

Spinal Column Fracture and Covid-19: A Systematic Review on Association with Outcome

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Received date: 03 June 2023; **Accepted date:** 19 July 2023; **Published date:** 25 July 2023

Citation: Bentes R dS, Conchy MMM, Andrade MCH, Junior EJPG, dos Santos BF, et al. (2023) Spinal Column Fracture and Covid-19: A Systematic Review on Association with Outcome. J Comm Med and Pub Health Rep 4(04):

<https://doi.org/10.38207/JCMPHR/2023/JUL04040578>

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Abstract

It has been observed that the COVID-19 virus presents potential systemic repercussions and affects multiple organs, including the ability to worsen pre-existing spinal column pathologies, including fractures, given its neurotropic action profile. Thus, according to standardized terms, 174 articles were obtained, of which only 10 were eligible for the present systematic review, specifically addressing spinal column fractures and COVID-19. In this context, COVID-19 requires early treatment to reduce sequelae after spinal column trauma and proper medical care to prevent infection by the healthcare team and disease transmission.

Keywords: spinal column; COVID-19; spinal fractures

Introduction

It is evident that the SARS-CoV-2 virus from the Coronaviridae family, which causes the disease known as COVID-19 (CV-19), has the potential for severe acute respiratory syndrome and systemic repercussions, affecting multiple organs, including the central nervous system and spinal column (SC), ranging from asymptomatic to severe cases. [1,2,3]

Furthermore, it has been suggested that patients with traumatic SC injury with superimposed SARS-CoV-2 infection may experience

more severe outcomes due to the neurotoxic hypoxic injury pathophysiological mechanism. [4]

Moreover, the relationship between acute spinal cord injuries, including spinal fractures (SCF), and COVID-19 should be studied, as advocated by the medical literature, [5] as it motivated the construction of the present study.

Therefore, this study aimed to analyze non-experimental observational studies through a systematic review of scientific publications that analyzed SCF and COVID-19 simultaneously.

Methodology

The methodology employed was a systematic review, using the MEDLINE® (Online System for Searching and Analyzing Medical Literature) and LILACS (Latin American and Caribbean Health Sciences Literature) platforms through BIREME (Regional Library of Medicine), as well as PUBMED® (US National Library of Medicine National Institutes of Health). In this context, the following terms were selected based on the Health Sciences Descriptors (DECS) platform, using both Portuguese and English descriptors: spinal fractures and COVID-19; spinal fractures and SARS-CoV-2; COVID-19 and cervical vertebrae; COVID-19 and thoracic vertebrae; COVID-19 and lumbosacral region.

The inclusion criteria were as follows: case reports or case series, cross-sectional studies, case-control and longitudinal studies, complete and available, conducted only on humans, and addressing both COVID-19 and spinal fractures, published within the five years before 2021, with a publication date up to December 17 of that year. The exclusion criteria for the present systematic review were systematic reviews and meta-analyses, controlled randomized clinical trials, studies that did not address COVID-19 and articles that did not meet the inclusion criteria.

Results and Discussion

According to the appropriate terms of the DECS platform, a total of 174 articles were obtained, and after applying the inclusion and exclusion criteria, 108 publications were captured. After carefully reading the titles and abstracts and eliminating duplicates, 27 articles were

selected for full-text reading, of which 10 were eligible for the present systematic review. The flowchart (Figure 1) demonstrates these methodological steps.

