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Considerations for Continuing Semielective and Emergency Otolaryngological Procedures During the COVID-19 Pandemic

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Abstract

Introduction: During the COVID-19 pandemic, worldwide over 600,000 human beings died due to the cause of the disease. In order to deescalate the transmission rate and to avoid crush loading the countries medical health systems social distancing, face masks, and lockdowns have been considered essential by the majority of governments. Whereas some countries have highly reduced or completely stopped otorhinolaryngological procedures, other countries have continued selected surgeries. The objective of this study was to analyze procedures and outcomes of continuing semielective and emergency surgeries during the COVID-19 pandemic. **Methods:** Retrospective analysis of n = 750 patients who received semi-elective or emergency surgery between March 26 and June 16, 2020, in the Otolaryngology Department of the Friedrich-Alexander-University of Erlangen-Nürnberg. All patients were screened for COVID symptoms and swabbed for SARS-CoV-2 prior to surgery. **Results:** Of the n = 750 patients, n = 699 patients received semielective surgery and n = 51 emergency surgery. For 27 patients, the swab result could not be awaited due to a life-threatening condition. In these cases, surgery was performed in full protective equipment. No patient was tested positive during or after the surgery (follow-up 45 to 127 days). No member of the medical personnel showed symptoms or was tested positive after contact with patients. Due to the continuation of surgeries, patients' lives were saved and improvement of long-term quality-of-life and outcomes is anticipated. **Conclusions:** Continuing selected otorhinolaryngological surgeries is crucial for patients' health, survival, and long-time quality of life, yet, the protection of the medical personnel has to be granted.

Keywords
COVID-19, otorhinolaryngological procedures, SARS-CoV-2 test, false-negative, patient's health

Introduction

Otolaryngology is one of the specialties that is exposed most to aerosols and droplets. Several studies in the context of the COVID-19 pandemic (coronavirus-19) have already shown the abundant formation and spread during various surgical otolaryngological procedures.[1-3] Due to the worldwide dissemination of the COVID-19 and the increasing number of related deaths, several countries reduced the otorhinolaryngological procedures in the clinic and the operation room to a minimum or suspended them completely. Primary goal is to avoid contamination and infection during highly ''aerosolizing'' procedures.[4,5] During the peak time of the incidence as well as the

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death rates in Germany, only medical emergencies and semielective surgeries were performed in our Otorhinolaryngological Department. However, it is now to determine if the continuation of the semielective and emergency surgeries demonstrated a benefit for the patients. In this context, it has to be kept in mind that patients suffering from a non-COVID-19 related illness may worsen or die as "collateral damage" when they are not being treated adequately. There, for example, have been reports from cardiac patients whose treatment was delayed and who experienced worsening symptoms, suffered a myocardial infarction or even deceased.[6] At this point of the pandemic, the question is whether the procedure of continuing to operate on semielective and emergency patients should be recommended in the future. This question is even more relevant in the context of a possible second wave of the pandemic. The objective of this study was to evaluate the medical impact of the continuation of the surgeries. In detail, the study sought to analyze the number of patients and medical personnel that was infected with SARS-CoV-2 before and perioperatively, and the characterization of the patient group that was operated on.

Methods

Study Design and Inclusion of Patients

Retrospective chart review of n = 750 patients who were undergoing surgery during the COVID-19 pandemic between 26 March and 16 June, 2020, in the Department of Otolaryngology, Head and Neck Surgery of the Friedrich-Alexander-Universität Erlangen-Nürnberg (FAU). During this time period, only emergency and semielective surgeries were performed. "Semielective" surgery was defined as a condition that would lead to the patient's death, to disease associated complications, or loss of quality of life if not being performed within reasonable time. Demographic data as well as indication for surgery were reviewed. The study was approved by the ethics committee of the FAU.

