Elective Orthopaedic Surgery During COVID-19

A Safe Way to Get Back on Track

Claudio Zorzi, MD, Gianluca Piovan, MD, Daniele Screpis, MD, Simone Natali, MD, Stefania Marocco, MD, and Venanzio Iacono, MD

Investigation performed at IRCCS Ospedale Sacro Cuore Don Calabria, Negrar di Valpolicella, Italy

Background: The novel coronavirus disease 2019 (COVID-19) pandemic, caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), has greatly changed our way of living and working. We have developed a method to treat urgent patients in a safe way, and we applied the same protocol to resume elective surgical procedures.

Methods: We reorganized the system and the management of our orthopaedic department to perform elective surgical procedures in a safe way. During the COVID-19 lockdown, 614 patients underwent elective orthopaedic procedures.

Results: No major postoperative complications were recorded. None of the orthopaedic surgeons, health-care personnel, or hospitalized patients was infected in this period of activity.

Conclusions: During COVID-19, it is possible to perform elective surgical procedures in a safe way.

One hundred years ago, a world already exhausted by war was hit by the H1N1 virus, which caused the famous Spanish influenza. This affected more than 500 million people and resulted in tens of millions of deaths. At the time, the movement of troops, who had lived in unhygienic environments and therefore were more prone to infection, led to spread of the virus. Today, globalization and ease of movement have laid the foundations for the current novel coronavirus disease 2019 (COVID-19) pandemic, caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2). Despite the technological and scientific advances in this century, the severity and spread of coronavirus have greatly changed our home and work lives. The invisibility of the threat and our lack of understanding of the virus as it changes unpredictably have caught the world unprepared. The first response to the emergency was a lockdown and redistribution of resources.

The virus has been identified as SARS-CoV-2 and bears similarities to the virus that caused the SARS (severe acute respiratory syndrome) epidemic in 2002 to 2003. The main transmission route is through direct contact with infected patients. In particular, the virus is spread through respiratory droplets emitted by coughing or sneezing. The incubation period is between 2 and 12 days. Even during incubation, patients can transmit the virus. Another important reason for the rate of transmission is the fact that asymptomatic, pre-symptomatic, or mildly symptomatic patients can still be contagious.

At first, doctors were misled because of how infectious the virus is, the length of the incubation period, and the heterogeneity of clinical symptoms (fever, cough, fatigue, slight dyspnea, sore throat, headache, conjunctivitis, and gastrointestinal issues) and asymptomatic infections. These highly nonspecific symptoms were mistaken for normal influenza symptoms, making it difficult to identify patients with COVID-19 and increasing the spread of the virus.

As orthopaedic surgeons, we are not on the front line in the battle against the virus. Both traumatology and elective treatments, although not life-saving, are fundamental for people to maintain dignity, quality of life, and the ability to perform chosen activities. In the initial acute phase of this pandemic, resources were diverted to deal with an emergency that has not been faced by our generation of doctors and all non-urgent treatments were suspended. Once the infection is under control, it will be essential to also propose patient management guidelines for traumatological and elective treatments in the short and long terms. To date, an effective therapy or vaccine for SARS-CoV-2 is not yet available, so there will be a phase of coexistence with the virus.

At the beginning of the pandemic, we reorganized the hospital organization and the management of the orthopaedic...
department to deal with urgent attention for patients coming from the emergency room. Observing the results, we also use this management model for non-deferrable elective surgical procedures.

The most important goals are protection and safety of all health-care staff, identification of patients with COVID-19 and asymptomatic carriers of SARS-CoV-2, preventing the hospital from being a possible site of transmission, and maintaining a COVID-19-negative clinical path.

Materials and Methods

The SARS-CoV-2 real-time polymerase chain reaction (RT-PCR) test is used as a diagnostic tool, collecting upper respiratory samples via nasopharyngeal and oropharyngeal swabs. We use swab tests because they are easy to perform and are highly accurate. The genes tested with the swab varied during the time period considered (N gene, E gene, and rTrP gene). Sensitivity and specificity values are still being evaluated and vary according to the gene considered. Overall, the sensitivity is 66% to 90%\(^{10}\). Collecting a sample with a nasopharyngeal swab is performed by dedicated and specialized personnel.