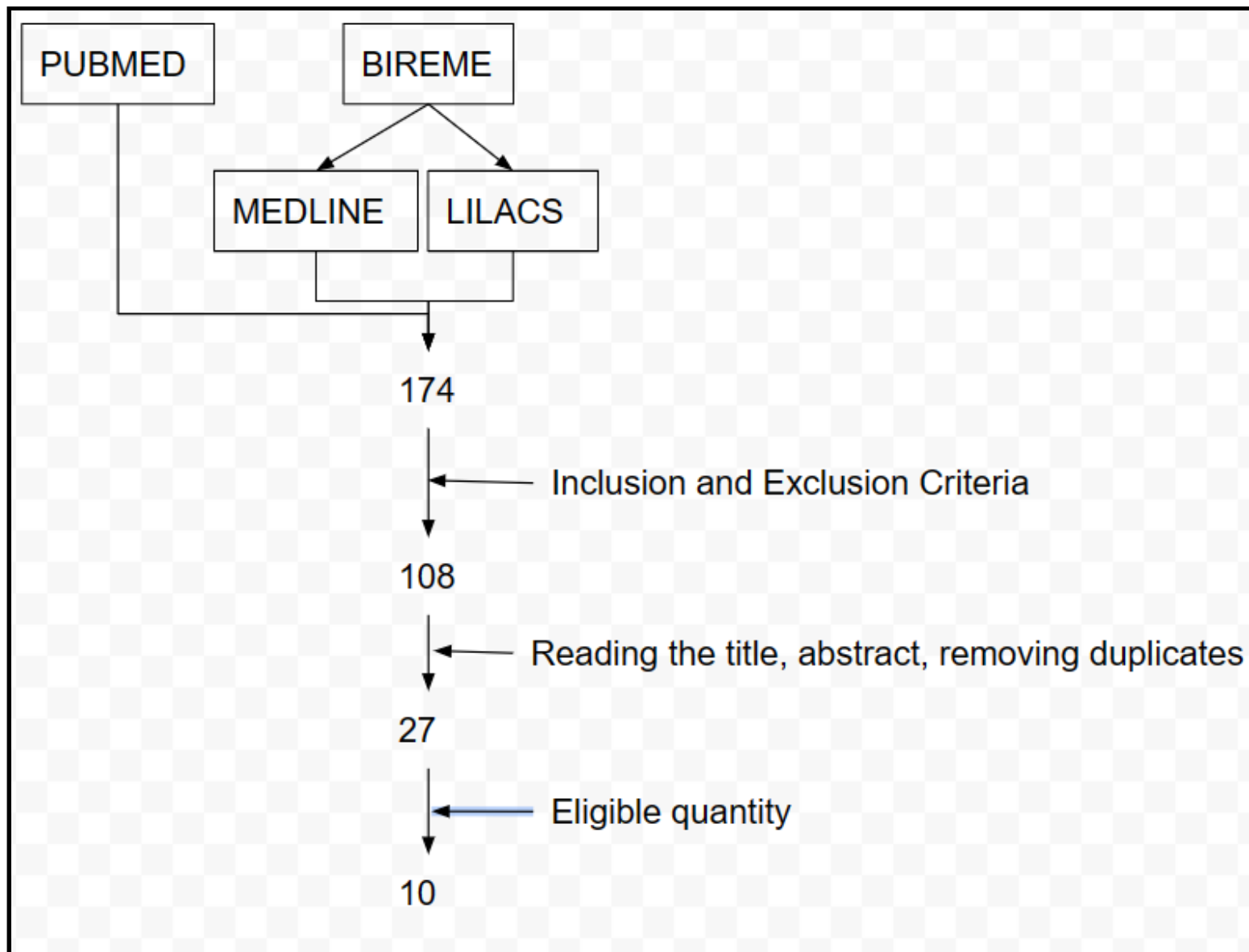


Figure 1: Demonstrates these methodological steps.

The spinal column plays a crucial role in maintaining body stability and ambulation function, while spinal column fractures (FCV) or injuries in this anatomical region can lead to significant morbidity and mortality.

Moreover, the COVID-19 pandemic has posed challenges in FCV management, as the postponement of elective surgeries raises ethical considerations, given that these surgeries are usually performed for

pain relief. Advanced age and overlapping chronic diseases have been associated with significantly increased chances of admission to intensive care units.[6]

Few studies have simultaneously addressed traumatic FCV and COVID-19, whereas ten observational studies were selected through a systematic review to analyze this relationship, summarized in **Table 1**.

Table 1: Observational Studies That Simultaneously Analyzed Spinal Fractures And Covid-19

Author	Sample Size*	Methodology	Age Range Included	Outcome Result
Sofia Battisti et al. (2021)	501	Case-Control	≥ 18 years	SCFs were not independently associated with short-term mortality in COVID-19 patients.
Lina Marengo-Hillebrand et al. (2019)	1	Case Series	≥ 18 years	Favorable outcome despite ICU hospitalization due to COVID-19
Jack Horan et al. (2021)	45	Retrospective Cross-Sectional	≥ 16 years	59 % reduction in spinal cord trauma rate
Javier M. Figueroa et al. (2021)	132**	Retrospective Cross-Sectional	Age not reported	Overall 62 % decline in spinal cord injuries during COVID-19 pandemic

Fareea Khaliq, Denesh Ratnasingam, and Michael Bush-Arnold et al. (2021)	1	Case Report	32 years	Importance of COVID-19 screening in hospitalized rehabilitation clinic patients
Lauren A. Wilson et al. (2020)	568,561	Retrospective Longitudinal	≥ 18 years	Thoracolumbar spine surgeries correspond to the highest cost and ICU admission requirement
Abolfazl Bagherifard et al. (2021)	1,244	Retrospective Longitudinal	≥ 17 years	Surgical treatment of lower limb fractures, not spinal fractures, was associated with higher COVID-19 infection rate
Raju Vaishya, Abhishek Vaish, and Ashok Kumar (2021)	133	Retrospective Longitudinal	NR	COVID-19 pandemic led to a reduction of more than 50% in spinal surgeries
Galih Indra Permana (2020)	1	Case Report	19 years	C2-C3 fracture with positive COVID-19 screening on admission, resulting in mortality before surgical intervention due to severe trauma
Achmad Jadi Didy Surachmana, Yanuarsoa, and Danar Lukman Akbarb (2021)	1	Case Report	24 years	Successful placement of pedicle screws at C7, T1, T2, and T3, laminectomy decompression at C7-T1, vacuum drain, and use of favipiravir for COVID-19 management

Note: *Sample size eligible for analysis in the present systematic review; CV-19: COVID-19; ICU: Intensive Care Unit; **Number of surgically treated cases; CV: Spinal Column; NR: Not reported.

