

Spectrum of Colonoscopy in Children: A Tertiary Centre Experience from Bangladesh

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Abstract

Background: Pediatric colonoscopy is a safe, sensitive and crucial tool for diagnosing as well as treating children with lower gastrointestinal diseases. In resource-limited countries like Bangladesh, the practice of pediatric colonoscopy remains rudimentary, lacking in trained professionals and appropriate instrumentation.

Objectives: The aim of the study was to find out the indications, common colonoscopic findings along with histopathologic evaluation and immediate post procedure complications of colonoscopy in children.

Methods: This was a retrospective study; the records of all the patients whose age was less than 18 years and who underwent colonoscopy from January 2017 to December 2021 were studied.

Results: Among the total of 196 children (8.23 ± 4.12), the most common indications were lower gastrointestinal bleeding (LGIB) in 107 (54.6%) patients followed by chronic diarrhea in 33 (16.8%), recurrent abdominal pain (RAP) in 16 (8.2%), follow up Inflammatory bowel diseases (IBD) in 14 (7.1%), chronic constipation, weight loss, recurrent oral ulcer, intestinal tuberculosis (TB) and melena. The most common pathologic findings were polyps in 81 (61.4%) children followed by non-specific colitis in 19 (14.4%), IBD in 17 (12.9%) and infectious colitis in 09 (6.8%) cases. Minor adverse events occurred in only 2.0% of children.

Conclusion: The commonest indication for pediatric colonoscopy was LGIB and the most common findings were colonic polyps. Pediatric colonoscopy is safe and effective diagnostic as well as therapeutic option for lower GI diseases.

Keywords: Colonoscopy, lower gastrointestinal bleeding (LGIB), polyp.

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Introduction

Flexible colonoscopy in children was introduced slightly later than upper gastrointestinal endoscopy.¹ In the literature, reports of pediatric colonoscopy first appeared in late 1970s.² Since then, improvements in fiber optic and video technology, conscious sedation, and physicians' experience have led the establishment of colonoscopy as a procedure for the diagnosis, evaluation, and management of lower gastrointestinal tract disorders in children.³⁻⁷ Due to poor compliance and cooperation in pediatric patients, colonoscopy is technically more challenging than esophagogastro-duodenoscopy.⁸

The safety and effectiveness of diagnostic or therapeutic colonoscopies in adults has been well established in the past two decades. However, its utility for pediatric patients is only recently emerging. Major hurdles for pediatric colonoscopy include the high level of technical challenge, poor compliance with bowel cleansing, and noncooperativeness during the procedure. The slightly higher risk of severe complications when compared with adults might also restrict its use in pediatric patients.⁸

Both diagnostic and therapeutic colonoscopies have had many advances in terms of operator skill and experience and are now being performed by most pediatric gastroenterologists. However, pediatric colonoscopy is far behind that of adults in the field of therapeutic endoscopy especially, such as endoscopic mucosal resection or endoscopic sub mucosal dissection.¹⁻² Although the major role of colonoscopy is the screening and diagnosis of colon cancer in adults, there are few children who are diagnosed with colon cancer.⁹⁻¹² Recently, the American Society for Gastrointestinal Endoscopy (ASGE) and the North American Society for Pediatric Gastroenterology, Hepatology and Nutrition (NASPGHAN) published modifications of their guidelines for pediatric patients, in which clear indications for colonoscopy in children were recommended.¹³⁻¹⁴ Lower gastrointestinal bleeding, chronic diarrhea, and unexplained anemia's are the most common indications for pediatric colonoscopy¹⁵⁻¹⁶, while polyps and colonic inflammation are the most common endoscopic

findings. The juvenile polyp is the most common type of colorectal polyp and is generally considered benign.⁸ Furthermore the incidence of IBD is increasing worldwide. It has been reported that approximately 20-30% of IBD patients are diagnosed in childhood.¹⁷ Early detection of both polyps and IBD can significantly improve the patients' quality of life and overall health. Therefore, in pediatric patients, colonoscopy is the best tool both for early lesion detection and as an effective therapy to treat lesions and remove polyps.¹⁸

Currently there are some retrospective reports about the utility of colonoscopy in pediatric patients.¹⁹⁻²². However, data regarding the clinical features, endoscopic findings, and the safety and efficacy of pediatric colonoscopy are limited, especially in Bangladesh. In view of this, we conducted a retrospective study among Bangladeshi children with the aim to investigate the demographics and clinical characteristics, find out indications, colonoscopic findings as well as safety and effectiveness by less or no complications in a pediatric patients undergoing colonoscopy.¹⁸

