

## Editorial

# Perioperative management recommendations to resume elective orthopaedic surgeries for post-COVID-19 “new normal”: Current vision of the Turkish Society of Orthopaedics and Traumatology

Kahraman Öztürk<sup>1</sup> , Ethem Ayhan Ünkar<sup>1</sup> , Ahmet Alperen Öztürk<sup>2</sup>

<sup>1</sup>Department of Hand Surgery, University of Health Sciences Baltalimanı Bone Diseases Training and Research Hospital, İstanbul, Turkey

<sup>2</sup>Department of Orthopaedics and Traumatology, University of Health Sciences Prof. Dr. Cemil Taşçıoğlu City Hospital, İstanbul, Turkey

## ARTICLE INFO

## Article history:

Submitted 25 May 2020

Accepted 28 May 2020

## ORCID iDs of the authors:

K.Ö. 0000-0002-7644-659X;

E.A.Ü. 0000-0002-0093-7886;

A.A.Ö. 0000-0002-1777-9060.

COVID-19 is a viral infection caused by the novel coronavirus, severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) (1). Since the start of the pandemic in December 2019 in China, guidelines issuing policies and action plans to deal with the COVID-19 pandemic were announced by the authorities of World Health Organization (WHO) (2). The arrival of the pandemic at Turkey and neighboring countries caused the authorities to implement strict regulations to prevent transmission of COVID-19 and to keep health institutions in sufficient capacity to meet the need. In March 2020, all elective surgical procedures were postponed to preclude the devastating consequences of COVID-19, both for the healthcare givers and for the patients and to reorganize the resources of the health centers for an endeavor to achieve sufficient health service for COVID-19 patients (3).

After the tense period of rapid increment in COVID-19 cases, necessary steps were taken for reorganizing the health system to deal with COVID-19. Considering orthopaedic perspective of surgical procedures during COVID-19 pandemic, by readjusting the stages from patient admission to postoperative care according to described preventive measures, acute traumatic injuries which could not be treated non-surgically, musculoskeletal malignancies and orthopaedic infection surgeries were proceeded (4, 5).

With the signs of decrement trend in diagnosed COVID-19 cases, which herald the normalization of the healthcare service is due to commence in a near future. Apparently, this period of transition from accustomed to “new normal era” practices will not be smooth and rapid with its own challenges to be confronted and prevailed.

Guidelines are needed in this transition period to roadmap the healthcare givers throughout the organization of the process of restarting elective surgical procedures and outpatient clinical services. As the COVID-19 crisis evolves on its own rapid tract, these guidelines must be revised according to emerging recent evidence (6, 7). Normalization plan should be commenced to overwhelm the load of deferments on the health care system (8, 9). Healthcare authorities’ official announcements addressing the restart of the elective surgical procedures must be awaited. Resuming of elective surgical procedures needs to be in an incremental way that considers the prevention of both the healthcare givers and the patients (10). In addition, increase in the numbers and complexity of the surgeries requires close monitoring of the incidence of COVID-19 patients, and must be in coherence with facility’s workforce and equipment reserves. Institutions must take into consideration the ability to cope with COVID-19 pandemic. Depending on the prevalence of COVID-19 in the region, institutions should

## Corresponding Author:

Ethem Ayhan Ünkar  
drethemunkar@gmail.com



Content of this journal is licensed under a Creative Commons Attribution-NonCommercial 4.0 International License.

**Cite this article as:** Öztürk K, Ünkar EA, Öztürk AA. Perioperative management recommendations to resume elective orthopaedic surgeries for post-COVID-19 “new normal”: Current vision of the Turkish Society of Orthopaedics and Traumatology. *Acta Orthop Traumatol Turc* 2020; 54(3): 228-33. DOI: 10.5152/j.aott.2020.20183.

reserve their staff and equipment resources for potential outbreak of the second wave.

The aim of this report is to provide a guideline, in the light of constantly updated information about COVID-19, for healthcare givers involved in perioperative care to follow for preserving the safety of patients and all healthcare givers.

