



Original Article

## Endoscopic endonasal skull base surgery during the COVID-19 pandemic: A developing country perspective

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### ABSTRACT

**Background:** Although primarily a respiratory disorder, the coronavirus pandemic has paralyzed almost all aspects of health-care delivery. Emergency procedures are likely continuing in most countries, however, some of them raises certain concerns to the surgeons such as the endoscopic endonasal skull base surgeries. The aim of this study is to present the current situation from a developing country perspective in dealing with such cases at the time of the COVID-19 pandemic.

**Methods:** A cross-sectional analytical survey was distributed among neurosurgeons who performed emergency surgeries during the COVID-19 pandemic in Cairo, Egypt, between May 8, 2020, and June 7, 2020. The survey entailed patients' information (demographics, preoperative screening, and postoperative COVID-19 symptoms), surgical team information (demographics and postoperative COVID-19 symptoms), and operative information (personal protective equipment [PPE] utilization and basal craniectomy).

**Results:** Our survey was completed on June 7, 2020 (16 completed, 100% response rate). The patients were screened for COVID-19 preoperatively through complete blood cell (CBC) (100%), computed tomography (CT) chest (68.8%), chest examination (50%), C-reactive protein (CRP) (50%), and serological testing (6.3%). Only 18.8% of the surgical team utilized N95 mask and goggles, 12.5% utilized face shield, and none used PAPRs. Regarding the basal craniectomy, 81.3% used Kerrison Rongeur and chisel, 25% used a high-speed drill, and 6.3% used a mucosal shaver. None of the patients developed any COVID-19 symptoms during the first 3 weeks postsurgery and one of the surgeons developed high fever with negative nasopharyngeal swabs.

**Conclusion:** In developing countries with limited resources, preoperative screening using chest examination, CBC, and CT chest might be sufficient to replace Reverse transcription polymerase chain reaction. Developing countries require adequate support with screening tests, PPE, and critical care equipment such as ventilators.

**Keywords:** Coronavirus, COVID-19, Developing Countries, Endoscopic, Skull base, Trans-sphenoid

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## INTRODUCTION

The coronavirus (COVID-19) pandemic has affected virtually all aspects of human existence with social and psychological repercussions that generations have not witnessed. It has devastated the world economy through massive layoffs, business disruption, and collapse of financial markets. Elective surgeries at all levels have been suspended and day-to-day interactions have changed as the virus is projected to afflict large portions of the world's population.<sup>[5,10,11,29]</sup>

Severe acute respiratory syndrome coronavirus-2 (SARS-CoV-2) was first identified in Wuhan, China, in December 2019.<sup>[20]</sup> On March 11, 2020, the World Health Organization (WHO) declared the infection a pandemic.<sup>[42]</sup> By August 8, 19,187,943 cases were reported worldwide resulting in 716,075 deaths.<sup>[12]</sup> For many nations, the epidemic has just begun, with few nations reaching peak incidence at the time of this writing. Repeated waves of infection over an indefinite future continue to threaten global health-care security.<sup>[14]</sup>

The impact on health care has also varied ranging from continued routine services to almost complete shutdown. Responses have largely varied by region, but also by where a community is temporally on the epidemic curve. In many countries, patients are finding nonemergency services cancelled or delayed including consultations and elective surgeries. In other regions, more aggressive measures have been taken suspending all nonemergency procedures.<sup>[9,13,34,36]</sup>

Emergency procedures are likely continuing in most countries, however, some of them raises certain concerns to the surgeons such as the endoscopic endonasal skull base surgeries which carries an additional risk of the sinuses harboring a high COVID-19 viral load as well as potential aerosolization during endoscopic endonasal instrumentation.<sup>[24]</sup>

When health care has to be delivered, it is incumbent on our institutions to provide such care in the safest manner possible. This has been another challenge across the planet with the lack of availability of essential testing, medical equipment, and personal protective equipment (PPE), especially in low-income countries. A worldwide survey study was conducted during the current pandemic and was published recently showing that 12% of the neurosurgeons did not utilize PPE while dealing with the patients. This was more common in the developing countries.<sup>[16]</sup>

The aim of this study is to present the current situation from a developing country perspective in dealing with emergency endoscopic endonasal skull base surgeries at the time of the COVID-19 pandemic in terms of preoperative patients' screening, surgical techniques, and intraoperative PPE utilization.

