

INDICATIONS, DIAGNOSTIC YIELD AND APPROPRIATENESS OF GASTROINTESTINAL ENDOSCOPIC PROCEDURES IN CHILDREN: EXPERIENCE OF A TERTIARY LEVEL TEACHING HOSPITAL OF NEPAL

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ABSTRACT

Gastrointestinal (GI) endoscopy has been a key diagnostic tool from the past in adult patients, but its usefulness has been increasing in pediatric cases also. With development of technologies, these procedures have been relatively safer than in the past and have increased the yield in the diagnosis of GI diseases. Nepal being a developing country, it still has lesser pediatric GI cases and the outcomes of such cases are also limited. This retrospective study aimed to assess the types of GI procedures done along with their indications and diagnostic yields of these procedures which were conducted by reviewing data of all the patients between the ages of 0-18 years who underwent endoscopy in our center from January 2018 to December 2022. Overall, 82% of the 323 procedures performed in 268 patients during this study period (mean age 10 years) had a positive endoscopic finding, among which gastritis/duodenitis was the commonest (32.1%). Most common indication for the endoscopic procedures was pain abdomen (28%) followed by vomiting (25.7%). Rectal bleeding (24.3%) was the most common indication for doing lower GI procedures. Based on ESGE and ESPGHAN guidelines, 98.15% of the procedures done were considered appropriate. Histopathologically 27 out of 65 (41.5%) cases had *Helicobacter pylori* positive gastritis while 28 (43.0%) had no abnormalities detected. No major procedural and post procedure complications were noted in any of the study children indicating safety of such GI procedures under proper sedation. General practitioners and pediatricians should be encouraged to refer such children for the diagnosis and proper management as there procedures have been accessible and considered safe nowadays.

KEYWORDS

Endoscopy, diagnostic yield, pediatrics, Nepal

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INTRODUCTION

Pediatric gastrointestinal (GI) endoscopy has been evolving as one of the new diagnostic modalities in the recent days. Innovative advances in the field of endoscopy have helped pediatric gastroenterologists for more accurate diagnosis of GI disorders as well as management of those conditions.¹ Ever since Hirschowitz introduced flexible endoscopes in the 1950s, use of upper GI endoscopy also started in Pediatrics.² Later on, fiberoptic endoscopes were developed for children in 1970's and thus upper GI endoscopy became a standard of care in diagnosis of many GI complains in children. Since then, pediatric gastroenterology has emerged as one of the most diverse subspecialties in Pediatrics in the developed world.³ In the developing world however, most health centers pediatric GI endoscopic procedures are still performed by conventional gastroenterologists as only few hospitals have specialized pediatric gastroenterologists. This is due to the fact that there are limited number of pediatric gastroenterologists available and not all of them are experienced enough to perform the procedures.⁴ Despite the high diagnostic yield, GI endoscopy is still an under recognized tool due to the Lack of awareness of its application, limited pediatric endoscopic devices and lack of adequately trained pediatric gastroenterologists who can safely perform the procedures.³⁻⁵

Endoscopic procedures in pediatric population include upper GI endoscopy both diagnostic and therapeutic like polypectomy, esophageal variceal ligation, esophageal dilatation and foreign body removal. Lower GI endoscopy include sigmoidoscopy, colonoscopy and polypectomy.⁶ The European Society of Gastrointestinal Endoscopy (ESGE) and European Society for Pediatric Gastroenterology, Hepatology, and Nutrition (ESPGHAN) have provided evidence-based guidelines with clear indications and timing of diagnostic and therapeutic endoscopy in pediatric patients.⁷ Indication of the procedure was described as appropriate when compliant with the 2016 Pediatric Gastroenterology Endoscopy Guidelines by the ESGE and ESPGHAN, whereas inappropriate indication described noncompliance.^{7,8}

In modern days children of all ages can safely undergo GI endoscopic procedures due to better anesthetic techniques and technological advances in the size and flexibility of specially designed pediatric endoscopes. As children are not young adults, adequate knowledge and a thorough understanding of the child's medical

background is must for the better management of them. Thus, upper GI endoscopy in children should be performed by pediatric-trained gastroenterologist whenever possible.⁹

A number of anesthetic drugs or sedatives are used by anesthetists for appropriate sedation in GI endoscopy in children. Most commonly used agents include benzodiazepines (e.g., midazolam), opioids (e.g. fentanyl), propofol, ketamine, etc.¹⁰

Despite the high diagnostic yield, GI endoscopic procedures are still under-utilized tool and information regarding its efficacy is scanty in most of the developing countries. This is mainly due to lack of awareness about the role of this important diagnostic modality in children which prevents referrals of these children to a center where this facility is available. Furthermore, there is lack of data from non-western countries regarding the appropriate indications of endoscopy in children or while referring a child for endoscopy.^{3,11}