Materials and Methods

The study was carried out in the department of Pediatric Gastroenterology, Hepatology & Nutrition, Bangladesh Shishu Hospital & Institute, Dhaka, Bangladesh. The medical records of all patients under the age of 18 years who underwent colonoscopy (both inpatient & outpatient department) from January 2017 to December 2021 were reviewed retrospectively. All of the pediatric patients (total 196) on whom colonoscopy was performed during the study period were included in the study. The need for colonoscopy was decided by the pediatric gastroenterologist as well as by the general pediatricians. Informed consent was taken from parents/patients for the procedure after careful explanation of procedure details and potential complications. Patients who did not give consent for colonoscopy and who had low hemoglobin (<8 gm/dl) along with or without thrombocytopenia and coagulopathy were excluded from the study. All pediatric colonoscopy were performed by the faculty members (Figure-1).

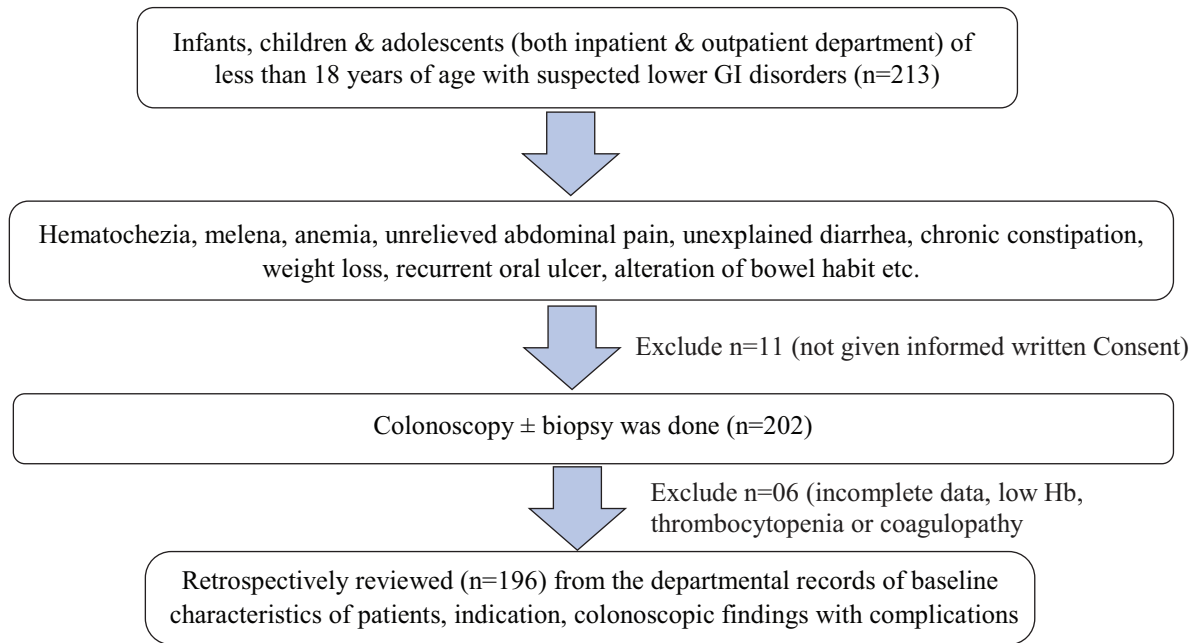


Fig.-1 Study flow chart of colonoscopy (n=196)

The patient received either an in-patient or outpatient preparation depending on the patient's age and the cooperation of the family. One to two days prior to the procedure, the patient was advised to begin a clear fluid diet. Children below the age of 6 years were admitted the day before the procedure. On the day before the procedure, patients were made to drink a solution of polyethylene glycol (PEG, 17 g) dissolved in water (250 mL) at a rate of 250 mL every 30 minutes. The stool output was checked in the afternoon, and another PEG solution was administered if the stool output contained solid components. At night, a saline enema was performed if solids particles were still present in the stool. If the patient could not drink the solution, the solution was administered through a nasogastric tube.

