


# The Covid 19 Pandemic Effect on the Epidemiology of Thoracolumbar Fractures Presenting to the Emergency Department in Patients Above 65 years Old

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## Abstract

**Introduction:** Studies investigating the Covid-19 Pandemic's orthopedic aspects are accumulating, including reports on a 10-33% decrease in hip fracture incidence alongside shorter times to surgery. Osteoporotic vertebral compression fractures (VCF) have not yet been discussed. This study evaluated the effect of the Covid-19 pandemic's first wave on VCF in the elderly. **Method:** A retrospective cohort of elderly patients diagnosed with VCF between 2018-19 (Pre-Covid-19 pandemic) to 2020. **Results:** The cohort included 172 patients above 65 years with VCF during 2018-2020. Patients' age and gender were similar between the two study groups. We found a higher proportion of high-energy VCF during 2020 (10.5% vs 6.7%). Incidence of recurrent fractures was 7.5 times higher during 2020 (5.3% vs .7%,  $P = .06$ ), and significantly higher rates of Ankylosing Spondylitis or Diffuse Idiopathic Skeletal Hyperostosis in 2020 (7.9% vs 1.5%,  $P = .04$ ). VCF ED admission rates were similar, with 60% treated conservatively. Admitted patients underwent more surgeries in 2020 (66.7% vs 60%,  $P = .71$ ) and a tendency towards Percutaneous Balloon Kyphoplasty (BKP) + fixation compared with BKP alone (15.8% in 2020 vs 7.5% in 2018-19,  $P = .29$ ). RR for BKP + fixation vs BKP alone was 1.95, suggesting higher odds for a more complex surgery during the Covid-19 pandemic. The complication rate was significantly higher during 2020 (18.4% vs 3.7%,  $P < .001$ ). Admission length was slightly longer during 2020 (12.2 days vs 9.9 days,  $P = .27$ ), and time to surgery was marginally longer, 6.25 vs 5.3 days ( $P = .55$ ). Many patients chose home over institutional rehabilitation during the Covid-19 pandemic (72.2% vs 58.8%). **Conclusion:** The Covid-19 pandemic did not alter VCF incidence, but patients' characteristics changed, affecting admissions, institutional rehabilitation, and a tendency towards complex surgery rather than BKP alone. It is still unclear if Covid-19 will remain an issue in the upcoming years, but its impact and lessons are still worthwhile.

## Keywords

osteoporotic fractures, vertebral compression fractures, pandemic, covid-19

## Introduction

The year 2020 will be remembered in history as the "Covid-19 year" with a colossal effect on all aspects of life. As in most countries worldwide, Israel suffered from a rapid spread of the Covid-19 pandemic, with the first wave peaking from mid-March to April 2020. This pandemic impacted many aspects of our society, including substantial

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medical, social, and economic challenges. The first Covid-19 patient in Israel was diagnosed on February 27th.<sup>1</sup> Starting March 11th, social distancing and movement restrictions were gradually tightened, with intermittent full lockdowns. Senior citizens were recommended to follow even stricter isolation practices, and many senior residents' homes did not allow residents to leave or have visitors. By the end of April, our country's largest medical center admitted 162 Covid-19 patients,<sup>1</sup> and our medical center had 65 patients treated in two designated Covid-19 departments.

Even Though the Covid-19 pandemic has been present for only a short period, studies investigating its orthopedic aspects are accumulating fast. Some reported on the influence of Covid-19 on orthopedic trauma, with hip fractures in the elderly, specifically<sup>2-7</sup> of a substantial decrease in orthopedic trauma load.<sup>8,9</sup> A few investigators from different countries reported a 10-33% decrease in hip fracture incidence, alongside shorter waiting times to surgery.<sup>8,10-13</sup> Osteoporotic vertebral compression fractures (VCF) are prevalent in the same large patient group but have not been discussed yet regarding the Covid-19 pandemic.