Nepal being a developing country has limited number of pediatric gastroenterologists who are trained for performing the diagnostic and therapeutic GI procedures. Thus, multiple centers utilize the adult gastroenterologists for the procedure. There are limited numbers of publications collecting the pediatric gastrointestinal procedures done by trained pediatric gastroenterologists. This study is focused on reviewing our pediatric patients who underwent GI endoscopic procedures at Nepal Medical College Teaching Hospital (NMCTH), a tertiary care center at Kathmandu, Nepal. It is aimed at describing the patient demographics, clinical presentation, indications for GI endoscopic procedure, sedation or anesthesia used, type of endoscopy used, appropriateness of the procedure, endoscopic findings, complications and final diagnosis.

MATERIALS AND METHODS

This is a hospital based retrospective descriptive study in children who underwent endoscopic (diagnostic and therapeutic) procedure at NMCTH. All patients upto the age of 18 years, who underwent gastrointestinal endoscopic procedure from pediatric OPD or from pediatric ward after admission at NMCTH during the 5-year period from January 2018 to December 2022 were included in the study, excluding those who were hemodynamically unstable. Ethical approval for the study was taken from the Institutional Review Committee (IRC) of NMCTH (Ref. No.: 57-079/080). All procedures

were performed by trained pediatric gastroenterologists in the endoscopy unit of NMCTH. Two types of endoscopes were used for the procedures: Fujifilm EG-760R and Karl Storz Xenon 100. In addition, other endoscopic equipments were also used for different endoscopic indications such as basket forceps for foreign body removal, snare cauterization forceps for polyp removal and bougie dilators for esophageal stricture dilatation. Necessary blood and radiological investigations of patients were done as indicated by the symptoms of the cases. All patients received sedation/anesthesia in accordance to their comfort level and cooperation for the procedure, either intravenous anesthesia or general anesthesia and was given by trained anesthesiologists. The patients who did not receive sedation received lignocaine (10%) gargle before the procedures. All patients with indications for undergoing the procedure were kept nil per oral for at least 6 hours prior to the procedure, intravenous line was secured and maintenance fluid was started till the procedure was complete. Patients were kept in recovery room to look for immediate procedure related complications and were monitored strictly for at least 4 hours post procedure until the reversal of anesthetic agents effects and the patient accepted orally. The socio-demographic data of all patients, various indications of the endoscopic procedure done, appropriateness of the procedure according to the guidelines, types of sedation used for the procedure, type of endoscopic procedure used along with the findings of the procedure, histopathology findings of the biopsied samples and any complications during the procedure were recorded in the preformed proforma. Data were collected and analyzed using SPSS-21. Statistical analysis was performed by descriptive method by using frequency, percentage, mean, median and standard deviation as per the nature of data. Data were

finally analyzed by using Microsoft Excel and SPSS-21.

RESULTS

During the study period, total of 323 GI procedures were performed in 268 patients. Out of these 268 patients, majority of patients were male (60.8%) (Fig. 1). The mean age of the patients was 10 years (SD – 5.60) at the time of GI procedures. Most common age group was 15-18 years (24.6%) and there were 6.7% of infants (<1 year of age) who required the GI procedure (Fig. 2).

Most common symptom requiring the upper GI endoscopy was pain abdomen (28%) and vomiting (25.7%). Similarly, rectal bleeding (24.3%) was the leading cause requiring sigmoidoscopy and colonoscopy (Table 1).

Based on ESGE and ESPGHAN guidelines, 98.15% of the total procedures performed during the study period were considered as appropriate. The remaining procedures considered inappropriate, were follow up endoscopy

