

# The Novel Corona Virus COVID-19 and Spinal Surgery Practice: Review and Updates

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## ABSTRACT

**Background Data:** In March 2020, WHO declared COVID-19 a pandemic and called for international effort to manage the disease. This pandemic has had many adverse effects on the globe. Spinal surgery and surgeons have dealt extensively with this pandemic.

**Purpose:** To review the available data of COVID-19 and the recent status of spinal surgery.

**Study Design:** Literature review.

**Patients and Methods:** We reviewed the English literature for the most up-to-date available data of the COVID-19 and reported the current status of spinal surgery and surgeons during the pandemic and how they have been affected by and handled the pandemic.

**Results:** The COVID-19 pandemic resulted in the global reconstruction of the health care services of the spinal surgery. New guidelines and recommendations have been released by many health authorities during the pandemic to optimize the working conditions and make maximum use of the available resources; other guidelines are in progress depending on the altering nature of the disease. Maximizing the use of telemedicine and online education would decrease the spread of infection, continuing the health care and education. We have to continue this practice as the pandemic is expected to last for many months and to learn lessons from the current and previous pandemics to avoid another pandemic wave.

**Conclusion:** Spinal surgeons have a crucial role as health care providers and society advocates. Optimizing the conditions for health care providers and patients in theatres, clinics, and inpatients would lessen the risk of spreading infections. Telemedicine and online education are playing a significant role during the pandemic. (2020ESJ134)

**Keywords:** COVID-19 virus; Pandemic; Spinal surgery; SARS-COV-2.

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## INTRODUCTION

The world has been exposed to many outbreaks of infectious diseases through the last decade, including SARS-CoV (Severe Acute Respiratory Syndrome) in February 2003, MERS-CoV (Middle East Respiratory Syndrome) in September 2012, and recently the novel coronavirus (COVID-19) epidemic reported in Wuhan city in China in December 2019.<sup>37,41</sup> The disease spread from Wuhan to most cities worldwide, as a result WHO (World Health Organization) has declared a global pandemic in March 2020 calling for global solidarity and effort to control the disease. Since then, the disease has spread in different continents across the globe while the patients' population is steadily growing.<sup>38</sup> The total number of diseased persons is now coming to 5,204,508 with 337,687 deaths distributed among every country in the world. In Egypt, while preparing this review, the number of patients, according to the Ministry of Health records, is around 16 513 with 735 deaths, and the number is increasing.<sup>37</sup>

The Health Care Authority has put the country on lockdown as a prophylactic measure in order to limit the rapid spread of the disease and reduce the number of diseased persons, allowing the limited available resources to provide reasonable health care to COVID-19 patients. Other measures included reduction in the nonemergency services with subsequent reduction of Outpatient Clinic Department (OPD) and elective surgeries including the spinal surgery to prevent the depletion of health care resources. This pandemic has a wide range of socioeconomic consequences such as severe pressure on the medical health service and suppliers and loss of the lives and sickness.

In this review, we will present an overview or summary of all the data available about the novel coronavirus "SARS-CoV-2" including the clinical presentations, infection transmission, and available therapy and how to optimize the workflow of the spinal surgery for either patients or spinal surgeons. As a relatively new disorder, the

data represent the current management protocol at the time of presenting this paper and may be changed according to future updates.

## VIROLOGY

Severe acute respiratory syndrome, coronavirus 2 "SARS-CoV-2", causing the recent pandemic "coronavirus disease 2019 or COVID-19" in 2020, is a member of the large family of zoonotic viruses termed coronaviruses (CoVs).<sup>17</sup> The current horrible medical situation "pandemic" that the world is living through is caused by this virus. This viral family mainly causes diseases related to the respiratory system in humans, ranging from simple common cold up to rare and severe forms of severe acute respiratory syndrome. SARS was detected for the first time in 2003 and, another form of this family, the Middle East Respiratory Syndrome "MERS" variant was detected in 2012.<sup>30</sup> Both SARS and MERS are hostile in nature and have higher mortality rates in the CoVs family. CoVs are divided into 4 subtypes: alpha, beta, gamma, and delta. The known subtypes to humans are situated in alpha and beta subtypes. Moreover, they are capable of infecting both humans and animals "that is why they are termed zoonotic". Interestingly, the source of SARS-Cov-2, which is currently spreading worldwide, was not yet found. It is vital to know the source of any virus so that the origin of the outbreak can be traced. To detect the source of any virus, it is mandatory to isolate the virus first and study its genetic map. SARS-Cov-2 genetic structure is similar to those viruses that were isolated in *Rhinolophus* genus of bats. It is closely related to the SARS virus detected early in 2003. However, the specific animal source is yet to be identified. SARS-CoV-2 is highly adapted to human cell receptors, as a result it easily infects human cells. SARS-CoV-2 was initially detected in late December 2019. Cases were directly linked to the Wholesale Seafood Market in Wuhan City, China, where wild animals are sold such as bats.<sup>17,30,32</sup>

