

Recent updates on the safety of neurosurgery during the COVID-19 pandemic

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Abstract

The coronavirus 2019 (COVID-19), caused by severe acute respiratory syndrome-coronavirus-2 (SARS-CoV-2), is highly contagious and has disastrous healthcare systems worldwide. Medical personnel are at a high risk of becoming infected with viruses; therefore, knowing what personal protective equipment (PPE) to use in each situation is critical. Furthermore, elective clinics and operations have been reduced to redirect the workforce to the acute specialties battling the outbreak; proper differentiation between patients who require immediate care and those who can be seen over the phone or whose treatment can be postponed is thus critical. Because Iran was one of the first and worst-affected countries, the Iranian Ministry of Health and Education has issued particular recommendations based on consensual best practices and, where available, literature. Only emergency surgical procedures are indicated, and all patients should be examined at least twice before surgery (on days 4 and 2). Procedures for positive patients should be postponed until the nasopharyngeal swab test is negative. Filtering facepiece 3 (FFP3) and/or powered air-purifying respirator (PAPR) devices, goggles, full-face visor, double gloves, water-resistant gowns, and protective caps are all required if the procedure is critical to the patient's survival.

It is advised that negative patients utilize at most minuscule an FFP2 mask. Drills should never be used because they enhance the aerosolization of potentially infectious mucous particles. The manipulation of the dura should be minimized due to the probable neurotropism of SARS-CoV-2. We will be able to deal with the evolving and intricate implications of this new pandemic only through generally agreed-upon protocols and coordination.

Keywords: Endoscopic sinus surgery; Endoscopic skull base surgery; Intracranial dura; Olfaction; Paranasal sinuses; Sinus surgery; Skull base

1. Introduction

The rapid expansion of the coronavirus epidemic has compelled us to make epochal adjustments in our daily routines and revolutionize our clinical and surgical practices. Since the World Health Organization (WHO) declared the coronavirus disease 2019 (COVID-19) infection, a true worldwide pandemic on March 12, 2020, healthcare personnel have been putting in place plans to contain the illness while safeguarding their patients' and their health as much as possible. [1] We also see significant constraints on healthcare resources, which must be reallocated to support pandemic management and thus withdrawn from routine clinical and surgical tasks. Like many other international scientific societies, the Iranian Ministry of Health and Education strives to offer clinical and behavioral guidelines to cope with the problem adequately. Our recommendations are based on the most recent scientific findings and the practical

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experience of individuals coping with the epidemic in the hotspots of infection. In addition, identifying and analyzing the key risk factors associated with various diseases and cancers is a critical step in the development of effective treatments in medicine. [2]

Other symptoms can assist in identifying at-risk patients in addition to fever, coughing, wheezing, and diarrhea. As verified by a large body of research, we would underline the importance of hyposmia and dysgeusia, which are configured as symptoms linked with severe acute respiratory syndrome-coronavirus-2 (SARS-CoV-2) infection evidence from several regions. [3]

Furthermore, one out of every six patients with recent-onset anosmia (isolated sudden-onset anosmia [ISOA]) reports this as an isolated symptom. Postviral etiologies account for 15% to 40% of Odor and taste loss cases. Even in telephone consultations, it is critical to evaluate this symptom to determine the existence of infection. This could assist in identifying disease carriers that are otherwise asymptomatic and prompt targeted testing. Patients with rapid onset of olfactory loss should be socially isolated in quarantine for at least 14 days, and nasal olfactory training should begin as soon as possible. Omega-3 supplementation has been shown to protect against olfactory loss during the healing phase after skull-base surgery; therefore, it may aid recovery after postviral loss [8]. A brief course of budesonide nasal irrigations can be recommended in individuals with isolated anosmia because it has been proven to increase olfactory ability [9] without damaging the local or systemic immunological status.

