Submitted: 27 August, 2021 Accepted: 16 November, 2021 Published: 08 July, 2022 DOI:10.22514/sv.2022.002

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ORIGINAL RESEARCH

Impact of the COVID-19 pandemic on osteoporotic vertebral fracture incidence and follow-up at the emergency department. A retrospective study of a tertiary hospital in southern Spain

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Abstract

The COVID-19 pandemic has affected trauma practices all over the world. Despite the increasing number of studies focused on the epidemiology of vertebral fractures (VFs) in COVID-19 patients, the impact of the pandemic on the incidence of trauma pathologies at the emergency department (ED) remains unclear. In Spain, very few studies have explored how the pandemic has affected the care of patients with osteoporotic vertebral fracture (OVF) in the ED and on their follow-up. The aim of this work is to evaluate the impact on the demand for care and diagnosis of VF during the COVID-19 pandemic, as well as the repercussions on patient follow-up. A longitudinal retrospective observational study was designed comparing two cohorts (pre-COVID and COVID) of patients for whom an emergency computed tomography scan was requested due to suspected vertebral fracture. Information was gathered on patient demographics, number and type of OVFs, time of day at which the diagnosis was made, follow-up, and treatment received. Comparative analyses were performed between both patient groups, with stratification by time intervals according to the pandemic waves in the COVID cohort. A total of 581 eligible patients were included in the study. The analyzed cohorts included 288 patients (145 and 143 in the pre-COVID and COVID cohorts, respectively), with a mean age of 73.4 $\pm$ 13.8 years and 205 (71.4%) women. No significant differences were observed on most measured variables. In the COVID cohort, the group of patients who received follow up care had a significantly lower mean age than the group that did not receive follow up care (70.2 $\pm$ 12.7 vs 76.2 $\pm$ 14.1 years, respectively, p = 0.008). In conclusion, the COVID-19 pandemic has had little impact on the diagnosis and management of patients with OVF in our hospital. This could be explained by the specific characteristics of OVFs and the type of patients it affects. Our study has some limitations, mainly derived from its retrospective and single-center nature with a short follow-up interval.

Keywords

COVID-19; Emergency department; Osteoporotic vertebral fracture; Post-discharge

1. Introduction

Following the COVID-19 pandemic declaration by the World Health Organization (WHO) on the 11th of March of 2020 [1], there have been several lockdowns in different parts of the world. In Spain, on the 14th of March, 2020 a state of alarm was promulgated which imposed strict confinement measures, although these were subject to changes over time, until its abolition on the 21st of June of 2020 [2]. The resulting fear established in the population led to a general decrease in assistance to hospital emergency services [3, 4], probably due to the risk of contracting COVID-19 [5]. This may have resulted in greater morbidity and mortality due to the reduction in attempts to access health care on behalf of the population [6]. However, the trend of avoidance in seeking urgent care was not observed across all diseases; although the incidence of most non-COVID-19 pathologies decreased [7] but others remained stable, such as osteoporotic hip, pelvic, spinal or periprosthetic fractures [8–10]. Therefore, there are other factors to be taken into account such as the considerable geographic variability and the fact that the true impact of the pandemic is still unknown.

One of the most common reasons behind emergency room visits in tertiary hospitals is vertebral fractures, especially those

of osteoporotic etiology given the generalized aging of the population; it is estimated that between 12 and 25% of patients between 50 and 60 years of age have at least 1 osteoporotic vertebral fracture (OVF) [11]. Indeed, VFs are the most frequent fracture in osteoporotic patients and are more frequent in the elderly and postmenopausal women [12]. They are usually secondary to accidental falls, low-energy blows, or mechanical stress, and their most frequent symptom in the acute setting is localized pain. OVF imaging is essential since a vertebral fracture, after minor trauma, is a hallmark of osteoporosis [13].

The repercussions derived from not diagnosing a VF can be devastating, since it has been proven that the presence of one or more OVFs significantly increases the risk of suffering other fractures in the future, regardless of the patient's body mass index, and it carries a morbidity and mortality similar to that of osteoporotic hip fractures [14–17]. In addition, the importance of follow-up in these patients must be highlighted, since it can influence various types of treatment depending on the characteristics and evolution of the VF (e.g., conservative treatment, cementoplasty, surgery) [18, 19]. In this last aspect, the role of traumatologists and interventional radiologists, who oversee the follow-up, treatment and prevention of new OVFs in the long term, is essential.

