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Impact of the COVID-19 Pandemic on an Emergency Traumatology Service: Experience at a Tertiary Trauma Centre in Spain[☆]



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ABSTRACT

Introduction: The severe disruptions caused by the SARS-CoV-2 coronavirus have necessitated a redistribution of resources to meet hospitals' current service needs during this pandemic. The aim of this study was to provide an overview of the impact of the pandemic, and its corresponding State of Emergency, on a tertiary traumatology emergency service.

Methods: An observational study was performed at a tertiary hospital within the Spanish National Health System. Four different periods were studied, including the first 20 days of Spain's current State of Emergency, from March 14 to April 02, 2020 (Period 4). This period was compared to the 20-day period prior to the State of Emergency (Period 3), and to matching periods in the two previous years (Periods 1 and 2). A total of 6,565 patient visits were analyzed: 1909 in Period 1 (29.1%), 2161 in Period 2 (32.9%), 1983 in Period 3 (30.2%), and 512 in Period 4 (7.8%). Variables collected included patient age and sex, insurance type, discharge destination and reason for hospital admission.

Results: The patients' mean age was 55.1 years old (Standard Deviation (SD): 22.1), and 51.8% were women (3495/6565). During the COVID-19 pandemic, there were significant reductions in total visits to the trauma emergency department, workplace accidents, traffic accidents and number of hospital admissions, particularly during Period 4. However, no statistically-significant differences were found in the number of osteoporotic hip fractures admitted between the four periods. The numbers of hospital admissions for osteoporotic hip fracture were 42 during Period 1, 41 during Period 2, 43 during Period 3 and 36 during Period 4.

Conclusions: While most traumatological presentations decreased in frequency over the course of the outbreak, the number of osteoporotic hip fractures remained stable. Thus, contingency plans in times of crisis need to be carefully targeted, and to keep in mind certain public health issues that do not decrease, despite a State of Emergency, like osteoporotic hip fractures.

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Introduction

Coronavirus disease 2019 (COVID-19), which began as an epidemic centered in Wuhan, China, was declared a public health

[☆] Despite reductions in the number of trauma emergency visits, workplace accidents, traffic accidents and number of hospital admission, the number of osteoporotic hip fractures remains stable.

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emergency on January 20, 2020 by the World Health Organization (WHO) and a public health emergency by the United States of America (USA) on January 31, 2020. On March 11, 2020, the WHO declared COVID-19 a pandemic, marking the first pandemic declaration since H1N1 in 2009. The early reported mortality rate, which was between 0.4 and 4.3%, appeared lower than that of Severe Acute Respiratory Syndrome (SARS) and Middle East Respiratory Syndrome (MERS) [1,2]. Current estimates of mortality rate for COVID-19 are believed to be inaccurate, however, with some believing they are underestimates, since most confirmed patients remain as inpatients, and others believing they

are overestimates, because mild and asymptomatic cases are not being included in the denominator [1,3]. Many different strategies have been proposed and implemented worldwide in an attempt to contain this pandemic, some more successful than others. In Spain, the number of COVID-19 cases is growing exponentially [4]. Unfortunately, as in many countries, radical measures were undertaken in a reactive rather than proactive manner: not until March 14, 2020, was a State of Emergency (implementation of stringent lock-down measures for the population) declared in Spain [5].

The spread of COVID-19 has been severely disruptive, and a redistribution of manpower and resources has been required to meet the current and anticipated hospital service needs during the outbreak. As per recommendations from various sources, including specific guidance in orthopaedics [6], there has been a reduction in elective clinics and surgeries to shift manpower towards acute specialties combatting COVID-19 and maximize the hospital beds and resources available. This rapid change in clinic provisions and the rescheduling of patients causes substantial inconvenience to patients and potentially poses a risk, due to delayed assessments and treatment, but is a necessity given the gravity of the current situation [7]. By limiting surgeries and clinics to emergent indications only, unnecessary exposure and contamination are limited for both patients and healthcare workers. However, this also results in delayed assessments for many patients, and ultimately adds to the healthcare burden, as some may not receive care until their disease is more advanced and potentially requiring hospital admission [6,8]. Trauma and orthopaedics may not seem to be in the front-line with coronavirus, but we do play a key role, and this must be planned for.

The aim of the current study was to provide an overview of the impact of a State of Emergency on a traumatology emergency service, in order to identify areas for improvement and future planning. Preparation for the continuing progression of this COVID-19 pandemic, and preparation for future pandemics, which may be even deadlier and more difficult to contain, is crucial. To our knowledge, this is the first study to analyze how the pandemic has affected a traumatology emergency service.

