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ORIGINAL ARTICLE

Early experience with universal preoperative and pre-procedural screening for COVID-19 in low-risk pediatric surgical patients requiring general anesthesia

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Abstract

Purpose The COVID-19 pandemic has placed extraordinary demands on healthcare services worldwide. Some have reported increased viral transmission to healthcare workers during aerosol-generating procedures such as intubation. We report our experience with universal preoperative and preprocedural screening for COVID-19 in children requiring general anaesthesia with low risk of having the infection.

Methods This was a data review involving children aged < 18 years undergoing procedures under general anaesthesia in our institution from 18th March to 31st May 2020 and deemed low risk for COVID 19 infection, as defined by our institutional protocol. Confirmation of COVID-19 was by real time reverse-transcription polymerase chain reaction with confirmation by nucleic acid sequencing. All patients were followed up 14 days post-swab.

Results Of the 66 children (median age 4.5 years, range 0–16.8) eligible for the study, 39 (60%) were male and infants (1–12 months) formed the largest group ($n = 24$, 36%). None were positive for COVID-19. On 14 day follow-up, none had symptoms related to COVID-19.

Conclusion Our study shows that low risk asymptomatic children with no history of contact with COVID-19 patients test negative on universal screening. Larger studies are required to ascertain the role of screening prior to procedures done under general anaesthesia.

Keywords COVID-19 · Screening · Pediatric · Preoperative preparation

Introduction

COVID-19, a disease caused by the severe acute respiratory syndrome coronavirus-2 (SARS-CoV2), was first reported in December 2019. At the time of writing, it has spread rapidly to over 213 countries, infecting more than 23,000,0000 persons. On March 11, 2020, the World Health Organization declared COVID-19 a global pandemic with many countries declaring a state of emergency [1].

Surgeons have responded in various ways to this pandemic. A number of expert groups from the United Kingdom and North America recommended postponing non-urgent procedures and considering non operative treatment as SARS-CoV2 patients who undergo surgery experience substantially worse postoperative outcomes compared to similar patients who are not infected [2, 3].

In addition, while SARS-CoV2 testing initially focused on the diagnosis and treatment of symptomatic patients, this effort has now expanded to include the surveillance of asymptomatic patients due to reports that thousands of healthcare workers (HCW) have been infected due to transmission from asymptomatic patients despite adherence to infection control measures [4, 5].

The first reported case of COVID-19 in our country, a developing higher middle-income country in Southeast Asia, was on 25 Jan 2020. A restricted movement order (lockdown) was announced by our federal government on 18 March 2020, by which time there was an average of 170 new cases per day, with a total of approximately 1800 cases nationwide. Our institution had by then been designated a COVID treatment hospital, i.e. a facility recognized as

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being capable of the full spectrum of care for patients with COVID-19, including intensive care. All COVID treatment hospitals in our country are publicly funded hospitals, with public hospitals serving approximately 85% of the local population. Among the institution-wide measures implemented in our response to the pandemic was mandatory pre-operative and pre-procedural COVID-19 screening for all patients planned for surgery under general anesthesia, both emergency and elective. This purpose of the protocol was to minimize exposure of HCW performing intubation for general anesthesia, which is an aerosol-generating procedure [6–9].

The aim of our study is to describe our early experience and results in universal preoperative and pre-procedural screening (pre-surgical swabbing, PSS) for COVID-19 in children undergoing surgery with low risk of having the infection.

Methods

This was a cross-sectional study using data from a prospectively collected database of all patients undergoing surgery and other procedures under general anesthesia in our institution, which is a university-affiliated academic center.

Study participants and eligibility criteria

For our study, we included all pediatric patients aged 18 years and under who had PSS from 18 March 2020 (the start date of lockdown) to 31st May 2020.

Each patient was evaluated for symptoms and risk factors for COVID-19, using a standard checklist which included the following:

1. Presence of COVID-19-related symptoms—fever, cough, sore throat, shortness of breath, coryza, and loss of or reduced sense of smell.
2. High-risk contact in the preceding 14 days.
    a. direct contact with anyone confirmed or suspected to have COVID-19;
    b. attendance at mass gathering events, eg conferences, places of worship, large weddings;
    c. travel from another country or location with confirmed cases of COVID-19.

A patient was categorized as 'low risk' when none of the above factors were present and was deemed eligible for inclusion in this study.