In Spain there are few studies that have explored the impact of the pandemic on the care of patients with VF in the emergency room and on their follow-up by specialized units. The objective of this work is to evaluate the impact on the demand for care and diagnosis of VF during the months of confinement during the COVID-19 pandemic, as well as the repercussions on patient follow-up.

2. Methods

A longitudinal retrospective observational (cohort) study was designed. Two cohorts of patients treated at the Neurotraumatology and Rehabilitation Hospital of Granada (Spain) were selected: the first group consisted of patients for whom an emergency computed tomography (CT) scan was requested due to suspected VF during the months of the pandemic (March 15, 2020 to March 14, 2021) while the second group consisted of patients for whom an emergency CT scan was requested for the same reason during the same time interval the previous year (March 15, 2019 to March 14, 2020).

In Spain, the National Health System offers universal access to urgent hospital care. In our center, patients diagnosed with OVF are systematically referred to the specialized spinal trauma unit in less than 1 month. Specialists in this area evaluate the patient, make modifications to the treatment depending on the patient's clinical and personal circumstances (conservative treatment, brace, interventional techniques, surgery, etc.) and request the appropriate tests for patient follow-up (radiograph, bone densitometry, magnetic resonance imaging, etc.).

The inclusion criteria of our study were: patients over 18 years of age who underwent spinal CT for suspected VF during admission to the emergency room. Exclusion criteria were: high-energy trauma, redundant studies (duplicate electronic request), pathological vertebral fracture (i.e., metastatic), type B or C fractures of the AO Spine classification [20], and chronic fractures (≥50% of vertebral height or signs of chronicity such as bone sclerosis or absence of fracture line).

The cohorts were selected from our hospital's radiological information system (RIS) database using the key term "fracture" in the spinal CTs performed in the emergency room. Sociodemographic information (age and sex) was collected for each patient with a diagnosis of VF, the day and time the CT was requested, the number and location of VF, the type of fracture according to the AO Spine classification, the type of treatment applied (conservative treatment, surgery or vertebroplasty) and if follow-up was carried out by the Spine Unit after the emergency room visit in the following three months. The patients diagnosed with one or more OVFs were classified in the time intervals corresponding to the 3 epidemic waves that have occurred in Spain. In this regard, we considered periods of high care pressure as those with the highest number of incident cases according to data from the Spanish Ministry of Health [21] up to the end of the study period (March 2021). According to these data, the periods were divided into First Epidemic Wave (March to April 2020), Second Epidemic Wave (September to November 2020), Third Epidemic Wave (January to February 2021) and Intermediate Periods (May to August 2020; December 2020 and March 2021). These intermediate periods correspond to lower health care pressure, as the average of incident cases were <50 cases/100,000 inhabitants.

First, a descriptive analysis of both cohorts was performed. Next, comparative analyses were carried out of the variables collected between both cohorts using chi-square tests in the case of qualitative variables and Student's *t* test for quantitative variables, after verification of the normality of the variables. Subsequently, a comparative analysis was performed stratifying according to healthcare pressure in Spain using the chi-square test for qualitative variables and one-way analysis of variance (ANOVA) for quantitative variables. Finally, a comparative analysis was carried out to analyze the existing differences within the COVID-19 cohort based on follow-up and number of OVFs. Statistical analysis was performed using the SPSS software (v. 23.0, IBM Corp, Armonk, NY, USA).

3. Results

3.1 Characteristics of the cohorts

Fig. 1 shows the flow chart of the study. A total of 581 eligible patients who requested an urgent CT scan due to suspected vertebral fracture were included, 304 from the pre-pandemic (pre-COVID) cohort and 277 from the pandemic (COVID) cohort. After applying the exclusion criteria, the analyzed cohorts included a total of 145 patients in the pre-COVID cohort and 143 patients in the COVID cohort.