### Patient selection and surgical timing

In order to restart elective orthopaedic surgical procedures, it must be confirmed that required adjustments have been made to conduct the situation, covering all aspects of perioperative care and limit the exposure of staff and patients to SARS-CoV-2. The estimated incubation period of the novel coronavirus is about 14 days, so it will be logical to resume elective surgical procedures after two weeks of downward trend in new cases of COVID-19 is observed (11). A multidisciplinary committee consisting of surgeons, anesthesiologists, infectious diseases specialists, nurses and administrators should be established and whole process of restarting elective surgeries should be supervised by the committee. Reports on unexpected outcomes relating to the restarting of elective surgeries must be monitored. According to the evolution of the pandemic, rapid and effective regulations must be issued to resume efficient healthcare service. To prevent workforce shortages, staff working schedules must be adjusted to process with minimum staffing necessary for sufficient patient care.

All non-emergent interventions applied for chronic problems of patients whose delay are not supposed to cause any harm in a short period or will change the outcome can be considered as elective (12).

As the signs of normalization emerge, feasible criteria should be introduced about which patients will be operated in the first phase, following the restart of elective surgeries to catch up with the accumulation of the postponed surgeries. It has been reported that elective surgeries like joint replacement and ligament reconstruction procedures decreased by 74 % to 84% during the pandemic (8). There will be a need for prioritization in providing healthcare services to meet the growing needs of patients. Following a very rapid reopening policy to diminish the accumulated patient volume may lead to an increase in the number of COVID-19 cases (9). In these times, the question of patient selection becomes an important issue. As mentioned previously, to date, emergent orthopaedic surgical procedures proceeded. In this phase of the pandemic, urgent conditions requiring surgical intervention should be prioritized. These conditions can be classified into three groups (13):

**Category 1:** Situations that require treatment within a 30-day period, which, if not treated, will quickly worsen the general condition, and require emergent intervention.

**Category 2:** Situations that require treatment within a 90-day period, which, if left untreated, may lead to pain or functional disability but will not quickly worsen the general condition, and require immediate intervention.

**Category 3:** Includes situations that can be treated later, cause minimal or no pain and loss of function, will not cause worsening in general condition, and require immediate intervention. Surgical intervention can be performed within a year.

American Academy of Orthopaedic Surgeons classified the orthopaedic surgical interventions in the pandemic era into four categories according to the timing of the surgeries (14) (Table 1). With some modifications, we assume that, this classification will address the current needs of orthopaedic surgeons throughout the first phase of resuming elective surgeries.

It is responsibility of the physician to determine the priority of the cases. Decision-making process requires judicious analysis of all aspects of perioperative procedures considering the degree of emergency in the first line (15). If the degree of emergency is the same, the priority must be decided according to:

- I. Duration of delay and whether the surgery has been postponed before,
- II. Patient related risk factors,
- III. Adequacy of the resources.

In the transition period, patient selection should be made considering the age of the patient, the history of exposure to SARS-CoV-2, American Society of Anesthesiologist (ASA) score, additional risk factors, occupational and social status. Additional risk factors, which are estimated to worsen the COVID-19 course, can be listed as: advanced age (>65 years), cardiovascular diseases (hypertension, coronary artery disease, congestive heart failure), ASA  $\geq 3$ , morbid obesity (BMI>35), diabetes mellitus, autoimmune diseases, history of blood transfusion, immune deficiency, kidney disease (glomerulonephritis, kidney failure), pulmonary diseases, malignancies, obstructive sleep apnea, and smoking (10, 16, 17).

In the starting phase of resuming elective orthopaedic surgeries, minimal invasive or arthroscopic surgeries with minimal blood loss must be favored. Surgeries should be done in the outpatient settings to minimize risk and utilization of resources, if possible. Duration of the surgical procedure must not exceed 3 hours and the expected hospital stay must be maximum 3 days (10).

Consequences of the surgeries applied for musculoskeletal malignancies will be a challenge for surgeons to overcome. In these cases, postponing surgery may cause significant increase in morbidity and mortality. In advanced staged patients,

**Table 1.** Recommendation of American Academy of Orthopaedic Surgeons for elective orthopaedic surgery in pandemic era (modified)