Other adjuvant treatment alternatives proposed in the past, before the COVID-19 outbreak, may be utilized to aid in the recovery of taste-olfactory function, albeit without a high level of evidence: vitamin A--based nasal drops, ten oral alpha-lipoic acid, caroverine, minocycline, and ginkgo Biloba [12] Oral corticosteroids, on the other hand, should be avoided since they may decrease the viral clearance and interfere with the infection's eventual course. [13] Because there is no precise data to suggest that topical nasal steroid therapy is contraindicated, ongoing chronic nasal topical steroid therapy should be continued regularly to avoid exacerbation of allergic and sinonasal symptoms that may mimic the symptoms of coronavirus infection [4]. According to a recent study, most patients will regain chemosensory function within weeks or months, corresponding to the remission of other disease-related symptoms. However, further studies on olfactory function recovery will be necessary to shed more light on this issue.

2. Precautionary rules for healthcare workers

Because this virus spreads by droplets, the more the operator is exposed to the patient's airways (e.g., outpatient treatments, endoscopic diagnostic procedures, and surgery), the higher the risk. Regardless of whether a patient is symptomatic or asymptomatic, the viral load of SARS-CoV-2 is higher in the nasal cavity than in the throat [15]. SARS-CoV-2 particles can last up to 3 hours in the air after being aerosolized. As a result, otolaryngologists and neurosurgeons are in danger. [16] The first instance of COVID-19 transmission during an endoscopic transsphenoidal pituitary surgery in Wuhan, China, which resulted in the cross-contamination of 14 healthcare workers, highlights the high risk of hospital-acquired viral infection [17]. This has caused widespread apprehension about endonasal endoscopic operations. Huang et al. [18] recently offered more information to clarify that occurrence, indicating that the infected healthcare staff was mainly outside the operating area. [8] As a result, the importance of social interaction between healthcare professionals and contaminated surfaces inward and living areas should be weighed against the influence of surgical-related exposure in fostering contamination [18]. Regardless of the probable contamination paths, hundreds of healthcare personnel have been hospitalized in China and Europe for COVID-19, with some regrettably dying. Wearing adequate personal protective equipment (PPE) such as a disposable filtering facepiece 2 (FFP2)/N95 mask, water-resistant gown, gloves, goggles, cap, and full-facial visor shield is recommended in managing patients with unclear COVID-19 status (e.g., outpatient service). Filtering facepiece 3 (FFP3) masks and/or powered air-purifying respirators (PAPRs) should also be used for COVID-19-positive individuals. [19]

3. Positive COVID-19 tests

SARS-CoV-2 nasopharyngeal swab tests based on reverse transcriptase-polymerase chain reaction (RT-PCR) are already available, with results available within 24 hours, depending on the institution. Abbott has recently made a newer test available to current practice, with results available in 15 minutes. Depending on the experience and training of individuals performing the swabs, these tests may be plagued by a non-negligible proportion of false negatives, ranging from 4% to 30% [20]. To improve the procedure's sensitivity, perform two nasopharyngeal swabs separated by at least two to four days. Furthermore, if the swab test is combined with chest imaging that shows symptoms of infection, the accuracy of the test can be improved.

