Caspian Journal of Pediatrics
Babol University of Medical Sciences
e-ISSN: 2383-3106

Indications and Benefits of Gastrointestinal Endoscopy in children: A Retrospective Study in a single center in India

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Article Info.

Article type:
Research Article

Received: 15 Nov. 2024
Revised: 23 May 2025
Accepted: 3 June 2025
Published: 3 June 2025

Keywords:
Abdominal Pain,
Child,
Endoscopy,
Hematemesis,
Melena

ABSTRACT

Background and Objective: Pediatric gastrointestinal (GI) endoscopies are often used as a diagnostic as well as therapeutic tool for children with gastrointestinal complaints, including unexplained abdominal pain, iron deficiency anemia, gastrointestinal bleeding, etc. The aim of this study was to investigate the indications and yield of pediatric GI endoscopies at a single center.

Methods: This retrospective analytical study was conducted from June 2022 to October 2023 in the Department of Pediatrics, Sri Aurobindo Medical College and Postgraduate Institute, India. All children from birth to 18 years of age who underwent gastrointestinal endoscopy were included in the study. The details of indications, endoscopic findings, and therapeutic procedures performed were recorded in a data collection sheet. All endoscopic procedures were carried out by a trained pediatric gastroenterologist under sedation and continuous monitoring.

Findings: A total of 222 GI endoscopies were performed in 150 children, including 182 (82%) upper GI endoscopies and 40 (18%) colonoscopies. The most common indication for endoscopy was abdominal pain in 48 (32%) children, followed by hematemesis in 28 (18%) and chronic diarrhea in 28 (18%) children. The diagnostic yield of upper GI endoscopy was (81/111) 73% and that of colonoscopy (15/36) 42%. The endoscopic yield at presentation with hematemesis and dysphagia was higher than for other presenting symptoms. Gastrointestinal bleeding was the most common indication for therapeutic GI endoscopic procedures. No procedure-related complications occurred.

Conclusion: Pediatric GI endoscopy was found to be useful in both diagnosis and treatment of various disorders, especially gastrointestinal bleeding and dysphagia.

Cite this Article: Singh SK, Golait A, Kela G. Indications and Benefits of Gastrointestinal Endoscopy in children: A Retrospective Study in a single center in India. Caspian J Pediatrs June 2025; 11: e5.

Introduction

Pediatric endoscopy first emerged in the 1960s and is frequently used as a diagnostic as well as therapeutic tool in children with gastrointestinal diseases [1]. The number of endoscopy procedures in children is increasing, but there is no evidence that the disease is spreading at the same level [2, 3]. Pediatric gastroenterology is a specific specialty with a training process that has led to an increase in the number of endoscopists [4]. Colonoscopy is considered to be more invasive than upper endoscopy. They need bowel preparation and long-term anesthesia, and in most centers, it is performed less frequently than endoscopy to investigate specific diseases. Recent pediatric studies from different regions around the world have shed light on the primary indications and pathology results associated with endoscopy and colonoscopy in children. A 2020 study conducted in the United Kingdom identified abdominal pain, persistent vomiting, and suspected celiac disease as the leading indications for upper gastrointestinal endoscopy, with histopathological outcomes commonly showing gastritis, esophagitis, and villous atrophy [5]. Similarly, a 2021 multicenter study from Saudi Arabia reported chronic diarrhea and unexplained anemia as the most frequent indications for pediatric colonoscopy, with inflammatory bowel disease (IBD)-particularly Crohn's disease and ulcerative colitis-emerging as the predominant diagnoses [6]. In the United States, a 2022 study observed that children undergoing endoscopy for growth failure and gastrointestinal bleeding were often diagnosed with eosinophilic esophagitis or colonic polyps [7]. Collectively, these studies highlight the importance of endoscopic evaluation in pediatric populations, especially in cases of persistent or unexplained gastrointestinal symptoms, with findings ranging from functional and inflammatory conditions to immune-mediated disorders.

The European Society for Pediatric Gastroentero-logy, Hepatology, and Nutrition (ESPGHAN) has developed guidelines for upper endoscopy and colonoscopy based on expert opinion and adverse evidence [8]. The aim of this study was to evaluate the indications and yield effects of various gastrointestinal (GI) endoscopic procedures in children.

Methods

Study design and participant

This retrospective analytical study was conducted in the Department of Pediatrics, Sri Aurobindo Medical College and Postgraduate Institute, India, from June 2022 to October 2023. Consecutive children from birth to 18 years of age who underwent a GI endoscopic procedure were included. As this was a retrospective data collection, there were no exclusions. The demographic parameters, clinical information (symptoms and signs), indications of the endoscopic procedure, type of endoscopic procedure (diagnostic or therapeutic), and findings of the endoscopy were recorded and analyzed.