Category	A	B	C	D
Degree of emergency	Emergency	Urgent	Urgent/Elective	Elective
Surgical interventions	<ul style="list-style-type: none"> <li>• Conditions of which expected outcome of the absence of immediate intervention will result in loss of either life or limb(s)</li> <li>- Traumatic amputation/replantation</li> <li>- Compartment syndrome</li> <li>- Open fracture</li> <li>- Avascular limbs</li> <li>- Septic arthritis</li> <li>- Cauda equina syndrome</li> </ul>	<ul style="list-style-type: none"> <li>• Joint/arthroplasty infections</li> <li>• Most trauma cases (cannot be treated with conservative methods)</li> <li>- Pelvic and acetabular fractures</li> <li>- Hip and long bone fractures</li> <li>- Spinal fractures with neurologic deficit</li> <li>• Benign aggressive and malign tumors of the musculoskeletal system</li> </ul>	<ul style="list-style-type: none"> <li>• Acute intraarticular or periarticular ligament &amp; tendon injuries</li> <li>• Compression neuropathies with rapid onset of motor deficit</li> <li>• Symptomatic benign tumors of musculoskeletal system</li> </ul>	<ul style="list-style-type: none"> <li>• Total joint arthroplasty</li> <li>• Chronic intraarticular or periarticular ligament &amp; tendon injuries</li> <li>• Chronic peripheral nerve compression neuropathies</li> <li>• Osteotomies</li> <li>- Malunion</li> <li>- Pediatric deformities</li> <li>• Degenerative spine</li> </ul>

prognosis should be discussed with patients and oncologist to decide whether to apply palliative treatments (18). On the other hand, it has been reported that treatment of Ewing sarcoma, osteosarcoma, chondrosarcoma, soft tissue sarcoma and resectable metastases cannot be postponed (19). The data indicate that cancer patients infected with COVID-19 have a higher rate of intensive care unit admission, mechanical ventilation, or death compared to patients without cancer (18, 20, 21). Decision of applying or postponing surgeries must be made on a patient-specific basis considering the character of the tumor and other treatment modalities (22).

The course of COVID-19 in paediatric population is mostly sub-clinical. However, their role in disease transmission should not be underestimated. To minimize the duration of contact with children elective surgeries must be postponed during the pandemic (23). If the paediatric patient is already undergoing the treatment requiring secondary procedures for conditions like club foot, developmental dysplasia of the hip, malalignment or limb length discrepancy, surgical procedures must be applied cautiously (24). Parents of the patients should also be questioned in terms of COVID-19 findings and contact history before surgery (10).

In patient selection process, patients' COVID-19 status and comorbidities should also be evaluated. To direct the physicians in patient selection process, patients can be classified in three main categories:

- I. Unknown to be exposed or infected, asymptomatic
- I<sub>c</sub>. Unknown to be exposed or infected, asymptomatic + comorbidities

- II. Recovered from COVID-19, considered to be immune
- II<sub>c</sub>. Recovered from COVID-19, considered to be immune + comorbidities
- III. Infected
- III<sub>c</sub>. Infected + comorbidities

Patients in category I and II can be considered and prioritized in the initial phase of resuming elective surgeries. Patients in category III and III<sub>c</sub> should not be operated until full recovery and adequate immune response observed. In category I<sub>c</sub> and II<sub>c</sub> patients, expected benefits and potential harms of surgery should be weighed and if possible, their surgeries must be delayed and should not be planned before experiences of initial surgeries analyzed and required readjustments fully operationalized.

### Preoperative evaluation

COVID-19 pandemic made routine preoperative evaluation protocols obsolete. This evolution inevitably entailed considerable changes in the preoperative algorithm to secure COVID-19-free pathway. All patients undergoing elective surgery must be screened. If it is possible, screening should be conducted on tele/videoconference platforms to minimize risk of transmission, if this cannot be met patients must be called for preoperative evaluation 48-72 hours prior to procedure. To reduce the time required for preoperative assessment, patients must be instructed to organize previous files and records documenting their health status before their arrival to hospital. Patients must be informed about the preoperative assessment protocols of the institution beforehand. Patients must be instructed to wear a mask and follow preventive measures from entrance to facility until exit (25).