The majority of the colonoscopic procedures were done with video endoscopes (OLYMPUS GIF-Q190; Olympus, To-kyo, Japan) for ≥ 2 years of age. In children less than 2 years or weighing less than 10 kg, colonoscopy was performed with a pediatric video endoscope (OLYMPUS GIF-XP190; Olympus, To-kyo, Japan) with a diameter of 5.8 mm.

Mode of anesthesia was decided by performing faculty member depending upon patient's age, level of cooperation and physicians comfort level. Parenteral Midazolam (0.05–0.1 mg/kg IV, maximum single dose of 4 mg) with or without Ketamine (1 mg/kg I/V) was used as sedatives. Further dosing was considered according to the patient's level of comfort and

maximum dose of the medications. In some adolescents, colonoscopy was done without sedation/ anaesthesia but under local xylocaine jelly.

The procedure was performed in the left lateral position. Position change and abdominal pressure were applied according to the procedure progression. In case a colorectal polyp was found, a snare polypectomy was performed and the polyp tissue was sent for histopathological examination.

Colonoscopic findings were documented for each patient and if needed, biopsy materials for histopathology were taken. Patients were kept in observation room to see the immediate post procedure complications. Patient's demographic data including age, sex and length of hospital stay were recorded. For descriptive purpose patients were divided into three age groups. Indications for colonoscopy, findings and post colonoscopic complications were recorded for each patient.

All data on categorical variables were presented as frequencies, percentages and were analyzed with a chi-square test. Data of various indications, colonoscopic findings and complications were entered into the SPSS (statistical package for social science) Version 24.0 statistical program and statistical significance was determined by a p-value less than 0.05.

Results

Over a period of 5 years (2017-2021), a total of 196 children underwent upper GI colonoscopy. Mean age

of patients was 8.6 years with a minimum age of 3 months and a maximum of 18 years. The children aged between 5-10 years had highest frequency of colonoscopy, *i.e.* 40.3% (n=79), followed by older children (>10 years of age), in which frequency of colonoscopy was 35.2% (n=69). The frequency of colonoscopy in youngest children between 0-5 years of age was 24.5% (n=48). Male were 105 (53.6%) and female were 91 (46.4%). The male female ratio was 1.1:1. Out of 196 children, 59 (30.1%) were from outpatient department and 137 (69.9%) from admitted patient. No sedation were required in 38 (19.4%) children especially from >10 year age group. Only midazolam was given in 131 (66.9%) children whereas midazolam plus ketamine were required in only 27 (13.7%) sensitive children. Other than polyps, biopsy obtained from 51 patients and specimen sent for histopathology. Colonoscopic snare polypectomy was done in 81 (41.3%) patients and for others (58.7%), only diagnostic colonoscopy was done (Table I).

Table I
Characteristics of Study population & procedure (n=196)

Variable	No.	Percentage
Age		
<5 years	48	24.5
5-10 years	79	40.3
>10 years	69	35.2
Sex		
Male	105	53.6
Female	91	46.4
Patient status		
Outpatient	59	30.1
Inpatient	137	69.9
Sedation		
No Sedation	38	19.4
Midazolam	131	66.9
Midazolam+Ketamine	27	13.7
Extent of colonoscopy		
Ileum	119	60.8
Cecum 8 (2.9%)	13	6.6
Ascending colon 9 (3.3%)	11	5.6
Transverse colon	33	16.9
Descending colon	11	5.6
Sigmoid colon 27 (9.8%)	09	4.5
Biopsy obtained		
Yes	51	26.0
No	145	74.0
Purpose of colonoscopy		
Diagnostic	115	58.7
Diagnostic+Therapeutic	81	41.3

The most common indications were LGIB in 107 (54.6%) patients. Chronic diarrhea was the next cause (16.8%) of the procedure. In 8.2% patients, colonoscopy was done due to RAP followed by follow up of IBD patients with 7.1%. Other less common indications were chronic constipation (4.1%), weight loss (3.6%), recurrent oral ulcer (2.6%), intestinal TB, melena and others (Figure-2).