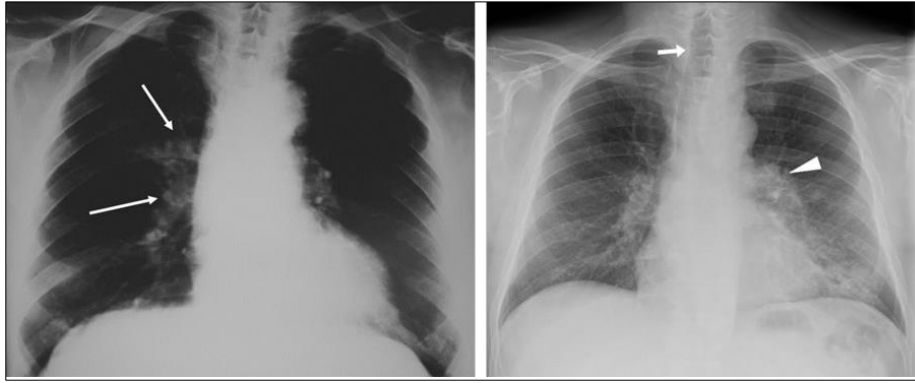


Figure 1 Chest X-ray images: positive Covid test

It has been proposed that chest computer tomography (CT) may be even more sensitive than repeated RT-PCR tests in detecting COVID-19. 20 For blood testing of specific immunoglobulin M (IgM) and IgG antibodies for SARS-CoV-2, new immune-assay approaches are becoming available to yield results in 20 to 40 minutes [22]. The IgM sensitivity of PharmACT's rapid IgM-IgG combined antibody test was 70% during the early stages of infection (first 4-10 days) but quickly increased to 92.3 percent between days 11 and 24. The IgG component of the test reaches 98.6 percent sensitivity during the same period of late infection. These new approaches, in addition to being speedier, have a reduced rate of false negatives (between 11 and 13 percent) and will likely be employed more frequently in the coming months. 22 Saliva may also be used as a noninvasive diagnostic tool for COVID-19, with preliminary findings suggesting that it is more accurate than a nasopharyngeal swab in detecting the novel coronavirus [24]. Saliva might be collected by the patient spitting into a sterile container, avoiding the need for healthcare services, and evaluated using nucleic acid extraction and the RT-PCR test. SARS-CoV-2 was found in saliva samples from 91.7 percent of COVID-19 patients, according to Chinese researchers. 24 To better understand the function of saliva in the rapid diagnosis of SARS-CoV-2 infection, more research is needed.

4. Outpatient assessments

According to the experts, all elective and non-urgent outpatient procedures should be postponed [26]. Many consultations and evaluations can be conducted over the phone or via videoconferencing. Telemedicine screening can also help identify urgent cases requiring immediate medical attention and patients with worrying symptoms who should be referred to COVID-19 diagnostic and therapeutic studies. Wearing suitable protective equipment, advising patients to use a surgical mask, maintaining an interpersonal distance of >1 meter, frequent handwashing and alcoholic disinfection, and only admitting patients to consultations themselves are all recommended (with exceptions made in the cases of minors or disabled patients). According to Workman et al.[27], using a barrier such as an intact surgical mask or a modified valved endoscopy of the nose and throat (VENT) mask in the outpatient context considerably improves endoscopy.

5. Skull-base surgery

Data from international clinical experiences suggest that surgical techniques that involve the airways or use them as a surgical corridor, such as trans nasal skull base surgery, should be regarded as high-risk procedures, at least until more information becomes available. The endoscopic procedure is not dangerous in and of itself; instead, the nasal and pharyngeal anatomical region is dangerous because it might operate as a reservoir for viruses with a high viral load. Given previous scientific evidence documenting the presence of respiratory viruses in the mucosa of the middle ear, all endoscopic, microscopic, and open surgical procedures involving these anatomical regions must be considered at risk; similarly, surgical procedures on the lateral skull base must be considered at risk [2,17]. Figure 1 summarizes our present recommendations, which are as follows:

- Elective surgical operations and non-urgent procedures must be put on hold.
- Only urgent surgical operations (severe trauma, bleeding, infections, abscesses) and non-deferrable surgical interventions (malignant tumors with critical local extension to the brain, orbit, and/or with borderline resectability where a significant delay could be fatal for the prognosis *quoad vitam et valetudinem*) should be performed. Pituitary tumors or lesions at the base of the skull with rapidly deteriorating eyesight should be treated. Acoustic neuromas, meningiomas, and other tumors showing hydrocephalus or brainstem

compression symptoms should also be treated as soon as possible. Slow-growing tumors with progressive symptoms, on the other hand, should be considered on a case-by-case basis. Finally, radiation therapy or systemic therapy should be considered an alternative to surgery whenever possible. [29]