All patients admitted for elective surgery must be directed to rooms dedicated for preoperative screening. Patients must be evaluated for presentation vitals (temperature, O<sub>2</sub> saturation, heart rate), screened for symptoms of COVID-19 (fever, cough, shortness of breath, respiratory distress, sore throat, myalgias, chills, diarrhea, loss/decrease of smell or taste sensation) and questioned about possible risk of exposure to the virus (travel history, contact with persons under suspicion or infected) (12, 26). Patients having a positive reply to any of these questions must be referred for additional evaluation and added to deferred patient list. All other patients must receive reverse transcription-polymerase chain reaction (RT-PCR) test from a nasopharyngeal swab sample. However, local prevalence of COVID-19 and current access to testing in terms of adequacy and availability must be considered while establishing institutional preoperative protocols (10, 27). COVID-19 RT-PCR tests have variable turn-around time range from 1 to 5-days. Therefore, samples should be taken according to turn-around time of the test to ensure obtaining results as close to the date of the procedure as possible. If a patient is asymptomatic and tested for COVID-19, while RT-PCR results pending, he/she may complete preoperative routine laboratory testing and visits. Patients with a negative RT-PCR tests are asked to quarantine, wear a mask, and note their body temperature daily until the day of the surgery. COVID-19 RT-PCR tests accepted valid for 7 days, so surgeries must not exceed this period (28). Patients who are asymptomatic but tested positive for COVID-19 must be quarantined and the surgery postponed for 14 days, if no symptom emerges at the end of 14 days the surgery can proceed without test repetition. Patients who have recovered from COVID-19 infection in the past 8 weeks and have no symptoms for 14 days must be allowed to proceed to elective surgery without retesting. Retesting is not advised for once COVID-19 positive patients, because their RT-PCR tests may maintain positivity for many weeks after the resolution of the infection (29).

All patients must be screened before their admissions for surgery. Screen-positive patients' surgeries should be postponed.

For facilities which are unable to perform RT-PCR test, low dose thorax computed tomography (CT) scans may be a good alternative for ruling out COVID-19 in preoperative evaluation. It has been reported that CT scans had 97 % sensitivity for COVID-19 based on positive RT-PCR results and 93 % of cases had positive CT scan findings prior to the initial positive RT-PCR results. CT scan is also recommended to diagnose symptomatic patients whose RT-PCR tests turned out negative (30, 31).

It has been reported that RT-PCR test has a false negative rate up to 30% in symptomatic patients and only presents the current state at the time of testing (30). Therefore, patients

must be warned for strict adherence to rules of isolation from testing until surgery not to be infected.

Preoperative testing protocols will continually be updated as more data is gathered about the course of COVID-19.

#### **Inpatient protocols**

Healthcare facilities planning to perform elective surgery should not have COVID-19 patients. If this condition cannot be met, all the perioperative services of patients undergoing elective surgery should be carried out in a separate, COVID-19-free buildings (27). Patients should be hospitalized in single rooms if possible. If the conditions are not suitable, at least 2 m. distance must be left between patient beds (32). Common areas should be disinfected at least twice a day and frequently ventilated. Nonpatient visitors' entrance to the wards must be limited, and facility entrance screening should be applied for all visitors. Patients must be informed about protective measures to be followed. All the patients must use face masks and comply with social distance rules during the hospital stay (25).

#### **Intraoperative protocols**

All preventive measures must be reviewed to provide safe and effective intraoperative care. The needed infrastructural adjustments must be completed prior to resuming elective surgeries. Education of the staff involved in intraoperative procedures is a requisite. Proper usage of personal protective equipment must be practiced.

Surgeons, nurses and other staff should be screened daily for symptoms of COVID-19 prior to entering operation room, and in case of suspicion, RT-PCR testing must be performed (33).

Personnel involved in patient transport should wear surgical masks, face shields and gloves. Surgeons and surgical team scrubbed for the operation should wear personal protective equipment (PPE), including N95 or FFP2 equivalent mask, protective eyewear (face shield or goggles) and surgical gowns. If anesthetic procedures with invasive airway management is needed, personnel involved in anesthetic care of the patient must wear the same personal protective equipments as scrubbed surgical team (10, 34, 35).

The ventilation system of the operation rooms should be adjusted to minimize the spread of airborne pathogens. Elective surgical procedures can be performed in positive-pressure operation rooms having High Efficiency Particulate Air (HEPA) filters with maintaining minimum 20 air changes/hour to reduce viral contamination (36, 37). A separate operation room must be assigned for the emergent surgeries of suspected or infected patients of COVID-19 patients. These rooms should be designed to have set up with negative pressure ventilation, separate entrances and exits; and surgical equipments to be used only in these rooms (27).

The number of surgical instruments, containers and devices in the operation rooms should be minimized. In order not to increase the contamination surface, fluoroscopy device, arthroscopy tower, etc. are not recommended to be kept in operation rooms when not necessary (10).

Personnel entrance and exit to the operation rooms should be limited during surgical procedure, especially during intubation and extubation.