When the answer was the affirmative to any of the above items, the patient was categorized as a 'Person Under Investigation' and additional precautionary measures were taken to prevent healthcare worker (HCW) transmission. The patient then entered an institutional workflow for suspected COVID-19 cases and was deemed NOT eligible for inclusion in this study.

In patients undergoing emergency surgery, swab results were used to guide post-operative management but confirmed results, either positive or negative, were not required prior to the start of the procedure. For semi-urgent or elective cases, swab results were confirmed prior to the start of surgery.

We used the following definitions to classify acuity of surgery, which were government issued guidelines during the study period:

(1) Emergency—patient's condition requires surgery within 24 h, without which life is threatened or morbidity is increased.
(2) Semi-emergency—patient's condition requires surgery within 1 week, without which there is increase in morbidity.
(3) Elective—patient's condition requires surgery within 1–6 months, without which the patient is affected in development, function, quality of life; or becomes an emergency.

Swab runs were performed by our laboratory twice a day, with results ready within 4 h of the run. All patients were confined to our inpatient wards while waiting for test results and for surgery. There was a blanket ban on visitors, with only a single caregiver allowed to accompany each child while in the ward.

Procedure and protocol for pre-surgical swabbing (PSS)

Once deemed 'low risk", patients are brought with a parent to an isolation negative pressure ventilation room for the swab. A designated team of trained medical personnel performs the swab in pairs. They don personal protective equipment (PPE), which consists of fit-tested disposable N95 respirators, face shields, long-sleeved gowns, double-layered gloves, and protective footwear to achieve maximum droplet and contact isolation protection.

During performance of the nasopharyngeal (NP) and oropharyngeal (OP) swabs, the patient must be seated comfortably with the back of the head against a parent's front of body. The OP swab is performed first in which the swab stick is inserted until it reaches the posterior pharynx between the tonsils. The OP swab is technically easier to perform than the NP. The NP swab is inserted in the nose horizontally, along an imaginary line between the nostril and the ear. The swab is directed toward the wall of the oropharynx and it is rotated about five times before removal. After taking

the sample, the swab stick is inserted into a viral contained transport media tube. The specimens are transported in ice in a tEriple layer package to the lab to be processed.

After completion of the swabbing procedure, doffing is followed by complete personal hand hygiene.

Confirmation of COVID-19 is based on detection of unique sequences of viral RNA by real-time reverse transcription polymerase chain reaction (rRT-PCR) with confirmation by nucleic acid sequencing [10].

Follow-up and data analysis

All patients were followed up for 2 weeks post-swab to assess for COVID-19-related symptoms, taking into account an incubation period of up to 14 days.

We performed a descriptive analysis, with data presented as median (range) and proportions described as *n* (%).

Results

There were 66 children eligible for the study, who underwent PSS for COVID-19 in our center from 17th March 2020 till 31st May 2020 (Table 1). They were aged 4.5 years (median, range day 4 of life—16.8 years).

The majority were male ($n=39$, 60%) and from the infant age group ($n=24$, 36%).

The start of the data collection period represented the initial phase of our lockdown, during which all elective cases were temporarily halted, and only urgent life-saving procedures were performed.

Out of 66 patients, 39 were male (60%) and 27 (40%) were female with a male to female ratio of 1.5:1. Most of them were infants (36%), followed by toddlers (17%), preschool (15%), school age (15%), adolescents (11%), and neonates (6%). In these 66 patients, 31 (47%) of them were from general pediatric surgery department, 13 (20%) from neurosurgery, 10 (15%) from oncology department, 6 (9%) from orthopedics department, 5 (7.5%) patients from gastroenterology and hepatology department, and 1 (1.5%) from plastic surgery department. Fifty-three (80%) patients underwent operative surgeries, whereas 10 (15%) patients were screened for imaging procedures (computed tomography and magnetic resonance imaging) and 3 (5%) had pre-surgical swabs but eventually did not proceed with surgery.

None of the patients in the study were positive for COVID-19.

When followed up for 14 days after the swab, none had symptoms related to COVID-19.

Overall, during the entire period of the study, only one child was assessed as 'high risk'. This 2-month-old infant presented with a strangulated hernia. Presence of yellowish mucus in the respiratory tract meant that he entered the 'suspected COVID-19' pathway and was, therefore, not eligible for this study. Nonetheless, he too eventually was confirmed negative for the infection.