It was observed that the diagnosis of FCV increased the risk of mortality in patients with CV-19 compared to a non-CV-19 group,^[7] with respective prevalences of 22.2 % vs. 19 % (p = 0.458). Additionally, 22 % of CV-19 patients had at least one detectable FCV on computed tomography. Furthermore, after adjusting for age, sex, and bone density, the mortality risk remained associated with FCV only in the non-COVID-19 group. Therefore, FCVs were not independently associated with short-term mortality (30 days) in patients with CV-19, although they paradoxically increased mortality risk in the non-CV-19 group.

In another case, an 80-year-old male with diffuse ^[8] idiopathic skeletal hyperostosis suffered an unstable traumatic spinal fracture after a fall from his height and was diagnosed with CV-19. He required re-operation due to wound dehiscence but had a favorable outcome, despite spending 13 days in the intensive care unit due to CV-19 complications (interstitial pneumonia, deep vein thrombosis, and hemothorax).

Furthermore, it was found that 1.7 % and 3.3 % of patients undergoing emergency and elective surgeries were positive for CV-19. ^[9] Among them, 8.4 % had associated fractures, such as posterior spinal fusion and spondylolisthesis. Moreover, it was inferred that lower limb fractures with limited ambulation, not spinal fractures, had a higher risk of acquiring CV-19 infections without an increased mortality risk than the general population.

The period preceding and during the pandemic was compared to analyze the seasonality of hospitalization rates due to CV-19. Comparing April and May 2019 (pre-pandemic) with the current pandemic period, ^[10] a 59 % reduction in referrals to the neurosurgery trauma

center for spinal cord injury was observed. Similar results were found in a study with an overall decline of 62 % in neurotraumas ^[11] and an 84 % reduction in traumatic neurosurgical cases, including spinal cord injuries when comparing the months of March and April from 2016 to 2020.

Likewise, in a tertiary care unit, the rates of spinal surgery were compared between the pre-pandemic and pandemic periods. ^[12] The number of procedures for decompression, discectomy, fusion, deformity correction, and fracture fixation decreased from 91 to 42, representing a 53.84 % reduction.

In a different study,^[13] a 19-year-old male involved in a motorcycle accident with a clinical picture of neurogenic shock and C2-C3 fracture was screened positive for CV-19 upon admission. Despite an unfavorable mortality outcome, the study emphasized the need for careful screening and treatment of this patient profile, requiring all medical teams to be prepared with the full and proper use of personal protective equipment (PPE).

The need for rehabilitation and screening of CV-19 patients confined to healthcare institutions has also been documented. In one study, a 32-year-old man with an acute traumatic spinal cord injury at the C4 ^[14] level was admitted to a rehabilitation unit and tested positive for CV-19, with the underlying clinical picture consisting only of persistent fever. This case highlights the importance of recognizing the disease to avoid delayed diagnosis and asymptomatic spread in rehabilitation clinics.

The impact of FCV combined with CV-19 was studied in a sample of 568,561 patients ^[6] indicated for elective spinal surgery in a CV-19 scenario. The retrospective analysis examined the type of spinal

fusion (cervical, thoracolumbar, or lumbar), the approach (anterior, posterior, or combined), and the number of fused vertebrae. During the CV-19 pandemic, thoracolumbar fusions had the highest resource utilization, followed by thoracic and lumbar fusions. Anterior discectomies had lower costs. Thoracolumbar fusions had a 19.8 % ventilation requirement and 56.8 % blood transfusion requirement, while cervical discectomies and anterior fusions had only a 1 % ventilation requirement and < 1 % blood transfusion requirement.

In another context, the successful use of favipiravir was reported in a 24-year-old male patient who suffered a fall from a height of approximately 10 meters, resulting in fractures from C7/T1-T3 and a clinical picture of hypoesthesia below the injury level, as well as motor-sensory dysfunction in both lower limbs. [15] He underwent surgical treatment with pedicle screw placement at C7/T1-T3, laminectomy at C7-T1 for decompression, and vacuum-assisted closure in the surgical wound.

The lack of methodological uniformity among studies and the need for more research with representative samples hinder the creation of

evidence-based recommendations for the clinical management of FCV in the context of CV-19.

Nevertheless, a significant decrease in elective surgeries, even in major centers, was noted due to the complexities imposed by the COVID-19 pandemic. On the other hand, emergency surgeries require specific considerations. A dedicated operating room for suspected or confirmed CV-19 patients is an acceptable strategy. Additionally, the appropriate use of personal protective equipment is crucial, regardless of the elective or emergency nature of the procedure. Ultimately, frequent testing of the medical team to prevent transmission to the patient and avoid comorbidity for the patient may be a suitable tactic to prevent unfortunate CV-19 contagion events since infected professionals can be placed in quarantine, even if they are asymptomatic.

Longitudinal studies with representative samples aiming to analyze FCV simultaneously with CV-19 are strongly encouraged based on the findings of this systematic review.

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