## MATERIALS AND METHODS

### Study design and participants

We conducted a cross-sectional analytical survey study to take a snapshot of the situation of the emergency endoscopic endonasal skull base surgeries during the COVID-19 pandemic in a developing country. To elicit prompt responses, data collection was performed electronically.

The survey was distributed electronically (Facebook Messenger and WhatsApp) among neurosurgeons from Cairo University, Egypt, who performed an urgent endoscopic endonasal skull base surgeries during the COVID-19 pandemic. We collected data between May 8, 2020, and June 7, 2020.

The survey was administered through Google Forms (Google, Mountain View, CA, USA). All responses were collated with Excel (Microsoft, Redmond, WA, USA) and cross-verified by three members of our team.

### Data collection tool

The survey consisted of 12 questions designed to explore three domains; patients' information (age, clinical manifestations [neurological and COVID-19 related], diagnosis, preoperative COVID-19 screening, and COVID-19 symptoms during the first 3 weeks postsurgery), surgical team information (age, chronic medical conditions, and COVID-19 symptoms during the first 3 weeks postsurgery), and operative information (PPE utilization and basal craniectomy). The questions were in a checkboxes format so they can choose multiple answers.

COVID-19-related symptoms included any of the following symptoms; fever, new onset of cough, worsening chronic cough, shortness of breath, difficulty breathing, sore throat, hoarse voice, difficulty swallowing, decrease or loss of sense of taste/smell, chills, headaches, unexplained fatigue/malaise/muscle aches, diarrhea, abdominal pain, nausea/vomiting, pink eye (conjunctivitis), runny nose/sneezing without other known cause, and nasal congestion without other known cause.

We first drafted a pilot survey and administered this to two neurosurgeons. Based on their feedback, the survey was revised before full administration.

### Data analysis

We used SPSS (V24, IBM Corp., USA) for data analysis. Descriptive statistics were used to summarize quantitative data and histograms for qualitative data.

### Ethical consideration

Neurosurgeons were informed first about the objectives of this survey and then had the option of not participating.

We maintained strict confidentiality regarding participant responses and personal data (Helsinki Declaration<sup>[43]</sup>). As for its retrospective nature, ethics board approval was not required.

## RESULTS

This manuscript was prepared in accordance with Strengthening the Reporting of Observational studies in Epidemiology (STROBE) guidelines.<sup>[41]</sup> We received 16 responses (response rate, 100%) with a total of 16 patients operated on by Cairo University neurosurgeons and ear, nose, and throat surgeons ( $n=48$ ) since the start of this pandemic in Egypt.

### Patients' data

#### Demographics and diagnosis

The mean age of the patients was  $44.9 \pm 17.7$  years (range, 8–78 years) with 18.8% ( $n = 3$ ) above the age of 60 years. About 81.3% ( $n = 13$ ) of the patients presented by rapid visual deterioration (one of them was associated with cranial nerve deficit), 12.5% ( $n = 2$ ) presented with pituitary apoplexy without visual deterioration, and 6.3% ( $n = 1$ ) presented with cranial nerve deficit only [Figure 1a]. Regarding the pathological diagnosis, 81.3% ( $n = 13$ ) were nonfunctioning pituitary adenoma (one of them was recurrent), 12.5% ( $n = 2$ ) were prolactinoma, and 6.3% ( $n = 1$ ) were GH secreting adenoma [Figure 1b].