More common in women, with more than a million cases per year,<sup>14</sup> VCF is a common pathology in every emergency department and orthopaedics\Spine unit. As osteoporosis worldwide is rising, the National Osteoporosis Foundation has estimated the prevalence of approximately 9 million adults in the United States and an additional 43 million with low bone mass, placing all at increased risk for VCF.<sup>15</sup> VCF can cause considerable morbidity, acute and chronic, functional limitations, constant pain, loss of autonomy, and respiratory difficulties.<sup>16,17</sup> VCF produces intractable pain, contributable to kyphosis, and considerably reduces the patient's quality of life. This vicious cycle begins with a VCF kyphotic deformity, leading to persistent back pain due to biomechanical load change. There will be higher susceptibility to adjacent fractures due to increased kyphosis, further escalating kyphotic deformity, causing pain, disability, and vice versa.<sup>18</sup>

In most cases, the initial treatment of VCF would include pain control with resuming activity as promptly as possible, accompanied by physical therapy.<sup>19</sup> Before applying percutaneous minimally invasive surgery, traditional analgesics and bed rest are the main therapeutic measures. Even Though most patients with VCF gradually improve with conservative treatment, intractable pain, decreased self-esteem, senile kyphosis, mood disorders, and increased mortality have been frequently reported.<sup>20-22</sup> Surgery, Percutaneous Vertebroplasty (VP) or Percutaneous balloon kyphoplasty (BKP), has two primary indications: pain control and mechanical considerations. Patients who do not show a timely significant pain relief under conservative treatment, patients who cannot tolerate oral analgesics, or have severe limitations to their essential

daily activities are considered candidates for surgery. Local or progressive kyphosis is another surgical indication, sometimes requiring stabilization beyond cementation. There is still much controversy regarding the correct indications and timing for those procedures for VCF.<sup>21-27</sup>

Mortality among patients suffering VCF is discussed extensively in literature.<sup>28-31</sup> The prevalence of VCF is approximately 5.4% in adults aged 40 years but rises to 18% in those 80 years and older, making it a widespread elderly ailment.<sup>32</sup> VCF can lead to a downward spiral of symptoms and morbidity at that age group, ranging from pain and disability to impaired pulmonary and respiratory function.<sup>33</sup> High mortality rates with up to 72% at five years and 90% at seven years following VCF were already reported.<sup>29,31,34</sup> Conservative treatment is still considered the first treatment line, including narcotics, analgesics, braces, and immobilization. This treatment is not always well-tolerated in elderly patients with reports of side effects, such as constipation, increased risk of falls,<sup>35,36</sup> and opioid dependency.<sup>37</sup> Minimal invasive surgical interventions such as VP and BKP can improve pain, function, quality of life<sup>36,38,39</sup> and decrease mortality rates by 25%-55% compared to conservative treatment.<sup>30,40-42</sup>

This study's objective was to evaluate the effect of the Covid-19 pandemic's first wave lockdown and isolation measures on the incidence, treatment, and mortality rate of elderly patients diagnosed with VCF in our emergency department.

## Methods

We completed a retrospective cohort study that included all patients above 65 years old diagnosed with acute vertebral compression fracture (VCF) at our medical center emergency department (ED) between 2018 and 2020. We included only patients with less than 4 weeks of symptoms.

We evaluated all patients' medical records and retrieved all relevant information, including Demographic characteristics (gender, age, and risk factors for Compression Fractures), Fracture mechanism (low energy, high energy, or fractures caused by malignancy), and Fracture location (thoracic or lumbar fractures). We also collected data from the admission records, including – time of admission and span, the indication for surgery and type of surgery (BKP vs a BKP with posterior spinal fixation). We summed all recorded complications; infectious, surgical (PMMA leakage, hardware misplacement or failure) or medical (renal failure, electrolyte imbalance, and cardiac complications) and 40-day mortality.

Statistical analyses were performed using the R Statistical Software, version 3.5.2 (Foundation for Statistical Computing, Vienna, Austria). Patients' age was compared between patients admitted to the ER during 2018-2019 and patients arriving during 2020 using the student's t-test.