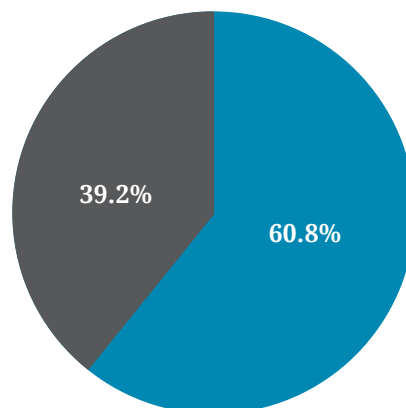


Fig 1: Gender distribution of children who underwent GI endoscopic procedures

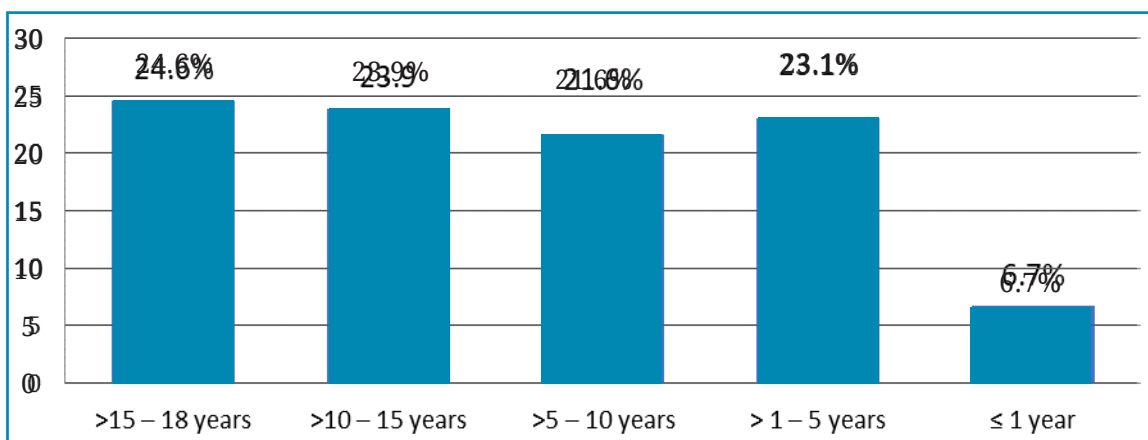


Fig 2: Different age groups of children requiring endoscopic procedures

Table 1: Chief complains in children for which procedure was done

Symptoms	n (%)
Pain abdomen	75 (28)
Vomiting	69 (25.7)
Rectal bleeding	65 (24.3)
Blood in vomiting	30 (11.2)
Dyspepsia	25 (9.3)
Corrosive ingestion	14 (5.2)
Anemia	10 (3.7)
Foreign body ingestion	8 (3.0)
Mass per rectum	5 (1.9)
Chronic diarrhea	4 (1.5)
Dysphagia	1 (0.4)

for the assessment of healing of gastric and duodenal ulcer following medical therapy in the absence of any signs and symptoms.

The majority of the diagnostic procedure done in children were upper GI endoscopy (61.2%) followed by colonoscopy (7.8%); while polypectomy (14.6%) was the most common therapeutic procedure done in this study

Table 2: GI procedure done

Procedure done	n (%)
Upper GI endoscopy	164 (61.2)
Sigmoidoscopy	11 (4.1)
Polypectomy	39 (14.6)
Colonoscopy	21 (7.8)
Esophageal dilatation	14 (5.2)
Esophageal variceal band ligation	11 (4.1)
Foreign body removal	8 (3)

followed by esophageal dilatation (5.2%) and variceal ligation (4.1%) (Table 2).

Majority of cases were done under intravenous anesthesia using midazolam and propofol (47.4%) as discussed in Table 3.

Table 3: Anesthesia given to the patients

Anesthesia used	n (%)
Midazolam + Propofol	127 (47.4)
Midazolam + Ketamine	34 (12.7)
General	4 (1.5)
Local (10% lignocaine spray)	103 (38.4)

Gastritis/Duodenitis was the commonest findings (32.1%) followed by normal findings (17.9%). Rectal polyp (16.8%), esophageal varices (8.2%) and esophageal stricture (5.2%) were among other abnormalities during the procedure. There were 2 cases of worms in duodenum and 2 cases of dieulafoy’s lesion found (Table 4).

Total 14 cases underwent upper GI endoscopy for esophageal stricture and esophageal dilations were also done at the same time.

Table 4: Findings of the procedure done

Procedure findings	n (%)
Gastritis/Duodenitis	86 (32.1)
Normal findings	48 (17.9)
Rectal polyp	45 (16.8)
Esophageal varices	22 (8.2)
Esophageal stricture	14 (5.2)
Hiatus hernia	9 (3.4)
Foreign body	8 (3)
Esophageal ulcer	7 (2.6)
Colitis	7 (2.6)
Gastric ulcer	5 (1.9)
Duodenal ulcer	5 (1.9)
Duodenal obstruction	5 (1.9)
Worms	2 (0.7)
Dieulafoy’s lesion	2 (0.7)
Hemorrhoids	2 (0.7)
Rectal ulcer	1 (0.4)

Table 5: Complications during the procedure

Complications	n (%)
No complications	262 (97.8)
Desaturation	5 (1.9)
Oozing from polypectomy site	1 (0.4)

Among these 14 cases, repeat dilations (9/14) were needed for recurrent stricture. Maximum number of dilatations required in a case was 6 times in three patients. These esophageal strictures were either due to corrosive induced stricture (n=5; 1.9%) or post-anastomotic (n=9; 3.4%) after the repair of trachea-esophageal fistula.