The exclusion criteria in the pre-COVID cohort were: high-energy trauma (41), redundant studies (12), pathological fractures (5), AO type B or C fractures (5) and chronic fractures (96). The exclusion criteria in the pandemic cohort were: high-energy trauma (28), redundant studies (3), pathological fracture (9), AO type B or C fracture (4) and chronic fracture (90). There were no significant differences in the causes of exclusion

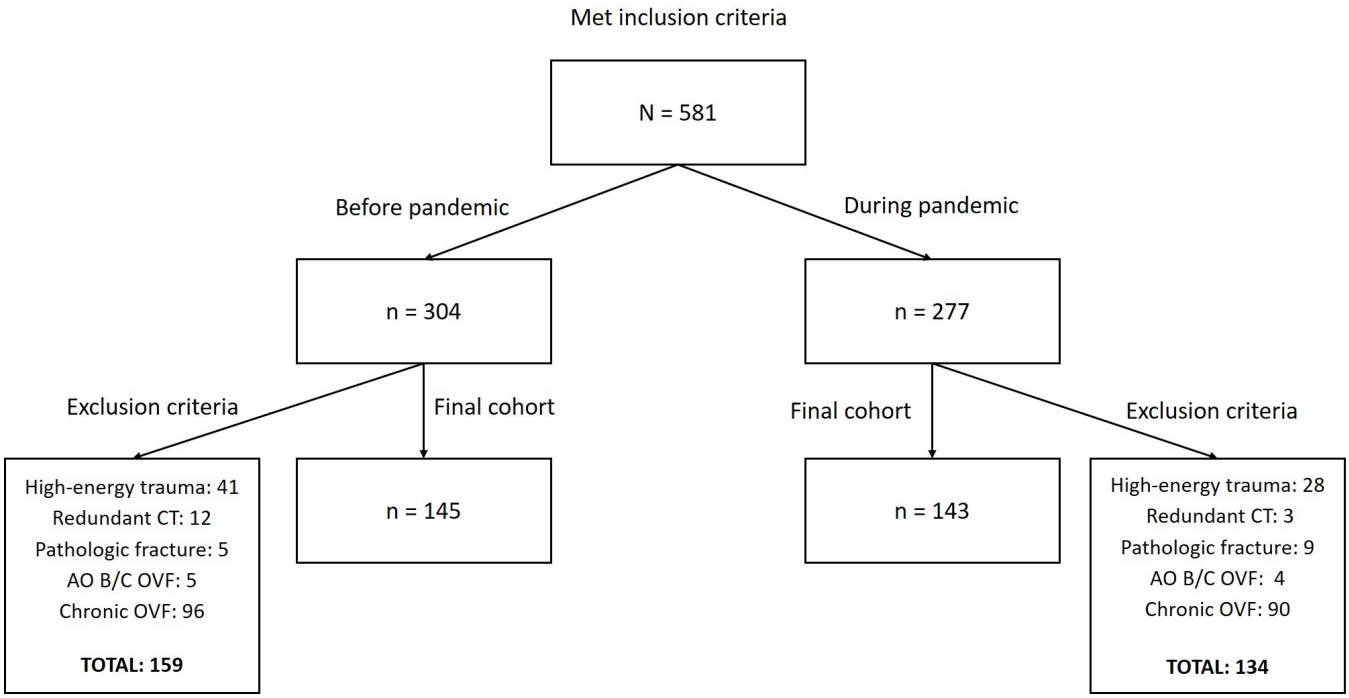

FIGURE 1. Flow chart of the patients selected and final included cohorts of the study.

between both cohorts (p = 0.125). Fig. 2 shows the causes of exclusion of the excluded patients.

Regarding the patients belonging to the COVID cohort, 20 (6.9%) were diagnosed during the period of maximum occupancy of the first epidemic wave in Spain (March to May 2020), 31 (10.8%) during the period of maximum occupancy of the second epidemic wave in Spain (October to December 2020) and 23 (8.0%) during the period of maximum occupancy of the third epidemic wave in Spain (January to February 2021), and 69 (24.0%) during periods of low or intermediate occupancy (June to September 2020 and March 2021). A total of 39 (13.5%) patients presented with multiple OVFs.

The final sample included 205 (71.2%) women, and the mean age of the cohort was 73.4 years (standard deviation, SD = 13.8). Conservative treatment was offered to 268 (93.1%), vertebroplasty to 15 (5.2%), and surgery to 5 (1.7%). One-hundred and fifty-three (53.1%) patients received specialized follow-up care.

