

# Lower Gastrointestinal Bleed in Children: Safety, Utility, and Yield of Colonoscopy: an Experience from a Large Tertiary Referral Endoscopy Center

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# Abstract

**Objective:** There is paucity of data on lower gastrointestinal bleed (LGIB) in the pediatric population. We aimed to retrospectively review the endoscopy findings in patients younger than 18 years, presenting with lower gastrointestinal (GI) bleed and undergoing colonoscopy.

Materials and Methods: Retrospective review of the endoscopy database at the department of gastroenterology at a tertiary care center from Western India was conducted between June 2017 until December 2021. Patients  $\leq$ 18 years with LGIB, who underwent colonoscopy within 7 days of onset of bleed, were included in the study. Demographic details, endoscopic findings, and complications were noted.

**Results:** In all, 55 patients were included in study (65% males; median age: 13 years [range: 1–18 years]). The most common endoscopic findings were polyps in 26 (47.2%) patients, colitis in 15 (27.2%) patients, solitary rectal ulcer syndrome (SRUS) in 6 (11.3%) patients, and hemorrhoids in 3 (5.4%) patients. Five (9%) patients had normal colonoscopy in whom the cause remained unidentified on further evaluation. However, no repeat episode was documented on a follow-up of 30 days. The most common location of a polyp was the rectum (64%). Two patients had multiple polyps (2 each). All the patients underwent a successful polypectomy. Pathology reported juvenile polyps in 25 biopsies. Four were diagnosed as inflammatory bowel disease (IBD), while 11 had acute infective colitis. Patients with infectious colitis as compared to IBD had higher incidence of fever (55 vs. 0%) and lesser incidence of previous similar events (22 vs. 66%). Those with polyps were younger than those without polyps (9.1 vs. 14.3 years; p = 0.000). Polyps were significantly more common in boys (84%; 22/26; p = 0.014) than in girls. No complications occurred in this cohort of patients.

## **Keywords** colonoscopy

- pediatric GI bleed
- polyps

**Conclusions:** Polyps are the most common cause of LGIB in patients  $\leq$ 18 years, followed by colitis. Polyps were more common in younger males.

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# Introduction

Lower gastrointestinal bleed (LGIB) refers to bleed from any site distal to the attachment of the ligament of Treitz.<sup>1</sup> Few authors have defined upper GI (UGI) bleed with an origin proximal to the papilla, mid-GI bleed as origin between the papilla and the ileocecal (IC) valve, and LGIB as that originating from a point beyond the IC valve.<sup>2,3</sup> Acute LGIB is defined as a GI bleed occurring from the colon, rectum, or anus, and presenting as either hematochezia (bright red blood, clots, or burgundy stools), melena, or bloody diarrhea.<sup>4</sup>

Overt LGIB may present as melena or hematochezia. The annual incidence of LGIB in the West is approximately 20 cases/100,000 population, and it accounts for 20% of all acute GI bleed.<sup>5</sup> This incidence of LGIB increases by greater than 200-fold from the third to the ninth decade of life, paralleling the increase in prevalence of colonic diverticulosis and angiodysplasia.<sup>6</sup> In a previous study from India by Dar et al from Jammu and Kashmir of 300 patients, 33% of all LGIB consisted of patients in the pediatric age group (<15 years).<sup>7</sup> All such patients require endoscopic evaluation (esophago-gastroduodenoscopy/colonoscopy/capsule endoscopy) to diagnose and treat the etiology. Similar to adults, capsule endoscopy has gained a widespread importance in pediatric population too.

Although LGIB is less common in the pediatric age group, it is considered an alarming sign and should be approached meticulously. Moreover, in children, GI bleed causes panic and stress for the parents. Common causes of LGIB in children vary among studies. Therefore, regional epidemiological data should be available in order to assist physicians with better management of these patients. The study center is a large tertiary referral drainage center located in western India for diagnostic and therapeutic endoscopic procedures including specialist pediatric endoscopic services with an annual endoscopic turnover of around 15,000 endoscopies. As there is a paucity of data on LGIB in the pediatric population, we aimed to retrospectively audit endoscopy findings in patients younger than 18 years, presenting with LGIB.