SARS-CoV-2 Swab Analysis Timetable and Analysis

All semielective surgery patients were screened preoperatively for COVID-19 symptoms and COVID-19 associated risk factors (contact with confirmed COVID-19 patients, stay in one of the international risk areas within the last 14 days) according to the daily updated recommendations of the Robert Koch Institute—a federal institute within the German Federal Ministry of Health. Those patients who did not show any symptoms were admitted to the ward with a surgical mask and a SARS-CoV-2 swab was performed preoperatively. The swabs were conducted maximally 24 hours before the scheduled surgery and were performed by a trained otolaryngologist according to World Health Organization guidelines. All swabs were processed in the Institute of Clinical and Molecular Virology of the FAU 3 times a day (12 pm noon, 4 pm, and 10 pm). Real-time polymerase chain reaction (RT-PCR) was conducted for identification of SARS-CoV-2. Our guidelines required that an asymptomatic patient with a positive test result was sent home to a strict domestic quarantine and that the surgery was cancelled. In case of COVID-19 symptoms and a positive test result, the patient was transferred to a COVID-19 specific ward. In case of a negative SARS-CoV-2 test, the scheduled surgery was performed the following day without special protective equipment (Figure 1A).

In case of an emergency, preoperative swabs were taken and analyzed as described above. However, it was the operating surgeon's decision to wait for the test results or operate immediately without the knowledge of the SARS-CoV-2 status due to the condition of the patient. In these cases, the general condition of the patient and the associated surgical urgency had to be weighted against the potential risk of infection. If the SARS-CoV-2 test result could not be awaited due to the condition of the patient, the surgery was performed with full protective equipment consisting of a FFP2 or FFP3 (filtering face piece mask), a gown, a face shield, and double gloves. If the SARS-CoV-2 test result was positive, surgery was also performed with the full protective equipment. If the SARS-CoV-2 test was negative, surgery was performed as in the semi-elective cases without the above named protective equipment (Figure 1B).

Differences in Face Masks Between Europe and the United States

We have used FFP masks which are the standard mouth-and-nose protection in Europe. Filtering face piece masks are classified in 3 different rating (P1/P2/P3). In the United States, the National Institute for Occupational Safety and Health (NI-OSH) recommends N95 masks or higher (United States NIOSH-42CFR84). Comparing the different masks, the closest European equivalent to N95 are FFP2/P2 rated masks, which show a filtering capacity (removal of x% of all particles 0.3 microns in diameter or larger) of 94% compared to the 95% of N95. Similarly, N99 and FFP3 masks both show a filtering capacity of at least 99%.

Follow-Up of Patients and Medical Personnel

The follow-up of all patients was 45 to 127 days. During the inpatient stay, each patient was allowed only one registered visitor per day and for 1 hour. The inpatient stay was kept as short as possible according to the respective operation and the general condition of the patient. Accommodation in triple rooms was avoided for infectiological reasons. Generally, patient returned around 2 weeks after discharge for another follow-up visit. At the 2-week follow-up visit, the surgical wound was evaluated, and the COVID-19 symptoms were assessed again. This procedure was also repeated during further follow-up visits. In case of a positive SARS-CoV-2 test of the patient, and this is also true if the test result was conducted by an external institution or a general health practitioner, it is the protocol of the Public Health Department to routinely notify the Department of Otolaryngology as a tertiary care center who