The procedures implemented at our institute to manage a safe reopening and deal with the coexistence phase with the virus will be described below.

During the COVID-19 lockdown, from April 11 to June 2, 614 patients underwent an elective orthopaedic surgical procedure. The type of surgical procedure performed and patient characteristics are shown in Table I.

Patient selection has been of great importance during the COVID-19 pandemic. In the initial critical phase, patient selection was extremely strict and only non-deferrable procedures were performed to avoid diverting resources from the COVID-19 department and intensive care unit (ICU). In our hospital, there is an ICU dedicated to patients with COVID-19.

As the spread of the infection slowed and screening protocols for patients were created, elective activity was progressively also started for non-urgent cases. We chose to treat only cases that could rapidly worsen, compromising the prognosis for patients with intense pain or severe dysfunction with the potential to severely reduce the quality of life. Patients suitable for a surgical procedure had to be in good clinical condition to reduce the risk of complications that could require ICU admission or could prolong the hospital stay. Selection was performed on the basis of a score of 1 or 2 on the American Society of Anesthesiologists (ASA) classification.

Protection and Safety of All Health-Care Staff

Health workers wear FFP1 (filtering facepiece 1) masks if they are working without close contact with patients; they wear FFP2 masks if they are working with close contact with patients. All health-care workers were tested with a swab test at the start of the lockdown in March 2020, and the test was then repeated approximately every 14 days.

In the event that a health-care worker has symptoms, he or she immediately undergoes nasopharyngeal and oropharyngeal swabs and is sent home to wait for the result. The waiting time for the result is 6 to 24 hours. If the result is positive, all staff who have been in contact with the individual with a positive test undergo the swab test to exclude a possible contagion.

Access to the Hospital

Access to the hospital is only granted to patients with a debilitating pathology, through a limited number of openings in order to avoid gatherings. The patients’ entrance is supervised by health-care personnel, who check that the patients’ nose and mouth are suitably covered (if they are not, a mask is provided to the patients, who must be assisted to ensure that they wear it correctly) and also check body temperature and positive

| Types of Surgical Procedures | No. of Patients | Age* (yr) | Sex |
|-----------------------------|----------------|-----------|-----|
| Knee prosthesis             | 125            | 64.6 ± 11.4 | 64  | 61 |
| Hip prosthesis              | 75             | 65.8 ± 10.9 | 43  | 32 |
| Knee arthroscopy            | 81             | 45.1 ± 14.0 | 52  | 29 |
| Foot and ankle surgery      | 64             | 49.3 ± 19.3 | 23  | 41 |
| Shoulder surgery            | 57             | 58.7 ± 9.9  | 18  | 39 |
| Knee prosthesis revision    | 19             | 71.2 ± 10.3 | 7   | 12 |
| Hip prosthesis revision     | 8              | 73.1 ± 13.4 | 3   | 5  |
| Removal of fixation devices | 31             | 38.5 ± 21.2 | 19  | 12 |
| Knee ligament reconstruction| 88             | 28.9 ± 11.2 | 62  | 26 |
| Other knee surgery          | 66             | 44.7 ± 16.2 | 36  | 30 |

*The values are given as the mean and the standard deviation.

| Types of Surgical Procedures | No. of Patients | Age* (yr) | Sex |
|-----------------------------|----------------|-----------|-----|
| Knee prosthesis             | 125            | 64.6 ± 11.4 | 64  | 61 |
| Hip prosthesis              | 75             | 65.8 ± 10.9 | 43  | 32 |
| Knee arthroscopy            | 81             | 45.1 ± 14.0 | 52  | 29 |
| Foot and ankle surgery      | 64             | 49.3 ± 19.3 | 23  | 41 |
| Shoulder surgery            | 57             | 58.7 ± 9.9  | 18  | 39 |
| Knee prosthesis revision    | 19             | 71.2 ± 10.3 | 7   | 12 |
| Hip prosthesis revision     | 8              | 73.1 ± 13.4 | 3   | 5  |
| Removal of fixation devices | 31             | 38.5 ± 21.2 | 19  | 12 |
| Knee ligament reconstruction| 88             | 28.9 ± 11.2 | 62  | 26 |
| Other knee surgery          | 66             | 44.7 ± 16.2 | 36  | 30 |

*The values are given as the mean and the standard deviation.
anamnesis by asking the patients if they recall having had cough, fever, and respiratory symptoms. In the presence of a body temperature of >37.5°C, the patient’s reason for entering the hospital must be assessed and discussed with the physician.