#### Preoperative screening

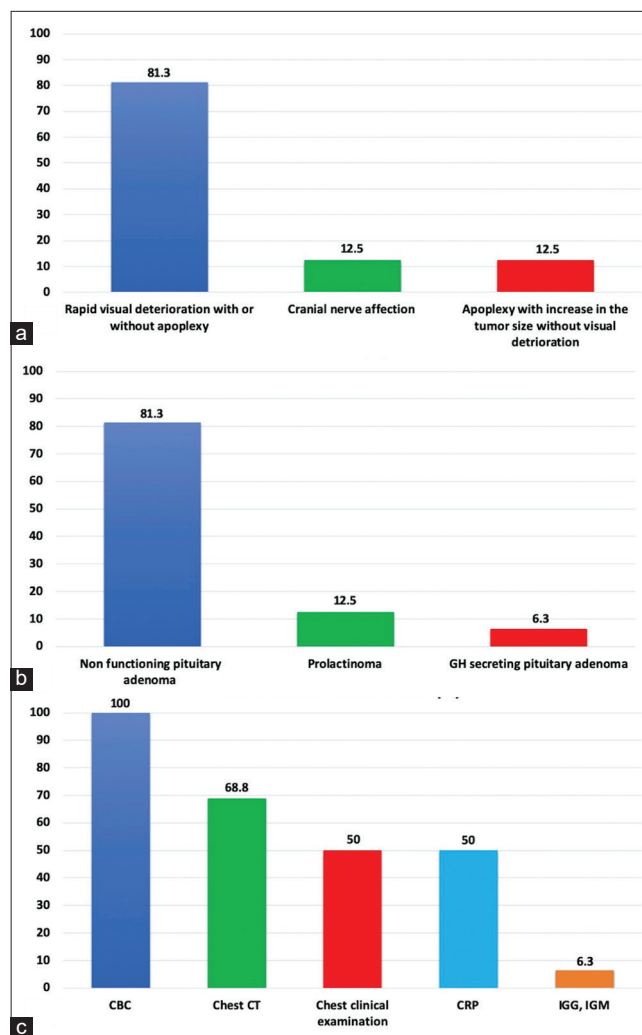
All of the patients were screened by a preoperative complete blood picture and plain chest X-ray. While only 68.8% ( $n = 11$ ) of the patients were screened through a CT chest, 50% ( $n = 8$ ) through chest examination, 50% ( $n = 8$ ) through C-reactive protein (CRP), and only 6.3% ( $n = 1$ ) through immunoglobulins serological testing [Figure 1c]. All of the above tests were normal in all patients. None of the patients were screened using the real-time reverse transcriptase-polymerase chain reaction (RT-PCR) from a nasopharyngeal swab.

#### Postoperative COVID-19-related symptoms

None of the patients developed any manifestation of COVID-19 such as fever or pneumonia-related symptoms during the first 3 weeks after surgery.

#### Surgical team data

About 16.7% ( $n = 8$ ) of the surgical team were above 60 years old [Figure 2a] and only 10.4% ( $n = 5$ ) of them have chronic medical conditions [Figure 2b]. There was only one surgeon