Transmission of SARS-CoV-2 is either directly through respiratory droplets from coughing, sneezing, and person-to-person direct contact or indirectly airborne infection and contact with contaminated surface.<sup>4,39</sup>

## CLINICAL PRESENTATION

Infections without clear COVID-19 manifestations were documented widely. However, their exact cause or specific numbers are not yet identified. For example, a cruise ship with COVID-19 outbreak had all onboard members screened, yet only 17% were asymptomatic and tested positive.<sup>27</sup> COVID-19 incubation period was found to be 14 days; however, the majority of patients started developing symptoms in 4-5 days.<sup>23</sup> Symptoms were put on a scale depending on the severity of the disease: mild (81%), severe (14%), and critical (5%).<sup>21</sup> The total mortality rate is 2.3% until now. The first clinical picture of COVID-19 infection was found to be one or more of the following, but no specific clinical presentation model is yet published: fever (99%), fatigue (70%), dry cough (59%), anorexia (40%), myalgias (35%), dyspnoea (31%), and productive cough (27%). Acute Respiratory Distress Syndrome (ARDS) is a major complication of COVID-19. It occurs in nearly 20% of cases and usually requires mechanical ventilation.<sup>36</sup> Other nonrespiratory complications were found to be linked to COVID-19, such as arrhythmias, acute cardiac injury, shock, and multiple organ failure.<sup>18,6</sup> A cohort study denoted that fever is not a major finding in the enrolled patients and only 20% had low-grade fever.<sup>18</sup> Anosmia or cacosmia was reported in few published studies and was not highlighted earlier.<sup>15</sup> (Table 1).

## RISK FACTORS

Risk factors for severe stage of the disease were found in high-risk patients with cardiovascular

diseases, diabetes mellitus, hypertension, cancer, chronic lung diseases, chronic kidney disease, obesity, and smoking.<sup>41,21</sup> Age was found to be risk factor of the infection with COVID-19, as it was found that median age of infection was 49 to 56 years.<sup>36</sup> Conditions with suppressed immunity such as liver diseases and HIV were included by Centres for Disease Control and Prevention "CDC", but there is no solid data until now.<sup>5</sup> A study from Italy reporting 355 COVID-19 mortalities with mean age  $79.5 \pm 8.1$  and 70% males. The mean number of preexisting diseases (comorbidity) was  $2.7 \pm 1.6$ , and, overall, 0.8% suffered from no underlying disease; 25%, one disease; 25.6%, 2 diseases; and 48.5%,  $\geq 3$  diseases.<sup>29</sup>

## DIAGNOSIS AND TREATMENT

Clinically suspected cases with or without history of exposure must be submitted to further laboratory tests and diagnostic images. Laboratory findings among confirmed COVID-19 cases were the following: lymphopenia, elevated aminotransaminase levels, elevated inflammatory markers, and elevated dehydrogenase levels. Chest X-ray showed no abnormal changes in most cases with few cases showing lung consolidations. Chest CT scan was more sensitive in detecting pulmonary changes such as ground glass opacifications with or without consolidations.<sup>33</sup> Every patient with new onset fever or upper or lower respiratory tract disease during the pandemic should be suspected for COVID-19. Patients with confirmed or suspected contact with a positive COVID-19 patient should be highly suspected of having infection. Confirming diagnosis is made by taking specimens from nasopharynx and oropharynx detecting COVID-19 RNA by nucleic acid amplification tests (NAATs) by reverse transcription polymerase chain reaction (RT-PCR).<sup>23</sup> As some swabs may be false negative, a repeated swab after 24-48 hours is mandatory. Serology tests can detect COVID-19 antibodies in blood samples, but the

