

Original Article



Impact of the Coronavirus Disease 2019 Pandemic on Pediatric Gastrointestinal Endoscopy: A Questionnaire-based Internet Survey of 162 Institutional Experiences in Asia Pacific

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OPEN ACCESS

Received: Mar 9, 2023
1st Revised: May 12, 2023
2nd Revised: Jun 16, 2023
3rd Revised: Jul 25, 2023
4th Revised: Aug 4, 2023
Accepted: Aug 12, 2023
Published online: Oct 30, 2023

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ABSTRACT

Purpose: The impact of coronavirus 2019 (COVID-19) on gastrointestinal (GI) endoscopy procedures in adults has been reported, with a drastic reduction in the number of procedures. However, there are no sufficient data regarding the impact on pediatric GI endoscopy. Here, we aimed to report that impact in the Asia-Pacific region.

Methods: A questionnaire-based internet survey was conducted from June to November 2021 among pediatric endoscopy institutions in the Asia-Pacific region, with each institution providing a single response. Overall, 25 questions focused on the impact of the number of procedures conducted, the usage of personal protective equipment (PPE), and endoscopy training programs during the pandemic.

Results: A total of 162 institutions across 13 countries in the Asia-Pacific region participated in the study, and 133 (82.1%) institutions underwent procedure changes since the emergence of COVID-19. The number of esophagogastroduodenoscopy and ileocolonoscopy procedures decreased in 118/133 (88.7%) and 112/133 (84.2%) institutions, respectively. Endoscopy for patient with positive COVID-19 in an emergency or urgent cases still carried out in 102/162 (62.9%) institutions. Screening of COVID-19 for all patients before endoscopy was done across 110/162 (67.9%) institutions. PPE recommendations varied among institutions. Pediatric gastrointestinal endoscopy training programs were discontinued in 127/162 (78.4%) institutions.

Conclusion: This study reports the impact of the COVID-19 pandemic on pediatric

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AD has a full funding support from the APPSPGHAN Educational Grants Application. The National Centre for Child Health and Development granted ethics approval for this study (2021-019NCCHD).

Conflict of Interest

The authors have no financial conflicts of interest.

gastrointestinal endoscopy in the Asia-Pacific region. There has been a significant reduction in the number of endoscopic procedures and relevant training programs.

Keywords: Pediatrics; Coronavirus; Pandemics; Gastrointestinal endoscopy

INTRODUCTION

Coronavirus disease 2019 (COVID-19) was declared a pandemic by the World Health Organization on March 11, 2020 [1]. Routine medical services, including gastrointestinal (GI) endoscopy practices, have experienced a significant impact due to the high risk of transmitting COVID-19. Direct person-to-person contact, infected aerosols, and direct contact with contaminated endoscope equipment or a patient's body fluids from the hand to the mucous membranes of the eyes, nose, and mouth have been the primary factors that account for the transmission of COVID-19 during endoscopy [2-5]. The identification of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) in stool raises concerns about the potential for fecal-oral route transmission [5].

In adult patients, the number of endoscopy procedures was reported to be markedly lower during the COVID-19 pandemic [3,6-8]. Globally, a large number of institutions reported a massive reduction in the average number of total endoscopies procedures [6,7]. The Global Endo-COVID working group reported 4/48 (2.45%) institutions completely stopped the endoscopy services in early 2020 [7]. A web-based survey in North America discovered that 64.8% (46/71) of endoscopy centers performed only $\leq 10\%$ of their normal procedures, and 25% performed about 25% of their normal procedures [8]. Likewise, in Asia, the number of GI endoscopies in adults decreased from 51-75%, compared with the numbers before the pandemic [3]. For pediatric GI endoscopy services, studies regarding the impact of the COVID-19 pandemic have been limited. More than 75% reduction in number of pediatric GI endoscopic practice was reported in 89/115 by an International Pediatric Gastroenterology COVID-19 Alliance survey [9]. In the Asia-Pacific region, a study from Korea has reported a reduction in the lower GI endoscopy rate, with a decrease of 21% in 2020 compared to the pre-COVID-19 era (2016-2019) in children and adolescents; and there have been no reports from other countries [10]. The above circumstances prompted us to conduct this questionnaire-based internet survey to investigate the impact of the COVID-19 pandemic on pediatric GI endoscopy in the Asia-Pacific region.