Electrocautery use must be minimized. Suction devices should be used effectively to reduce the potential risks of surgical smoke. The usage of orthopaedic devices generating aerosols, like power drills, reamers, oscillating saws, and pulsed lavage systems should be reduced. Instead of these, hand drills, osteotomes, gigli saws and saline in a syringe should be used depending on the procedure-specific requirements. Precautions for aerosol generating procedures should be followed strictly (38, 39, 40).

General anesthesia is known to predispose the healthcare givers to SARS-CoV2 transmission. Regional or local anesthesia should be favored for patients having elective surgery during the pandemic (41, 42).

Adequate time should be allocated between surgeries for appropriate disinfection.

### Postoperative care

Hospitalization period of the patients should be minimized to reduce the risk for nosocomial COVID-19 infection. Body temperature of the patients must be monitored regularly and any patient with early postoperative fever should be isolated and tested for COVID-19. All medical staff involved in the care of the patient under suspicion should be isolated and observed for symptoms until COVID-19 infection is ruled out (7).

Postoperative rounds should be limited and performed with appropriate PPE to avoid transmission.

Tele/videoconferences can be held to provide safe and essential postoperative care for the patients. If outpatient clinic visits are mandatory, the number of patients in the reception area and waiting rooms should be limited (32).

### Conclusion

The COVID-19 pandemic has dramatically changed all aspects of healthcare services and get back to the normal rhythm of our pre-pandemic professional lives does not seem to be a realistic expectation. We should adapt to the practices of post-pandemic “new normal era.” New guidelines delineating the key considerations in perioperative management of patients will continuously emerge as we learn more about COVID-19 and its outcomes. These guidelines should be

applied judiciously depending on the state of the pandemic in any location, and the availability, or scarcity of your resources. Coping with the COVID-19 crisis is a long-termed process, and prudent considerations with rapid regulations to maintain sustainable resumption of healthcare services will be needed.

### References

1. Gorbalenya AE, Baker SC, Baric RS, et al. The species Severe acute respiratory syndrome-related coronavirus: classifying 2019-nCoV and naming it SARS-CoV-2. *Nat Microbiol* 2020; 5: 536-44. [Crossref]
2. Cucinotta D, Vanelli M. WHO Declares COVID-19 a Pandemic. *Acta Biomed* 2020; 91: 157-60.
3. T.C. Sağlık Bakanlığı. Elektif İşlemlerin Ertelemesi ve Diğer Alınacak Tedbirler. Available from: URL: <http://e-belge.saglik.gov.tr> File number: 6c85fd66-4b9c-49f4-b8d4-138caf886537
4. Liang CZ, Ye Chong MS, Sim MA, et al. Surgical considerations in patients with COVID-19: What orthopaedic surgeons should know. *J Bone Joint Surg Am* 2020; 10.2106/JBJS.20.00513. doi: 10.2106/JBJS.20.00513. Online ahead of print. [Crossref]
5. Anoushiravani AA, Barnes CL, Bosco JA, et al. Reemergence of multispecialty inpatient elective orthopaedic surgery during the COVID-19 pandemic. Guidelines for a new normal. *J Bone Joint Surg Am* 2020; doi 10.2106/JBJS.20.00829. [Epub ahead of print]. [Crossref]
6. Sarac NJ, Sarac BA, Schoenbrunner AR, et al. A review of state guidelines for elective orthopaedic procedures during the COVID-19 outbreak. *J Bone Joint Surg Am* 2020; e20.00510. doi: 10.2106/JBJS.20.00510. Online ahead of print. [Crossref]
7. Iyengar KP, Jain VK, Vaish A, Vaishya R, Maini L, Lal H. Post COVID-19: Planning strategies to resume orthopaedic surgery-challenges and considerations. Review. *J Clin Orthop Trauma* 2020; doi: 10.1016/j.jcot.2020.04.028. [Epub ahead of print]. [Crossref]
8. Jain A, Jain P, Aggarwal S. SARS-CoV-2 impact on elective orthopaedic surgery: implications for post-pandemic recovery. *J Bone Joint Surg Am* 2020; doi: 10.2106/JBJS.20.00602. Online ahead of print. [Crossref]
9. Wong JSH, Cheung KMC. Impact of COVID-19 on Orthopaedic and Trauma Service: An Epidemiological Study. *J Bone Joint Surg Am* 2020; doi: 10.2106/JBJS.20.00775 [Epub ahead of print]. [Crossref]
10. Parvizi J, Gehrke T, Krueger CA, et al. Resuming elective orthopaedic surgery during the COVID-19 pandemic: Guidelines developed by the international consensus group (ICM). *J Bone Joint Surg Am* 2020; doi: 10.2106/JBJS.20.00844. [Epub ahead of print]. [Crossref]
11. Lauer SA, Grantz KH, Bi Q, et al. The incubation period of coronavirus disease 2019 (COVID-19) from publicly reported confirmed cases: Estimation and application. *Ann Intern Med* 2020; 172: 577-82. [Crossref]
12. American College of Surgeons (ACS). 2020 COVID-19 update: guidance for triage of non-emergent surgical procedures. Available from: URL: <https://www.facs.org/covid-19/clinical-guidance/triage> (Accessed 19 May 2020).
13. Australian Institute of Health and Welfare. National definitions for elective surgery urgency categories. Proposal for

