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The proximal femur fracture epidemic continued during the COVID-19 pandemic: Results of an observational study

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A B S T R A C T

Introduction: The aim of this study was to compare the volume and characteristics of emergency trauma surgery procedures done at our hospital between March 20 and April 20, 2020 (the first month of the national lockdown in France) and to compare these data to the same period in 2019. We hypothesized that a portion of fractures are unavoidable, thus specific preventative measures will be needed to reduce their incidence.

Methods: This was a continuous, observational and single center study. All patients who required urgent surgery for a fracture between March 20 and April 20, 2020, were included. Data for the same period in 2019 was retrieved. All the procedures were done at our hospital, which is a regional level II trauma center.

Results: During the first month of the lockdown, 70 patients underwent emergency surgery because of a fracture, versus 109 patients in the same period in 2019, thus an overall 36% drop. The mean age of the patients was higher in 2020 (68.4 years SD = 22) than in 2019 (60.3 years SD = 24, $p = 0.0210$). There were fewer recreational and motor vehicle accidents in 2020 (34 vs. 10) and fewer work-related accidents (7 vs. 2) although the number of accidents at home were similar (65 vs. 55).

Conclusion: During a public health emergency, it is vital to continue doing trauma surgery procedures, even though it requires a specific care pathway. The lockdown and associated behavioral changes have altered the spectrum of trauma surgery. A major decrease in motor vehicle, recreation and work-related accidents is the avoidable portion of this surgical activity, justifying specific preventative measures during a public health crisis. Conversely, the incidence of geriatric fractures – particularly of the proximal femur – did not change much overall, thus there is need for additional preventative measures in these patients.

Level of evidence: V, observational study.

1. Introduction

Since December 2019, the world has been in the midst of an exceptional situation due to the COVID-19 pandemic [1]. In France, like in many other countries, one of the public health measures implemented was a national lockdown. This unprecedented situation was regulated by the ORSAN REB plan aiming to limit virus transmission to reduce its impact on the population as a whole and the healthcare system more specifically [2].

Consequently, in March 2020, most of the healthcare facilities in France had stopped their planned surgical activity and had delayed

their scheduled surgeries to preserve the majority of their resources to deal with COVID+ patients [3]. However, some surgery practices like trauma cannot be completely stopped, even during a lockdown.

While it is difficult to obtain precise data on the volume of trauma in France, it was estimated at about 266,000 cases in 2014 [4], of which about 76,000 were hospital stays for a proximal femur fracture [5]. These fractures have multiple causes and are multifactorial. According to Arshi et al. [6], economic factors can predict the occurrence of a traumatic event. While lifestyle and economic factors are directly related to the incidence of trauma (road, recreational, work, etc.), the COVID-19 pandemic and the public health restrictions implemented should have a major impact on the occurrence of fractures.

This led us to hypothesize that the COVID-19 pandemic and lockdown period will alter the volume and types of fractures treated

Table 1
Demographic data.

| | 2019 | 2020 | <i>p</i> |
|-------------------------------|--------------|--------------|----------|
| Population, <i>n</i> | 109 | 70 | |
| Sex | 63 | 41 | |
| Female | 46 | 29 | |
| Male | | | |
| Age | 60 SD = 24.2 | 68 SD = 22.5 | 0.021 |
| Multiple fractures | 7 | 1 | |
| COVID+ | 0 | 3 | |
| Injury mechanism | | | |
| Recreational | 11 (10%) | 4 (6%) | |
| Accident at home | 65 (60%) | 55 (79%) | |
| Motor vehicle accident | 23 (21%) | 6 (8%) | |
| Other | 10 (9%) | 5 (7%) | |
| Work-related injury | 7 | 2 | |
| Average length of stay (days) | 6 SD = 4.4 | 5.6 SD = 3.7 | 0.447 |
| Time to surgery (days) | 1.7 SD = 1.8 | 1.8 SD = 1.7 | 0.674 |
| Discharge destination | | | |
| Home | 61 | 26 | |
| Rehab facility | 31 | 37 | |
| Medical ward | 8 | 4 | |
| Nursing home | 6 | 3 | |

at our hospital. Thus, it will be possible to differentiate between “avoidable” trauma (motor vehicle, recreational and work-related accidents) and “non-avoidable” trauma that both require specific preventative measures. The aim of this study was to compare the volume and characteristics of emergency trauma surgery procedures done at our hospital between March 20 and April 20, 2020, and to compare these data to the same period in 2019.