Table 1 Demographics of patients who underwent universal swab screening

	Patients ($n=66$) (%)
Age group	
Neonate (first 4 weeks of life)	4 (6%)
Infant (1 month–1 year)	24 (36%)
Toddler (1–3 years)	11 (17%)
Preschool (3–5 years)	10 (15%)
School age (6–12 years)	10 (15%)
Adolescent (13–18 years)	7 (11%)
Services	
General paediatric surgery	31 (47%)
Neurosurgery	13 (20%)
Orthopedics	6 (15%)
Oncology	10 (9%)
Gastroenterology and hepatology	5 (7.5%)
Plastic surgery	1 (1.5%)
Gender	
Male	39 (60%)
Female	27 (40%)
Procedure	
Operative	53 (80%)
Imaging (CT and MRI)	10 (15%)
Emergency standby (surgery not done)	3 (5%)
Setting	
Emergency	19 (29%)
Semi-emergency	12 (18%)
Elective	35 (53%)

Discussion

Our study shows that all children assessed as 'low risk' tested negative for COVID-19 on universal preoperative and pre-procedural screening for the virus. To our knowledge, this is the first study in the literature describing the results of routine screening in children undergoing general anesthesia.

Early studies from China reported that 9% of pediatric COVID-positive cases were asymptomatic and 65% presented with features of an upper respiratory tract infection, symptoms already very common in the pediatric population [11]. Many reports of adult COVID-19 patients highlighted the possibility of viral shedding in asymptomatic patients, leading to HCW infections during clinical examination and other procedures, albeit contributed by lack of appropriate PPE [12].

Despite the explosion of data and publications regarding COVID-19 in recent months, there remains much that is unknown and not understood. The measures taken by our institution must be interpreted against the background of uncertainty that existed during the time of implementation. Issues at play were conservation of personal protective equipment, concerns regarding HCW infection exposure to the virus during aerosol generating procedures and worries about the possibility of asymptomatic or pre-symptomatic transmission. Certain procedures increase the risk of viral transmission to HCW through aerosolization, such as airway management, endotracheal intubation, and upper aerodigestive endoscopy [13–15]. We also had to consider ringfencing resources required to treat the anticipated wave of COVID-19 patients at the height of the pandemic, while maintaining clinical services for non-COVID patients.

Specifically, in children who form just 2% of infected patients worldwide [16] their role in transmission of the disease remains controversial, with conflicting evidence as to whether or not they contribute significantly [17–21]. In our study, only one of the children coming in for a procedure was classified as high risk, and was still eventually found to be negative. Institution wide, despite being designated as a COVID treatment center and managing a large number of adult cases, only one pediatric patient was confirmed to be infected, and this child was discovered via contact tracing (the child's parent was positive).

Nevertheless, our prospective universal screening strategy had its benefits. Coupled with a thorough symptom and risk factor evaluation, we were able to accurately stratify the risk of infection, thus reducing the need for aerosol level PPE amongst operating theatre staff. The additional layer of checks also alleviated anxiety levels amongst HCW. An additional factor to consider is the operative risk to COVID-19-positive patients. Large studies have reported adverse outcomes in COVID-19-infected adult patients undergoing surgery with ensuing recommendations to screen asymptomatic patients prior to surgery, but this risk remains unknown in children [22].

We acknowledge the limitations of our approach. This was a single-center study with a small sample size, taking place over a narrow period of 10 weeks. We relied on a single measure of real time polymerase chain reaction (rt-PCR) with a reported sensitivity of 78% [23]. There is a risk for false-positive results where prevalence is low, but true community prevalence rates were not available as our limited resources did not allow nationwide mass testing. However, these limitations are mitigated by a number of factors. Our institution is located at the heart of a constituency reporting the highest incidence of new infections nationwide. The 10-week period encompassed the peak of the epidemic in our country. Finally, we are one of only two public hospitals in our local area designated as COVID treatment facilities. Therefore, our study is likely to be representative of our population's experience with COVID-19. The negative results were also associated with absence of COVID-19 symptoms in all patients when followed up for 14 days after.

We do not claim that universal pre-procedural swabbing in children should be the practice globally as clinical protocols should be guided by local resources, transmission rates, and cultural norms. Rather, we hope that our results will serve to inform these protocols as we edge closer towards relief of lockdown measures, whatever form they may take anywhere in the world.

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Compliance with ethical standards

Conflict of interest The authors declare that there are no known conflicts of interest associated with this publication.

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