Materials and Methods

An observational study was performed at a tertiary hospital within the Spanish National Health System.

Our university hospital is one of the referral trauma centers in Spain, and is located in the city of Barcelona, in the autonomous community of Catalonia. The hospital covers a catchment area of more than 550,000 inhabitants. Four different periods were studied, including the first 20 days of the Spain State of Emergency (March 14 to April 02, 2020, hereafter referred to as Period 4). The other periods analyzed were the 20 days immediately before the state of Emergency (February 23 to March 13 2020, hereafter referred to as Period 3), as well as the same periods as Period 4 from the past two years (March 16 to April 04, 2019: Period 2, and March 17 to April 05, 2018: Period 1).

The inclusion criteria for patients were: 1) presenting to traumatology emergency services, and 2) age 15 years or older. If the same patient visited the emergency service two or more times during the same time period, each clinical visit was counted as a different episode.

The variables collected were patient age and gender, insurance type (Catalan Health Service, work accident or traffic accident), and discharge destination (home discharge, hospital admission, flight or abandonment, or voluntary discharge). Likewise, for admitted patients, the admitting diagnosis was collected.

Statistical methods

General descriptive analysis was conducted, overall and by period, including measures of central tendency for quantitative variables. Continuous variables were reported using means and standard deviations (SD) if they followed a normal distribution; otherwise, the median and range were used. Absolute frequencies and proportions were used to summarize categorical variables. To compare the four different time periods, analysis of variance (ANOVA) and Pearson chi-square analysis were employed for all variables of interest, and results further depicted in graphs. For all analyses, the statistical package IBM SPSS version 25.0 (IBM Corp., Armonk, New York, USA) was used.

Results

A total of 6565 emergency traumatology visits were analyzed: 1909 visits during Period 1 (29.1%), 2161 during Period 2 (32.9%), 1983 during Period 3 (30.2%) and 512 during Period 4 (7.8%). The mean age of the patients was 55.1 years old (Standard Deviation (SD): 22.1) and 51.8% (3495/6565) were women. No statistically-significant differences were found in age or sex between the four analyzed time periods.

Comparing the four periods for emergency trauma visits, a significant reduction in the number of emergency trauma visits were identified in Period 4, which had approximately one-fourth as many trauma admissions as any other period. Emergency trauma visits during Period 4 accounted for just 7.8% of all the admissions (Fig. 1). No statistically-significant differences were found in the category of visits, when we compared the different periods ($p = 0.2$), though decreases in labor and traffic accidents were observed in Period 4.

There was a statistically-significant difference ($p = 0.001$) in patients' discharge destinations, with an increase in the rate of hospital admissions in Period 4 (Table 1). The rate of hospital admissions was 7.6% in Period 1, 6.3% in Period 2, 8.2% in Period 3, and 12.9% in Period 4. In all the four periods, osteoporotic hip fracture was the most common reason for hospital admissions. Moreover, the number of hospital admissions for osteoporotic hip fracture remained relatively stable throughout the four periods: 42 patients in Period 1, 41 in Period 2, 43 in Period 3 and 36 in Period 4 ($p = 0.06$) (Fig. 2).

Among the 36 hip fracture patients admitted during the State of Emergency, 13 patients were diagnosed with COVID-19 (7 patients confirmed at admission and 6 diagnosed post-operatively). Among these 13 patients, three died prior to undergoing surgery, one died after surgery, four were discharged home, and five remain alive in the hospital. The remain 23 patients, who were COVID-19 free, were discharged home. Though in-hospital mortality appeared somewhat higher in Period 4 (11.1%), no statistically-significant difference versus the other periods was found ($p = 0.7$). The pre-operative mortality rate was statically different, however ($p = 0.01$), the only cases of pre-operative death occurring in Period 4.