Preparation for Endoscopic Procedure:

- Fasting for 6 hours was ensured before endoscopy.
- Pre-anesthetic evaluation and intravenous access were secured.
- A history of allergies and chronic illnesses was elicited.
- The procedure was explained to the guardians, and written informed consent was obtained.

All endoscopic procedures (upper GI endoscopy and colonoscopy) were performed under sedation using midazolam, ketamine, or fentanyl with continuous vitals monitoring with strict asepsis. The endoscopic procedures were performed by trained pediatric gastroenterologists under sedation with continuous monitoring. Fujifilm EG-720 and EG-740N gastroscopes and EC-760ZP-V/L colonoscopes were used for carrying out various endoscopic procedures.

All the pathology specimens from the endoscopy were examined by two senior pathologists with experience in gastrointestinal pathology. The pathological evaluation of biopsy specimens involved several staining techniques and grading scales to accurately diagnose and assess the severity of various conditions. Hematoxylin and eosin (H&E) staining was the routine method used to

examine tissue architecture and detect inflammation, mucosal atrophy, or eosinophilic infiltration. Eosinophilic esophagitis was diagnosed when eosinophil counts were >15 eosinophils per high-power field. In cases of suspected Helicobacter pylori infection, Giemsa or Warthin-Starry stains were applied for bacterial visualization. For diagnosing celiac disease, the Modified Marsh Classification (or Marsh-Oberhuber classification) was employed [9]. It grades mucosal changes from Marsh 0 (normal mucosa) to Marsh 3 (villous atrophy with crypt hyperplasia), aiding in diagnosis and treatment planning.

Outcome assessment

For all diagnostic procedures, a positive yield was considered when endoscopic or histologic findings showed diagnostic or prognostic value, defined as a reasonable explanation for presenting symptoms and/or a finding that affects management change. Minor, non-specific endoscopic findings, such as subtle erythema or minor increase or decrease of vascularity were considered normal in the absence of any significant histologic changes. Similarly, minor, non-specific histologic findings, such as mild chronic gastritis with no activity or non-specific duodenitis, were considered normal if unrelated to the presenting indication. A therapeutic endoscopic procedure was considered successful if the desired outcome of the procedure was achieved.

Statistical analysis

Descriptive statistics were used to calculate quantitative variables (mean and standard deviation) and categorical variables (frequency and percentage). Statistical software, SPSS version 20.0, was used for statistical analysis. A p-value of less than 0.05 was considered statistically significant, indicating a meaningful association between the tested variables.

Results

A total of 150 children were included in the study, who underwent 222 GI endoscopic procedures. The mean age of study subjects was 9 (±4.3) years, with a male-to-female ratio of 1:1.2.

Of these, 114 (76%) children underwent 182 upper GI endoscopies, and the remaining 36 (24%) children underwent 40 lower GI endoscopic procedures. Of the 182 upper GI endoscopies, 111 (61%) were diagnostic and 71 (39%) were therapeutic. Similarly, of 40 colonoscopies, 36 (90%) were diagnostic and 4 (10%) were therapeutic. Indications of all endoscopic procedures are shown in Table 1. The most common indication of endoscopy was abdominal pain in 48 (32%) children, followed by hematemesis in 28 (18%) and diarrhea in 28 (18%) children.

Diagnostic yield of upper GI endoscopy:

Of 111 diagnostic upper GI endoscopic procedures, a positive diagnostic yield was found in 81 cases (73%) as shown in Table 2. Abdominal pain was the most common indication (n=36), with gastritis (47%) being the most common finding. Hematemesis as an indication of endoscopy (n=28) had a high yield of 86%, and the most common finding was esophageal varices (58%). Celiac disease was the most common diagnosis in children undergoing upper GI endoscopy for chronic diarrhea. The majority of the children who underwent upper GI endoscopy for evaluation of dysphagia were detected to have an esophageal stricture.

Diagnostic yield of colonoscopy

Thirty-six children underwent colonoscopy for diagnostic purposes, with an overall positive finding in 15 cases (42%), as shown in Table 3. Lower GI bleeding was the commonest indication in 13 children, and rectal polyp was the commonest finding in just over one-third of the children. Twelve children underwent colonoscopy for abdominal pain where intestinal tuberculosis was diagnosed in one-fourth of them. Colonoscopy for chronic diarrhea (n=8) had the highest diagnostic yield of 75%, including Crohn's disease (2), ulcerative colitis (1), and ileocecal TB (1).