During the hospital stay, 1 caregiver is allowed to accompany minors; pregnant women; disabled, fragile, or non-self-sufficient patients; and patients with linguistic and cultural barriers. This caregiver will undergo a nasopharyngeal swab test before entering the ward.

A minimum distance of 1 m between people must be ensured in all spaces and rooms of the structures, especially in the common areas, which include waiting rooms, corridors, refreshment areas, bathrooms, and open outdoor waiting areas. The staff of each department or service must verify that this distance is respected. Access to the waiting room is regulated and is limited to the number of people who can occupy the seats identified as usable and reserved primarily for patients involved in the visit. In case of overcrowding, any accompanying persons must move away from the area as much as possible.

Dispensers of hydroalcoholic gel are positioned in strategic points of the building, to remind patients and health-care workers of the need to sanitize their hands frequently by washing them with soap and water or hydroalcoholic gel.

**Admission to the Hospital**

To plan an elective surgical procedure, a consultation with the patient is first performed by telephone by administrative office staff, who provide a telephone triage (possible presence of fever, cough, respiratory difficulty, possible contacts with patients with COVID-19); explain to the patient how to access the hospital (indications and precautionary measures, use of a mask, exceptions with regard to the presence of caregivers); and request the patient to self-quarantine at home in the 2 weeks prior to the procedure.

Before undergoing preoperative tests and clinical examinations, patients are scheduled for a SARS-CoV-2 RT-PCR test using a nasopharyngeal swab. The swab test is performed in a dedicated structure detached from the medical and surgical departments. The swab test is performed approximately 1 to 4 days before the surgical procedure, not exceeding the threshold of 6 days. When 6 days have passed, the swab test is repeated.

The result of the SARS-CoV-2 RT-PCR test must be checked by the ward staff before the patient is admitted to the hospital. In the event of a positive test, hospitalization is suspended, and the positive result must be promptly communicated to the patient and to the general practitioner. The patient is placed in quarantine and undergoes swab tests approximately every 7 to 10 days. The patient is considered suitable for a surgical procedure after 2 consecutive negative swabs.

If the SARS-CoV-2 RT-PCR test is negative, the patient is considered to be suitable for accessing the hospital and the orthopaedic ward. The patient is asked to sign a consent form declaring acceptance of voluntary quarantine before the surgical procedure (see Appendix). In any case, it is preferable to plan preoperative tests and clinical examinations the day before the surgical procedure to minimize contact with other people.

**Postoperative Rehabilitation**

Physiotherapy after hip and knee replacement is performed as usual, starting the day after the surgical procedure by the physiotherapists of the orthopaedic department in the department gym. If the clinical condition of the patient is good, the patient is transferred into the rehabilitation department between the fourth day and the seventh day following the surgical procedure.

A pathway for the admission of patients in the rehabilitation department was created. A nasopharyngeal swab is performed the day before transfer in order to keep both departments free from infection. If the swab test gives a positive result, the patient is transferred to the infectious disease department, where physiotherapy will be carried out in a safe way.

Rehabilitation takes about 14 days for patients with knee implants and 10 days for patients with hip implants. Physiotherapy is performed in dedicated rooms that meet all safety precautions. A rehabilitation protocol and indications for self-isolation at home are given to patients who undergo a same-day surgical procedure. A follow-up visit is scheduled for 2 weeks after the surgical procedure. A clinical evaluation is made, and possible complications are recorded. Access is regulated with the same procedures (telephone triage and swab tests are repeated).

**Results**

From April 11 to June 2, 622 patients were scheduled for an elective surgical procedure. Preoperative swab tests detected 8 asymptomatic patients, who had their surgical procedures postponed and later underwent the same protocol for clearance and surgery. We performed elective operations on 614 patients following COVID-19 protocols.