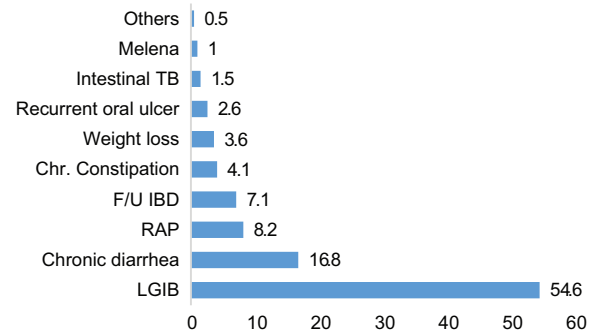


Fig.-2 Indications of colonoscopy (n=196)

Colon polyps were the most common colonoscopic finding among 81 (41.4%) children followed by normal cases 64 (32.7%), erythema & linear ulcerations 29 (14.7%) and diffuse nonspecific ulcers 22 (11.2%) cases (Figure-3).

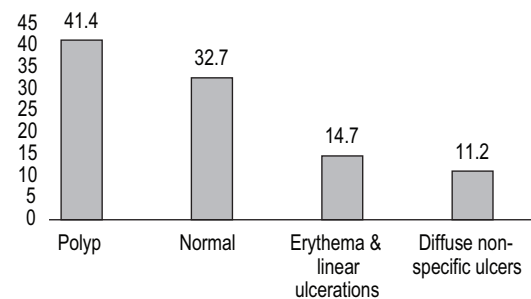


Fig.-3 Colonoscopic findings of studied children (n=196)

Pathologic findings after colonoscopy

The most common histopathological finding was juvenile polyps 81 (61.4%) followed by diffuse non-specific colitis in 19 (14.4%) patient, infectious colitis in 09 (6.8%) patient, Ulcerative colitis 7 (5.3%), unclassified IBD in 6 (4.5%), CD in 4 (3.0%), intestinal TB and SRUS of each in 2 (1.5%) cases (Table-II & figure-4).