**Table 1.** Characteristics of Patients Diagnosed with Thoraco-Lumbar Fracture During 2018-19 and 2020.

	2018-19 N= 134	2020 N= 38	P-value
Age (years)	80.7 ± 8.4	80.1 ± 5.6	.64
Sex = male	38/134 (28.4%)	13/38 (34.2%)	.46
Sex = female	96/134 (71.6%)	25/38 (65.8%)	
AS/DISH	2 (1.5%)	3 (7.9%)	.04
Surgery	52 (38.8%)	16 (42.1%)	.71
Surgery type = BKP	42 (31.3%)	10 (26.3%)	.29
Surgery type = BKP plus fixation	10 (7.5%)	6 (15.8%)	
Time to surgery (days)	5.3 ± 4.6	6.25 ± 7.3	.55
Admissions	86 (64.2%)	24 (63.2%)	.91
Admission length (days)	9.9 ± 8.6	12.2 ± 9.5	.27
Recurrent fracture	1 (.7%)	2 (5.3%)	.06
Low energy fractures	120 (89.6%)	33 (86.8%)	.37
High energy fractures	9 (6.7%)	4 (10.5%)	
Fractures d/t malignancy	5 (3.7%)	1 (2.6%)	.74
Thoracic fractures	38/134 (28.4%)	13/38 (34.2%)	.24
Lumbar fractures	96 (71.6%)	21/38 (65.8%)	
Total complications	5 (3.7%)	7 (18.4%)	.001

BKP = Percutaneous Balloon Kyphoplasty; AS = Ankylosing Spondylitis; DISH = Diffuse Idiopathic Skeletal Hyperostosis. Details are summed in [Table 2](#). Per patient.

Patients' gender, previous diagnoses (Ankylosing Spondylitis, Osteoporosis or spinal malignancy), fracture mechanism, first or recurrent fracture, hospitalization rate, type of surgery performed and surgical complications were compared between the groups using the Chi-square or Fisher exact tests. Time to surgery and admission length in days were compared using the Mann-Whitney test.

Further multivariate analyses were performed. Negative binomial regression was used to assess the independent risk for total complications, adjusting for patients' age and surgery type (BKP and spinal fixation vs BKP alone), multivariate risk assessment, adjusting for patients' age and previous compression fracture.

We also assessed the independent association between the year of arrival and admission length using linear regression, adjusted for patients' age and surgery type.

## Results

Our cohort included a total of 172 VCF patients diagnosed at our medical center ED. Of which, 134 patients were diagnosed before the Covid-19 pandemic during 2018-2019 and 38 during 2020, while the Covid-19 pandemic peaked in our country ([Table 1](#)).

[Table 1](#) presents a comparison between patients diagnosed with VCF during 2018-19 and 2020. Patients that attended the ED during 2020 were the same age as those attending 2018-2019 (80 years old); We found no differences concerning patients' age ( $P = .64$ ) or gender ( $P = .46$ ).

**Table 2.** High Energy Fracture.

	2018-19	2020
Total	9 (6.7%)	4 (10.5%)
Conservative treatment	8	2
BKP	0	1
BKP plus fixation	1	1

BKP = Percutaneous Balloon Kyphoplasty.

We found no differences in the proportion of low-energy and Fractures d/t malignancy between the two periods ( $P = .34$ ,  $P = .74$  respectively). However, although statistically insignificant, there was a 1.5 times higher incidence of high-energy fractures during 2020 than 2018-19 (10.5% vs 6.7%, [Table 2](#)). Half of the high-energy fractures in 2020 were treated conservatively, while 89% were treated conservatively in 2018-19.

The incidence of recurrent fractures was 7.5 times higher during the Covid period (5.3 % in 2020 vs only .7% during 2018-19,  $P = .06$ ). Furthermore, among compression fracture patients, significantly higher rates of Ankylosing Spondylitis (AS) or Diffuse Idiopathic Skeletal Hyperostosis (DISH) were observed in 2020 (7.9% vs 1.5% during 2018-19,  $P = .04$ ).