MATERIALS AND METHODS

Study design and participants

A questionnaire-based internet survey (**Supplementary Fig. 1**) was conducted at centers in Asia-Pacific countries that conduct pediatric GI endoscopy. The questionnaire was distributed via email to the centers between June 2021 and November 2021. Each institution could only provide one response. The National Centre for Child Health and Development granted ethical approval for this study (2021-019NCCHD).

Questionnaire

All participants provided informed consent, and information was collected anonymously. The 25-item questionnaire was about pediatric GI endoscopy service adaptations during

the COVID-19 pandemic; these included demographics, endoscopy numbers, endoscopy training, patient and staff COVID-19 screening, personal protective equipment (PPE) usage, and COVID-19 prevention strategies (such as negative pressure room, staff limitation, changes in sterilization, and post-procedural clean-up).

Statistical analysis

The data are presented using a descriptive analysis of the number and percentage of responses from the participants. Survey responses were collected and analyzed quantitatively using Microsoft Excel (V.16.57, 2019; Microsoft).

RESULTS

Respondents' background characteristics

A total of 162 pediatric GI endoscopy institutions across 13 countries in the Asia-Pacific region participated in this study (**Fig. 1**). Out of all respondents, the three countries with the highest number of participants were Japan (33, 20.4%); Thailand (32, 19.8%); and Taiwan (25, 15.4%). Most respondents worked in tertiary academic hospitals (112, 69.2%) (**Table 1**).

Impact of the COVID-19 pandemic on the practice of pediatric gastrointestinal endoscopy

The COVID-19 pandemic has led to changes in pediatric GI endoscopy services. A number of 109/162 (67.3%) institutions have made a local guidelines related to pediatric GI

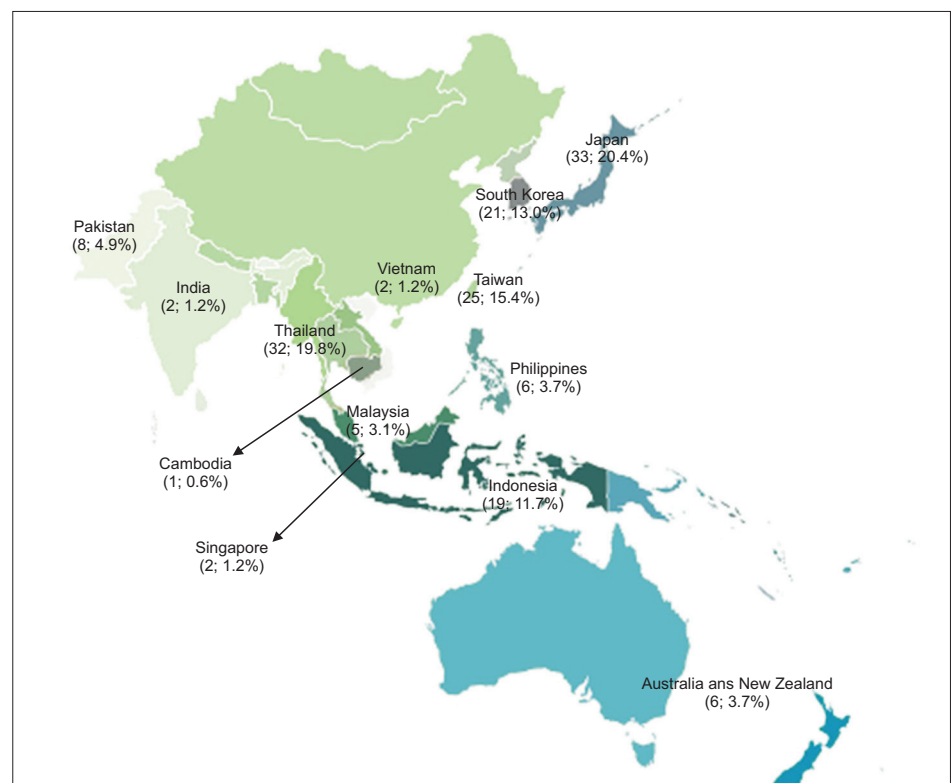


Fig. 1. Geographical distribution of the pediatric gastrointestinal endoscopy institutions in the Asia-Pacific region.