No major postoperative complications were recorded. No patients needed admission to the ICU. No complications were recorded at the follow-up.

Four patients needed blood transfusion after the surgical procedure (2 patients after total hip arthroplasty and 2 patients after total knee arthroplasty). Nineteen patients had fever of >37.5°C after the surgical procedure, and all cases were isolated because of possible COVID-19 and were treated with adequate antibiotic therapy. One patient had a pulmonary embolism after knee replacement. He was treated with low-molecular-weight heparin, without admission to the ICU.

None of the orthopaedic surgeons, health-care workers, and hospitalized patients was infected during this period of activity.

**Discussion**

In Italy, the lockdown was established on March 9 because of the rapid spread of the infection, particularly in the northern regions. In Veneto, our region, lockdown was progressively eased starting from the end of April through the month of May. In the first phase, during the month of March, our institution reorganized many departments and created a new ICU to manage the large number of infected patients who were due for treatment. A month afterwards, the infection in our region seemed under control, with the rate of new cases declining. On this basis, we developed this protocol for infection control in
the orthopaedic department. After the initial critical phase of the pandemic passed and the number of infections reduced throughout Italy, with a consequential reduction in pressure on health-care facilities, we restarted elective surgical procedures.

To our knowledge, there have been no results regarding management protocols for resuming orthopaedic elective surgical procedures during the COVID-19 pandemic in the literature. Several studies have proposed guidelines and protocols for a safe start, but none has offered scientific data[5–7].

Our patient management for urgent or emergency interventions has proven to be effective and safe. Therefore, we applied the same protocol to the elective procedures, maintaining this level of safety.

Although the swab is not the most sensitive diagnostic tool, combined with an accurate medical history, it has proved to be a tool capable of identifying subjects at risk. The approach adopted was able to avoid the nosocomial transmission of COVID-19. Treating patients who were undergoing an elective surgical procedure required ensuring that patients did not have COVID-19, to prevent both operative risks and the risk of COVID-19 transmission.

We can perform elective surgical procedures without letting our guard down, by being prepared for the next phase of coexistence with the virus and the possible new wave. Ensuring the continuation of protection and safety of all health-care workers, the identification of patients who are positive for SARS-CoV-2, and the creation of a COVID-19-negative clinical pathway is, is the basis for the safe management of orthopaedic patients.

Despite all of the preventive measures to avoid the risk of a SARS-CoV-2 infection during a surgical procedure and hospitalization, this risk cannot be entirely excluded. For that reason, this protocol can be used until the virus is defeated. It is important that the patients are informed about any risks and about all aspects of their care pathway that could change because of the current emergency health situation, and dedicated informed consent needs to be included in the medical record.

The future of the spread of coronavirus is uncertain, as other major pandemics in history had a second wave. However, the hope is to quickly get a vaccine and adequate treatment that can reduce the spread of the pandemic. The COVID-19 pandemic is not predictable, but because of our progressive easing of COVID-19 restrictions on public life, contact between individuals and the relative numbers of new cases will certainly increase. The Hippocratic Oath requires us to protect health and therefore avoid risky conditions. However, as orthopaedic surgeons, we have to guarantee that all surgical procedures will improve the quality of life of patients.

Our protocol, developed and activated during the initial acute phase of the COVID-19 pandemic, has demonstrated that it is possible to perform elective procedures in a safe way. This pathway is dynamic and could easily be modulated on the basis of the future evolution of the pandemic. Further studies on the clinical long-term evaluation of patients who underwent surgical procedures in this historical period would be interesting.

Appendix

Supporting material provided by the authors is posted with the online version of this article as a data supplement at jibs.org (http://links.lww.com/JBJSOA/A224).