In the pre-COVID cohort, 89% (129) of the acute fractures were single fractures and the remaining 11% (16 VFS) were multiple fractures, of which 68.8% (11) affected 2 vertebral levels and the rest (31.2%) affected 3 levels. In the COVID cohort, 83.9% (120) of acute OVFs were single fractures and the remaining percentage were multiple fractures, of which 78.3% (18) affected 2 vertebral levels and the rest affected 3 levels. The total number of vertebral levels affected in both cohorts was 337 OVFs.

As shown in Table 1, which summarizes the characteristics of both cohorts, no significant differences were observed in the measured variables between the two groups, except for time of diagnosis, with a lower number of OVFs been diagnosed in the morning during the pandemic (p = 0.029). A trend toward significance was observed regarding follow-up (p = 0.100), with the COVID cohort having a poorer follow-up care.

3.2 Differences between epidemic waves

The contrastive analysis between epidemic waves (Table 2) shows that, during the COVID-19 pandemic, fewer diagnoses took place in the morning (especially during the second epidemic wave), with differences at the limit of significance (p = 0.052). In addition, a shorter follow-up is observed in the first and third waves, although the differences do not reach statistical significance. No significant differences were found in the rest of the variables.

In the comparative analyses between Pre-COVID vs 1st wave, Pre-COVID vs 2nd wave, Pre-COVID vs 3rd wave and Pre-COVID vs intermediate periods, no significant differences were found in the analyzed variables (data not shown).

3.3 Differences in the follow-up variable for the COVID cohort

The results in Table 3 show that the patients who received non-conservative treatment (vertebroplasty or surgery) were followed up in all cases, with statistically significant differences with respect to the group that was treated conservatively ($p < 0.001$). The group of patients who received follow up care had a significantly lower mean age (6 years) than the group that did not receive follow up care (p = 0.008). The same tendency of receiving less follow up care was observed in-patients diagnosed during the night, although this difference was not significant. Multiple fractures were associated with a shorter follow-up period, with a trend towards significance (p = 0.062). The youngest patients received more follow up care (p = 0.008) and men were followed up on for longer periods of time, but without statistically significant differences (p = 0.232).

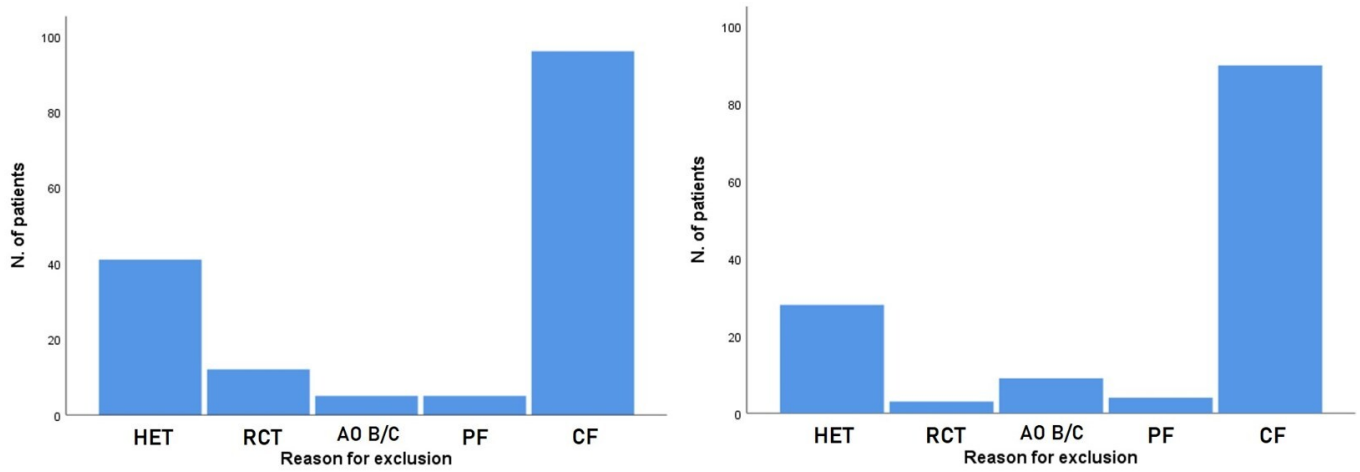

FIGURE 2. Flow chart of the patients excluded from each cohort. HET, High-energy trauma; RCT Redundant CT; AO B/C, B or C vertebral fracture according to the AO Spine classification; PF, Pathologic fracture; CF, Chronic fracture.

TABLE 1. Characteristics and contrastive analysis of the two cohorts included in the study.

