Evaluation of Children Undergoing Endoscopic Procedures During the Normalization of the Coronavirus Disease 2019 Pandemic

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ABSTRACT

Background: *Given that procedures involving gastrointestinal tract lumens are high-risk and aerosol forming, the functioning of endoscopy units has been reorganized during the coronavirus disease 2019 pandemic. Guidelines recommend that all personnel should carry out procedures in a negative-pressure room with personal protective equipment; in the absence of a negative-pressure room, an adequately ventilated room should be used. During the normalization of the coronavirus disease 2019 pandemic, this study aimed to evaluate children who were treated in our endoscopy unit without a negative-pressure chamber in terms of coronavirus disease 2019 after procedures.*

Methods: *Patients were questioned and evaluated prospectively for symptoms and contact with coronavirus disease 2019 patients on before and 7th and 14th days after the procedure.*

Results: *Seventy-eight procedures were performed on 69 patients over a 3-month period. The mean age of patients was 12.0 ± 5.1 years. Among all the procedures performed, 54 (69.2%) involved upper gastrointestinal system (GIS) endoscopy and 24 (30.8%) involved colonoscopy. Furthermore, 72 (91.3%) of the procedures were performed in the pediatric endoscopy unit, and 6 (7.7%) were performed in the operating room. No coronavirus disease 2019 symptoms or presence was detected in the patients.*

Conclusion: *The ideal setting for an endoscopic procedure is in a negative-pressure chamber. However, this study has shown that endoscopic procedures can be performed in units without negative-pressure rooms but with appropriate protective equipment and evaluation of patients for coronavirus disease 2019 symptoms.*

Keywords: *Children, COVID-19 pandemic, endoscopic procedures*

INTRODUCTION

Coronavirus disease 2019 (COVID-19) started in December 2019, and the World Health Organization identified it as a global pandemic on March 11, 2020. The first case of COVID-19 in Turkey was seen on March 11, 2020.[1]

The functioning and safety of endoscopy units have been severely affected by the COVID-19 pandemic, which affects all areas of life and health systems worldwide. Upper gastrointestinal tract endoscopies are considered high-risk procedures because they form aerosols.[2,3] Colonoscopy is also a risky procedure due to the live virus identified in the stool. Healthcare professionals in endoscopy units are at increased risk of developing COVID-19 via airborne droplet inhalation, conjunctival contact, and fecal–oral transmission.[2] Therefore, the functioning of endoscopy units and the protection of healthcare professionals have become a matter of concern during the pandemic.

The European Society for Gastrointestinal Endoscopy (ESGE), the European Society for Paediatric Gastroenterology, Hepatology and Nutrition (ESPGHAN), and the North American Society for Pediatric Gastroenterology, Hepatology, and Nutrition (NASPGHAN) have proposed temporarily postponing non-urgent endoscopic procedures during the early stages of the pandemic.[2,4] In our center, which is a pandemic hospital, only emergency endoscopic procedures were performed until June 1, 2020, in line with the recommendations of the Ministry of Health, by taking the current situation of the pandemic into account. Coronavirus disease 2019 guidelines for ESGE and

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NASPGHAN endoscopy units recommend that endoscopic procedures be performed by experienced personnel in a negative-pressure room. If negative-pressure rooms are not available, the procedures can be carried out in a room with adequate ventilation by taking personal protective measures.[2,4]

This study aimed to evaluate pediatric patients and team members in our endoscopy unit, which lacks a negative-pressure chamber, in terms of COVID-19 development after endoscopic procedures.

MATERIALS AND METHODS

In our center, only emergency endoscopic procedures were performed during the first wave of the COVID-19 pandemic. By June 1, 2020, the rate of case increase in Turkey has been controlled, and the situation has become normal. According to the Ministry of Health data, the daily number of new COVID-19-positive patients is <2%, and procedures are increasingly needed; hence, the performance of elective endoscopic procedures was started in our unit. In this duration, the recommendations of the Ministry of Health, Turkish Gastroenterology Association, ESGE, and ESPGHAN regarding endoscopic procedures in the COVID-19 pandemic were followed.[2-6]

Our endoscopy unit is well-ventilated but lacks negative pressure. The procedures were carried out with a minimum number of healthcare professionals (2 pediatric gastroenterologists, 2 anesthesiologists, a nurse, and an auxiliary staff). Before and after each procedure, healthcare professionals washed their hands with soap and water and performed hand disinfection. All healthcare professionals involved in the procedures wore filtering facepiece (FFP) 2 masks, waterproof gowns, 2 pairs of gloves, goggles/face shield, hairnet, and booties/shoe covers. Surgical masks were applied to patients who underwent colonoscopy. At the end of each procedure, all surfaces (stretchers, tables, furniture, and floors) that came into contact with the patient and staff were cleaned and disinfected. Endoscopes and equipment were washed with pure water in accordance with the guidelines and cleaned with high levels of disinfectant and viral agents. As much as possible, another scope was used for each patient, and re-operation using the same scope within the same day was avoided. Twenty to 30 minutes of pause were allotted between each procedure, where 2 windows of the room were kept open, and the atmosphere was ventilated. Up to 6 endoscopic procedures were performed daily.