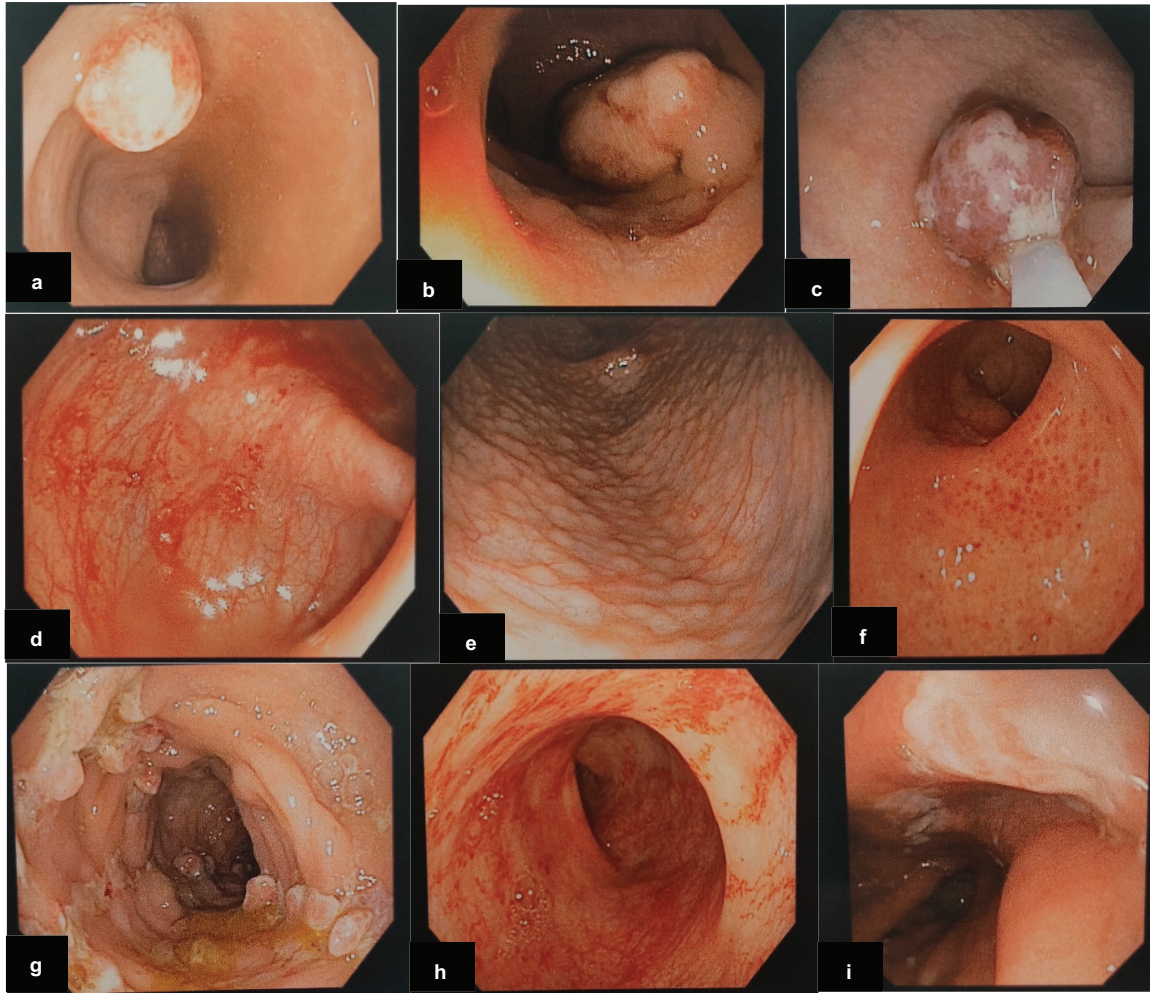


Fig-4 Various colonoscopic views: **(a)** Sessile polyp, **(b)** Pedunculated polyp, **(c)** During snare polypectomy, **(d)** Infectious colitis, **(e)** Non-specific colitis, **(f)** Proctitis, **(g)** Crohn's disease, **(h)** Ulcerative colitis, **(i)** SRUS

Findings	No.	Percentage (%)
Juvenile Polyps	81	61.4
Non-specific colitis	19	14.4
Infectious colitis	09	6.8
Ulcerative colitis	07	5.3
Unclassified IBD	06	4.5
Crohn's disease	04	3.0
SRUS	02	1.5
Intestinal TB	02	1.5
Internal Hemorrhoid	01	0.8
Eosinophilic proctitis	01	0.8
Total	132	100

IBD: Inflammatory bowel disease
SRUS: Solitary rectal ulcer syndrome

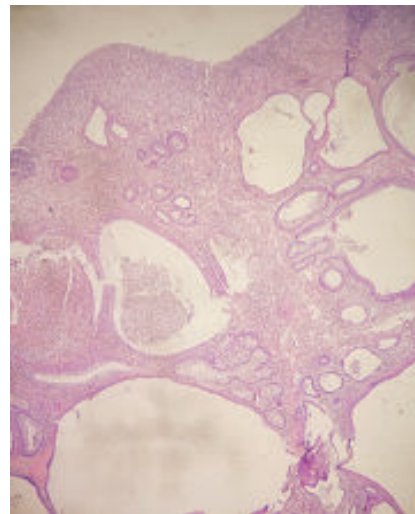


Fig-5 H & E stain, low-power image, Juvenile rectal polyp varying sized and cystically dilated glands filled with mucus, devoid of atypical features, and separated by an inflamed and edematous stroma

Table III
Association of age with polyp (n=81) and other pathological diseases (n=51)#

Age group	Polyp (n=81) (%)	Non-specific colitis (n=19)	Infectious colitis (n=9)	UC (n=7) (%)	Unclassified IBD (n=6) (%)	CD (n=4) (%)	SRUS (n=2) (%)	Intestinal TB (n=2) (%)	Internal Hemorrhoid (n=1) (%)	Eosinophilic proctitis (n=1) (%)	p value
<5 years	39 (48.1)	2(10.5)	2(22.2)	2(28.6)	2(33.4)	1(25)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	<0.001*
5-10 years	36(44.5)	8(42.1)	5(55.6)	4(57.1)	3(50)	2(50)	1(50)	1(50)	0(0.0)	1(100)	
>10 years	06 (7.4)	9(47.4)	2(22.2)	1(14.3)	1(16.6)	1(25)	1(50)	1(50)	1(100)	0(0.0)	

#Other than polyp: Non-specific colitis, Infectious colitis, Ulcerative colitis, Unclassified IBD, Crohn's disease, SRUS, Intestinal TB, Internal hemorrhoids, Eosinophilic proctitis Chi-square test; *Significant

In addition, the study showed that polyps were more common in <5 years age group (48.1%) than other pathology and that was statistically significant (Table-III).

No side effects were observed in 98% of children following colonoscopy procedure. Adverse events were recorded only in 4 (2.0%) cases. Delayed minor bleeding in 3 (1.5%) cases whereas abdominal pain only in 1 (0.5%) case. All of them were minor and did not affect the overall survival and hospital stay (Figure-5).