	Total	Pre-COVID cohort	COVID cohort	*p* value*
	n (%), x (s)	n (%), x (s)	n (%), x (s)	
Total	288 (100)	145 (50.3)	143 (49.7)	-
Age	73.4 (13.8)	73.4 (13.8)	73.3 (13.7)	0.941
Sex				
Female	205 (71.2)	101 (49.3)	104 (50.7)	0.565
Male	83 (28.8)	44 (53.0)	39 (47.0)	
Follow-up				
Yes	153 (53.1)	84 (54.9)	69 (45.1)	0.100
No	135 (46.9)	61 (45.2)	74 (54.8)	
Treatment received				
Conservative	268 (93.1)	135 (50.4)	133 (49.6)	
Vertebroplasty	15 (5.2)	6 (40.0)	9 (60.0)	0.301
Surgery	5 (1.7)	4 (80.0)	1 (20.0)	
Time of diagnosis				
Morning (8–15 h)	179 (62.2)	101 (56.4)	78 (43.6)	
Afternoon (15–22 h)	98 (34.0)	39 (39.8)	59 (60.2)	0.029
Night (22–8 h)	11 (3.8)	5 (45.5)	6 (54.5)	
Fracture				
Single	249 (86.5)	129 (51.8)	120 (48.2)	
Multiple	39 (13.5)	16 (41.0)	23 (59.0)	0.211^
2 OVF	29 (74.4)*	11 (68.8)*	18 (78.3)*	
3 OVF	10 (25.6)*	5 (31.2)*	5 (21.7)*	
AO Spine OVF subtype				
A0	21	7	14	
A1	184	92	92	
A2	10	5	5	0.571
A3	111	56	55	
A4	11	4	7	
Total number of OVFs	337	164	173	

**Percentage of total multiple fractures in the group. ^ Chi-square test p-value for single vs multiple OVF comparison.*

TABLE 2. Comparative analysis of cohorts, with the COVID cohort stratified according to epidemic waves. Interim: intervals between waves during the pandemic.

	Total n (%), x (s)	Pre-COVID n (%), x (s)	1st wave n (%), x (s)	2nd wave n (%), x (s)	3rd wave n (%), x (s)	Interim n (%), x (s)	*p* value*
Total	288 (100)	145 (50.3)	20 (6.9)	31 (10.8)	23 (8.0)	69 (24.0)	-
Age	73.4 (13.8)	73.4 (13.8)	76.9 (10.5)	71.8 (13.3)	75.8 (14.0)	72.1 (14.6)	0.556
Sex							
Female	205 (71.2)	101 (69.7)	14 (70.0)	25 (80.6)	19 (82.6)	46 (66.7)	0.451
Male	83 (28.8)	44 (30.3)	6 (30.0)	6 (19.4)	4 (17.4)	23 (33.3)	
Follow-up							
Yes	153 (53.1)	84 (57.9)	9 (45.0)	20 (64.5)	10 (43.5)	30 (43.5)	0.140
No	135 (46.9)	61 (42.1)	11 (55.0)	11 (35.5)	13 (56.5)	19 (56.5)	
Treatment received							
Conservative	268 (93.1)	135 (93.1)	17 (85.0)	28 (90.3)	22 (95.7)	66 (95.7)	0.506
Vertebroplasty	15 (5.2)	6 (4.1)	2 (10.0)	3 (9.7)	1 (4.3)	3 (4.3)	
Surgery	5 (1.7)	4 (2.8)	1 (5.0)	0 (0.0)	0 (0.0)	0 (0.0)	
Time of diagnosis							
Morning (8–15 h)	179 (62.2)	101 (69.7)	13 (65.0)	12 (38.7)	14 (60.9)	39 (56.5)	0.052
Afternoon (15–22 h)	98 (34.0)	39 (26.9)	5 (25.0)	18 (58.1)	8 (34.8)	28 (40.6)	
Night (22–8 h)	11 (3.8)	5 (3.4)	2 (10.0)	1 (3.2)	1 (4.3)	2 (2.9)	
Fracture							
Single	249 (86.5)	129 (89.0)	18 (90.0)	28 (90.3)	19 (82.6)	55 (79.7)	0.363
Multiple	39 (13.5)	16 (11.0)	2 (10.0)	3 (9.7)	4 (17.4)	14 (20.3)	

**Results of the chi-square or Fisher's exact test for qualitative variables and ANOVA for the quantitative variable "age". Percentages by columns.*

3.4 Differences in the variable number of fractures for the COVID cohort.

As shown in Table 4, for the COVID cohort, the factors associated with multiple fractures are younger age, (statistically significant differences, $p = 0.005$), and male sex and shorter follow-up, with clear trends towards significance ($p = 0.057$; $p = 0.062$, respectively).