Main Points

- *During the normalization of the coronavirus disease 2019 (COVID-19) pandemic, the endoscopic procedures can be performed in the units where they have no negative-pressure system but are well-ventilated.*
- *The evaluation of patients with symptom questioning for COVID-19 is a simple and safe method.*
- *The use of appropriate personal protective equipment by healthcare professionals during the procedures is a safe option to be protected from COVID-19.*

While wearing surgical masks, patients waited in the waiting room of the endoscopy unit before the procedure. Patients under the age of 10 years were admitted with a single companion wearing surgical masks, whereas older patients were admitted alone. A distance of at least 1 m was maintained between a patient and his relatives in the waiting area, and alcohol-based hand antiseptics were kept in accessible places.

The patients who were treated were questioned for symptoms and contacts, taking into account the COVID-19 guidelines of the Ministry of Health, and a questionnaire was completed (Appendix 1). Polymerase chain reaction (PCR) testing was planned for those with symptoms and/or contacts.

Children between the ages of 1 and 18 years who underwent emergency and elective endoscopic procedures between June 1, 2020 and August 31, 2020 (i.e., the normalization period) were included in the study and evaluated prospectively. The demographic and characteristics of the patients, indication of the procedure, location of the procedure, procedures performed, and post-procedure diagnoses were recorded. Patients were called by the same person on the 7th and 14th day before and after the procedure for evaluation of their symptoms and clinical manifestations of COVID-19 infection (e.g., fever, cough, respiratory distress, sore throat, headache, vomiting, diarrhea, myalgia, and abdominal pain). A similar history of diseases in residential community, a history of being abroad in the last 14 days, contact with a patient with COVID-19, and a history of hospitalization in the last 14 days were noted. Complete blood count, C-reactive protein (CRP), coagulation profile, COVID-19 PCR, lung x-ray, and thoracic computed tomography (CT) results were recorded before admission. All endoscopic procedures were performed under sedoanalgaesia. An ethics committee approval was received from the ethical

committee of the SBU Tepecik Training and Research Hospital (2020/13-32).

Statistical Analysis

Given the McNemar test and power analysis results, the study required a sample size of at least 47 patients. Data were evaluated using descriptive statistics (frequency, percentage distribution, average, and standard deviation). Data were analyzed using the Statistical Package for Social Sciences (SPSS) version 21.0 (IBM Corp.; Armonk, NY, USA). The suitability of variables to normal distribution was examined by visual and analytical methods (Kolmogorov–Smirnov test, given that $n > 50$). Average ± standard deviation was used in cases where continuous data conformed to the normal distribution, whereas median (minimum-maximum), number (n), and percentages (%) were used for categorical data without normal distribution.

RESULTS

Seventy-eight procedures were performed on 69 patients over a 3-month period. Nine patients underwent 2 procedures at least a week apart. The mean age of patients was 12.0 ± 5.1 years (minimum: 1, maximum: 18 years). Fifty (72.5%) patients were female and 19 (27.5%) patients were male. Among all the procedures performed, 54 (69.2%) involved upper GIS endoscopy, and 24 (30.8%) involved colonoscopy. Furthermore, 72 (91.3%) of the procedures were performed in the pediatric endoscopy unit, and 6 (7.7%) were performed in the operating room.

The symptoms of the patients treated included gastrointestinal bleeding (30.8%), dyspeptic complaints (28.2%), vomiting (11.5%), chronic diarrhea (5.1%), chronic abdominal pain (3.8%), and other causes (20.5%), such as the ingestion of foreign bodies and food allergies. The endoscopic diagnoses of patients after the procedures performed are shown in Table 1.

The most common symptoms in our cases were vomiting, diarrhea, and abdominal pain, which are also the symptoms presented upon admission to the gastroenterology outpatient clinic. Prior to the procedure, 2 (2.6%) patients presented with cough, and 3 (3.8%) patients had myalgia complaints. The symptom manifestations of the cases and the examinations for COVID-19 are given in Table 2.

Before the procedures, PCR was performed on 2 patients because of their fever and cough complaints, and the procedures were carried out after negative results were obtained. Before the procedures, none of the patients showed respiratory distress, sore throat, or headache, which are the criteria for considering COVID-19 infection. The risk assessment showed that none of the patients had a history of contact with a person suspected/diagnosed with COVID-19 or a history of leaving the country before the procedure. On the 7th and 14th days after the procedure, the patients did not develop symptoms and had no history of contact with COVID-19 cases. Hence, COVID-19 PCR was not required. No features were

Table 1. Endoscopic Diagnoses of Patients After the Procedure

	n (%)
Esophagitis	3 (3.8)
Gastritis	39 (50)
Enteropathy	7 (9)
Polyps	3 (3.8)
IBD	12 (15.4)
Rectal ulcer	1 (1.3)
Normal	7 (9)
Other	6 (7.7)
Total	78 (100)

IBD, inflammatory bowel disease.