2. Methods

This was an observational, retrospective, single-center study carried out in the Orthopedic and Trauma Surgery Department of the Marseille (France) University Hospital, a level II trauma center in a city of about 800,000 inhabitants. All the patients who underwent surgical treatment for a fracture between March 20 and April 20, 2020, were included. Data from the same period in 2019 was also retrieved. Patients who were admitted for a fracture, but who did not require surgical care, were excluded from the study.

For each patient, the demographics, injury mechanism and type of surgical procedure were collected. Data on the length of hospital stay and discharge destination were also collected. Note that hand surgery procedures were not captured in our study as these procedures are done in a different department at our hospital.

2.1. Organization during the lockdown

To limit the risk of contamination during a hospital stay, all the rooms in the orthopedic and trauma surgery ward were transformed into individual rooms, resulting a decrease in the number of available beds from 47 to 23. In the operating suite, two distinct care pathways were implemented with one room dedicated to COVID+ patients and one room to COVID− patients. In the COVID+ room, all the non-anesthesia staffs were asked to leave the room when the patient was being intubated or extubated and a 1-hour break was implemented between two procedures. Despite the smaller number of operating rooms (typically 4 in normal times vs. 1.5 during the lockdown), one room was solely dedicated to trauma surgery, like it was before the public health crisis.

During the lockdown, all patients were administered a COVID PCR test preoperatively. If any symptoms were present, a low-dose chest CT-scan was also done. Patients were asked to wear a mask during the perioperative period and during their entire hospital stay. Postoperatively, if patients had symptoms associated with

COVID-19, another PCR test was done, and all the potential contacts (medical team) were also tested.

The 2020 and 2019 data were compared with Student’s *t*-test and a 5% significance threshold.

3. Results

3.1. Study population

During the lockdown, 70 urgent surgical procedures were done versus 109 during the same period in 2019, a 36% drop. The mean age of the patients was higher in 2020 (68.4 years SD = 22) than in 2019 (60.3 years SD = 24, *p* = 0.0210). Three COVID-positive patients required urgent surgical care. The mean length of hospital stay and the time to surgery were not altered by the pandemic (Table 1).

During the 2020 lockdown, there was much fewer recreational and road traffic accidents than in 2019 (34 vs. 10) and there were fewer work-related injuries (7 vs. 2). Conversely, the number of accidents at home was similar between the two periods (65 vs. 55).

3.2. Surgical data

Proximal femur fractures were the most common indication for surgical treatment in 2019 and in 2020, with a similar number of patients in the two periods: 35 in 2019 vs. 33 in 2020. These fractures made up nearly half of all surgical emergencies in 2020 (47%). Relative to 2019, there was a significant decrease in vertebral, leg and ankle fractures (Fig. 1).

During the 2019 study period, seven patients suffered multiple fractures versus only one in 2020. The surgical procedures by anatomical region are summarized in Table 2.

4. Discussion

During the COVID pandemic, most healthcare resources were dedicated to caring for COVID-positive patients, requiring that other sectors reorganize. Various scientific societies put out recommendations to care for patients in these other sectors [3,7–9]. Most of the recommendations place a priority on surgical emergencies. Generally, when it is possible and will not cause a missed opportunity for the patient, conservative treatment or delaying surgeries are preferable [10–12].