**Table 1.** Data summary of COVID-19†.

Topic	Key facts
What is COVID-19?	Coronavirus originating from Wuhan, People's Republic of China, in December 2019 Originated from an animal source
How is it transmitted?	Can be transmitted directly (via droplets through sneezing or coughing) or indirectly (via contaminated surfaces) Can be transmitted by asymptomatic and presymptomatic persons Every infected person can be expected to spread disease to approximately 2 more people
Global pandemic	Global pandemic declared on March 11, 2020 As of March 23, 2020: 332,930 infected and 14,510 dead
Clinical presentation and diagnosis	Most common symptoms are fever and cough Symptoms present, on average, 5.1 days after infection, with 97.5% of patients presenting by 11.5 days 88.2% have abnormalities on chest radiograph Diagnosed using real-time RT-PCR
Survival, serious illness, hospitalization	Mortality rate estimates are approximately 4.4% in confirmed cases Comorbidities most likely linked to mortality are cardiovascular disease and diabetes 20% of cases are severe or critical
Risk mitigation	Good hygiene (hand washing), social distancing, and isolation are the most recommended mitigation measures Public and private closures are recommended in specific cases
Race for a vaccine	At least 4 phase I trials evaluating a vaccine have been initiated
Lessons from history	Social distancing seems effective in flattening the curve from evidence of the 1918 influenza pandemic A second wave was seen in both the SARS and 1918 influenza epidemics following relaxation of containment methods
Managing expectations	Pandemic expected to last well into 2020
Guiding surgeons	Assessing the need of planned elective or nonemergency surgical procedures Transferring surgical procedures to outpatient settings, when possible Minimizing the use of essential items Planning for potential surge of critical care patients Creating multiple teams that are completely insulated from one another Assessing the possibility of virtually or remotely completing mandatory meetings or patient examinations Implementing specific infection control protocols when a surgical procedure for a patient with suspected or confirmed COVID-19 is necessary
Resources	US CDC, WHO

†Adopted from Vannabouathong et al.<sup>35</sup>

sensitivity and specificity of these tests are still uncertain.<sup>2</sup> Definitive treatment for confirmed cases of COVID-19 is not yet confirmed, but clinical trials are being conducted to reach an agent that could work against the virus infection. Currently, there are 783 interventional studies for COVID-19 therapy on ClinicalTrials database. Early reports from France and China revealed the role of chloroquine/hydroxychloroquine

and azithromycin in severe symptoms cases;<sup>10,13</sup> however, the FDA formally recommended not using these drugs for safety elements.<sup>11</sup> On May 01, 2020, the FDA issued an emergency use authorization for a drug called Remdesivir, a broad-spectrum antiviral medication, for treating suspected or laboratory-confirmed cases with COVID-19.<sup>12</sup> Meanwhile, pharmaceutical companies are working on developing an active

vaccine to prevent future cases. Several phase I trials are registered on ClinicalTrials.gov, although the assessment of safety and efficacy and the manufacturing might take months to years to be available. The availability of definitive therapy, early detection, isolation, and supportive therapy are the only line of treatment.

## SPINAL SURGERY PRACTICE

The profile of the spinal surgery practice and health priorities have changed dramatically during the current COVID-19 pandemic. Lockdown status enforced by local authorities in most countries, cancellation of elective surgeries, transforming some general hospitals into quarantine zones, and increase in the telemedicine healthcare had an impact on the pattern of the spinal surgery practice. These measures resulted in decrease of the number of trauma surgeries, delay in elective surgeries, transferring surgeons to internal medicine departments and Intensive Care Units (ICUs). All these measures and emergent issues worked together to achieve optimize usage of the available resources, prevent the rapid depletion of limited available health care resources, decrease the spread of the infection, and flatten the curve of the pandemic. The main purpose of urgent spinal surgery is to prevent or reduce neurological impairment. During the pandemic and in an attempt to minimize the consumption of health care resources, many international official health care authorities have published clinical guidelines and recommendations to offer a framework for surgical triage.<sup>16,28,35</sup> Additionally, many health care systems<sup>3,14,19</sup> have developed their own protocol and new guidelines for stratifying surgical procedures into emergent, urgent, and elective procedures to facilitate the performance and achieve the best usage of the available local health care resources (Table 2).