Therapeutic endoscopic procedures: (n=75)

A total of 75 therapeutic endoscopic procedures were performed in children for various indications, and their outcomes are shown in Table 4.

Endoscopic variceal band ligation for esophageal varices was the most commonly performed therapeutic procedure with no complications. This was closely followed by esophageal stricture dilatations, which were also performed successfully without encountering any procedure-related complications. Four children with solitary rectal polyps underwent successful endoscopic snare polypectomy. One child with multiple colonic polyps was referred for surgery. All were juvenile polyps on histology. Three cases with a history of foreign body ingestion underwent successful endoscopic removal. All procedures were uneventful.

Table 1: Indications of gastrointestinal endoscopy in children

Indications	N (%)
Abdominal pain	48 (32%)
Hematemesis	28 (18%)
Chronic diarrhea	28 (18%)
Dysphagia	18 (12%)
Lower GI bleed	13 (8.5%)
Vomiting	7 (4.5%)
Constipation	3 (2%)
Foreign body ingestion	3 (2%)
Screening endoscopy	2 (1.5%)
Total number of children	**150 (100)**

Table 2: Diagnostic Yield of Upper GI Endoscopy

Indication	**No. of Children** (N=111), N (%)	**Positive Findings;** N (%)	**Most Common Findings**	**Positive Yield;** N (%)
Abdominal Pain	36 (32)	•Significant gastritis: 17 (47) (Helicobacter pylori infection positive in 5 cases) •Hiatus hernia: 3 (10) •Celiac Disease: 2 (6) •Esophageal Candidiasis: 1 (3)	Significant gastritis	23 (64)
Hematemesis	28 (25)	•Esophageal varices: 16 (58) •Portal hypertensive gastropathy: 3 (10) •Mallory-Weiss: 2 (7) •Hemorrhagic gastritis: 2 (7) •Diffuse mucosal bleed: 1 (4)	Esophageal varices	24 (86)
Chronic Diarrhea	20 (18)	•Celiac: 9 (45%) •Lymphangiectasia/duodenitis: 2 (10) •Portal duodenopathy: 1 (5) •Giardiasis: 1 (5)	Celiac disease	13 (65)
Dysphagia	18 (16)	•Esophageal stricture: 10 (56) (post-tracheo-esophageal fistula repair-6; post-corrosive, n=4) •Achalasia; 2 (11) •Hiatus hernia; 2 (11) •Thermal injury; 2 (11)	Esophageal strictures	16 (89)
Vomiting	7 (6)	•Helicobacter pylori gastritis; 3 (43)	H. pylori gastritis	3 (43)
Chronic Liver Disease with portal hypertension	2 (1.8)	•Small esophageal varices; 2 (100)	Small esophageal varices	2 (100)

Table 3. Diagnostic Yield of colonoscopy

Indication	No. of Children (N=36), N (%)	Positive Findings; N (%)	Most Common Findings	Positive Yield; N (%)
Lower GI Bleeding	13 (36)	•Rectal polyps: 5 (38) •Chronic colitis: 1 (7)	Rectal polyps	6 (46)
Abdominal Pain	12 (33)	•Intestinal TB: 3 (25) •Infective proctosigmoiditis: 1 (8) •Crohn's disease: 1 (8)	Intestinal tuberculosis	5 (42)
Diarrhea	8 (23)	•Crohn's: 2 (25) •Chronic colitis: 2 (25) •Ulcerative colitis: 1 (12) •Ileocaecal TB: 1 (12)	Crohn's disease, colitis,	6 (75)
Chronic Constipation	3 (8)	•Rectal ulcer: 1 (33)	Rectal ulcer	1 (33)

Table 4: Therapeutic Endoscopic Procedures

Indication	No. of Children (N=75); N (%)	Procedure Performed N (%)	Details	Complications
Hematemesis (Varices)	16 (21%)	Variceal Band Ligation, 15 (93) Endoscopic Sclerotherapy, 1 (6)	35 sessions (median 2); Sclerotherapy: 3 sessions	None
Dysphagia	10 (13%)	Endoscopic Esophageal Dilatation	30 sessions (median 2 per child)	None
Lower GI bleed	5 (6%)	Endoscopic polypectomy, 4 (80) Referred to surgery, 1 (20)	Juvenile polys confirmed on histology	None
Foreign Body Ingestion	3 (4%)	Foreign Body Removal	Peanut (roth-net), plastic sticker (rat-tooth forceps), 2 button batteries (loop basket)	None