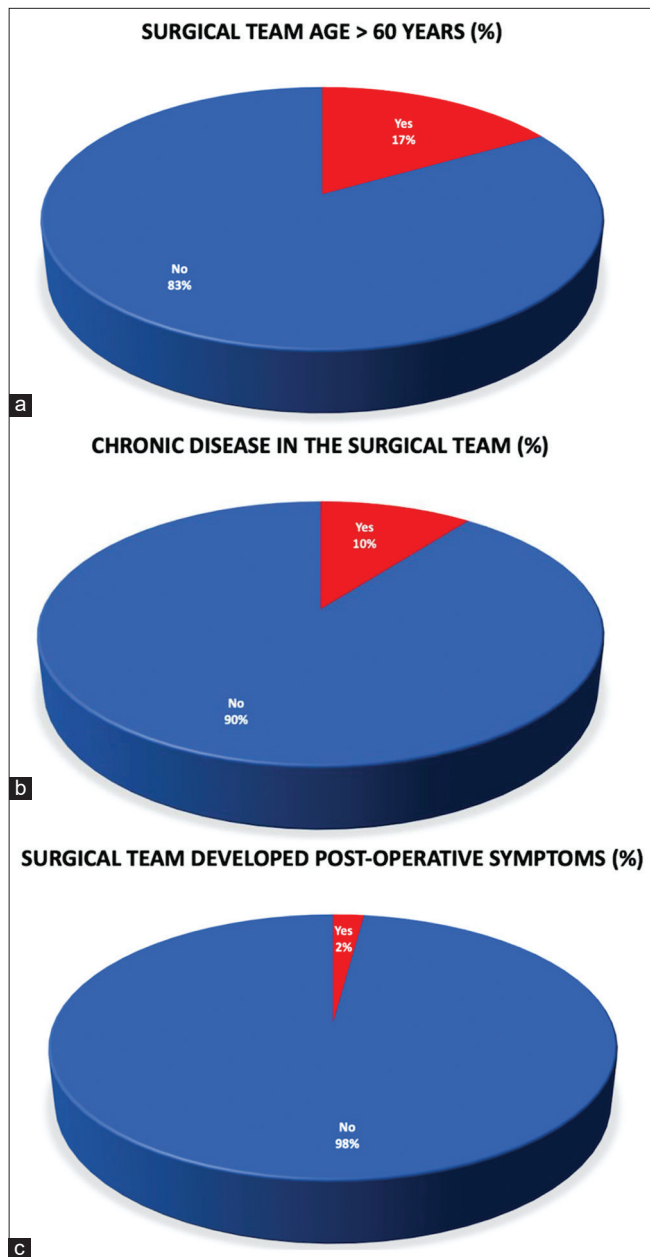
**Figure 1:** Patients' information (multiple answers were allowed). (a) A bar chart graph showing the clinical presentation distribution. (b) A bar chart graph showing the pathological diagnosis. (c) A bar chart graph showing the preoperative screening tests utilized.

who developed a high-grade fever, malaise, and bony aches in the first 3 days after surgery who had undergone two nasopharyngeal swabs with RT-PCR testing 1 week apart and both came back negative representing 2.1% of the surgical team members [Figure 2c].

### Operative data

#### PPE utilization

About 62.5% ( $n = 30$ ) of the surgical team used regular surgical masks only covering nose and mouth, while only 12.5% ( $n = 6$ ) used regular surgical mask and goggle, and only 6.3% ( $n = 3$ ) of the surgeons used regular surgical mask with protective shield, regular surgical mask, protective shield, and N95 mask, regular surgical mask and N95 mask, or N95 mask only [Figure 3a]. All of the surgeons used

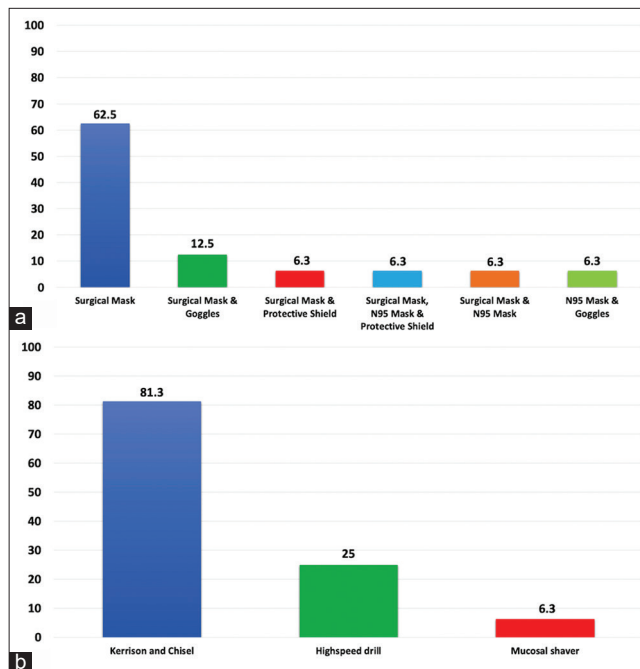


**Figure 2:** Surgical team information (multiple answers were allowed). (a) A pie chart graph showing the percentage of the surgical team that was above 60 years at the time of the surgery. (b) A pie chart graph showing the percentage of the surgical team that was having chronic medical conditions at the time of the surgery. (c) A pie chart graph showing the percentage of the surgical team that presented with COVID-19 symptoms during the first 3 weeks postsurgery.

a single-layer regular gown and none of them used full powered air-purifying respirators (PAPRs) mask.