4. Discussion

The impact of the COVID-19 pandemic on the healthcare of patients with pathologies other than COVID-19 has been studied in various fields, but there is still controversy about its magnitude and scope depending on the pathology and geographic region. In the case of osteoporosis, several studies reported a decline in the adequate care of patients both in terms of diagnosis and treatment. A survey conducted by Peeters *et al.* [22] showed that, during the COVID-19 pandemic, osteoporosis care almost completely arrested, especially due to the discontinuation of dual X-ray absorptiometry scanning and closing of outpatient clinics. On the other hand, there is increasing evidence that, contrarily to the case of trauma-related fractures, the incidence of fragility fractures during the pandemic remained unchanged. A systematic review conducted by Kumar Jain *et al.* [23] supported this observation. The authors also reported a significantly higher risk of mortality in elderly patients with fractures, thus they recommended to adopt conservative strategies in non-obligatory fractures, limiting surgical management facilities with a robust intensive care. In addition, the relationship between COVID-19 and fracture mortality has been also described by other authors. A retrospective cohort study carried out by Battisti *et al.* [24] in Italy during the first pandemic wave showed that vertebral fractures were not associated with short-term mortality in COVID-19 patients. Interestingly, these authors found that vertebral fractures significantly increased 30-day mortality risk in non-COVID-19 patients, both in the case of single and multiple fractures, with hazard ratios of 7.46 (95% CI 3.12–17.8) and 6.2 (95% CI 2.75–13.98), respectively.

Regarding the epidemiology of fractures in the field of trauma, a study by Dass *et al.* [25] carried out in the United Kingdom during national confinement for a period of 5 weeks, found that urgent care of patients in a trauma hospital was reduced by 56% compared to the same period during the previous year, a figure very similar to the decrease in the demand for urgent care in the National Health Service (NHS) during that period. These authors found that most of these patients were treated for low-energy fractures, hip fractures being the most frequent. In addition, the proportion of patients treated surgically increased, although these differences were not significant. Interestingly, these authors did not include vertebral fractures within the group of fractures analyzed,

TABLE 3. Differences in the follow-up of patients in the COVID cohort.

Variable	Total n (%), x (s)	Patients with follow-up n (%), x (s)	Patients with no follow-up n (%), x (s)	*p* value*
Total	143 (100)	63 (48.3)	74 (51.7)	-
Age	73.2 (13.7)	70.2 (12.7)	76.2 (14.1)	0.008
Sex				
Female	104	47 (45.2)	57 (54.8)	0.232
Male	39	22 (56.4)	17 (43.6)	
Treatment received				
Conservative	133	59 (44.4)	74 (55.6)	<0.001
Vertebroplasty	9	9 (100.0)	0 (0.0)	
Surgery	1	1 (100.0)	0 (0.0)	
Time of diagnosis				
Morning (8–15 h)	78	33 (42.3)	45 (57.7)	0.165
Afternoon (15–22 h)	59	34 (57.6)	25 (42.4)	
Night (22–8 h)	6	2 (33.3)	4 (66.7)	
Fracture				
Single	120	62 (51.7)	58 (48.3)	0.062
Multiple	23	7 (30.4)	16 (69.6)	

**Results of the chi-square or Fisher's exact test for qualitative variables and Student's t test for the quantitative variable "age". Percentages by rows.*

TABLE 4. Differences in the COVID-19 cohort based on number of fractures.