- the Standing Council on Health. 2012. Available from: URL: <https://www.aihw.gov.au/getmedia/509f8a18-73c9-416c-92a5-f5073201df46/15778.pdf> (Accessed 17 May 2020).
14. Guy DK, Bosco, JA 3rd, Savoie FH 3rd. AAOS Guidelines for Elective Surgery During the COVID-19 Pandemic. Available from: URL: <https://www.aaos.org/about/covid-19-information-for-our-members/aaos-guidelines-for-elective-surgery>. (Accessed 13 May 2020).
  15. Plastik Rekonstrüktif ve Estetik Cerrahi Uzmanları için Covid-19 Pandemi Rehberi. Ed. Bülent Saçak. 3rd ed. 15 May 2020.
  16. Huang C, Wang Y, Li X, et al. Clinical features of patients infected with 2019 novel coronavirus in Wuhan, China. *Lancet* 2020; 395: 497-506. [\[Crossref\]](#)
  17. Vannabouathong C, Devji T, Ekhtiari S, et al. Novel coronavirus COVID-19: Current evidence and evolving strategies. *J Bone Joint Surg Am* 2020; doi: 10.2106/JBJS.20.00396. [Epub ahead of print]. [\[Crossref\]](#)
  18. Al-Shamsi HO, Alhazzani W, Alhuraiji A, et al. A practical approach to the management of cancer patients during the novel coronavirus disease 2019 (COVID-19) pandemic: An international collaborative group. *Oncologist* 2020; doi: 10.1634/theoncologist.2020-0213. Online ahead of print. [\[Crossref\]](#)
  19. Cardoso P, Rodrigues-Pinto R. Surgical management of bone and soft tissue sarcomas and skeletal metastases during the COVID-19 pandemic. *Eur J Surg Oncol* 2020; doi: 10.1016/j.ejso.2020.04.027. Online ahead of print. [\[Crossref\]](#)
  20. Ueda M, Marcns R, Hendrie PC, et al. Managing cancer care during the COVID-19 pandemic: Agility and collaboration toward a common goal. *J Natl Compr Canc Netw* 2020; doi: 10.6004/jnccn.2020.7560. [Epub ahead of print]. [\[Crossref\]](#)
  21. Liang W, Guan W, Chen R, et al. Cancer patients in SARS-CoV-2 infection: a nationwide analysis in China. *Lancet Oncol* 2020; 21: 335-7. [\[Crossref\]](#)
  22. Bartlett DL, Howe JR, Chang G, et al. Management of Cancer Surgery Cases During the COVID-19 Pandemic: Considerations. *Ann Surg Oncol* 2020; 27: 1717-20. [\[Crossref\]](#)
  23. Farrell S, Schaeffer EK, Mulpuri K. Recommendations for the care of pediatric orthopaedic patients during the COVID pandemic. *J Am Acad Orthop Surg* 2020; 28: 477-86. [\[Crossref\]](#)
  24. NHS. Clinical guide for the management of trauma and orthopaedic patients during the coronavirus pandemic. Available from: URL: <https://www.england.nhs.uk/coronavirus/wp-content/uploads/sites/52/2020/03/specialty-guide-orthopaedic-trauma-and-coronavirus-v1-16-march-2020.pdf> (Accessed 13 May 2020).
  25. Leung CC, Lam TH, Cheng KK. Mass masking in the COVID-19 epidemic: people need guidance. *Lancet* 2020; 395: 945. doi:10.1016/S0140-6736(20)30520-1 [\[Crossref\]](#)
  26. Chen N, Zhou M, Dong X, et al. Epidemiological and clinical characteristics of 99 cases of 2019 novel coronavirus pneumonia in Wuhan, China: a descriptive study. *Lancet* 2020; 395: 507-13. [\[Crossref\]](#)
  27. Mouton C, Hirschmann MT, Ollivier M, Seil R, Menetrey J. COVID-19 - ESSKA guidelines and recommendations for resuming elective surgery. Review. *J Exp Orthop* 2020; 7: 28. doi: 10.1186/s40634-020-00248-4. [Epub ahead of print]. [\[Crossref\]](#)