### Basal craniectomy

Regarding the basal craniectomy, 81.3% ( $n = 13$ ) used Kerrison Rongeur and chisel, 25% ( $n = 4$ ) used a high-speed



**Figure 3:** Operative information (multiple answers were allowed). (a) A bar chart graph showing the PPE utilized among the surgical team. (b) A bar chart graph showing the instruments used during the basal craniectomy.

drill, and 6.3% ( $n = 1$ ) used a mucosal shaver. There was only one case where the surgeons used the Kerrison Rongeur, chisel, high-speed drill, and mucosal shaver [Figure 3b].

## DISCUSSION

The COVID-19 pandemic has been a major threat to global health care. The impact on health systems worldwide is unprecedented. All areas of medicine have had to undergo rapid transformation. Nonessential care has been eliminated in many regions and continues unscathed in some places. Preparedness for this crisis also has varied by nation. A worldwide survey study was conducted during the current pandemic showed that hospitals from low-income countries were insufficiently prepared.<sup>[16]</sup>

When health care has to be delivered, it is incumbent on our institutions to provide such care in the safest manner possible. This has been a challenge in developing countries with the lack of availability of essential screening tests (PCR) and PPE. Physicians, nurses, and other health care workers are stressed for these reasons. Furthermore, the lack of treatments, incomplete understanding of the disease, absence of a vaccine, and misinformation have further compounded this stress.

Now in the midst of the pandemic, health-care facilities in developing countries are overwhelmed by COVID-19

patients. These hospitals were already overcrowded with patients suffering from acute and chronic medical conditions and patients requiring surgical treatment. Furthermore, developing countries will not be able to reduce significantly the surgical volumes to make room for patients with COVID-19. This is due to the largest portion of the surgical volume in developing countries cannot be postponed safely due to their urgent and emergent nature.<sup>[33]</sup> Another major challenge that we did not face until now is the shortage of intensive care (ICU) beds.<sup>[30]</sup> Even if the ICU beds are abundant, there will be a significant shortage of supplies such as ventilators and oxygen, and all of the other supplies required for severe respiratory failure patients' care.<sup>[28]</sup>

The Egyptian authorities announced the first case infected with COVID-19 on February 14, 2020.<sup>[19]</sup> The absence of open screening due to the lack of supplies has attributed to the underreporting of positive COVID-19 cases similar to other developing countries. This underreporting may reach up to 7.4 times the reported COVID-19-positive patients.<sup>[19]</sup> Despite the low reported numbers, it was recommended by the Ministry of Health to postpone all elective surgeries due to the fact that all the hospitals are quickly becoming hot zones for transmission and treatment of the COVID-19 patients. Starting from early April 2020, the daily number of new infections started to escalate with the increase of screening parameters<sup>[12]</sup> with the rapid increase in the COVID-19-related physician mortality rate among the nationwide mortality rate reaching 4.4% on May 29, 2020.<sup>[15]</sup> By June 7 (last day of the survey), 32,612 cases were reported in Egypt resulting in 1198 deaths.<sup>[12]</sup>

Emergency procedures were continued similar to most countries, however, there are some of these procedures require more precaution due to high viral load of the SARS-CoV-2 in the upper airway with potential aerosolization during the procedure such as endoscopic endonasal surgeries.<sup>[24]</sup> Most of the sellar-suprasellar lesion patients present subacute or chronic symptoms and can wait, however, patients presenting with progressive neurological deficits, pituitary apoplexy, and high-flow cerebrospinal fluid (CSF) leak secondary to a sellar-suprasellar lesion which is considered urgent. It will be unforgivable to allow such patients to be blind or develop meningitis during this pandemic. In this study, we are presenting 16 patients with pituitary adenoma and their management from a developing country perspective during the current pandemic.