Discussion

The most important finding identified in the current study is that the absolute volume of osteoporotic hip fracture admissions remained stable during Spain's State of Emergency. This was despite reduced volumes of trauma emergency visits, workplace accidents, traffic accidents and hospital admissions. The new outbreak of the respiratory illness known as 'COVID-19' has generated serious global public health concern [9]. This being said, healthcare systems must nonetheless continue to treat other diseases and

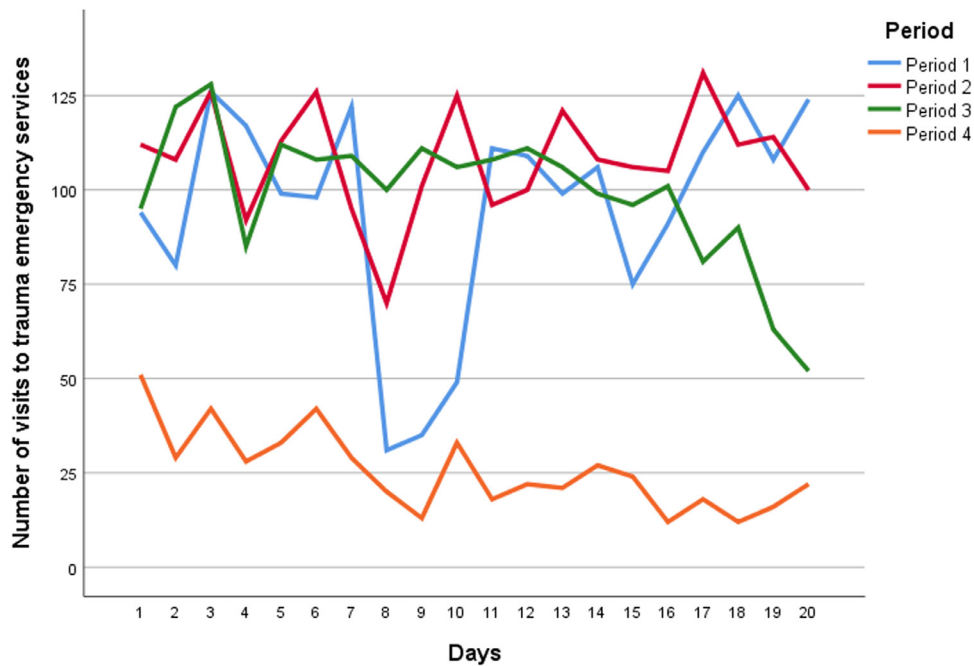


Fig. 1. Number of visits to trauma emergency services throughout the four periods analyzed. Period 1 (blue): from March 17 to April 05, 2018; Period 2 (red): from March 16 to April 04, 2019; Period 3 (green): from February 23 to March 13, 2020, the 20 days immediately before Spain's State of Emergency; Period 4 (orange): from March 14 to April 02, 2020, the first 20 days of Spain's State of Emergency.

Table 1

General characteristics of the study participants.

	PERIODS ANALYZED DURING OUR STUDY				TOTAL	P value
	Period 1	Period 2	Period 3	Period 4		
Age. Median (SD)	56.6 (21.6)	54.5 (21.8)	54.6 (22.5)	57.5 (22.5)	55.1 (22.1)	0.08
Sex						
Men (%)	908 (47.6)	967 (44.7)	948 (47.8)	247 (50.9)	3070 (48.2)	0.14
Women (%)	1001 (52.4)	1194 (55.3)	1035 (52.2)	265 (49.1)	3495 (51.8)	
Discharge Destination						
Home discharge (%)	1736 (90.9)	1977 (91.5)	1762 (88.9)	436 (85.2)	5911 (90.3)	0.001
Hospital admission (%)	146 (7.6)	137 (6.3)	162 (8.2)	66 (12.9)	511 (7.6)	
Flight or abandonment (%)	23 (1.3)	42 (1.9)	54 (2.7)	9 (1.8)	128 (1.9)	
Voluntary discharge (%)	4 (0.2)	5 (0.2)	5 (0.3)	1 (0.2)	15 (0.2)	
Insurance Type						
Catalan health service (%)	1809 (94.8)	2033 (94.1)	1852 (93.4)	483 (94.3)	6177 (94.0)	0.2
Workplace accident (%)	17 (0.9)	36 (1.6)	47 (2.4)	11 (2.1)	111 (1.7)	
Traffic accident (%)	83 (4.3)	92 (4.3)	84 (4.2)	18 (3.5)	277 (4.3)	
Hospital admission						
Osteoporotic Hip Fracture (%)	42 (28.8)	41 (29.9)	43 (26.6)	36 (54.5)	160 (31.3)	0.06
Non-Osteoporotic Hip Fracture (%)	104 (71.2)	96 (70.1)	119 (73.4)	30 (45.5)	351 (68.7)	
Age. Median for Hip Fractures (SD)	86.4 (6.4)	86•4 (6.3)	86•2 (7.8)	88•4 (9.2)	86•9 (7.5)	0.1
In-hospital Mortality of Hip Fractures (%)	2 (4.8)	3 (7.3)	3 (7.0)	4 (11.1)	12 (7.4)	0.7