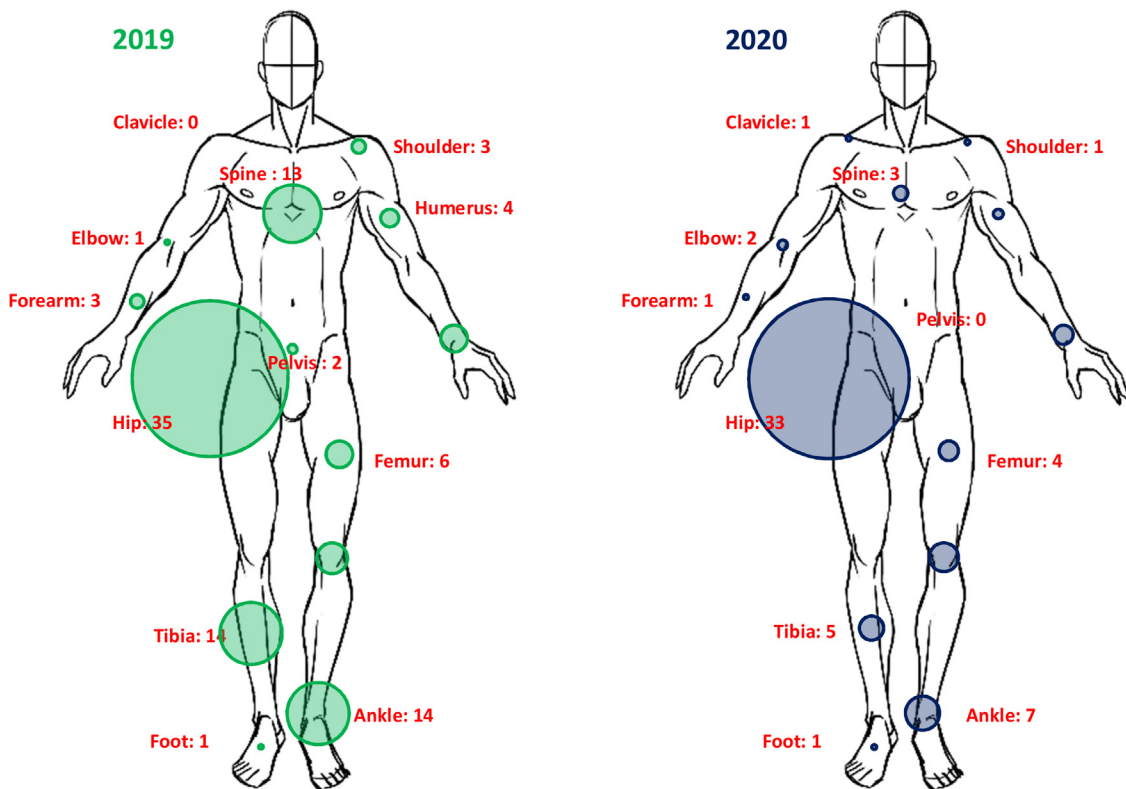


Fig. 1. Distribution of the surgical procedures by anatomical site in 2019 (left) and 2020 (right).

As for the volume of trauma surgery, there was a 36% drop at our hospital, which is similar to data reported by Hernigou et al. [13]. However, this decline in activity was not in the geriatric population, since the incidence of proximal femur fractures was unchanged between 2019 and 2020, corresponding to “unavoidable” trauma. These results are comparable to the study by Zhu et al. who reported more than 58% proximal femur fractures in China between January 20 and February 19, 2020 [14].

Given how vulnerable these patients are, with a mortality rate of about 50% at 5 years [15], they should be prioritized for early surgical treatment, as recommended by Delaveau et al. [16]. Despite the reduction of available resources in the operating room (anesthesiologists and nurse anesthetists, number of rooms, amount of anesthesia products available, etc.) at our hospital, we decided to have one room dedicated to trauma cases. This room was largely used to care for geriatric fractures. It also seems essential to look to reduce the length of hospital stay to limit their exposure and risk of intrahospital contamination. Thus, we decided to quickly discharge them to a rehabilitation center to reduce the time spent in the hospital and to limit the need for home care, corresponding to the concept of systematic clinical pathway defined by Tittel et al. [17]. This was made possible by a reorganization of the rehabilitation centers into COVID– and COVID+ units, providing a rapid response to hospital demands.