	Total n (%), x (s)	Patients with single OVF n (%), x (s)	Patients with multiple OVFs n (%), x (s)	*p* value*
Total	143 (100)			
Age	73.4 (13.8)	74.7 (11.8)	65.9 (19.9)	0.005
Sex				
Female	104	91 (87.5)	13 (12.5)	0.057
Male	39	29 (74.4)	10 (25.6)	
Treatment received				
Conservative	133	111 (83.5)	22 (16.5)	1.000
Vertebroplasty	9	8 (88.9)	1 (11.1)	
Surgery	1	1 (100.0)	0 (0.0)	
Time of diagnosis				
Morning (8–15 h)	78	64 (82.1)	14 (17.9)	0.316
Afternoon (15–22 h)	59	52 (88.1)	7 (11.9)	
Night (22–8 h)	6	6 (66.7)	2 (33.3)	
Follow up care				
Yes	69	62 (89.9)	7 (10.1)	0.062
No	74	58 (78.4)	16 (21.6)	

**Results of the chi-square or Fisher's exact test for qualitative variables and Student's t test for the quantitative variable "age". Percentages by rows. OVF, Osteoporotic vertebral fracture.*

probably due to the lower frequency with which they are treated surgically. A similar study in Cardiff (UK) found an overall reduction of 48% in care for orthopedic pathology compared to the analogous period in 2019 [26]. In this case, spinal fractures were recorded (although etiology is not mentioned) but made up a small fraction of the recorded fractures, less than 5% of the total. Further studies in the UK found fewer emergency visits for specific pathologies such as hand trauma [27, 28]. Interestingly, a multicentre study by Hampton *et al.* [29] found a 53.7% reduction in trauma admissions

during lockdown compared to 2019, but the authors reported a statistically significant increase in fragility injuries (35% vs 21.7%), as well as in the proportion of low energy falls from standing height (67% vs 44%).

Other studies carried out in the United States also found a significant decrease in the frequency of trauma fractures in first and second level centers. A study carried out in a first level trauma hospital during the initial period of the COVID-19 pandemic (March 18–31, 2020) found a reduction of 44.9% compared to the previous period (March 1–14, 2020) [30]. The main limitation of this study is its short duration and the proximity of the control cohort to the start of the pandemic, since the population was probably already alert at that time. This would imply an underestimation of the reduction in urgent care. Another study at a second-level trauma hospital in Michigan comparing demand during 2020 with a retrospective cohort found an overall reduction in care demand of 45.1%, and found no significant differences in the proportion of high vs low-energy accidents [31]. In this case, the control cohort was selected from hospital records between 2016 and 2019, so selection bias was reduced.

Wong and Cheung in Hong Kong conducted a contrastive analysis with a total of almost 1 million patients comparing the pandemic period with the sum of the analogous periods four years prior [9]. They found differences of 41.1% in spinal fracture surgery but found that they were not significant after performing the Bonferroni multiple test correction. In addition, they analyzed trauma care in outpatient clinics and found that these decreased by 29.4%. However, the authors did not provide stratified analyses based on specialized units such as the spinal unit. In South Africa, the impact of lockdown measures on trauma presentations during the month of April, 2020, was assessed by Morris *et al.* [32] These authors found a 47% reduction in the number of trauma cases, but no significant changes were observed for severe cases. A similar percentage (43% in all injury-related admissions) was reported by Christey *et al.* [33] in a level one trauma centre in New Zealand during national level 4 lockdown for COVID-19.

In Spain, some epidemiological studies have been carried out on the impact of COVID-19 on urgent traumatic pathology. Nuñez *et al.* [8] carried out a retrospective analysis comparing admissions to a trauma department of a tertiary hospital in Catalonia during the first 20 days of the State of Alarm in Spain, the analogous periods 2 years prior and the 20 days before the onset of the state of alarm. Although these authors found a generalized decrease in the total number of hospital visits during the pandemic (approximately one-fourth as many trauma admissions as any prior period), they did not observe significant differences in the number of osteoporotic hip fractures. The authors do not provide data on vertebral fractures recorded during this period. In addition, Martín-Playa *et al.* [34] reported a decrease in the number of emergency hand cases as perceived by orthopedic surgeons based on a nationwide survey in Spain.

Our results did not show significant differences in the number and characteristics of patients diagnosed with OVF before and during the pandemic. In addition, no differences regarding the follow-up of these patients, although a trend towards significance was observed ($p = 0.10$). It is striking that more diagnoses were made in the afternoon than in the morning. To our knowledge, no previous studies have analyzed the impact that the time at which the patient was diagnosed with OVF had on follow-up during the pandemic. Our findings could be explained by the changes in the patterns of emergency care seeking by the population, in addition to the hours and personnel hired during the pandemic compared to the time period before. It should be noted that, in Spain, on-call shifts last 24 hours, but in the context of the pandemic, in our environment it has not been uncommon to facilitate the reduction of shifts due to care overload.