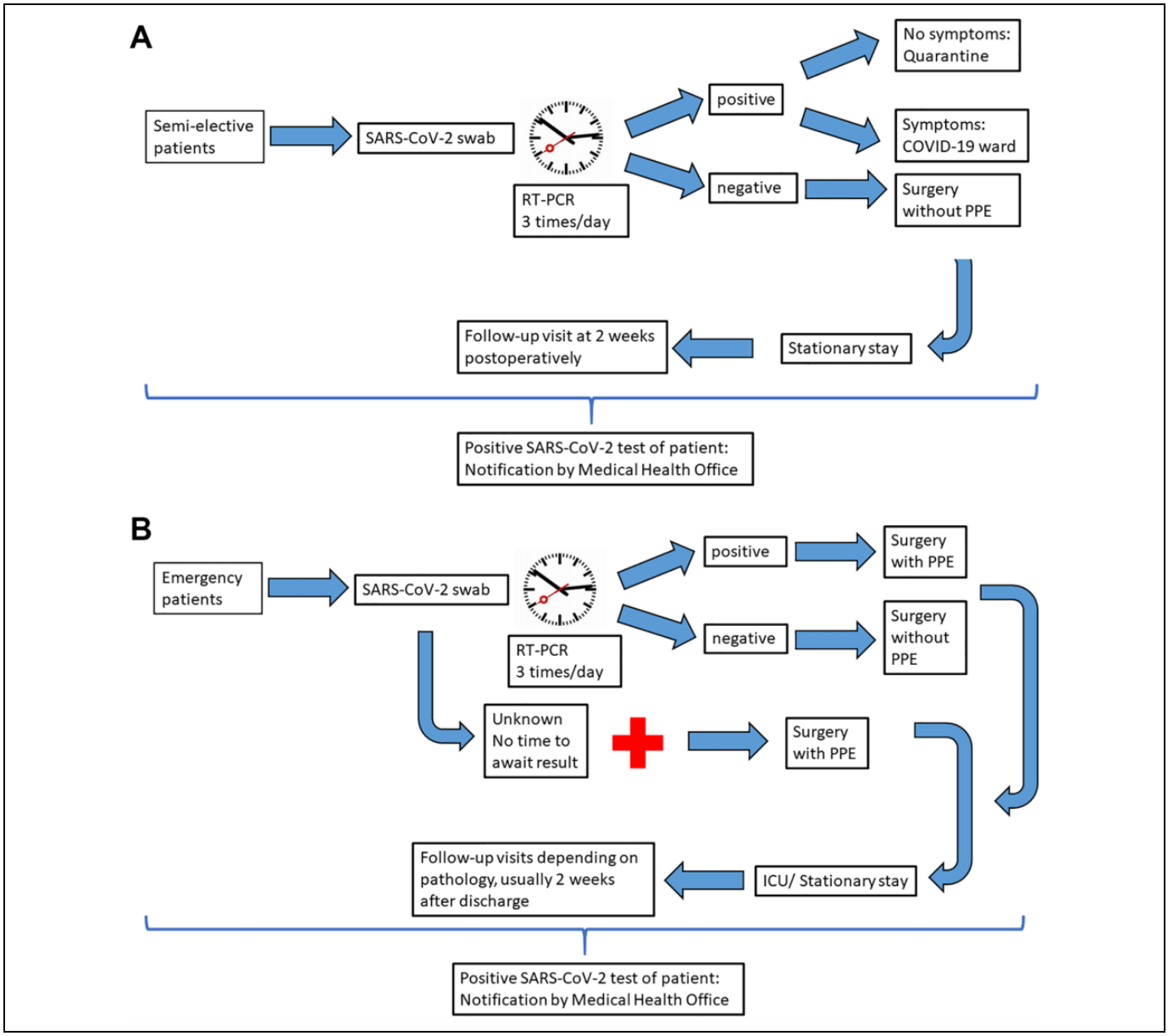

Figure 1. Flow chart of the standard operating procedures for (A) semielective and (B) emergency surgeries as well as for patients' follow-up. RT-PCR indicates real-time polymerase chain reaction; PPE, personal protective equipment.

has treated the patient. Using this protocol, a SARS-CoV-2 positive patient will be identified and the paths will be tracked. Medical personnel were advised to screen themselves regularly for COVID-19 symptoms and keep a symptom dairy.

Results

Patient Demographics

In total, n = 750 patients were included. The age was 49 ± 21.98 years, the male-to-female ratio was 1.7:1. Patient demographics are displayed in Table 1.

Table 1. Patient Demographics.

Characteristic	n (%)
Gender	
Male	474/750 (63.2)
Female	276/750 (34.8)
Age	49 ± 21.9
Surgery	750 (100)
Semielective surgery	699/750 (93.2)
Emergency surgery	51/750 (6.8)
SARS-CoV-2	
Positive	0/750 (0)
Negative	750/750 (100)

Table 2. Indications and Types of Surgeries for the n = 699 Semielective Surgeries.