## **Materials and Methods**

A retrospective review of the endoscopy database at the department of gastroenterology at a tertiary care center from Western India between June 2017 until December 2021 was done.

As this was a retrospective study, ethical clearance was waived off by the local ethical committee at the institute level.

Bloody diarrhea is defined as loose stools mixed with fresh red or altered blood. Hematochezia is defined as passage of maroon or bright red blood or blood clots per rectum. Melena is defined as black tarry stool and results from degradation of blood to hematin or other hemochromes by intestinal bacteria.<sup>8</sup>

Severe GI bleeding is defined as documented GI bleeding accompanied by shock or orthostatic hypotension, a decrease

in haematocrit value by at least 6% (or a decrease in hemoglobin level of at least 2g/dL), or transfusion of at least 2 units of packed red cells.<sup>8</sup> Stable bleeds can be categorized as major or minor using a risk assessment tool such as Oakland score, which defines minor bleed with a score of  $\leq 8$  and major bleed as greater than 8.<sup>9</sup>

The inclusion criteria were all consecutive patients with age  $\leq$ 18 years with LGIB, who underwent colonoscopy within 7 days of onset of bleed.

Patients whose complete clinical and follow-up records could not be traced or those who had any underlying coagulopathy were excluded.

According to the institution's protocol, all patients who presented with melena initially underwent UGI endoscopy and thus these patients were included in the study only if they had inconclusive UGI study and required to undergo colonoscopy within the stipulated time. Others under the ambit of LGIB (fresh bleeding per rectum or bloody diarrhea) initially underwent colonoscopy followed by UGI endoscopy, if required. Further evaluation was done with relook upper endoscopy or colonoscopy, capsule endoscopy, computed tomography (CT) angiography, and Meckel's scan wherever appropriate if colonoscopy was unyielding. Patients were subsequently managed according to the etiology identified.

Demographic details and other clinical history including presence of diarrhea, abdominal pain, and need for blood transfusion were noted. History of any previous episodes of bleed, any history of medications, and blood and radiological investigations were recorded. Final endoscopic diagnosis, details of endotherapy, if performed, and procedural complications if any, were noted. In patients in whom endoscopic resection of colonic polyps or biopsy was done, final histopathologic diagnosis was reviewed. Comparative analysis between age of presentation and endoscopic diagnosis was done.

#### **Statistical Analysis**

Continuous variables were represented as mean (standard deviation) or median (range). Categorical variables were represented as frequency (percentage). Comparison between quantitative variables was done using the independent *t*-test or Mann–Whitney *U* test as applicable according to the distribution of data. Categorical variables were compared using the chi-squared test. Statistics were done using SPSS version 23.0 (IBM, Armonk, NY, United States).

### Results

Sixty patients were screened, out of which 3 patients were excluded because of incomplete documentation, while 2 patients had underlying coagulopathy. Thus, 55 patients were included in the study (**-Fig. 1**). The baseline characteristics are as in **-Table 1**. The median age was 13 years (1–18 years), and 65% of the patients were boys (36/55). More than half were in the adolescent age group (13–18 years, 55%). Two-thirds had hematochezia (n = 37; 67%), and nearly one-fourth had bloody diarrhea (n = 12; 22%). Six (11%) patients had melena who underwent colonoscopy due to unyielding upper



Fig. 1 Flowchart of patient selection.