On the other hand, differences were found in the profiles of patients who were followed up on versus those who were not within the cohort diagnosed during the pandemic. In particular, a more erratic follow-up was carried out in patients treated conservatively compared to those treated by surgery or vertebroplasty ($p < 0.001$), which could be explained by the need for more exhaustive monitoring related to the possible added complications of these procedures (re-fractures, loosening or breakage of the osteosynthesis material, cement migration, etc.). A significantly shorter follow-up was also observed for older patients, which could be explained by the greater precautions of these patients when attending hospital centers. In addition, trends towards significance were found in the following variables: sex, number of synchronous fractures, and diagnosis at night—this should be taken into account for larger studies.

The common denominator of most of the studies published in the literature in this context is that they analyze trauma pathology globally, without performing specific analysis of vertebral fractures, and rarely do they analyze patient follow-up. This has been precisely the object of our study, which provides important information in order to plan actions throughout the course of the pandemic as well as in similar future public health scenarios in which States of Alarm occur. In the case of OVFs, there are some specific elements that differentiate them from most trauma pathologies, particularly in the setting of emergency care services. First, OVFs tend to be less severe in terms of short-term mortality. Second, conservative treatment can be applied without the need for specialized care by the trauma surgeon in the acute presentation. Furthermore, follow-up is extremely important since VFs have been shown to be associated with future VFs and other osteoporotic fractures, with 1-year mortality similar to that of hip fracture [35]. Finally, perhaps the main reason why the differences found in the frequency of diagnosis of OVFs in our study is that their cause, in most cases, is low-energy trauma. In agreement with other authors, the figures published in the literature on the impact of the pandemic on the demand for health care due to fractures suggest that the fractures typically associated with household activities were the ones that most frequently led patients to demand urgent care [25]. OVFs are the prototype for this type of fracture. These distinctive characteristics could explain the low impact of the COVID-19 pandemic on the number of undiagnosed patients as well as the few losses to follow-up.

The main limitations of our study lie in its retrospective observational design and single-centered nature, as well as the relatively short follow-up period. Further studies are needed to

evaluate other variables such as vertebral collapse or mortality in the long-term.

5. Conclusions

The COVID-19 pandemic has had little impact on the diagnosis and management of patients with OVF seen in our hospital's emergency department. This could be explained by the specific characteristics of VF, especially its etiology (falls or low-energy trauma) and the profile of the patients it affects. More comprehensive studies focused on particular aspects such as long-term consequences of the pandemic in the epidemiology and management of OVFs need to be conducted to accurately determine the impact of the pandemic on the population diagnosed with OVFs.

AUTHOR CONTRIBUTIONS

AJLRB and BLM designed the research study and wrote the first draft of the manuscript. AJLRB, BLM and MRI conducted the research and advised on methodology. FRS mentored the work. All authors read and approved the final manuscript.

ETHICS APPROVAL AND CONSENT TO PARTICIPATE

This study complies with the principles of the Declaration of Helsinki. A completely anonymized database was used for the analyses. No identification data were used. The study was approved by the Provincial Research Ethics Committee of Granada (ref. TFG-FX-2019).

ACKNOWLEDGMENT

The authors wish to thank Prof. Benítez Sánchez of the University of Granada for his statistical assistance.

FUNDING

This work was supported by the 'Artificial Intelligence for the diagnosis and prognosis of COVID-19' project (CV20-29480), funded by the Consejería de Transformación Económica, Industria, Conocimiento y Universidades, Junta de Andalucía, and the FEDER funds.

CONFLICT OF INTEREST

The authors declare no conflict of interest. Antonio J. Láinez Ramos-Bossini is serving as one of the Guest editors of this journal. We declare that Antonio J. Láinez Ramos-Bossini 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 YZ.

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How to cite this article: Antonio J. Láinez Ramos-Bossini, Bárbara Láinez Millán, Fernando Ruiz Santiago, Mario Rivera-Izquierdo. Impact of the COVID-19 pandemic on osteoporotic vertebral fracture incidence and follow-up at the emergency department. A retrospective study of a tertiary hospital in southern Spain. Signa Vitae. 2022; 18(4): 15-23. doi: 10.22514/sv.2022.002.