Table 2. The Symptom Manifestations of the Cases and the Examinations for COVID-19

		After the Procedure	
	Before the Procedure, n (%)	7th Day, n (%)	14th Day, n (%)
Fever	2 (2.6)	-	-
Cough	2 (2.6)	-	-
Vomiting	6 (11.5)	3 (3.8)	3 (3.8)
Diarrhea	15 (19.2)	4 (5.1)	4 (5.1)
Myalgia	3 (3.8)	-	-
Abdominal pain	19 (24.4)	5 (6.4)	5 (6.4)
Application to another hospital	13 (16.7)	1 (1.3)	-
Hospitalization	20 (25.6)	24 (30.7)	11 (14.1)
PCR	2 (2.6)	-	
Chest x-ray	7 (9)	-	-
Chest CT	1 (1.3)	-	-

COVID-19, coronavirus disease 2019; PCR, polymerase chain reaction; CT, computed tomography.

detected in chest x-ray and chest CT evaluations made in the last 14 days prior to the procedure.

Members of the endoscopy team involved in this duration were evaluated for symptoms of COVID-19, and none were diagnosed with the disease. Two doctors who were members of the team underwent PCR tests on suspicion of non-endoscopy contact and tested negative.

DISCUSSION

Protocols of children's endoscopy units have become an important issue to protect patients and staff from infection during the COVID-19 pandemic. It is also not clear what the attitude of the centers without the negative-pressure chamber recommended by the guidelines will be. In this study, in our endoscopy unit where no negative-pressure room was available, pediatric patients who were subjected to endoscopic procedures with personal protective equipment (PPE) and appropriate ambient ventilation were evaluated prospectively, and none of them developed COVID-19 infection.

During the COVID-19 pandemic, endoscopic procedures are ideal to be performed in a negative-pressure chamber.[2] However, depending on the country and hospital conditions, in centers without negative-pressure rooms in units outside an operating room, procedures should be performed, considering the high patient density. Our center is a third-level center, where patient referral is frequent. The rate of increase in cases was under control; the number of positive patients per day was <2% (35 525 tests/825 cases). At the end of the 3-month period, the case rate was decreased by 1.4% per day (110 102 tests/1587 cases).[6] During this period, PCR procedures were performed as recommended by the Ministry of Health, and all of our patients were evaluated with pre-procedure symptom enquiry. Polymerase chain reaction tests were performed on 2 suspected cases, and the results were negative. No pre-procedure PCR analysis was performed on other patients without COVID-19 symptoms. No side effects were seen in any postoperative case. After the procedure, the patients were evaluated prospectively by making symptom inquiries, and no COVID-19 symptoms/infections were detected.

The literature shows a limited number of studies in this field. Duci et al[7] reported that COVID-19 was seen in 3 surgeons, 1 anesthesiologist, and 1 nurse who performed endoscopic procedures on 30 pediatric patients between March 15 and April 30 in the operating room. However, they did not relate to endoscopic procedures.[7] Given that 7 patients required emergency intervention, the results of swab tests were not available and the patients were considered potentially infected, the PPE protocol, including the use of FFP2/FFP3 masks, was applied. In 23 other patients, the procedure was performed with standard PPE after negative SARS-CoV-2 swab tests were obtained.[7] In our study, 72 endoscopic procedures were performed in our endoscopy room without negative pressure, and 6 procedures were performed in the operating room environment with a negative-pressure room. In all procedures, our team used PPE, including FFP2 respiratory masks, and no medical personnel was infected. Coronavirus disease 2019 guidelines for ESGE endoscopy units recommend that each staff uses an FFP2/FFP3 mask, a waterproof gown, 2 pairs of gloves, goggles/face shield, hairnet, and booties/shoe covers during the procedure.[2] Our team members meticulously used PPE in accordance with the guidelines in all operations.

At the beginning of the pandemic, SARS-CoV-2 was thought to be unlikely transmitted from the air. However, increasing evidence suggests that infectious microdroplets can hang in the air for up to 3 hours.[8,9] The Centers for Disease Control and Prevention highlights the importance of ambient ventilation, noting that contact with an infected person in low-ventilated enclosed spaces for more than 30 minutes causes transmission.[10] The ESGE and NASPGHAN guidelines emphasize that a well-ventilated room should be used in the absence of negative pressure.[2,4] In line with these recommendations, our endoscopy room, in addition to the central ventilation system, was sufficiently ventilated by keeping 2 windows open during the 20–30 minutes break both during and between procedures during the study. The maximum number of cases was limited to 6 per day, processing intervals were limited to 20–30 minutes, and operations were applied with as many different scopes as possible on the same day to reduce the risk of transmission. If the same scope was required, it was ensured to be meticulously cleaned.