Conversely, this study found a large decrease in the number of trauma cases in younger patients, corresponding to what we could call “avoidable” fractures. In France, during the month of March 2019, 5326 people were injured in motor vehicle accidents, versus 2965 in March 2020, corresponding to a 45% drop in road-related morbidity although the lockdown was only imposed on March 17 [18].

This reduction in traffic accidents (8% of procedures in 2020 vs. 21% in 2019) was accompanied by a reduction in work-related accidents, affecting a working-age population, dropping

from 6.5% to 3% of the surgical volume between 2019 and 2020. This decrease in the number of accidents greatly decreases the morbidity and mortality in the younger segment of the population and lessens the load on the healthcare system, which seems to be particularly important during a public health crisis.

These major changes in the fracture epidemiology highlight the importance of road-related preventative measures, but also the urgent need to improve the prevention of falls in the general population as reported by Christey et al. [19] to limit as best possible the “avoidable” portion of fractures, especially during a public health crisis. In France, about 84,000 patients required surgical care for a post-traumatic proximal femur fracture [20]. Optimization of the preventative measures for “non-avoidable” trauma is very relevant for the healthcare system, whether during a public health crisis or normal times.

As for the urgent surgical care of COVID+ patients, various recommendations have been made, initially for the anesthesia teams who are more at-risk during the intubation and extubation of patients, but also for the surgical teams [21]. Orthopedic surgery is associated with a significant risk of aerosolization when cutting with an oscillating saw or with drilling, along with smoke from the electrocautery tip. While these risks have not been fully identified, the use of glasses or a face shield by surgeons is recommended, among other measures [22].

The surgical indications for COVID+ patients must be discussed in a multidisciplinary manner with anesthesiology and infectious disease specialists to clearly identify the risk-benefit ratio of an operation. In fact, it has been reported that the prognosis is worse and mortality increased in COVID+ patients who have a fracture [23] [13]. In our study, three COVID+ patients required surgical care and one of them died within the first postoperative week. This small number of COVID+ cases obviously does not allow us to draw any conclusions about this subset of patients but highlights

Table 2

Surgical procedures done for trauma in 2019 and 2020.