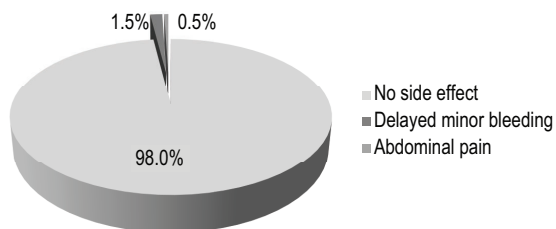


Fig.-6 Complications of colonoscopy (n=196)

Discussion

Colonoscopy is routinely performed nowadays, both in infants and children for the evaluation and treatment of lower gastrointestinal diseases, especially under the circumstances when other investigations are not conclusive.¹⁴

In the present study, older children aged 5-10 years had highest frequency of colonoscopy with 40.3%. Same phenomena were observed in Begum et al²³ (36.7%) from another study of Bangladesh, Sharma et al²⁴ (43.8%) and Bhadauria et al²⁵ (63.1%) from India. Less fear and much more lower gastrointestinal diseases in older children probably the possible causes. The Male female ratio was 1.1:1. Different studies from different countries stated

different ratio. The ratio was 1.6:1 from Bangladesh²³, 2.1:1 from India²⁵, 0.8:1 from USA²⁶ and 0.8:1 from Taiwan³. Different geographical distribution as well as variable genetic basis probably the causes.

Colonoscopy is performed less frequently in children than in adults because of difficulties in preparation and sedation, which are usually needed in children.³ In the present study, due to good bowel preparation prior to colonoscopy, inpatient number (69.9%) was much higher than outpatient (30.1%). No sedation were required in 38 (19.4%) children especially from >10 year age group. Yoshioka et al¹⁴ (18.2%) and Nambu et al⁹ (8.0%) from Japan also stated the same phenomena. Appropriate counseling and good cooperation of older children probably the possible etiology. In the present study, mild sedation with intravenous midazolam was given in 66.9% children whereas midazolam plus ketamine were required in only 13.7% sensitive children. Midazolam ± Ketamine were also used in Korea¹ & Japan⁹, Midazolam ± Pethidine used in Bangladesh²³ & China¹⁸ and Midazolam ± Propofol used in Taiwan³. In different studies^{1,3,9,18,23}, midazolam was commonly used as a sedative agent during colonoscopy as it is safe, short acting, rapid onset with minimal side effects. Due to unavailability of anesthetic support and inadequate number of experienced pediatric anesthesiologist, conscious sedation is the key for developing countries. Like other developed countries in Japan, general anesthesia (GA) was used in 47% children during colonoscopy.⁹

In the present study, the most common indications were lower gastrointestinal bleeding (LGIB) in 54.6% patients followed by chronic diarrhea (16.8%), recurrent abdominal pain (RAP) (8.2%) and follow up IBD 7.1%. Begum et al²³ (69.8%) from

Bangladesh, Altamimi et al¹⁶ (46.2%) from Jordan, Yoshioka et al.¹⁴ (57.2%) & Nambu et al⁹ (75.0%) from Japan, Wu et al³ (53.5%) from Taiwan, Mantos et al²⁷ (79.6%) from Philippines and Deep et al.²⁸ (73.3%) from Egypt were also observed the commonest indication was LGIB.

In the present study, colorectal polyps constituted 81 (41.4%) of all colonoscopy cases. Begum et al²³ (41.3%) & Azim et al²⁹ (40.4%) from Bangladesh and Deep et al²⁸ (44.0%) from Egypt also observed the same phenomena. Colorectal polyp was found 26.4% in a study done in Korea which is albeit lower than our findings.²⁴ In the literature, there are great variations in the prevalence of colorectal polyps in pediatric patients who underwent colonoscopy. It is reported high in India (61.7%-67.7%) and also in Pakistan (75%) compared with western data (4%-17.5%).^{3,24,30-32} Almost one third of the children (32.7%) who underwent upper GI endoscopy in our study had normal endoscopic findings. Another study from Bangladesh²³ (36.3%), Korea¹ (36.5%), Japan¹⁴ (29.5%), Jordan¹⁶ (42.0%) and China¹⁸ (29.5%) also observed the same type of findings. In Philippines²⁷ (9.2%) and Egypt²⁸ (6.6%), normal findings were much less in relation to other mentioned studies. Patients from different geographical area as well as sampling technique are responsible for these variation. Erythema & linear ulcerations were found during colonoscopy in 29 (14.7%) and diffuse nonspecific ulcers in 22 (11.2%) cases. Begum et al²³ (12% & 10.2%) from Bangladesh and Deeb et al.²⁸ (25.3% & 24.0%) from Egypt also found consecutively same type of findings.