ED admission rates for diagnosed VCF were similar in 2018-2019 compared to 2020 (64% vs 63%). Most of the patients with VCF were treated conservatively (about 60%). When comparing the admitted patients, we found a higher rate of surgeries in the 2020 group (16/24 (66.7%) vs 52/86

**Table 3.** Patients' Complications.

	2018-19	2020	P-value
Total complications	5 (3.7%)	7 (18.4%)	<b>&lt;.001</b>
Conservative treatment	Sepsis with UTI Pneumonia	AF MI UTI	
BKP	Pneumonia & UTI	ARF X2 MI leading to SD	
BKP plus fixation	Intraoperative resuscitation Post-operative infection	AF with hypokalemia	

UTI = Urinary tract infection; AF = Atrial fibrillation; MI = Myocardial infarction; ARF = Acute renal failure; SD = Sudden death. Significance for bold value is  $P < 0.001$ .

(60%),  $P = .71$ ). We also found a difference in the rates of BKP plus fixation compared with BKP alone during 2020 (15.8% in 2020 vs 7.5% in 2018-19,  $P = .29$ ). In multivariate analysis, the Relative Risk for BKP plus fixation vs BKP alone was 1.95; 95% CI 0.84-4.53, suggesting higher odds for more complex surgery chosen or indicated during the 2020 Covid-19 pandemic.

Post-surgical complication rates were significantly higher during 2020 than 2018-19 (18.4% vs 3.7%,  $P < .001$ ; Table 3). Out of all documented complications, only one can be related to the surgical procedure, i.e., surgical site infection. Conservative treatment was associated with about 40% of the complications documented for both groups, i.e., 40% in 2018-19 and 42.9% during 2020. The 2020 medical complication category included: two patients with acute renal failure, one patient with atrial fibrillation and hypokalemia, one patient with pulmonary emboli, one patient with pulmonary edema, and one who sustained a sudden cardiac death. In the 2018-2019 group, only one case of sudden cardiac death was reported (14.3% vs 20%,  $P < .001$ ). The adjusted RR for overall complications was 1.18 (95% CI 1.01-1.38).

Admission length was slightly longer during 2020 vs 2018-19 (a mean of 12.2 days vs 9.9 days,  $P = .27$ ), and time to surgery was also marginally longer, 5.3 vs 6.25 ( $P = .55$ ), but without statistical significance.

During the Covid-19 pandemic, many patients choose home over institutional rehabilitation ( $P = .13$ ). When comparing institutional to home rehabilitation, we found that 80/194 (41.2%) were sent to institutional rehabilitation in 2018-19 compared to only 28.8% (17/59) in 2020.

Overall, six patients died during the 40-day follow-up, three out of 194 in 2018-19 and 3 out of 59 in 2020. We found no difference in fractures distribution across the spine between the two periods ( $P = .24$ ).

## Discussion

The covid-19 pandemic peaking in 2020 has created a new reality where we are expected to provide a quality service

despite the challenges presented.<sup>43,44</sup> Our objectives in this study were to evaluate the effect of the Covid-19 pandemic's first wave and the lockdown and isolation measures in our country on the incidence, treatment, rehabilitation trends, and mortality patterns of patients diagnosed with VCF evaluated at our emergency department. As VCF in the elderly is common and makes a significant component of our service, we chose to focus on this group first, learn, and evaluate resource allocation.

As Covid-19 vaccination was not available yet during our study, the fear of exposure was at its peak, influencing patients' behavior. Vaccination for Covid-19 was available in Israel only at the end of December 2021.

We saw significant changes in our VCF patients compared to the era before the Covid-19 pandemic. We found that during the peak of the Covid-19 pandemic, fewer patients attended the ED for VCF (38 in 2020 vs 134 in 2018-19), representing a 44% decrease. This decrease could be explained by the fear of Covid-19 exposure in the ED; thus, patients with VCF were reluctant to come to the ED for diagnosis and treatment. Despite similar age and gender distributions, the 2020 VCF patients had a higher incidence of AS or DISH and a significant portion of recurrent fractures than the 2018-19 group. The injury mechanism shifted slightly to higher energy etiologies in 2020. We speculate that due to the countries' lockdown and fear of Covid-19 exposure in the ED, many patients with minor trauma mechanisms chose community medicine to handle their injury rather than approaching the ED. Such behavior explains why higher energy injuries in our ED were more common in 2020 than the usual lower energy fracture mechanism.<sup>45</sup>