Indication	Surgery	n
Head and neck cancer (oropharynx, oral cavity, hypopharynx, larynx)	Panendoscopy	170
	Tumor resection, bilateral neck dissection, tracheostomy, flee flap	15
	Tumor resection, neck dissection	4
	Neck dissection	31
	Total laryngectomy, bilateral neck dissection	8
	Partial laryngectomy	10
	Brachytherapy seed implantation	6
	Pharyngeal fistula	3
	Tracheostomy closure	9
	Resection submandubular gland	7
	Tracheostomy	1
Parotid tumor	Parotidectomy	56
	Parotidectomy, neck dissection	6
Sinonasal carcinoma	Lateral rhinotomy	5
	Endoscopic resection	6
Inverted papilloma	Endoscopic resection	4
Cutaneous SCC nose	Tumor resection, reconstruction	10
Cutaneous SCC ear	Tumor resection, reconstruction	10
Thyroid nodule	Complete or partial thyroidectomy	16
Chronic rhinosinusitis/mucocele	Endoscopic resection	58
Encephalocele/ rhinoliquorrhea	Endoscopic closure	5
Blockage of nose	Open/closed septoplasty	56
Nasal fracture	Reposition	3
Septal perforation	Obturator	1
	Endoscopic closure	2
Hearing loss	Cochlear implant	43
	Tympanosplasty III (cholesteatoma)	53
	Tympanosplasty I (perforation)	8
	Middle ear implant	2
	Tympanoscopy (sealing round window)	3
	Stapes surgery	5
Speech development disorder (children)	Adenectomy, myringotomy, ear tubes, BERA	44
Recurrent tonsillitis (children)	Tonsillectomy	14
Laryngeal papillomatosis	Resection	5
Branchial cyst	Resection	5
Prodructing ears (children)	Otoplasty	4
Zenker's diverticulum	Resection	3
Facial nerve paresis	Blepharoplasty/weight implantation eyelid	4
Ranula	Resection sublingual gland	3
Laryngocele (dyspnea)	Resection	1

Abbreviations: BERA, brainstem evoked response audiometry; SCC, squamous cell carcinoma.

Significant Number of Semielective and Emergency Surgeries During the COVID-19 Pandemic

Of all patients, n = 699 patients received a semielective surgery. Patients receiving semielective surgery were, for example, suffering from conditions including suspected and histologically verified cancer or preliminary stages, large cholesteatomas with a proximity to the skull base, deafness in children or adults. A detailed description of the semielective surgeries performed is displayed in Table 2.

On the other hand, n = 51 patients received an emergency indication for surgery. Types of emergencies are displayed in Figure 2. For n = 27 patients, the swab result was available before surgery. However, for n = 24 critically ill patients, the swab results could not be awaited due to life-threatening emergencies. For these scenarios, patients were treated as SARS-CoV-2 positive and full personal protective equipment as described above were used for all medical personnel including surgeons, nurses, and anesthesiologists.

Absence of Postoperative Short- or Long-Time COVID-19 Infection of Patients and Medical Personnel

Of all n = 750 patients, not a single SARS-CoV-2 swab showed a positive result. There was 1 patient where the swab was inconclusive at the first swab but was shown to be negative after a second swab. No patient displayed any signs of a COVID-19 infection during the stationary stay or up to the 2-week follow-up visit. Our department also subsequently received no notification from the local health authority of a