One case had developed oozing from polypectomy site (managed with hemoclip) and

5 patients had developed desaturation during the procedures which were also managed with no further complications (Table 5).

Total 65 (24.3%) patients had undergone biopsy during the GI procedure, which showed

Table 6: Biopsy findings

Biopsy findings (n=65)	n (%)
Normal	28 (43)
<i>Helicobacter pylori</i> positive gastritis	27 (41.5)
Erosive gastritis	7 (2.6)
Colitis	3 (1.1)

majority of cases, 28/65 (43%) had normal biopsy finding and 27/65 (41.5%), had *H. pylori* gastritis. There were 3 cases of colitis in the biopsy among which one was confirmed as Ulcerative colitis and 2 others were infective colitis (Table 6).

DISCUSSION

Gastrointestinal (GI) endoscopy has major role in evaluating and managing diseases related to digestive system in children. There has been an increased use of these procedures which include diagnostic upper GI endoscopy, sigmoidoscopy, colonoscopy, polypectomy, esophageal dilatation, etc. Easy access and very less complication rate of such procedures nowadays have led to a considerable rise in the use of them and also increased the associated health cost.¹² In order to increase transparency and lucidity about the patient care, management and outcomes, pediatric GI endoscopy quality measurements are must.

GI disorders are very common problems seen in children, especially in school-going. Most of them are benign in nature; but around one fifth of them require evaluation as they present with persistent symptoms.⁵ These disorders are a diagnostic challenge clinically, where investigations like GI procedures help the pediatricians. Due to their easy accessibility, low complications rate and rise in recognition of pediatric gastroenterology as a sub-specialty has considerably increased the rate of these procedures.⁵

This study showed the experience of pediatric endoscopy over a period of 5 years in tertiary hospital of Kathmandu, Nepal. There was male predominance (60.8% vs 39.2%) among the children who underwent GI procedure in our endoscopy department. It was similar to study done by Thapa *et al.*² This gender variation might be attributed to cultural differences.²

In our study abdominal pain was the most common indication for upper endoscopy (28%) followed by vomiting (25.7%). Our result was consistent with the study done by Fachler *et al.*¹³ which has shown abdominal pain (26%) as the leading cause in children undergoing endoscopy. One of the study in Jordanian children done by Altamimi *et al.*⁷ had reported 45.1% of children requiring endoscopy for abdominal pain.⁷ Similarly, Thapa *et al.*² had reported 50.8% of patients with abdominal pain requiring endoscopy. In literature from most of the developing countries, recurrent abdominal pain has been reported to be the commonest indication of upper GI endoscopy. In various reports this frequency of abdominal pain is reported to be ranging from 8% to 43%.¹¹ Khan *et al.*³ had similar leading cause as failure to thrive in 31% of Pakistani children who required endoscopy. In contrast to developing countries, in a study from France, Jantchou *et al.*¹⁴ have reported failure to thrive (suspected celiac disease), seen in 30.4% of children as the leading cause requiring endoscopy. Abdominal pain was the leading cause for the endoscopy in children (38%) as per the PEDS-CORI database which included 17,180 endoscopies from North America.¹⁵

Lower GI bleeding was the main cause for doing sigmoidoscopy and colonoscopy which was 24.3% of all the symptoms. Rabeh *et al.*¹⁶ reported 57.1% of children with lower GI bleeding requiring sigmoidoscopy and colonoscopy. In contrast to findings in this study, another study had 87.5% children with rectal bleeding which required lower GI procedure.¹⁷ The higher percentages of rectal bleeding was most probably because these studies included only the lower GI procedures. In study by Silva *et al.*¹² 12% of total cases underwent lower GI procedure for bleeding per rectum. Data from western world has highest burden of suspected IBD (57.9%) which warranted colonoscopy in children followed by rectal bleeding (10%).¹⁸

A total of 26.9% of all the procedures done during this study period were therapeutic intervention procedure which included polypectomy (14.6%), esophageal dilatation (5.2%), esophageal band ligation (4.1%) and foreign body removal (3%).

Out of all the procedures done in our unit, 98.15% were considered as appropriate based on ESGE and ESPGHAN guidelines. 1.85% (n=6) which were considered inappropriate, which were follow up cases of gastric and duodenal ulcers following medical therapy in the absence of any signs and symptoms, which was almost similar to findings by Wani *et al.*¹⁹ that found 94.9%

of all pediatric GI procedure as appropriate following the NASPGHAN and ASGE guidelines. A study from Jordan which had followed ESGE and ESPGHAN guidelines reported 13.9% of procedures as inappropriate.⁷ Lee *et al*¹⁰ reported 0.3% of GI procedures in children as inappropriate according to NASPGHAN and ASGE guidelines which was comparable to our findings.