Next to Juvenile polyp, non-specific colitis was observed in 19 (14.4%) cases. Begum et al²³ (13.5%) from Bangladesh, Deeb et al²⁸ (20%) from Egypt, Wu et al³ (22.7%) from Taiwan, Nambu et al⁹ (13%) and Yoshioka et al¹⁴ (11.8%) from Japan also found the similar type of results. Non-specific colitis was most common in a study of Philippine²⁷ (49.5%) which was different from other studies. Poor sampling technique as well as lack of well-trained histopathologist may be the answer. Infectious colitis was found in only 9 (6.8%) cases. Near similar results were observed in Korea¹ (5.0%) cases.

IBD including UC, CD and unclassified IBD are also common etiologies of lower GI bleeding in children. Previous studies have shown that approximately 20% of patients with IBD are diagnosed before the age of

20 years, among whom most are below 15 years of age.³³ In our study, IBD (UC, CD & unclassified IBD) were the 4th most common histological causes of colonoscopy and accounted for 17 (12.9%) of all pathologic patients. Begum et al²³ (6.0%) from Bangladesh and Sharma et al²⁴ (8.77%) found IBD cases which is close to our study. In our study, UC cases were 07, unclassified were 06 and 04 cases were CD. All the UC cases had pancolitis whereas CD cases had aphthous ulcers and linear ulcers. Non-caseating granuloma was found only one third of cases, probably subcutaneous nature of granuloma could be the cause.

In the present study, intestinal TB and SRUS of each in 2 (1.5%) cases. Begum et al²³ (1.5%) & Azim et al²⁹ (1.8%) from Bangladesh, Sharma et al²⁴ (3.5%) from India and Park et al. from Korea (1.0%) also observed a few cases of intestinal TB. All the cases had positive contact with tranverse ulceration. Only one had caseating granuloma. SRUS was found in 2(1.5%) cases. A few study from Bangladesh^{23,29} and Jordan¹⁶ also found a few cases of SRUS. In a study from Iran regarding the etiology of lower GI bleed in children, juvenile polyp and solitary rectal ulcer accounted for most of the pathologies that caused rectal bleeding in children and adolescents, respectively.³⁴ In all our cases of SURS, children had a history of associated constipation and straining during defecation along with mucorrhea.

In the present study, juvenile polyps were huge (61.4%) in relation to other (38.6%) pathology. Polyps were more common in <5 years age group (48.1%) than other pathology and that was statistically significant. Begum et al.²³ & Alam et al.³⁵ from Bangladesh, Deeb et al.²⁸ from Egypt and Moravej et al.³⁶ from Iran also found the similar results.

Perforation is the most serious complication of colonoscopy in children especially in therapeutic colonoscopy. The risk ranges from 0.01% to 0.3%.^{37,38} It can be successfully managed with surgical intervention. Bleeding after a diagnostic procedure is very rare in children as in adults. Bleeding after colonoscopy was reported to occur at an incidence of 1.4% in a large-scale study.²⁹ In the period of 2010-2015, Park et al¹ from Korea found that, two cases of delayed bleeding occurred after colonoscopic polypectomy. In the present study, 3 (1.5%) patients complained of delayed minor bleeding and 1 (0.5%) patient had abdominal pain. Spontaneous hemostasis

developed in all cases. All the adverse events were minor and did not increase morbidity or mortality.

Limitations of the study

This study's primary limitation is that it was a single-center study. Furthermore, its retrospective nature may have resulted in inaccurate findings regarding underreporting of adverse events in OPD patients.

Conclusions

A safe and successful colonoscopy can be achieved in the majority of children with good bowel preparation and adequate sedation. Lower gastrointestinal bleeding & chronic diarrhea was the most typical indication, and polyps, non-specific colitis & IBD's were the most common pathological findings of pediatric colonoscopy. We observed that colonoscopy is beneficial and can be safely used in children of all ages. Children presenting with symptoms or signs of lower gastrointestinal disorders should undergo colonoscopy to obtain a definite diagnosis and prompt treatment.

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