Table 1. Basic characteristics of the pediatric gastrointestinal endoscopy institutions in Asia Pacific region

Characteristics	Number of respondents (n=162)
Hospital type	
Primary care hospital	2 (1.2)
Academic secondary hospital	16 (9.9)
Non-academic secondary hospital	13 (8.0)
Academic tertiary hospital	112 (69.1)
Nonacademic tertiary hospital	17 (10.5)
Others	2 (1.2)
Pediatric hospital bed	
≤10	1 (0.6)
11–30	28 (17.3)
31–100	58 (35.8)
101–200	32 (19.8)
>200	43 (26.5)
Total number of operator performing pediatric gastrointestinal endoscopy	
1	73 (45.1)
2–3	53 (32.7)
4–5	24 (14.8)
>5	12 (7.4)

Values are presented as number (%).

endoscopy practices in COVID-19 pandemic. A total of 82.1% (133/162) of the institutions have undergone changes in pediatric GI endoscopy practices since the emergence of the pandemic. The number of both esophagogastroduodenoscopy (EGD) and ileocolonoscopy (IC) procedures decreased in 88.7% (118/133) and 84.2% (112/133) of the institutions, respectively (**Table 2**). Notably, there were no changes in 12 (9.0%) and 8 (6.0%) institutions, respectively. In contrast, one (0.8%) institution reported an increased number of EGD and IC procedures during the COVID-19 pandemic. Most respondents (63.0%) continued to perform endoscopic procedures for emergent or urgent cases. In 34% of the respondents, the endoscopy procedure was cancelled or postponed if the result of patient screening was positive for COVID-19. Other effects of the COVID-19 pandemic on the practice of pediatric GI endoscopy are shown in **Table 2**.

Impact of the COVID-19 pandemic on the pediatric gastrointestinal endoscopy training

Endoscopic training has changed since the emergence of COVID-19. Most (78.4%) of the institutions discontinued their endoscopy training programs, and only 21.6% continued their training courses on endoscopy (**Table 2**).

COVID-19 prevention in the endoscopy unit

Negative pressure rooms for patients with confirmed COVID-19 and staff limitations with 3–4 staff members present during the procedure as a form of COVID-19 infection prevention in the endoscopy unit were reported in 54.3% and 14.8% of institutions, respectively. Changes in endoscopic sterilization procedures and post-procedural clean-up for the scope were reported in 48.8% (79/162) and 64.8% (105/162) of the institutions, respectively. Other COVID-19 prevention measures in the endoscopy unit are shown in **Table 2**.

COVID-19 Screening for patients and staff

Screening for COVID-19 before the endoscopy procedure was performed by most institutions. A total of 67.9% of institutions screened all patients, and 22.2% of institutions screened only selected patients. However, 9.9% of the patients were not screened before

Table 2. Impact of the COVID-19 pandemic on the practice of pediatric gastrointestinal endoscopy

Questionnaire items	Number of respondents (n=162)
EGD during the COVID-19 pandemic	
Decrease $\geq 51\%$	53 (39.8)
Decrease 25–50%	27 (20.3)
Decrease $< 25\%$	32 (24.1)
No difference	12 (9.0)
Increase	1 (0.8)
No data	8 (6.0)
IC during the COVID-19 pandemic	
Decrease $\geq 51\%$	56 (42.1)
Decrease 25–50%	28 (21.1)
Decrease $< 25\%$	34 (25.6)
No difference	8 (6.0)
Increase	1 (0.8)
No data	6 (4.5)
Defined local guidelines	
Yes	109 (67.3)
No	53 (32.7)
Endoscopy procedure in COVID-19 confirmed patient	
Yes	5 (3.1)
Only in emergent/urgent cases	102 (63.0)
No/postponed	55 (34.9)
Negative pressure room use for patients with confirmed COVID-19	
Yes	88 (54.3)
No	74 (45.7)
Staff limitations during endoscopy procedures	
1–2 people	3 (1.8)
3–4 people	24 (14.8)
> 5 people	17 (10.6)
No data	3 (1.8)
No limitation	115 (71.0)
Changing in the endoscope sterilization procedure	
All endoscopy procedures	28 (17.3)
Only in high-risk patients (with diagnosis or suspicion of COVID-19)	51 (31.5)
No	83 (51.2)
Details for changing in the endoscope sterilization procedure (n=79)	
Double the sterilization process	19 (24.0)
Special detergent	10 (12.7)
Do not know the detail	50 (63.3)
Changing in post-procedural clean-up	
All endoscopy procedures	39 (24.8)
Only in high-risk patients (with diagnosis or suspicion of COVID-19)	66 (42.1)
No	52 (33.1)
Details for changing in post-procedural clean-up (n=105)	
Leave the room unused for some time to exchange the room air	54 (51.4)
Use of a special detergent to clean-up the room	78 (74.3)
Ultraviolet germicidal irradiation	1 (0.9)
Do not know the detail	2 (1.8)
Endoscopy training course during the start of COVID-19	
Yes	35 (21.6)
No	127 (78.4)

Values are presented as number (%).