Table 2 Findings on colonoscopy

Parameter	n (%)	
Age (y)	<6	9 (16%)
	6–12	16 (29%)
	13–18	30 (55%)
Gender	Male	36 (65%)
Clinical presentation	Hematochezia	37 (67%)
	Bloody diarrhea	12 (22%)
	Melena	6 (11%)
Blood transfusion required	Yes	10 (19%)

 Table 1
 Baseline characteristics (N = 55)

GI endoscopy. In these patients with melena, colonoscopy showed one patient having polyp in the ascending colon, two having features suggesting right-sided colitis, while other three had normal colonoscopy. The yield of colonoscopy in determining the source of LGIB was 90.9% (50/55), with a yield of 50 and 96% in patients with and without melena, respectively. Blood transfusions were required in 19% (10/55) patients. Out of these 10 patients, 2 patients had colitis, 7

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**Fig. 2** Single pedunculated polyp (size  $\sim 1 \times 0.7$  cm).

patients had polyps, and 1 patient had normal colonoscopy in which no cause could be identified.

The most common source of LGIB as determined by colonoscopy was colonic polyp (n = 26, 47%) followed by colitis (15, 27.2%), solitary rectal ulcer syndrome (SRUS; 6, 11%), and hemorrhoids (3, 5.4%; see **-Table 2**).

Polyps were found in 59% (n = 23) of all patients who presented with hematochezia and in only 16.6% of patients who presented with bloody diarrhea (n = 2) or melena (n = 1)each (p = 0.006; **Figs. 2** and **3**). Conversely, patients with polyps had a significantly higher presentation as hematochezia (n = 23, 88.4%) than melena (n = 1, 3.8%) or bloody diarrhea (n = 2, 7.7%; p = 0.006). Twenty-eight polyps were found in 26 patients (2 patients had 2 polyps each). The most common location of polyps was the rectum (64%; n = 18), followed by sigmoid colon (18%; n = 5; **Fig. 4**). Most of them were pedunculated polyps (71%; n = 20) with mean size of 1.7 cm, while only eight polyps were sessile (29%) with mean size of 0.9 cm; the distribution is shown in - Table 3. Polyps were significantly more common in boys (84%; 22/26; p = 0.014) than in girls. Those with polyps were younger than those without (9.1 vs. 14.3 years, p < 0.001). All the patients underwent successful polypectomy. No adverse effects were encountered in any of these patients barring mild self-limited abdominal pain in four patients. None of the patients suffered from postpolypectomy syndrome. Loop application was required in six patients who had polyp size greater than 2 cm or stalk greater than 5 mm,

Colonoscopy findings	Severity of bleed		Presentation		
	Massive	Mild-moderate	Hematochezia	Melena	Bloody diarrhea
Polyps (26, 47.2%)	7 (27%)	19 (73%)	23(88.4%)	1 (3.8%)	2 (7.7%)
Colitis (15, 27.2%)	2 (13.3%)	13 (86.6%)	3 (20%)	2 (13.3%)	10 (66.6%)
Solitary rectal ulcer syndrome (6, 11%)	0	6 (100%)	6 (100%)	0	0
Hemorrhoids (3, 5.4%)	0	3 (100%)	3 (100%)	0	0
Normal (5, 9%)	1	4	2 (40%)	3 (60%)	0



**Fig. 3** Multiple pedunculated polyps of varying size with overlying mucosal ulceration.

while no patients required surgical polyp excision or endoscopic mucosal resection or endoscopic submucosal dissection. Histopathology reported 25 of 28 polyps to be juvenile retention polyps (**~Fig. 5**).

Colitis was found in 15 (27.2%) patients (**-Fig. 6**). SRUS (**-Fig. 7**) and hemorrhoids were found in 6 (10.9%) and 3 (5.4%) patients, respectively. Fifteen patients had mucosal erythema, ulcerations, and friability, suggestive of colitis, which was localized in the rectum and sigmoid colon in 11 patients, while pancolitis was seen in four patients. All of them were managed medically. Out of 15 patients with colitis, 4 were diagnosed as inflammatory bowel disease (IBD), while 11 had acute infective colitis, which resolved completely with medical management. Patients with infectious colitis had higher incidence of fever (55 vs. 0%) and lesser incidence of previous similar events (22 vs. 66%). There was no difference between bleed severity, anorexia, and

 Table 3 Distribution of polyps according to morphology

	Pedunculated, n (%)	Sessile, n (%)
Rectum	11 (55)	7 (87)
Sigmoid colon	5 (25)	0 (0)
Descending colon	3 (15)	0 (0)
Transverse colon	1 (5)	0 (0)
Ascending colon	0 (0)	1 (13)
Total	20	8

weight loss among those with or without infectious colitis. No patient was referred for surgical intervention.