Claudio Zorzi, MD1
Gianluca Piovano, MD1
Daniele Screpis, MD3
Simone Natali, MD1
Stefania Marocco, MD1
Venanzio Iacono, MD3

1Department of Orthopaedics (C.Z., G.P., D.S., S.N., and V.J.) and Department of Infectious-Tropical Diseases and Microbiology (S.M.), IRCCS Ospedale Sacro Cuore Don Calabria, Negrar di Valpolicella, Italy

Email address for D. Screpis: drscrepis@gmail.com

ORCID iD for G. Piovano: 0000-0003-0175-216X
ORCID iD for D. Screpis: 0000-0003-1381-4057
ORCID iD for S. Natali: 0000-0002-5123-8989
ORCID iD for S. Marocco: 0000-0002-3058-7530
ORCID iD for V. Iacono: 0000-0003-4461-5843

References

1. Taubenberger JK, Morens DA. 1918 influenza: the mother of all pandemics. Emerg Infect Dis. 2006 Jan;12(1):15-22.
2. Gilat R, Haunschled Ed, Tauro T, Cole BJ. Recommendation to optimize safety of elective surgical care while limiting the spread of COVID-19: primum non nocere. Arthrosc Sports Med Rehabil. 2020 Apr 27. [Epub ahead of print].
3. Vannabouathong C, Devji T, Ekhtiari S, Chang Y, Phillips SA, Zhu M, Chagla Z, Venanzio Iacono, MD1
4. Caï J, Sun W, Huang J, Gamber M, Wu J, He G. Indirect virus transmission in cluster of COVID-19 cases, Wenzhou, China. 2020. Emerg Infect Dis. 2020 Jun; 26(6):1343-5. Epub 2020 Jun 17.
5. Lauer SA, Grantz KH, Bi Q, Jones FK, Zheng Q, Meredith HR, Azman AS, Reich NG, Lessler J. The incubation period of coronavirus disease 2019 (COVID-19) from publicly reported confirmed cases: estimation and application. Ann Intern Med. 2020 May 5;172(9):577-82. Epub 2020 Mar 10.
6. Rothe C, Schunk M, Sothmann P, Bretzel G, Froeschli G, Wallauch C, Zimmer T, Thié V, Janke C, Guggemos W, Seilmaier M, Drosten C, Vollmar P, Zwirgmaier K, Zange S, Wolfel R, Hoelscher M. Transmission of 2019-nCoV infection from an asymptomatic contact in Germany, N Engl J Med. 2020 Mar 5;382(10):970-1. Epub 2020 Jan 30.
7. Yu P, Zhu J, Zhang Z, Han Y. A familial cluster of infection associated with the 2019 novel coronavirus in China: report of 11 cases including one child. J Med Virol. 2020 Mar;92(3):1173-6.
8. Bai Y, Yao L, Wei T, Tian F, Jin DY, Chen L, Wang M. Presumed asymptomatic carrier transmission of COVID-19. JAMA. 2020 Apr 14;323(14):1406-7.
9. Pascarella G, Striuma A, Pillegi C, Bruno F, Del Buono R, Costa F, Scarlata S, Agro FE. COVID-19 diagnosis and management: a comprehensive review. J Infect Dis. 2020 May 11;221(11):1757-61.
10. Bai Y, Yao L, Wei T, Tian F, Jin DY, Chen L, Wang M. Presumed asymptomatic carrier transmission of COVID-19. JAMA. 2020 Apr 14;323(14):1406-7.
11. Chow TT, Kwan A, Lin Z, Bai W. Conversion of operating theatre from positive to negative pressure environment. J Hosp Infect. 2006 Dec;64(4):371-8.
12. Mouton C, Hirschmann MT, Ollivier M, Seil R, Menetrey J. COVID-19 - ESSKA guidelines and recommendations for resuming elective surgery. J Exp Orthop. 2020 May 13;7(1):28.
13. Mummert A, Weiss H, Long LP, Amigó JM, Wan XF. A perspective on multiple waves of influenza pandemics. PLoS One. 2013 Apr 23;8(4):e60343.
14. Rodrigues-Pinto R, Sousa R, Oliveira A. Preparing to perform trauma and orthopaedic surgery on patients with COVID-19. J Bone Joint Surg Am. 2020 Jun 3;102(11):946-50.
15. Randelli PS, Compagnoni R. Management of orthopaedic and traumatology patients during the coronavirus disease (COVID-19) pandemic in northern Italy. Knee Surg Sports Traumatol Arthrosc. 2020 Jun;28(6):1683-9. Epub 2020 Apr 25.