### Demographics

According to reports from the CDC, Italy and China, patients with underlying chronic medical problems and the elderly are associated with more severe COVID-19 disease.<sup>[7,22,18]</sup> In our series, 18.8% of the patients and 16.7% of the surgical team were older than 60 years. Regarding chronic medical

conditions, 10.4% of the surgical team have chronic medical conditions.

### Preoperative screening

Tedros Ghebreyesus, the World Health Organization (WHO) chief executive, said, "You cannot fight a fire blindfolded" and his key message was "test, test, test." The WHO has criticized countries that have not prioritized COVID-19 testing.<sup>[42]</sup> The positive RT-PCR test for nasopharyngeal swab is the gold standard for the diagnosis of COVID-19.<sup>[8,20]</sup> According to several recent reports, the initial RT-PCR is less sensitive than CT chest and many suspected patients with atypical findings on the CT chest and the RT-PCR came back negative.<sup>[2,17,21,44]</sup> The other advantage of CT is that it is a relatively quick, simple, and available screening tool for COVID-19 in countries with limited availability of the RT-PCR.<sup>[35,39]</sup>

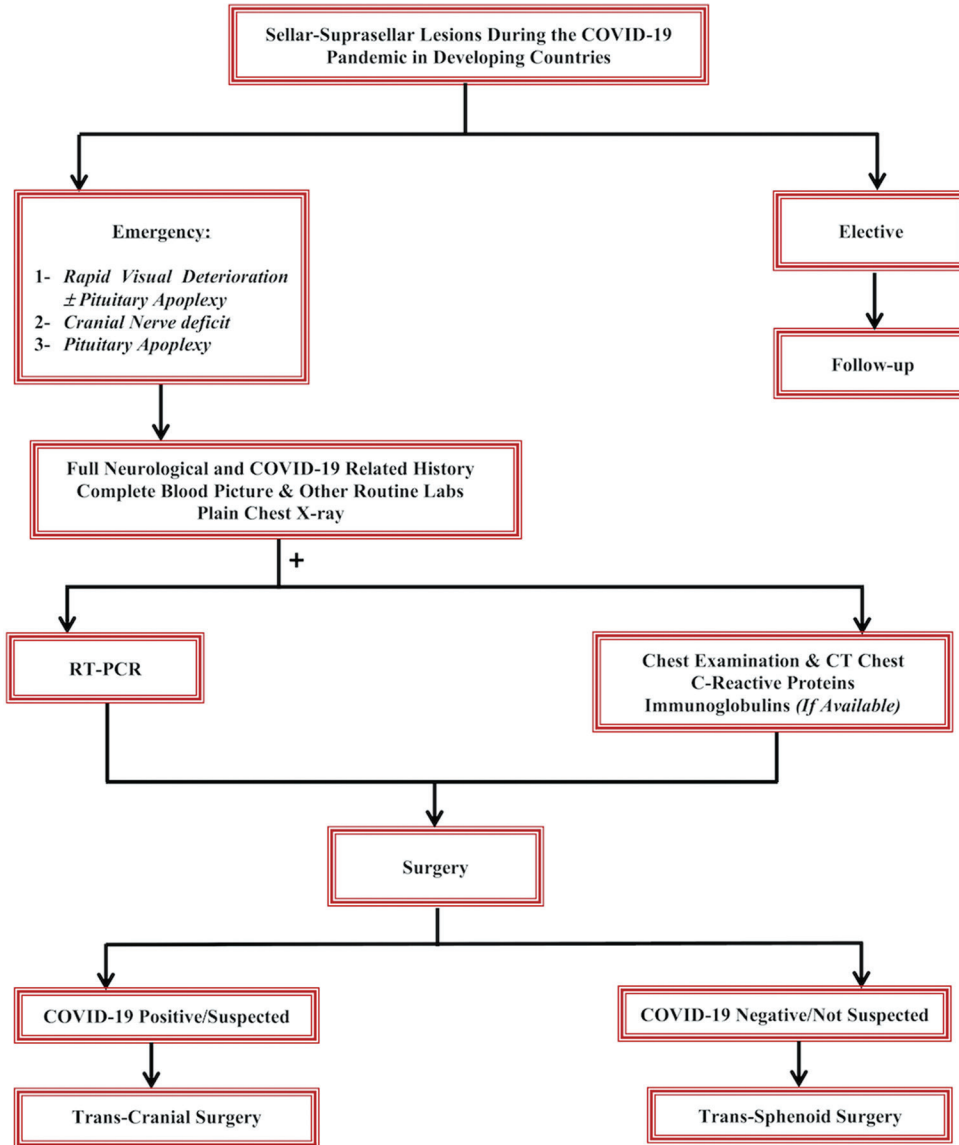
About 30% of asymptomatic patients and 56% of mildly symptomatic patients can transmit SARS-CoV-2 infection.<sup>[25]</sup> In China, several reported cases presented with either no symptoms or mild flu-like symptoms who undergone endoscopic trans-sphenoid surgery and multiple members of the surgical team became infected with COVID-19.<sup>[32,37]</sup> This led them to recommend that all patients undergoing endoscopic trans-sphenoid surgery to be dealt with as suspected COVID-19 positive and should be investigated fully for COVID-19 (blood test, CT chest, and RT-PCR) and all providers utilize enhanced PPE.<sup>[27]</sup>

