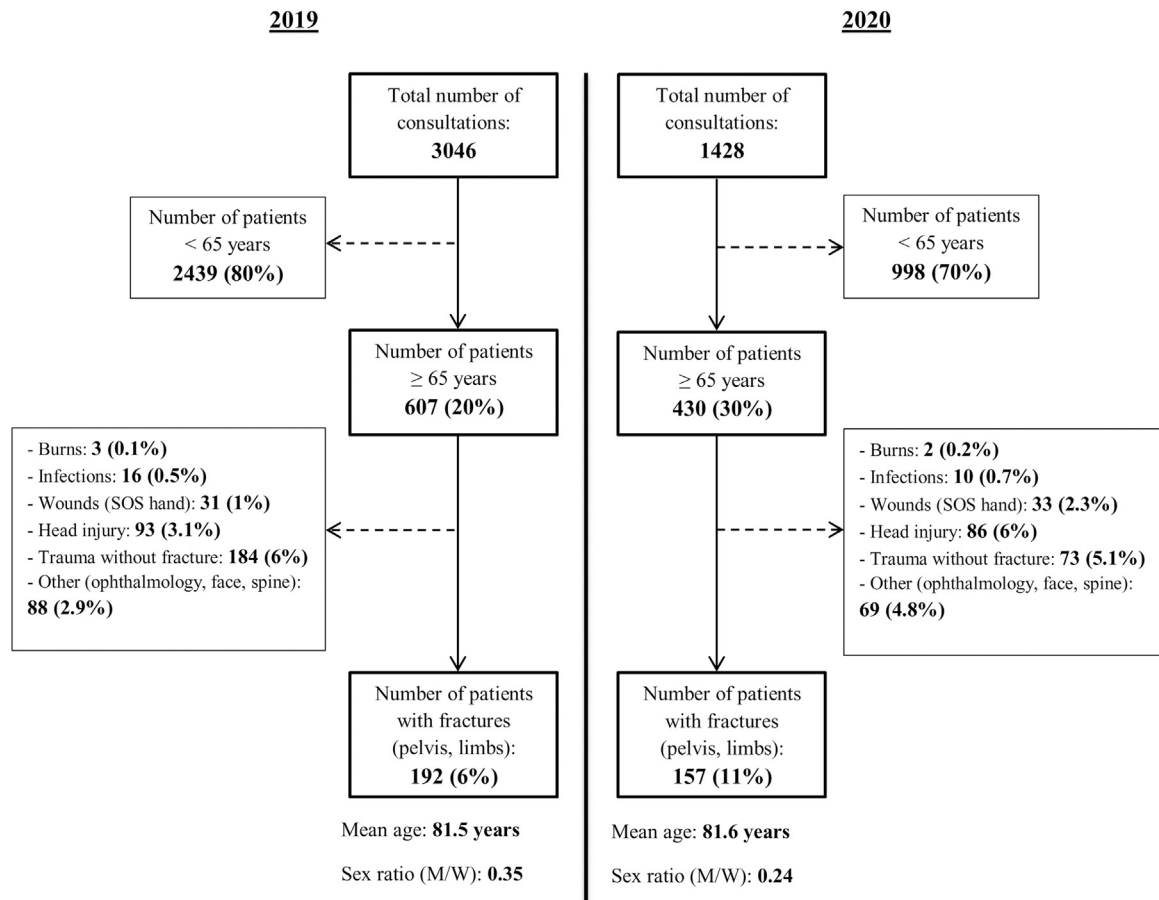


Fig. 1. Study flow chart for patients included in 2019 and 2020.

Table 2
Analysis of fragility fractures, specifically proximal femur fractures: hospitalization and treatment data.