We are learning in spine surgery that many aspects of what we do can be accomplished via telehealth. Models to compensate surgeons and hospitals for the effective use of telehealth would be a positive aspect of this pandemic and providing opportunities for new learning. Other positive aspects of this pandemic are maximizing the utilization of web-based meeting and conference platforms and remote learning opportunities and courses.<sup>14</sup> Residency and fellowship programs have to consider novel way of learning. Many programs have already transitioned all of their weekly conference activities into online virtual spaces.

## SPINAL SURGEONS' ROLE

Spinal surgeons, as a part of the health care team, have been responded to the emergent hospital regulations. With their variable health status and ages, spinal surgeons are still treating urgent spinal conditions and exposed to COVID-19 infection. Cancellation of elective surgery in order to preserve hospitals' resources reduced the workflow dramatically. This would help in preserving hospitals' resources, including health care providers themselves, inpatients, ICU beds and ventilators, and PPEs, and decreasing direct contact infections. The number of attendees is reduced to the minimum in outpatient clinics and these clinics now use telemedicine in order to reduce the risk of spreading the infection. This supports the 'Stay-at-Home' policy implanted by the health authority and limits the risk of spreading the infection. As a result of reducing their workflow, many spinal surgeons have been asked to share in the medical patient care or the ICU service and to be on the front lines in the battle against COVID-19. As the pandemic subsides, the capacity for providing health care has to be increased to accommodate the large numbers of the postponed procedures.

**Table 2.** The North American Spine Society guidance to spinal health care providers<sup>†</sup>.

Category	Clinical considerations	Recommendations
Emergent	<ul style="list-style-type: none"> <li>Progressive or severe neurologic deficit due to neurologic compression from any cause (e.g., infection, tumor, fracture, and disc herniation)</li> <li>Spinal instability at risk of causing neurologic injury from any cause (e.g., fracture, tumor, and infection)</li> <li>Epidural abscess requiring surgical decompression</li> <li>Postoperative wound infection.</li> </ul>	Do not postpone the procedure/treatment
Urgent	<ul style="list-style-type: none"> <li>Cervical or thoracic myelopathy due to spinal stenosis, with recent progression</li> <li>Spinal infection (e.g., discitis, osteomyelitis, and epidural abscess) that fails to respond to medical management</li> <li>Persistent significant neurologic deficit due to neurologic compression with or without deformity (distinguished from “severe neurologic deficit” that is listed under emergent)</li> <li>Spinal conditions causing intractable pain that result in ED presentation, severe functional limitations, and/or excessive opioid use despite nonprocedural attempts at management (e.g., painful disc herniation, painful fracture, and progressive fracture related deformity).</li> </ul>	Proceed with procedure/treatment if the local situation and resources allow (see above)
Elective	<ul style="list-style-type: none"> <li>Spinal conditions where pain and dysfunction can be reasonably managed without procedural intervention during the crisis (e.g., chronic conditions, degenerative spinal disorders such as degenerative disc disease, some disc herniations, and spinal stenosis or spondylolisthesis without significant neurologic deficit)</li> <li>Scoliosis and/or kyphosis correction</li> <li>Symptomatic hardware or pseudoarthrosis.</li> </ul>	Consider postponing the procedure/treatment

<sup>†</sup>Adopted from the North American Spine Society.<sup>3</sup>

## THEATRE MANAGEMENT

The whole surgical process during the COVID-19 pandemic changed dramatically to ensure the safety of both the healthcare providers and the patients. Postponing elective surgeries until proper management of the pandemic was structured and if the condition persisted, elective surgeries for the COVID-19 positive patients should be postponed until infection is cleared.<sup>22</sup>