EGD: esophagogastroduodenoscopy, COVID-19: coronavirus disease 2019, IC: ileocolonoscopy.

endoscopy. Before performing endoscopy, a SARS-CoV-2 polymerase chain reaction (PCR) test was performed to screen patients suspected of having COVID-19 in 85.2% (138/162) of the institutions.

Table 3. COVID-19 screening types for patients with suspected COVID-19 and staff

Screening types	Value (n=162)
Patients	
History	77 (47.5)
Temperature check	0 (0.0)
Antibody rapid test	7 (4.3)
Antigen rapid test	33 (20.3)
PCR	138 (85.2)
Complete blood count	32 (19.8)
Thorax imaging	34 (21.0)
Staffs	
History	32 (19.8)
Temperature check	0 (0.0)
Antibody rapid test	2 (1.2)
Antigen rapid test	17 (10.5)
PCR	73 (45.1)
Complete blood count	3 (1.9)
Thorax imaging (such as radiograph and CT-thorax)	3 (1.9)

Values are presented as number (%).

COVID-19: coronavirus disease 2019, PCR: polymerase chain reaction, CT-thorax: computed tomography of thorax.

Table 4. Usage of PPE during gastrointestinal endoscopy procedures for patients with suspected COVID-19

PPE	Value (n=162)
Surgical cap	108 (66.7)
Goggle	84 (51.9)
Face shield	117 (72.2)
Surgical mask	47 (29.0)
N-95 mask or equivalent mask (KF-94, KN-95, etc.)	142 (87.7)
Reusable respirator	17 (10.5)
PAPR	1 (0.6)
Apron	47 (29.0)
Non water-resistant gown	6 (3.7)
Water-resistant gown	107 (66.0)
Hazmat	67 (41.3)
Single gloves	29 (17.9)
Double gloves	96 (59.3)
Shoe cover/boots	103 (63.6)
None	6 (3.7)

Values are presented as number (%).

PPE: personal protective equipment, COVID-19: coronavirus disease 2019, PAPR: powered air purifying respirators.

COVID-19 screening for staff members for COVID-19 was performed in more than half of the institutions, with 20.4% of it screened all staff and 37% of it screened only selected staff who had comorbidities. However, 42.6% of the participants did not screen their staff members. Overall, <50% of the institutions used the SARS-CoV-2 PCR test to screen endoscopy staff (73, 45.1%). The details of COVID-19 screening for patients and staff are listed in **Table 3**.

Use of PPE during endoscopy procedures

In this survey, we evaluated the usage of PPE for patients with suspected COVID-19 and found varying results among the participating institutions (**Table 4**). Recommended PPE (a face shield, N95 mask or equivalent, surgical cap, water-resistant gown, and gloves) was noted in 35.2% (57/162) of the institutions during endoscopy for patients suspected of having COVID-19.

DISCUSSION

The number of pediatric GI endoscopy services has significantly decreased. Similar to this survey, an international survey conducted in the early pandemic (April 2020) on pediatric gastroenterologists affiliated with The European Society for Paediatric Gastroenterology Hepatology and Nutrition and the North American Society For Pediatric Gastroenterology, Hepatology & Nutrition reported that more than 80% institutions performed fewer number of endoscopy procedures, with 10% of the normal number being done, and 89.6% of institutions postponed all elective endoscopy services [2]. In Italy, there was a 37.2% decrease in the number of endoscopic services performed during the pandemic (February–June 2020) compared with before the pandemic happened (February–June 2019) [11]. School closures, social distance, and the fear of visiting hospital due to the COVID-19 infection were some of the reasons that have also contributed to this decline in numbers.