Fragility fracture	2019 (n = 135)		2020 (n = 113)		p
	n	(%)	n	(%)	
Hospital stay					
Yes	92	(68.1)	68	(60.2)	0.19*
None	43	(31.9)	45	(39.8)	
Length of hospital stay (days)	Mean and SD		Mean and SD		p
	9 ± 6.6		8.1 ± 5.4		0.62‡
Discharge destination					
Convalescence home	37	(40.2)	22	(32.4)	0.51‡
Return home	45	(48.9)	39	(57.3)	
Another hospital	7	(7.6)	3	(4.4)	
Death	3	(3.3)	4	(5.9)	
Trochanteric/femoral neck	2019 (n = 135)		2020 (n = 113)		
	n	(%)	n	(%)	p
Surgical treatment					
Yes	52	(82.5)	46	(92)	0.03‡
None	11	(17.5)	2	(4)	
NA	0		2	(4)	
Time to surgery (days)	Mean and SD		Mean and SD		p
	3.3 ± 2.5		2.6 ± 3.1		0.02‡
Hospital stay					
Yes	62	(98.4)	50	(100)	1‡
None	1	(1.6)	0	(0)	
Length of hospital stay (days)	Mean and SD		Mean and SD		p
	10.2 ± 6.6		9.4 ± 5.4		0.72‡
Discharge destination					
Convalescence home	22	(35.5)	18	(36)	0.85‡
Return home	31	(50)	25	(50)	
Another hospital	6	(9.7)	3	(6)	
Death	3	(4.8)	4	(8)	

SD: standard deviation; *: Chi² test; †: Wilcoxon test; ‡: Fisher's exact test; NA: not applicable.

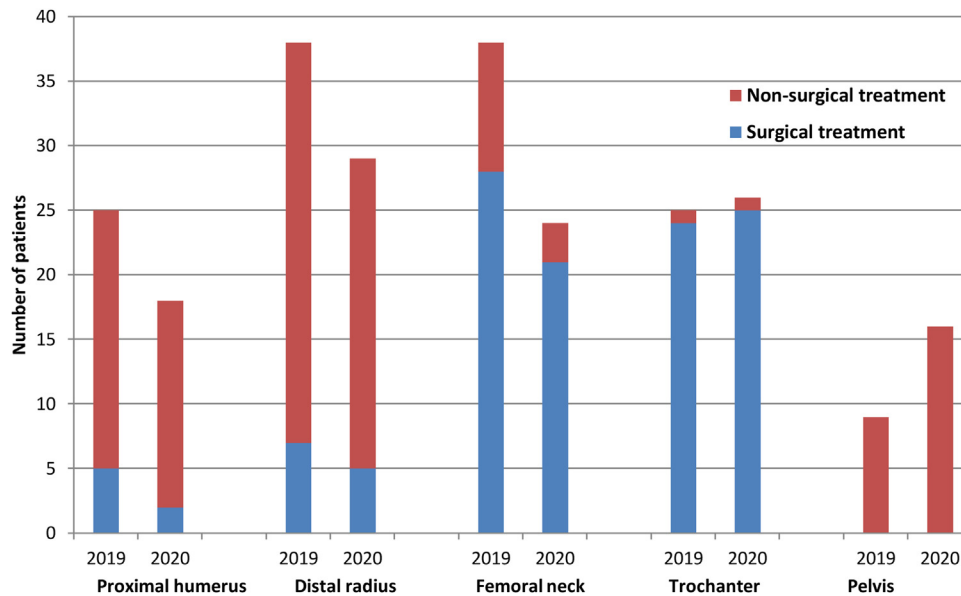


Fig. 2. Distribution of the fragility fractures and their treatment in 2019 and 2020.

trauma that did not result in fracture were reduced by 37.5% and 60%, respectively. According to Ogliari et al., in England, there was a significant 67.5% decrease in fragility fractures treated in an outpatient setting in patients 65 years and older during the 6 weeks of lockdown versus the same period in 2019 [5]. In their study, the mean number of new hospitalizations for proximal femur fractures was unchanged.

Like other teams [6–9], we found a 21% decrease in the incidence of proximal femur fractures. These fractures most often occur in older adults who have a lower activity level [10], for whom the lockdown likely had less impact in their day-to-day lives. Wong et al. did a study of 43 public hospitals and 122 outpatient clinics in Hong Kong [11] and found a significant 21% decrease in hip fractures during the COVID lockdown period relative to the same periods in 2016 to 2019. However, their analysis was not limited to adults over 65 years of age. Also, in their study, hip fractures were the top reason for hospital admission during the COVID period. Similar findings were reported by Hernigou et al. [12] in Belgium: proximal femur fractures in all age groups were lower by 33%, although the share of these fractures as the reason for surgical treatment in adults had increased.