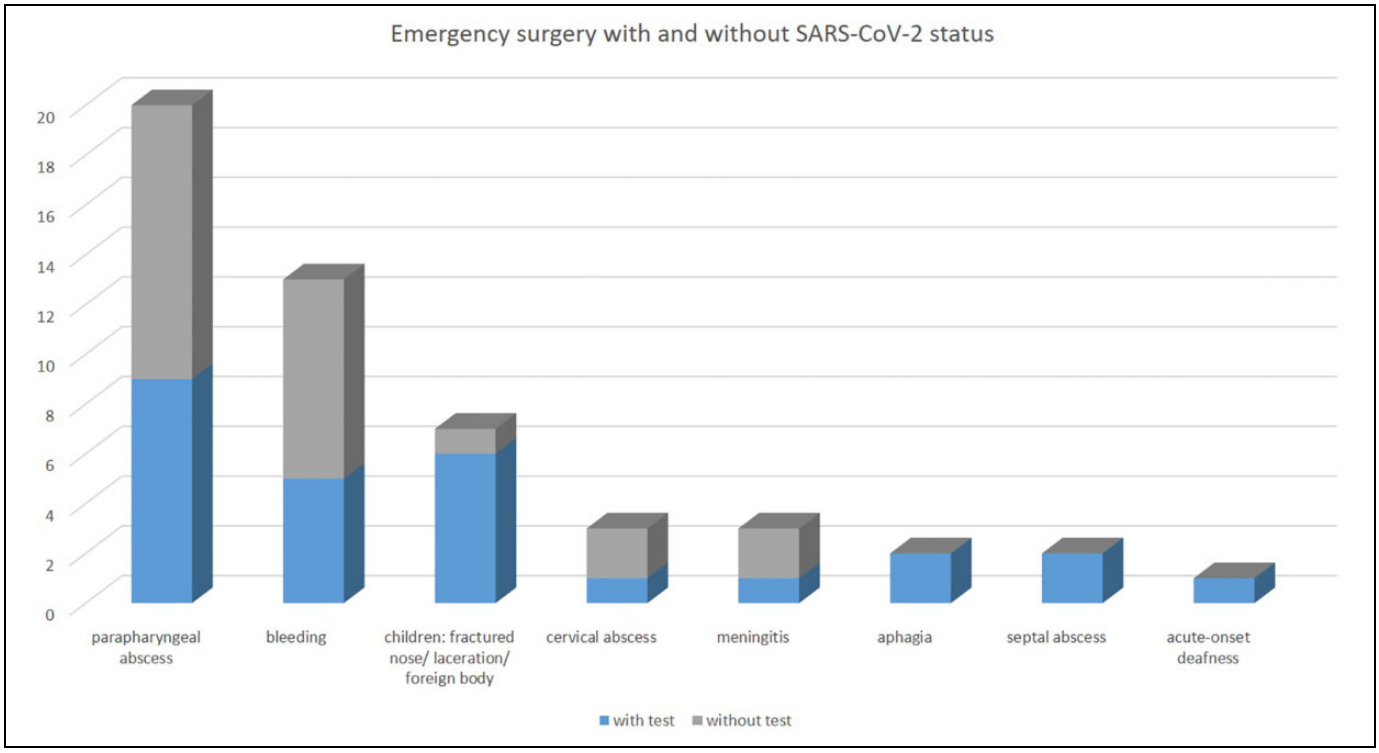

Figure 2. Bar graph of all indications for emergency surgeries as well as SARS-CoV-2 test status during the surgery. The blue color represents patients who were operated on after awaiting the SARS-CoV-2 test results, the grey color represents patients in life-threatening conditions in which the result of the SARS-CoV-2 swab could not be awaited and surgery was performed with full protective equipment (FFP3 mask, face shield).

SARS-CoV-2 infection concerning the previously hospitalized patients. Additionally, no health care worker involved in the treatments of these patients showed any COVID-19 symptoms at any time.

Discussion

During the COVID-19 pandemic, worldwide over 600,000[7] human beings died due to the cause of the disease. Therefore, social distancing, face masks, and lockdowns have been considered essential by the majority of governments in order to deescalate the transmission rate and to avoid crush loading the countries medical health systems. Additionally, for example, in Germany, the medical health system has restructured itself, to maximize the capacities of intensive care units with shifting medical personnel and medical equipment to the intensive care units and emergency rooms. However, this leads necessarily to the diminution of the care of patients who are more or less critically ill but are not SARS-CoV-2 positive. Consequently, there needs to be a balance between continuing care on the patients who need it and at the same time provide the resources for treating patients with COVID-19 while keeping the medical personal safe. This study sought to determine if continuing to operate on patients with a semielective or emergency indication can be recommended in the future, for example against the background of a possible second wave of the COVID-19 pandemic.