Discussion

The present study from a single center highlighted the role of pediatric GI endoscopy in the evaluation and management of various GI disorders in children. A single-center study showed a 12-fold increase in the utility of pediatric GI endoscopy over the 20 years from 1985 to 2005 [10]. However, it is important to identify the appropriateness of the indication of GI endoscopy, as it is a relatively invasive procedure and requires sedation and monitoring. Over the years, the indications for GI endoscopy have changed. In their study, Franciosi et al observed that GI bleeding constituted a major indication in 34% of all GI endoscopies in 1985, which decreased to only 5% in 2005, while there was an increase in endoscopies performed for abdominal pain over the same time period from 23% to 43%. [10]. In the present study also, abdominal pain was the most common indication in nearly one-third of all procedures, followed by GI bleeding in nearly one-fifth of endoscopic procedures.

Different studies have documented different yields of pediatric endoscopic procedures [11-18]. However, these studies differ from each other in the way that some are diagnostic only, some have included all GI endoscopic procedures, and some are restricted to analyzing specific symptoms such as abdominal pain. Also, the definition of a positive yield was not uniform, making them too inhomogeneous to compare. These studies reported an overall positive diagnostic yield from as low as 19% to as high as 76% [11-18]. The diagnostic yield of upper GI endoscopy and colonoscopy varied significantly based on the indication in our study. The diagnostic yield of upper GI endoscopy was

73%, while that of colonoscopy was 42%, making an overall yield of 65%, which is in range with the published literature.

When specifically assessing those cases referred for abdominal pain, the diagnostic yield ranged from 36% to 63% across the studies [11, 15, 17, 18]. Our study also reported a similar yield of 64% in children undergoing upper GI endoscopy for abdominal pain as an indication. In a recent study by Wang et al. from China, the yield of upper GI endoscopy for gastrointestinal bleeding and dysphagia was 83% and 94%, which was higher as compared to the yield for vomiting (67%) and chronic diarrhea (66%) [11]. This is similar to the present study, where children presenting with GI bleeding and dysphagia had a higher proportion of positive findings (86% and 89%, respectively) contributing to the treatment compared to those presenting with vomiting (43%) and chronic diarrhea (65%). In another study in children from India done in an adult gastroenterology setting by adult gastroenterologists, the diagnostic yield for upper GI bleeding was higher compared to that for vomiting (71% vs 38%, respectively) [18].

The diagnostic yield of colonoscopy was 42% in the present study, while other pediatric studies have shown slightly lower yields ranging from 25% to 33% [12, 13]. The reason for the higher yield in the present study could be the careful selection of patients with a higher likelihood of positive findings before the procedure.

Gastrointestinal bleeding was the most common indication in 57% of all therapeutic endoscopic procedures. In children presenting with GI bleeding, variceal band ligation was the most common endoscopic procedure, followed by polypectomy. The other therapeutic procedures included esophageal stricture dilatation and endoscopic removal of ingested foreign bodies. In a recent study from Bahrain in children undergoing GI endoscopies, esophageal stricture dilatation was the most common therapeutic procedure, followed by foreign body removal from the gastrointestinal tract [16]. All therapeutic procedures were successful without any complications.

The role of GI endoscopy is not limited to looking for positive findings. The importance of a negative yield is to reassure parents and relieve their anxiety. It also helps to confirm a functional etiology in selected cases or may indicate the need for further investigation on a case-to -case basis.

This is the first study from Central India done in an exclusive pediatric endoscopy setting by pediatric gastroenterologists, in contrast to the previously published retrospective study from an adult center [18]. However, there were certain limitations to this study. Being a single-center study with a limited number of patients, the generalization of results may not be appropriate. We suggest multicenter studies from exclusive pediatric gastroenterology centers to generate more information from India.

Conclusion

The overall positive diagnostic yield of endoscopy in children was found in nearly two-thirds of the procedures. However, the yield varied based on the indication of the endoscopic procedure. Children with more alarming symptoms like GI bleeding and dysphagia had higher yield as compared to those with non-specific symptoms like abdominal pain and vomiting. Thus, a more careful selection of patients may prevent an unnecessary endoscopy. All endoscopic procedures were well tolerated without any procedure-related complications.

Acknowledgment

None.

Ethical consideration

The procedure was explained to the guardians, and written informed consent was obtained. The study was approved by the institutional ethics committee. [IEC NO- SAIMS/RC/IEC/161/24].

Funding

There was no financial support for this research.

Conflict of interest

There is no conflict of interest.

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