Hospitals had to be reorganized to deal with COVID-positive patients. To limit the shortage of anesthesia products required for COVID patients being intubated in the intensive care unit (ICU) and to free up specialized personnel (anesthesiologists and nurse anesthetists) and ICU beds, scheduled surgery was drastically reduced. While we had three operating rooms for scheduled surgery and one emergency room for our specialty, during the crisis, the surgical activity was reorganized into two emergency rooms per day for all surgical specialties (gastrointestinal, urological, maxillofacial, ORL, gynecological, neurosurgical, plastic and trauma) and one or two rooms per day for scheduled surgery that cannot be deferred (mainly tumor resection surgery). The emergency operating rooms were organized each day by representatives of each surgical specialty, anesthesiologists and healthcare managers. COVID-positive patients were operated towards the end of the schedule to avoid cross-contamination of other patients. Since surgical specialties that deal with life threatening emergencies were prioritized, we could expect long time to surgery for patients whose emergency could be deferred but who had a high risk of mortality such as proximal femur fractures and eventually a noticeable shift to

managing fractures by immobilization and functional treatment since no operating room was available in a timely manner. In our study, we found no significant difference in the decision to use surgical treatment; the time to surgery for proximal femur fractures was actually shorter.

Several studies [13–15] have shown benefits in terms of lowered mortality when surgical treatment is initiated within 48 hours of a proximal femur fracture. Delaveau et al. observed in their French study [16] a mean time to surgery of 14 ± 31 hours with increased mortality beyond 22 hours. In our study, the mean time to surgery for proximal femur fractures was longer than the recommended 48 hours. This difference can be explained by the fact that we did not exclude patients from our study who were taking direct oral anticoagulants or certain platelet aggregation inhibitors that are contraindications for early surgical care [17,18].

Our study showed that despite the hospital reorganization implemented to manage this health crisis, there was no loss of opportunity for patients who required surgical care, as evidenced by the shorter time to surgery for the treatment of proximal femur fracture and the fact that intrahospital mortality did not significantly increase ($p=0.51$). It is important to point out that at our hospital, trauma-related emergencies are managed by plastic surgery and orthopedic surgery residents, under the responsibility of an attending surgeon, which ensures specialized care upon a patient's arrival to the emergency room (prompt preoperative assessment, quick treatment decision, fast-track care of fracture, etc.).

Despite this comparative study capturing the entire lockdown period in France, the fact that it was retrospective and single-centered are limiting factors, along with the fact that vertebral fractures were not included (particularly, vertical compression fractures).

5. Conclusion

The lockdown due to the SARS-CoV-2 epidemic in France led to a 16% decrease in the incidence of peripheral and pelvic fragility fractures in patients 65 years and older at our University hospital. The type of care chosen for these fractures (surgical, functional, immobilization) was not altered because of the health crisis. Reorganization of the operating room allowed these patients to be

treated with time to surgery comparable to the pre-pandemic period, helping to counter the significant risk of increased mortality associated with these fractures. The continued availability of technical facilities (materials, operating room, staffing) despite the health crisis is crucial for attaining our goal of optimal fracture treatment.

Disclosure of interest

The authors declare that they have no competing interest.

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Contributions

Dr Loisel and Dr Pluvy conceptualized and designed the study. Dr Sleiman, Dr Dabert and Dr Runtz collected data. Dr Runtz prepared the initial version of the article. Dr Loisel, Dr Pluvy, Dr Sleiman and Dr Runtz reviewed and modified the manuscript.

Prof. Garbuio, Prof. Obert, Dr Loisel and Dr Pluvy coordinated and supervised the data collection, and provided critical input on the intellectual content of this manuscript.

All the authors approved the final manuscript as submitted and have agreed to be responsible for all aspects of this work.

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