  28. Tahamtan A, Ardebili A. Real-time RT-PCR in COVID-19 detection: issues affecting the results. *Expert Rev Mol Diagn* 2020; 20: 453-4. [\[Crossref\]](#)
  29. Lan L, Xu D, Ye G, et al. Positive RT-PCR Test Results in Patients Recovered From COVID-19. *JAMA* 2020; doi:10.1001/jama.2020.2783 [Epub ahead of print]. [\[Crossref\]](#)
  30. Ai T, Yang Z, Hou H, et al. Correlation of chest CT and RT-PCR testing in coronavirus disease 2019 (COVID-19) in China: A report of 1014 cases. *Radiology* 2020; doi: 10.1148/radiol.2020200642. Online ahead of print. [\[Crossref\]](#)
  31. Chen D, Jiang X, Hong Y, et al. Can chest CT features distinguish patients with negative from those with positive initial RT-PCR results for coronavirus disease (COVID-19)? *AJR Am J Roentgenol* 2020; 1-5. [\[Crossref\]](#)
  32. Prem K, Liu Y, Russell TW, et al. The effect of control strategies to reduce social mixing on outcomes of the COVID-19 epidemic in Wuhan, China: a modelling study. *Lancet Public Health* 2020; 5: e260. doi:10.1016/S2468-2667(20)30073-6. [\[Crossref\]](#)
  33. de Caro F, Hirschmann TM, Verdonk P. Returning to orthopaedic business as usual after COVID-19: Strategies and options. *Knee Surg Sports Traumatol Arthrosc* 2020; doi: 10.1007/s00167-020-06031-3. Online ahead of print. [\[Crossref\]](#)
  34. 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; doi: 10.2106/JBJS.20.00454. Online ahead of print. [\[Crossref\]](#)
  35. Roberge RJ. Evaluation of the rationale for concurrent use of N95 filtering facepiece respirators with loose-fitting powered air-purifying respirators during aerosol-generating medical procedures. *Am J Infect Control* 2008; 36: 135-41. [\[Crossref\]](#)
  36. Chow TT, Kwan A, Lin Z, Bai W. Conversion of operating theatre from positive to negative pressure environment. *J Hosp Infect* 2006; 64: 371-8. [\[Crossref\]](#)
  37. Parvizi J, Barnes S, Shohat N, Edmiston Jr CE. Environment of care: is it time to reassess microbial contamination of the operating room air as a risk factor for surgical site infection in total joint arthroplasty? *Am J Infect Control* 2017; 45: 1267-72. [\[Crossref\]](#)
  38. Nogler M, Lass-Flörl C, Ogon M, et al. Environmental and body contamination through aerosols produced by high-speed cutters in lumbar spine surgery. *Spine* 2001; 26: 2156-9. [\[Crossref\]](#)
  39. van Doremalen N, Bushmaker T, Morris DH, et al. Aerosol and surface stability of SARS-CoV-2 as compared with SARS-CoV-1. *N Engl J Med* 2020; 382: 1564-7. [\[Crossref\]](#)
  40. Yeh HC, Turner RS, Jones RK, Muggenburg BA, Lundgren DL, Smith JP. Characterization of aerosols produced during surgical procedures in hospitals. *Aerosol Sci Technol* 2020; 22: 151-61. [\[Crossref\]](#)
  41. Zhong Q, Liu YY, Luo Q, et al. Spinal anaesthesia for patients with coronavirus disease 2019 and possible transmission rates in anaesthetists: retrospective, single-centre, observational cohort study. *Br J Anaesth* 2020; 124: 670-5. [\[Crossref\]](#)
  42. Lie SA, Wong SW, Wong LT, Wong TGL, Chong SY. Practical considerations for performing regional anesthesia: lessons learned from the COVID-19 pandemic. Review. *Can J Anaesth* 2020; doi: 10.1007/s12630-020-01637-0. [Epub ahead of print] [\[Crossref\]](#)