No statistical difference was found in the symptoms of our patients on the 7th and 14th days after the procedure. It was reported that although the most common clinical symptoms of COVID-19 in pediatric patients are fever (59.1%) and cough (55.9%), 19.3% of patients may be asymptomatic.[11] We cannot provide data in terms of asymptomatic diseases in our study, given that PCR samples could not be taken from asymptomatic cases according to the protocol of our Ministry of Health. Likewise, ESGE recommends that viral tests be performed in patients at high risk of COVID-19 infection before endoscopy during the period we applied the study.[12]

CONCLUSION

Endoscopic procedures can be performed in pediatric patients in units without negative pressure during the COVID-19 pandemic. As guidelines indicate, an ideal endoscopic procedure is to be performed in a negative-pressure chamber. This study has shown that a well-ventilated room for pediatric endoscopic procedures is useful where a negative-pressure unit is not available. In addition, the following steps are beneficial in preventing infection to staff and patients: identify high-risk patients with pre-procedure symptom enquiry, follow personal protective measures specified in guidelines, and allow a break between 2 procedures for sufficient ventilation.

Ethics Committee Approval: The study was approved by the medical ethics committee of SBU Tepecik Training and Research Hospital.

Informed Consent: Written informed consent was obtained from the patients who agreed to take part in the study.

Peer-review: Externally peer-reviewed.

Author Contributions: Concept – Ş.O.K., B.A.; Design – Ş.O.K., M.B.; Supervision –M.B., Y.Ç.A.; Resources – D.Y.Ç., Ş.O.K.; Materials – B.A., Y.Ç.A.; Data Collection and/or Processing –S.K.Ç, S.G.; Analysis and/or Interpretation –S.K.Ç, S.G.; Literature Search – Ş.O.K., B.A.; Writing Manuscript – Ş.O.K., B.A.; Critical Review – M.B., Y.Ç.A.

Declaration of Interests: The authors have no conflict of interest to declare.

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FORM OF CASE REPORT
First and Last Name:
ID No:
Date of Birth/Age:
Gender: 1. Girl 2. boy
Process Indications: 1. Dyspepsia 2. Vomiting 3. Abdominal pain 4. Diarrhea 5. Bleeding 6. Other
Transaction Date:
Procedure: 1. Upper GIS endoscopy 2. Colonoscopy 3. Ileoscopy
Diagnosis as a result of the procedure (Endoscopic diagnosis): 1. Esophagitis 2. Gastritis 3. Reflux 4. Entreropathy 5. Polyp 6. Inflammatory bowel disease 7. Other
Where the procedure was performed: 1. Children's endoscopy 2. Operating room 3. Other

Parameter	Before the procedure	After the procedure 7th day	After the procedure 14th day
Fever (>38 C)	1. Yes 2. No	1. Yes 2. No	1. Yes 2. No
Cough	1. Yes 2. No	1. Yes 2. No	1. Yes 2. No
Respiratory distress	1. Yes 2. No	1. Yes 2. No	1. Yes 2. No
Sore throat	1. Yes 2. No	1. Yes 2. No	1. Yes 2. No
Headache	1. Yes 2. No	1. Yes 2. No	1. Yes 2. No
Vomiting	1. Yes 2. No	1. Yes 2. No	1. Yes 2. No
Diarrhea	1. Yes 2. No	1. Yes 2. No	1. Yes 2. No
Myalgia	1. Yes 2. No	1. Yes 2. No	1. Yes 2. No
Abdominal pain	1. Yes 2. No	1. Yes 2. No	1. Yes 2. No
Similar history of diseases in the environment	1. Yes 2. No	1. Yes. No	1. Yes 2. No
History of being abroad in the last 14 days (family and/or children)	1. Yes 2. No	1. Yes 2. No	1. Yes 2. No
Patient contact with COVID-19	1. Yes 2. No	1. Yes 2. No	1. Yes 2. No
Another hospital application in the last 14 days	1. Yes 2. No	1. Yes 2. No	1. Yes 2. No
Hospitalization in the last 14 days	1. Yes 2. No	1. Yes 2. No	1. Yes 2. No
Hemoglobin:			
Leukocytes:			
ALC:			
ANC:			
Platelets:			
CRP:			
İNR**:**			
COVID-19 PCR:			
Chest X-ray:			
Chest CT:			

ALC, absolute lymphocyte counts; CRP, C-reactive protein; ANC, absolute neutrophil count; PCR, polymerase chain reaction; CT, computed tomography