- There is new evidence for SARS-CoV-2's neurotropism, and a transcribiform route for SARS-CoV-2 to reach the brain has been proposed. The most compelling proof of SARS-CoV-2 neurovirulence would be the isolation of SARS-CoV-2 RNA in the cerebrospinal fluid.²⁹ As a result, dura handling during skull-base surgery should be done with extreme caution, especially in endoscopic endonasal and lateral skull-base approaches. Extradural surgery should be recommended whenever possible, whereas transdural methods should only be used in exceptional circumstances.
- Patients scheduled for surgery should be pretreated with povidone-iodine (PVP-I) solution provided by nasal irrigations and oral wash in the preoperative environment, whenever possible, to reduce the potential virus load. [31]
- In order to reduce the chance of false negatives, all patients who are candidates for surgery (except for emergency procedures) must be tested for COVID-19 with at least two tests, repeated at a 2- to 4-day interval. Within 48 hours of surgery, the final test must be completed.
- Procedures for COVID-19–positive individuals should be postponed until following swab test negativity. If the procedure is vital for the patient's survival, it must be done in a dedicated negative-pressure operating room with a predetermined allocated run that does not interfere with the COVID-19–free zones. Not only for the length of operation but also the duration of the patient's stay in the operating room, all medical and nursing staff in the operating room must wear FFP3 and/or PAPR devices, goggles, full-face visors, double gloves, water-resistant gowns, and protective caps. [17]
- If COVID-19 testing is not available (emergency treatments such as trauma, significant bleeding, or abscesses), follow the same measures as positive individuals.
- In COVID-19–negative individuals, surgical operations should be performed with the highest individual protection criteria (at least the FFP2 mask) because of the high incidence of false negatives from the existing swab tests.
- High-speed drills that increase the aerosolization of possibly infected mucous particles (aerosol-generating surgery) should be avoided or minimized in endoscopic transnasal techniques. To minimize bony drilling, osteotomes such as Kerrison and Catelli rongeurs, circular punches, chisel, and hammer should be used wherever possible. Cold surgical instruments and shavers/microdebriders, on the other hand, appear to have a lower danger of aerosolization.²⁶ Although this may be true for bigger particles, we do not know if the same is true for smaller aerosolized particles. When transcranial surgery is possible without causing additional morbidity for the patient, it should be considered instead of endonasal surgery in some circumstances. [17]
- Mastoid drilling produces droplets and causes particle aerosolization. Hence it should be considered an aerosol-generating procedure. As a result, conventional PPE should be used (face shields and N95) [32-34]. Additionally, after the mastoid and middle ear is exposed, a topical PVP-I solution should be used to lower the viral burden on the mucosal surface. [31]
- Not only throughout the length of surgery but for the duration of the patient's stay, the entire operating area must be regarded as at risk. As a result, it is best to keep the number of people in the operating room to a minimum. Similarly, observers, fellows, and residents in training must be absent from operating sessions to reduce exposure. [1]
- To avoid subsequent superinfections, COVID-19–negative patients who undergo surgery should be given sound advice on how to follow proper hygiene-behavioral rules during the postoperative period, which should include emphasizing the importance of proper and frequent handwashing, wearing a surgical mask, and social distancing (greater than 1 meter).

6. Conclusion

COVID-19, caused by SARS-CoV-2, is highly contagious and has strained global healthcare systems. Medical personnel need appropriate PPE, and elective procedures are reduced to prioritize urgent care. Iran permits only emergency surgeries, requiring patients to be tested twice. Critical procedures demand extensive PPE, including FFP3 masks, PAPR devices, and protective gear. Avoid drills due to aerosol risks and minimize dura manipulation. Coordinated protocols are essential for effective pandemic management.

Compliance with ethical standards

Disclosure of conflict of interest

No conflict of interest to be disclosed.

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