In developing countries such as Egypt with limited testing for the SARS-CoV-2,<sup>[19]</sup> focused testing is only done to severely symptomatic patients leading to less strain on health-care systems. This led to stretching the laboratory and radiographic investigations beyond our capacity as well as relying on clinical history and examination. This is evident in this series where none of the patients were investigated in the form of RT-PCR and we relied only on complete blood cell (CBC) (100%), CT chest (68.8%), clinical history and examination (50%), CRP (50%), and serological test (immunoglobulins) (6.3%).

The basic clinical examination, CBC, CRP, and chest imaging were the main preoperative diagnostic tools used and created convenient prophylactic measures that served in operating on 16 urgent patients at the time of the pandemic uprising in Egypt without any report for a surgery-related spread of infection.

### Intraoperative PPE utilization

There is enormous demand for PPE around the world and will be more difficult in obtaining them in developing countries. The endoscopic trans-sphenoid surgery creates clouds of aerosols and droplets which may contaminate the



**Figure 4:** Suggested management algorithm for sellar-suprasellar lesions in low-resource settings.

operating theater environment when operating on a positive COVID-19 patient.<sup>[40,45,46]</sup> However, there is uncertainty regarding the exact mechanisms of viral transmission, viral load amount exposure, degree of aerosolization, and inadequate data on the appropriate PPE utilization during endoscopic trans-sphenoid surgeries. Furthermore, due to the limited availability of the gold standard test (RT-PCR) makes us deal with all the patients as COVID-19 positive. This is supported by the American Association of Otolaryngology-Head and Neck Surgery (AAO-HNS) recommendations that advocated the use of enhanced PPE regardless of the status of the COVID-19 testing.<sup>[1]</sup> The enhanced PPE includes N95 respirator, face shield, goggles, double-layered gloves, and three-layered gowns to achieve maximum contact/droplet isolation precautions.<sup>[26,31,38]</sup>

Despite all these measures including N95 respirator utilization, in Wuhan, the ENT surgeons were one of the worst specialties affected.<sup>[23]</sup> This led to formal guidelines from China as well as informal US and UK advisories that recommended the use of full PAPRs in endoscopic trans-sphenoid surgeries which reduced the rate of transmission.<sup>[27,32]</sup> However, the utilization of PAPRs or even N95 masks is challenging in limited resource hospitals. In our hospital, the OR supplies the surgical team with only one regular surgical mask and one overhead per surgeon per day whatever the number of cases the surgeon operating upon. Apart from single-layered gloves and single-layered gown, the PPE utilization is surgeon dependent. This can be seen in our results where a surgical mask was utilized in 93.8%, N95 and goggles were utilized only in 18.8%, and a protective face shield was used in only 12.5%.