In the United States, the number of pediatric GI endoscopy procedures has greatly declined in the first 2 months of the pandemic (April–May 2020). This was because only emergency/urgent cases were allowed to save PPE and minimize the transmission of COVID-19. After the first 2 months, the number of procedures was similar to that of the pre-pandemic year [12,13]. Ruan et al. [14] also reported that pediatric GI endoscopy practice globally had already evolved in November 2020, 7 months after the initial survey in the early pandemic (April 2020). An increase in the number of procedures was reported in 70.7% of the institutions, and 76.0% of the institutions no longer postponed elective procedures. However, in this survey, we did not evaluate whether the number of endoscopy procedures returned to pre-pandemic levels.

More than 60% of the institutions in this survey continued to perform emergency or urgent endoscopies for confirmed COVID-19 cases. In line with this study, 78.3% of institutions worldwide continued to perform emergency/urgent procedures for children with suspected or confirmed COVID-19 even in the early waves of the pandemic [2]. NASPGHAN mentioned that in children with known or highly suspected COVID-19, endoscopy procedures should only be performed for essential, emergency, or urgent cases by experienced staff [15]. A risk-to-benefit balance must be obvious in such circumstances for both patients and the staff involved. Lifesaving endoscopies, such as button battery ingestion and GI bleeding, are mandatory and should not be delayed [16].

Different countries have been affected differently by the pandemic, i.e., at different time points during the pandemic, with different access to PPE and different adherence to the guidelines [17]. These factors may be some of the reasons for the varied use of PPE among the participating institutions in this study. Recommendations regarding the use of PPE have been provided by NASPGHAN. The appropriate PPE must include N95 or its equivalent, double gloves, facial protection (i.e., a full visor and/or face shield), whole-body water-resistant disposable gowns or coveralls, shoe covers, and a hairnet [15].

Almost 80% of the institutions in this survey discontinued their endoscopy training programs after the emergence of the COVID-19 pandemic. Forbes et al. [8] reported that 49% of the institutions eliminated trainees' involvement during endoscopy. Endoscopy training during the COVID-19 pandemic had become a point of concern. The presence of fellows in training may prolong the endoscopy procedure, expose them to undue risk, and limit the availability of PPE [15]. Besides the institutional policies limiting trainee access, lack of

cases, and redeployment to high-priority clinical areas, there are other barriers to endoscopy training [18]. Supplemental endoscopy educational materials, such as simulation-based training, endoscopy videos, or online resources, need to be prepared if the participation of fellows in training is limited or stopped [15].

To the best of our knowledge, this is the first regional multicenter survey on the adaptation of pediatric GI endoscopy centers in the Asia-Pacific region. This study described the conditions of pediatric GI endoscopy 1 year after the COVID-19 pandemic. The study had some limitations, including the fact that it did not evaluate the evolving knowledge and trends in endoscopic procedures for COVID-19 cases over time. Other limitations of this study include the different severity levels of the pandemic by country, the different numbers of participating institutions by country, and the different levels of hospitals that participated.

We can learn a lot from the survey about how the pediatric GI endoscopy institutions deal with airborne transmitted disease such as COVID-19 in this global pandemic. The adaptation of pediatric GI endoscopy training programs in the midst of pandemic is needed. Restoration of pediatric GI endoscopy services is another problem that must be considered in many cases that have been delayed during the pandemic. In the United Kingdom, restoring normal endoscopy services quickly, refining endoscopy referral pathways, increasing the clinical vetting of referrals to reduce waiting lists, and considering the use of alternative investigations were some of the steps in the early restoration and recovery phases of the COVID-19 pandemic [19]. Further studies on how to overcome these problems and the establishment of a recovery plan should still be conducted, considering that there are no relevant data in the Asia-Pacific region.

In conclusion, this study evaluated the impact of the COVID-19 pandemic on 162 pediatric GI endoscopy centers in the Asia-Pacific region. A recent study discovered that the number of pediatric GI endoscopy procedures was reduced in more than 80% of all institutions and that endoscopy training for trainee was stopped in almost 80% of the training programs. However, most centers have implemented adaptations and safety measures to provide proper pediatric GI endoscopy services.

ACKNOWLEDGEMENTS

All pediatric gastrointestinal endoscopy centers that are members of the Asian Pan-Pacific Society of Pediatric Gastroenterology, Hepatology, and Nutrition (APPSPGHAN) contributed to this study.

SUPPLEMENTARY MATERIAL

Supplementary Fig. 1

Overview of questions in the questionnaire.

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