As younger children usually those less than 10 years of age may not be cooperative and usually require sedation for the GI procedure,²⁰ we used combination of midazolam with propofol and midazolam with ketamine for deep sedation. This need for deeper sedation in children is one of the contributing factors for the development of complications during the procedure.²⁰ In this study we used midazolam and propofol in 47.4% of children followed by local anesthesia with 10% lignocaine spray in 38.4% without deep sedation. Out of all the children 1.5% (n=4) procedures were done under general anesthesia (using sevoflurane along with propofol infusion and fentanyl) and rest were under deep sedation using midazolam and ketamine (12.7%). There were total 5 cases (1.8%) that developed hypoxia during the procedure. Among these children three patients received combination of midazolam and propofol, one had received midazolam with ketamine and remaining one was on general anesthesia. The incidence of respiratory adverse events makes up a considerable percentage (5.5%) of the complications of sedation in children.²¹ Disma *et al*²² had published 2.5% children developing hypoxia after receiving midazolam and propofol for GI endoscopic procedure. Similar finding was noted by Najafi *et al*²³ with adverse events associated with sedation during endoscopy in 3.4% of children. The involvement of pediatric anesthesia team for sedation and monitoring throughout the procedure could be one of the reason for insignificant number of cases developing complication like hypoxia in our study. One of the case after polypectomy developed oozing of blood from the polypectomy site which was stopped by using a hemoclip. None of the patients developed severe complications and no procedure had to be aborted despite the above mentioned complications.

This study had diagnostic yield of 82% among total 268 children which was consistent with the findings in the study done by Zuleta *et al*²⁴ The finding was in contrast to the result obtained by the study done by Thapa *et al*² and Mudawi *et al*²⁵ The commonest upper endoscopic finding was gastritis/Duodenitis (32.1%). Lower GI procedure had rectal polyp (16.8%) as the major finding in our study. In

one of the study by Joshi *et al*²⁶ from Nepal most of the endoscopic studies were reported normal (66%) which was contrast to our finding (17.9%). PEDS-CORI²⁷ project which is considered as one of the largest registry for pediatric endoscopic procedures in the world has reported normal yield of endoscopy in 44% and similarly normal colonoscopy yield in 41% of children, which is in contrast to our study where 17.9 % had normal procedure findings.

There were 65 cases whose biopsies were obtained during the endoscopic procedure according to the baseline clinical symptoms of the children. Majority (43%) had normal biopsy findings followed by *H. pylori* positive gastritis (41.5%). There were 3 (1.1%) cases of colitis, among which one was confirmed as ulcerative colitis. Similar retrospective study in from Asian country by Khan *et al*³ reported gastritis as the most common histopathological finding on biopsy (31%) with 15.5% having normal biopsy result. In another study from Nepal by Joshi *et al*¹⁵ 8.34% histopathology reported Giardiasis, which was not found in any of the case in this study. In developing countries giardiasis has been reported to have prevalence of 20-30% in contrast to developed countries (3-7%).²⁸

In conclusion, with the increase in technology nowadays the endoscopic procedures in children is regarded as a safer investigation in selected patients. Although this procedure can be performed without sedation or anesthesia in adult patients and older children, no specific guidelines for pediatric age group has been developed. The indications for the procedures in children are not clearly defined. There is a need to increase awareness about the diagnostic and therapeutic role of the GI procedures amongst the practicing physicians and pediatricians, especially in developing countries. There are very few centers in our country with facility for pediatric endoscopic procedures. Hence, there are scarce data on the pediatric GI disorders and their outcome. Various training programs in pediatric gastroenterology need to be developed along with specific guidelines for the procedure and sedation during the procedure so that children with GI diseases may benefit from this advanced diagnostic modality. In this study we have studied the common indication of GI procedures in children along with the diagnostic yield and appropriateness according to the recommended guidelines. The data from this study can be used to find out the common GI disorders and their manifestations which require endoscopic procedures. This study may help the practicing pediatricians and pediatric gastroenterologist to correctly identify the

children who fulfill the criteria for undergoing the procedure thus referring them for the same.

However, this study has some restrictions among which retrospective nature of study is the major one. Another restriction in this study is the pre-procedure medications taken by children which were not taken into account which could have led to discordance between endoscopic and histopathological findings.

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