| | 2019 | | 2020 | |
|---|------|------|------|------|
| | n | % | n | % |
| Proximal femur | 35 | 32.1 | 33 | 47.1 |
| Total/partial joint replacement | 8 | 7.3 | 11 | 15.7 |
| Trochanteric nail/DHS | 16 | 14.7 | 20 | 28.6 |
| Triple screw fixation | 1 | 0.9 | 1 | 1.4 |
| Joint lavage | 3 | 2.8 | 0 | 0 |
| Periprosthetic fracture (THA) | 4 | 3.6 | 1 | 1.4 |
| Other | 3 | 2.8 | 0 | 0 |
| Proximal humerus | 3 | 2.8 | 1 | 1.4 |
| Arthroplasty | 1 | 0.9 | 0 | 0 |
| Fracture fixation | 2 | 1.8 | 1 | 1.4 |
| Tibia | 14 | 12.8 | 5 | 7.1 |
| Intramedullary nailing | 5 | 4.6 | 2 | 2.9 |
| Open fixation | 9 | 8.3 | 3 | 4.3 |
| Knee/patella | 7 | 6.4 | 6 | 8.6 |
| Tension-band wiring of patella | 4 | 3.7 | 2 | 2.9 |
| Joint aspiration/joint lavage/debridement | 3 | 2.8 | 2 | 2.9 |
| Reattach intercondylar eminence | 0 | 0 | 2 | 2.9 |
| Wrist | 6 | 5.5 | 4 | 5.7 |
| Anterior radius plate fixation | 5 | 4.6 | 4 | 5.7 |
| K-wires | 1 | 0.9 | 0 | 0 |
| Elbow | 1 | 0.9 | 2 | 2.9 |
| Arthroplasty | 1 | 0.9 | 0 | 0 |
| Olecranon fixation | 0 | 0 | 2 | 2.9 |
| Clavicle | 0 | 0 | 1 | 1.4 |
| Ankle | 14 | 12.8 | 7 | 10 |
| Lateral malleolus fixation | 1 | 0.9 | 4 | 5.7 |
| Bimalleolar fixation | 6 | 5.5 | 2 | 2.9 |
| Achilles tendon repair | 4 | 3.7 | 0 | 0 |
| Other | 3 | 2.8 | 1 | 1.4 |
| Vertebra | 13 | 11.9 | 3 | 4.3 |
| Kyphoplasty | 10 | 10 | 3 | 4.3 |
| Posterior fixation | 3 | 3 | 0 | 0 |
| Humerus | 4 | 3.7 | 2 | 2.9 |
| Open fixation | 3 | 2.8 | 1 | 1.4 |
| Intramedullary nailing | 1 | 0.9 | 1 | 1.4 |
| Femur | 6 | 5.5 | 4 | 5.7 |
| Open fixation | 4 | 3.7 | 2 | 2.9 |
| Intramedullary nailing | 2 | 1.8 | 2 | 2.9 |
| Foot | 1 | 0.9 | 1 | 1.4 |
| Lisfranc dislocation | 1 | 0.9 | 0 | 0 |
| Calcaneal pinning | 0 | 0 | 1 | 1.4 |
| Forearm | 3 | 2.8 | 1 | 1.4 |
| Pelvis | 2 | 1.8 | 0 | 0 |
| Acetabulum fixation | 1 | 0.9 | 0 | 0 |
| Pubic symphysis separation | 1 | 0.9 | 0 | 0 |
| Total | 109 | 100 | 70 | 100 |

the importance of carefully evaluating the risk-benefit relationship preoperatively.

Our study has its limitations. The short inclusion period does not allow us to extrapolate the results. Furthermore, the national lockdown has no recent historical equivalent and several of the measures taken throughout the world were specific to each country, making it difficult to compare the response of different healthcare systems during the pandemic. Additional studies are needed to be able to derive re-useable lessons in case a similar threat reappears in the future.

5. Conclusion

Even during a major public health crisis, it is essential to continue trauma surgery activity if specific measures are in place. Each surgical procedure must be discussed and evaluated by the impacted health professionals. This novel lockdown period and its associated restrictions have changed the volume and characteristics of trauma patients at our level II trauma center, with a large decrease in “avoidable” trauma (road, recreational, work) and stability in the “non-avoidable” trauma, especially proximal

femur fractures in the geriatric population. These elements highlight the importance of preventing “avoidable” fractures during a public health crisis, but also more broadly, of preventing falls in older adults, even when not in a public health crisis.

Disclosure of interest

P. Tropiano: relationship with LDR-Zimmer, Depuy-Synthes, FH Orthopedics not related to this study.

JN. Argenson: relationship with Zimmer-Biomet and Symbios not related to this study.

B. Blondel: relationship with Medicea International, Vexim, Implanet not related to this study; associate editor for RCOT/OTSR.

The authors S. Prost, M. Carissimi and A. Munoz declare that they have no competing interest.

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Contribution

S. Prost, M. Carissimi, A. Munoz and B. Blondel wrote the manuscript.

Jean-Noël Argenson and Patrick Tropiano reviewed the manuscript.

Given his role as editor, Benjamin Blondel had no involvement in the peer-review of this article and has no access to information regarding its peer-review. Full responsibility for the editorial process for this article was delegated to Jérôme Tonetti.

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