SD: Standard deviation; %: percentage; Period 1: from March 17 to April 05, 2018, Period 2: from March 16 to April 04, 2019; Period 3: from February 23 to March 13, 2020, the 20 days immediately before Spain's State of Emergency; Period 4: from March 14 to April 02, 2020, the first 20 days of Spain's State of Emergency.

public health problems that continue to occur regularly, like osteoporotic hip fractures [10]. When planning for the remaining course of the current pandemic, as well as future pandemics and other global emergencies, it is important to understand which presentations are less common during a State of Emergency, and which presentations occur with the same or even increased frequency.

Significant reductions in visits to the emergency trauma service, workplace accidents, traffic accidents and number of hospital admission were found. This is likely because, like many countries around the world, the Spanish government has imposed quarantines and travel bans on an unprecedented scale. Flattening the curve – slowing the spread of COVID-19 across space and time – is critical, because no healthcare system can sustain a massive influx of infectious cases to emergency departments and hospitals

[11]. With the population being encouraged and/or mandated to stay at home, there are lower risks of traffic and workplace accidents. Currently in many countries, only essential work is being performed on site, the majority of the work being performed remotely, even involving certain medical specialties [5,12]. This reduction in service visits, accidents and hospital admissions also might be explained by there being an understandable fear of visiting hospitals among the public. This fear can be expected to exist to a greater degree in areas where COVID-19 is more prevalent. At the time of this writing, on April 02, 2020 in Spain, there had been 102,136 cases of COVID-19 confirmed, with 9,053 deaths [4].

The number of osteoporotic hip fractures remained stable over the first twenty days of the State of Emergency. Thirty-six patients (22.6% of all the osteoporotic hip fractures studied) were admitted

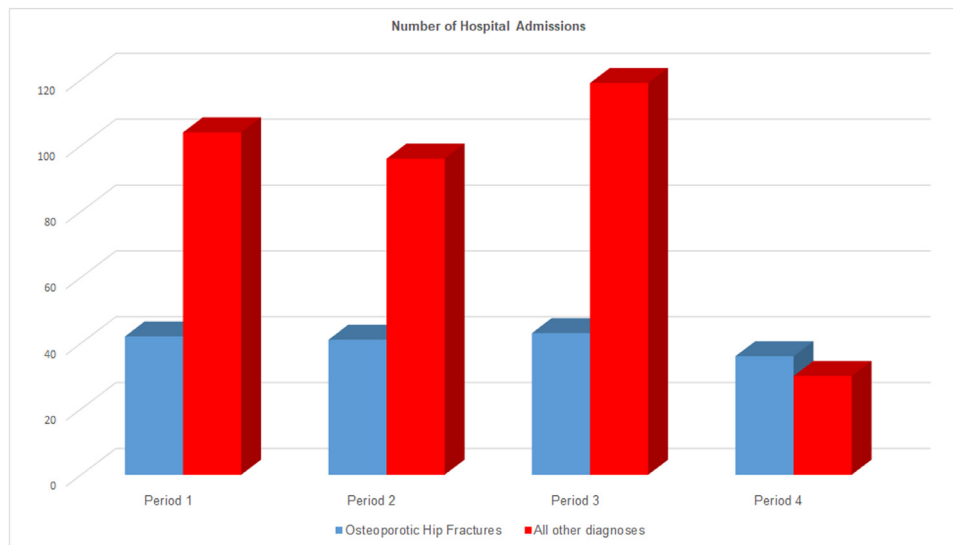


Fig. 2. Reasons for hospital admission for trauma emergencies throughout the four periods analyzed. Blue: osteoporotic hip fractures; Red: all other diagnoses.

during Period 4. Hip fractures are devastating injuries that often result in long-term disability and may lead to premature death, especially in the elderly [13]. Due to the rapidly-expanding elderly population, these fractures are one of the most challenging and fastest-growing public health concerns [14]. This problem will continue to grow in the future. It is expected that, worldwide by 2040, Spain will be the country in which the elderly comprise the highest percentage of the overall population [15].

Another interesting finding of our study is that all 23 hip fracture patients who remained COVID-19 free were discharged home during this pandemic outbreak. Another four hip fracture patients with COVID-19 were discharged home, while five currently remain alive in the hospital.