## Basal craniectomy

The SARS-CoV-2 aerosolization during upper airway procedures and sinonasal procedures is very high, especially with the use of powered instruments such as drills and debriders due to the upper airway high viral load.<sup>[23,46]</sup> This attributed to recommendations to avoid the utilization of power instruments and the use of chisels and Kerrison Rongeur instead without affecting surgical exposure.<sup>[6]</sup> Furthermore, if drilling is mandatory, meticulous irrigation is recommended to avoid aerosolization.<sup>[27]</sup> In this series, 81.3% of the cases Kerrison Rongeur and chisel were utilized in the basal craniectomy, 25% of the cases a high-speed drill was used, and in 6.3% of the cases, a mucosal shaver was utilized. There was only one case where the surgeons used the Kerrison Rongeur, chisel, high-speed drill, and mucosal shaver. The aim of decreased utilization was to avoid aerosolization.

## Postoperative care

Our recommendation is to deal with the patient as suspected COVID-19 positive as long as we are not able to perform an RT-PCR nasal swab to them. All the patients are transferred to the regular single-bed room for isolation and postoperative care. Daily body temperature assessment and respiratory history were done and in consistence with recommendations.<sup>[38]</sup> Any patient with cough or new-onset fever should be isolated and investigated thoroughly to rule out COVID-19 infection.<sup>[4]</sup> The isolation should be in a negative pressure single room with sufficient nebulization and oxygen supply.<sup>[3]</sup> None of our patients were in a negative pressure room due to inadequate preparation of the hospital. Fortunately, all of our patients did not develop any COVID-19-related symptoms such as fever or pneumonia-related symptoms in the 1<sup>st</sup> 3 weeks postsurgery. Medication administration and postoperative rounds should be done by the health-care personnel under full PPE, however, our team was only using a surgical mask and gloves.<sup>[38]</sup> In positive COVID-19 patients, all health-care personnel that dealt with the patient should be quarantined for 14 days.<sup>[38]</sup> There was one surgeon in our series who developed a high-grade fever, malaise, and bony aches in the 1<sup>st</sup> 3 days after surgery who had undergone two nasopharyngeal swabs with RT-PCR testing 1 week apart and both came back negative.

## Limitations

At the time of this submission, the situation is rapidly evolving in our country, and all of the above policies might change in the near future. Furthermore, fortunately, all our cases did not present with COVID-19-related symptoms whether pre- or postoperative which might be due to asymptomatic form of the disease or they are COVID-19 negative despite that most

cases were during the uprise of COVID-19 reported cases in Egypt. This series of patients is from single-center surgeons and there might be other COVID-19 confirmed positive cases operated in other centers. Although this study was discussing the urgent trans-sphenoid skull base cases that were operated on during this pandemic, it is missing the number of nonurgent cases that presented to our clinics or emergency department with clinical signs of COVID-19. However, in case of a patient that requires urgent surgery and is clinically or radiographically suspected of COVID-19, an urgent craniectomy will be indicated [Figure 4].

## CONCLUSION

The surgeons' safety should be placed at the highest priority and the governments should balance the limited resources and surgeons' safety. The idea of waking-up nearly every week on a loss of one of the neurosurgical or skull base teams to this virus is terrifying. We highlight the situation of urgent endoscopic skull base practice from a developing country with limited resources, preoperative screening using chest clinical history and examination, CBC, and CT chest might be sufficient to replace RT-PCR. All patients should be managed as suspected COVID-19 until 2 weeks postsurgery with enhanced PPE whenever possible and avoiding power drills whenever possible. If the patient requires urgent surgery and the above test are suggesting COVID-19, transcranial excision is recommended. Developing countries require adequate support with screening tests, PPE (N95 masks and PAPRs), and critical care equipment such as ventilators.

## Declaration of patient consent

Patient's consent not required as patients identity is not disclosed or compromised.

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Nil.

## Conflicts of interest

There are no conflicts of interest.

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