In various spinal procedures, we use drills, hammers, burrs, osteotomes, and so forth; consequently, these can splash virus onto the ceiling, other metals, and surrounding surfaces of the theatre. The SARS-CoV-2 can withstand living on these surfaces for 2-3 days.<sup>8</sup> Therefore, any surgery during the following 2 days will expose all attendants to the virus sucked by the fans and

blown again through the AC or ventilator system. The viral load here is very severe compared to touching an ordinary button used in our daily lives and then touching our eyes or noses.<sup>25</sup> This load could be deadly due to cytokines storm, which is a specific immune response in which the body's own defences overreact, causing inflammation and wreaking havoc in the lungs.<sup>26</sup> Special precautions should be taken prior to planned surgery on patients, healthcare providers, and the hospital's operating theatres and recovery rooms. Patients should be screened for the SARS-CoV-2, and they should be surveyed for symptoms related to the infection in the last 2 weeks. The American Society of Anaesthesiologist (ASA) has recommended that patients undergoing nonemergency surgeries in areas with high prevalence of COVID-19 infections should all be tested for SARS-CoV-2.<sup>1</sup> Consequently, it is better

to test for COVID-19 prior to surgeries; however, if it is not feasible in some countries, all measures should be taken for all patients as they are considered potentially infected with COVID-19. Commonly, operating rooms (ORs) are designed to be positively pressured; however, it was found that negatively pressured rooms are favourable for controlling the infection. Positively pressured rooms should have high-rate air exchange cycle rates >25 cycles/hour.<sup>34</sup> The number of the attending personnel should be kept at minimal levels. Training residents and staff should be kept in a backstage area that is isolated from the OR. Prior to patient arrival to OR, all the required drugs, instruments, and equipment should be brought to the room to minimize movement outside the room during surgery. All equipment inside the room should be covered with disposable sheets. Sharp instruments should be managed carefully and disposed in safety containers that are changed after each case. Hygienic measures during the operation should be kept at their maximum levels.<sup>34,40</sup> OR doors should be closed during the operation by minimizing going through it unless it is highly necessary. After finishing surgeries, ORs are sanitized immediately after the patient is discharged. Chloro-derivative solutions are found to be disinfecting SARS-CoV-2. All equipment's surfaces should be disinfected; disposal items should be safely disposed in safety disposal containers.<sup>20,40</sup>

Operating room personnel should follow strict protocol during COVID-19 pandemic. Any healthcare provider in contact with COVID-19 patients should be in fully personal protective equipment "PPE". For those working closely with patients, for example, during intubation, a filtering facepiece (FFP3) mask is highly recommended along with face shield.<sup>36</sup> The safe protocol is following proper steps starting from receiving patient in the OR and until discharge to the postoperative recovery centre. Patients should follow a known path that is regularly sanitized up to the OR. During intubation, only the anaesthetic

team should be involved in the OR alone until finishing up and the surgical team should be called for the procedure. Patients should receive antiemetics and analgesics during the extubating to ease the extubating process.<sup>7</sup> Patients should follow a known path to the recovery rooms along with specific team for the transfer.

PPE removal requires certain instruction technique because the wearer of the PPE could catch infection during unsafe removal. The first crucial part of PPE is the gloves, which they are highly infective. First to remove the first pair of gloves followed by Suit, shoe covers, head caps; subsequently, safely removing masks and face masks. The second pair of gloves is the last part to be removed.<sup>9</sup>

## CLINIC MANAGEMENT

The aim of the healthcare providers in the management of the OPD is to minimize and prevent exposure of COVID-19 positive patients to other healthcare providers and other patients. OPDs should work in close relation with emergency departments for a better-coordinated work. In every outpatient program, a respiratory clinic should be far from the other clinics or in an ambulatory form; therefore, patients with chest conditions are not examined in proximity to other patients.<sup>31</sup>

OPDs should apply the same concepts applied with the COVID-19 patients. An initial telephone triage is done first to assess the severity of the attendance to OPD. Telehealth system is another option to allow patients to address their medical concerns from their homes and limit the exposure between physicians and patients. However, the idea of not physically assessing the patients is still not well established. For those attending to the OPDs, several precautions should be followed such as keeping a safe distance between individuals in waiting areas, using the PPEs for healthcare stuff, maintaining proper sterilization and hygienic methods, and taking the time to sanitize

clinics between patients. The use of disposable instruments at the OPDs is highly suggestive.<sup>24</sup>

## CONCLUSION

The COVID-19 pandemic resulted in the global reconstruction of the health care services of the spinal surgery. New guidelines and recommendations have been released by many health authorities during the pandemic to optimize the working conditions and make maximum use of the available resources and others are in progress depending on the altering nature of the disease. Spinal surgeons have a crucial role in the health care provider and the society advocate. Optimizing the conditions for the health care providers and patients in theatres, clinics, and inpatients would lessen the risk of spreading infections. Maximizing the use of telemedicine and online education would decrease the spread of infection, continuing health care and education. We must this practice as the pandemic is expected to last for many months and have to learn lessons from the current and previous pandemics to avoid another pandemic wave.