During the Covid-19 pandemic, we also found a higher prevalence of Ankylosing spondylitis and DISH in our ED referrals, probably since these diagnoses are considered more severe even in the presence of minor trauma, therefore requiring ED over a community-based assessment. The number of recurrent VCF reported during the 2020 Covid-19 pandemic also increased. We attribute this

finding to better patient awareness of VCF and a higher suspicion index when the patient had already experienced a similar injury in the past.

We found a similar surgery rate in 2020 with slightly more complex procedures (higher number of combined fixation with BKP) than in the 2018-2019 period. Our data suggest that minor falls with lower energy fractures were treated in the community. At the same time, the portion of cases that required surgery, including more complex surgery, slightly increased with that trend. We found similar admission rates between 2020 and 2018-2019, with a modest increase in the number of patients being offered surgery in 2020. Our findings suggest that more patients refused admission or even referral to the ED when conservative treatment is evident due to Covid-19 exposure concerns.

Discharge and continued care characteristics changed between 2018-19 and 2020. Longer admission time could result from concerns of leaving the department to an institutional rehabilitation center, with reports of Covid-19 flare-ups in those centers at that time, leading to prolonged admissions until patients regained enough self-care ability for home discharge. When comparing institutional to home rehabilitation, more patients opted for home care in 2020 (only 28.8% went to institutional rehabilitation in 2020 vs 41.2% in 2018-19). The change in pattern could result from patients' concerns due to the high rates of Covid-19 in rehabilitation centers and patients' fear of exposure.<sup>46</sup>

The Covid-19 pandemic insignificantly changed the time to surgery, which increased from 5.3 to 6.25 days of admission, correlating with our department's policy of a conservative treatment trial before offering BKP. This policy did not change despite Covid-19 surgical theatre regulations and restrictions. Despite the Covid-19 burden on our medical center, we had regular operating rooms at

all times, allowing us to offer procedures as needed with rapid Covid-19 tests to the patients.<sup>35</sup>

Complications reported for VCF patients were higher in 2020 than 2018-2019 but within the reported rates in the literature.<sup>47,48</sup> We noticed a higher rate of pneumonia and UTI in 2020 and other medical complications. However, we did not find a difference in the surgical complication rate. The change in population characteristics can explain those findings; more patients with complex medical backgrounds were admitted in 2020 than healthier patients in 2018-2019.

Limitations to this study are several. First, this is a relatively short-term analysis, and we lack long-term follow-up. Also, we lack community data regarding patients treated in the community. Finally, we compare relatively small groups of patients, thus making trends harder to reach statistical significance.

In conclusion, the Covid-19 pandemic affected our work significantly; patients and medical personnel respond to its hazards requiring adjustments and a better understanding of the new situation. VCF are very common, and while the health system is preoccupied with the Covid-19 pandemic, those patients still require proper care. We found that this pathology was as common as before, but patients' behavior and expectations somehow changed. We suspect that patients with simple VCF that tolerated the pain preferred community treatment. More of the admitted patients required surgery with a tendency to undergo more complex surgery rather than BKP. We found a prolonged hospitalization period and higher demand for home care over institutional rehabilitation. It is still unclear if Covid-19 will remain an issue in the upcoming years, but its impact and lessons are still worthwhile.

## Appendix

### Abbreviations

CI	Confidence Interval
RR	Relative Risk
AS	Ankylosing Spondylitis
DISH	Diffuse Idiopathic Skeletal Hyperostosis
ED	emergency department
BKP	Percutaneous Balloon Kyphoplasty
RR	Relative Risk

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### Ethical Approval

Edith Wolfson Medical Center gave IRB approval, Holon, Israel, affiliated with Sackler Faculty of Medicine, Tel Aviv University, Tel Aviv, Israel IRB committee.

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