Due to the State of Emergency, there has been a suspension in elective clinics and surgeries, as recommended. We agree with this plan, as it limits the capacity of COVID-19 to spread. Given that essential emergency surgeries are still proceeding as usual, however, contingency plans are needed to maintain these services even as the pandemic worsens. A systematic review of 257,367 patients demonstrated that operative delays beyond 48 hours after admission may increase the odds of 30-day all-cause mortality in hip fracture patients [16]. Similarly, Nyholm et al, in an analysis of 3,517 hip fracture surgeries, found that a surgical delay of more than twelve hours significantly increased thirty-day mortality [17]. Recent studies also have demonstrated that older patients with medical comorbidities are more adversely affected by COVID-19 infections, owing to their diminished functional reserves and weakened immune systems [18]. This is important to consider in the hip-fracture population, the majority of whom are older and have multiple medical co-morbidities (in our study, the mean age of these patients was 86.9 years old). During this type of pandemic, which most adversely affects this exact population, these patients may need to be prioritized for early surgery even more so than normal, which may help to reduce their length of stay and, thus, their probability of acquiring a nosocomial infection like COVID-19. In the largest randomized controlled trial to assess hip fracture patients, published recently, an accelerated care pathway was found to be associated with a significantly shorter length of hospital stay [19]. Because of the risk of infection and deaths among hip fracture patients with COVID-19, at our center we have developed an algorithm for caring for these patients during the pandemic, which is initiated at patient admission (Fig. 3). Among the osteoporotic hip fracture patients analyzed during the Spanish State of Emergency,

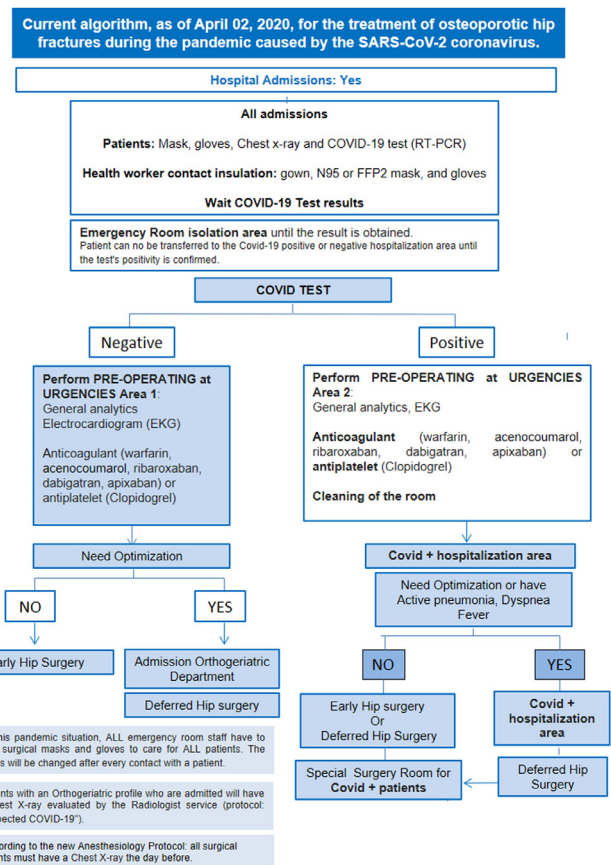


Fig. 3. Current algorithm, as of April 02, 2020, for the treatment of osteoporotic hip fractures during the pandemic caused by the SARS-CoV-2 coronavirus.

19.4% were COVID-19 positive at admission. Given this rate of positive tests, a routine COVID-19 test at admission for all patients with osteoporotic hip fracture was performed, which also may help to protect healthcare personal.

Among the limitations of the current study are its retrospective observational design and single-centered nature. Strengths of the study are that it is the first of its kind at a time of global crisis,

and that the center of interest is a large tertiary referral center within the Spanish National Health Service.

In summary, care must be taken, while developing contingency plans for reallocating resources during States of Emergency, not to assume that all trauma presentations will decrease. Health problems like osteoporotic hip fractures may, in fact, remain stable in incidence during such times. Moreover, given that osteoporotic fractures disproportionately affect an elderly population with multiple comorbidities, operative delays may increase the risks of both in-hospital mortality and nosocomial infection with the pandemic virus. With appropriate monitoring and treatment, hip fracture patients with and without COVID-19 can do well during this pandemic outbreak, and ultimately be discharged home.

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Declaration of Competing Interest

None.

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