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## الملخص العربي

### فيروس كورونا الجديد COVID-19 وجراحة العمود الفقري: مراجعة وتحديثات

**البيانات الخلفية:** في مارس ٢٠٢٠ أعلنت منظمة الصحة العالمية مرض كوفيد-١٩ انه وباء عالمي و طلبت من العالم التضامن لمواجهة هذا المرض. هذا الوباء له تأثير قوي علي العالم اجمع. و كان له تأثير خاص علي جراحات و جراحيين العمود الفقري.

**الغرض:** مراجعة المعلومات و البيانات المتاحة لمرضي كوفيد-١٩ و الحالة العامة لجراحات العمود الفقري في ظل هذا الوباء.

### تصميم الدراسة: مراجعة سرديه

**الطرق:** تمت مراجعة المنشورات العلمية الإنجليزية الحديثة التي تم نشرها التي لها علاقة مباشرة بين مرض كوفيد-١٩ و الحالة العامة لجراحات و جراحيين العمود الفقري و كيف تم التأثير علي ممارسة جراحات العمود الفقري في ظل هذا الوباء.

**النتائج:** لقد حدث تغيير في ممارسات جراحات العمود الفقري بعمر جائحة مرض كوفيد-١٩ ولأولويات تقديم الخدمة الصحية. سببها الحظر الذي تم فرضه من الحكومات، وقف نشاط الجراحات الغير طارئة وتحويل بعض المستشفيات الي مستشفيات للحجر الصحي واستخدام الخدمة الصحية بالاتصال المرئية. كل هذا له تأثير مباشر على مباشرة جراحات العمود الفقري. من بعض صور هذا التأثير هو تقليل عمل الجراحات لحوادث العمود الفقري ووقف نشاط بعض الجراحات الغير طارئة وتحويل بعض جراحيين العمود الفقري للعمل بمستشفيات الحجر الصحي والعناية المركزة. كل هذه التغييرات هدفها الاستخدام الأمثل للموارد الصحية المحدودة والحد من انتشار العدوي. في علم جراحات العمود الفقري ان الجراحات الطارئة تكون فقط لمنع حدوث ضعف عصبي للمريض وهذه هي الحالات الطارئة التي لا يمكن ان تؤجل بعض المنظمات البحثية الخاصة بجراحات العمود الفقري قامت بنشر اهداف محدده للممارسة الصحية لجراحة العمود الفقري اثناء وباء الكوفيد-١٩ وقامت بتقسيم الجراحات الي جراحات غير طارئة وطارئة وعاجلة جدا وهذا لبذل أقصى درجات الحفاظ على الموارد الطبية المحدودة.

**الاستنتاج:** تسبب وباء كوفيد-١٩ في تغيير كامل للبيئة المسؤولة عن تنظيم العمل بجراحات العمود الفقري. تم عمل إرشادات ونظم من مسؤولي الصحة في كل البلاد لتنظيم هذا العمل لحماية مقدم الخدمة الصحية والمرضي والحد من انتشار الوباء والحفاظ على الموارد الطبية المحدودة للبلاد. لجراحيين العمود الفقري دور هام في مواجهة وباء كوفيد-١٩ وهو تنظيم العمل لعلاج امراض وجراحات العمود الفقري في المستشفيات والعيادات والعمليات والاستخدام الأمثل للخدمة الصحية وذلك للحد من اهدار الموارد الصحية المحدودة. دورهم في تقديم الخدمة الصحية المرئية وذلك للحفاظ على مبدئ البقاء في المنزل للمرضي وتحديد من يحتاج للحضور للفحص من عدمه. في النهاية يجب علينا التعلم من هذا الوباء والأوبئة السابقة وذلك للحد من انتشارها والحماية من تكرار هذه الكارثة مرة اخرى.