Our study showed that none of the 750 patients who received a SARS-CoV-2 swab showed a positive test. However, as different studies show, 2% to 40%[8-11] of the tests show false negative results. False negative rates mainly vary based on sampling timing, location, acquisition, and prevalence.[12] Generally, it is believed that the highest risk for false negative results occurs in the presymptomatic period up to 4 days prior to symptom onset.[13] In terms of sample location, it is suggested that the nasopharynx is a better sampling location compared to the oropharynx or nasal cavity.[14,15] For proper sampling, adequate viral material must be obtained in order to be amplified and subsequently detected by RT-PCR. Consequently, the swabs were sampled by a trained otolaryngologist scratching the oropharynx as well as the nasopharynx. Regarding the prevalence, it is important to consider that a population with low prevalence tends to produce more false positive results than a population with a high prevalence, which produces a higher rate of false negative results. Woloshin et al[8] nicely explained the dilemma about pretest and posttest probability: If you presume that the probability of becoming infected after contact with a SARS-CoV-2 positive patient is 50% and the sensitivity is 70% (specificity 95%), the posttest probability of a false negative results is still 23%. This is an incredibly high number. However, when you look at our semielective patients, the pretest probability was significantly lower (0.2%)[16] due the prevalence and the nonsymptomatic patients. This means that even with the same sensitivity and specificity (70% and 95%,

respectively) the posttest probability is below 5%. We consider a posttest probability of below 5% sufficiently low to continue operating on semielective patients. We also believe that the combination of the reviewing of symptoms and the RT-PCR test additionally increases accuracy. Additionally, the patients with semielective surgery were obliged to self-quarantine themselves before their surgery. Summarizing that no patient and medical personnel was infected, we suggest that continuing surgeries in specific cases and with a standard operating procedure of how to identify infected patients and personnel is doable. However, it is essential to avoid contamination and infection of the medical personnel by all means and, when in doubt, full personal protective equipment should be recommended.

Our data also show that n = 39 patients received emergency surgeries that saved their lives. We suppose that out of experience with other critically ill patients with the same diagnosis, those patients would have died without a surgery. These scenarios include parapharyngeal and cervical abscesses, severe bleeding incidents, as well as intracranial complications of sinusitis. Subjectively, the abscesses were larger and patients in a worse medical condition larger than in previous years. This might be because of a delayed presentation to the hospital due to the lockdown or fear of getting diagnosed respectively infected with COVID-19. Especially patients with a sore throat and a fever, known symptoms of COVID-19 but also for parapharyngeal abscesses, reported being hesitant to present to the emergency department.

Furthermore, one has to take into consideration that the 5-year survival rate through all cancers in the head and neck area stated by the national cancer institute is roughly 50%.[17] In the patients with head and neck cancer, a delay of surgery might have worsened the symptom load, complicated a later surgery, increased the cancer stage, and therefore worsened prognosis and outcome. However, the effect of a treatment delay in these cancer patients can only be displayed short-term (5-year follow-up) or long-term (10-year follow-up). The alternative of sending these patients to the Department of Radiation Oncology was controversially discussed, however, the capacities for treating an aggrandized number of patients during the COVID-19 pandemic would not have been sufficient either. Furthermore, we, for example, considered cochlear implant surgeries for children or adults with acute-onset deafness due to meningitis as semielective. As literature shows early and bilateral cochlear implants lead to the best spoken language outcomes.[18] We decided not to delay surgery as this might have had an impact on speech and hearing for these children in their later life. For adult patients with acute-onset deafness due to meningitis time is crucial to prevent ossification of the cochlea.[19] These examples point out that not continuing semi-elective and emergency surgeries lead to an ethical dilemma and endangers patients' quality of life and survival.

Conclusions

Continuing selected otorhinolaryngological surgeries is crucial for patients' health, survival, and long-time quality of life, yet, the protection of the medical personnel has to be granted.

Declaration of Conflicting Interests

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