In five patients, no cause was found despite upper GI endoscopy and colonoscopy, out of which three had presented with melena and two with hematochezia. Further evaluation was done with relook upper endoscopy/colonoscopy, capsule endoscopy, CT angiography, and Meckel's scan wherever appropriate. Cause could not be elicited in any of these patients despite above additional workup and none of these patients had any further episode of GI bleed over a follow-up period of 30 days.

## Discussion

LGIB in the pediatric population has always been a matter of concern, especially considering scarcity of regional data to prognosticate and predict the etiology and expected outcome. Out of all emergency department (ED) visits for LGIB, 33% are children younger than 15 years.<sup>7</sup> Our study's age distribution differed slightly from that in the Western literature. Pant et al<sup>10</sup> extracted ED visits for pediatric GI bleed from the Nationwide Emergency Department Sample (2006–2011) and showed that 40% of patients were aged 15 to 19 years, while 38%



Fig. 4 Distribution of polyps according to location.



Fig. 5 Polyps distribution according to histopathology.

were in the 0- to 5-year age group. We had a lesser proportion in the younger age cohort (0–6 years; **– Table 1**), likely due to hospital selection bias. The male-to-female ratio found in our study was 2:1. This was similar to previous studies by Bhadauria et al,<sup>11</sup> Khurana et al,<sup>12</sup> and Poddar et al<sup>13</sup> who found a male-to-female ratio in the range of 2 to 3.5:1. Although in alignment with previous studies, a social fabric where boys are given more attention and their symptoms brought to medical attention earlier can be a contributing factor.

For any patient presenting with acute LGIB with hematochezia, colonoscopy is the first test used as diagnostic and therapeutic modality. Patients with melena usually have a source in the esophagus, stomach, or duodenum (UGI bleed). However, in some instances, bleed may arise beyond the ligament of Treitz (duodenojejunal flexure) and still present as melena. These patients should be planned for upper endoscopy for the sheer reason of commonality, followed by lower endoscopy and small bowel evaluation. The same algorithm was followed in the present study for patients with melena. The majority of patients in our study presented with hematochezia (n = 37; 67%), followed by bloody diarrhea (n = 12; 22%) and melena (n = 6; 11%). This finding was in accordance with what other studies have shown.<sup>11,14</sup>

All the patients underwent complete colonoscopy, without any complications. The cause for LGIB could be determined in 50 patients, while five (9%) patients had normal colonoscopy findings. All these patients with normal colonoscopy had spontaneous resolution of GI bleed and no recurrent episode was reported in any of them over a follow-up of 30 days. It is also noted that only one of five patients who had normal colonoscopy required blood transfusion.

Significant bleed requiring blood transfusion was seen in almost one-fifth (19%) cases of LGIB. Colonoscopic yield in these patients with significant LGI bleed was 90%.



Fig. 6 Erythema, edema, erosions, and ulcerations suggestive of colitis.



**Fig. 7** Solitary rectal ulcer syndrome (SRUS; size  $\sim 1 \times 1$  cm).

The most common etiology for GI bleed in these patients was the presence of polyps (80%), followed by colitis (10%) and other etiologies. All the patients with polyps subsequently underwent polypectomy.

Normal colonoscopy was found in a variable proportion of patients in different studies.<sup>12,14,15</sup> Normal colonoscopy could be attributed to several etiologies including lesion hidden behind mucosal folds, etiology in the small bowel that resolved by itself, and missed lesions due to poor preparation or ulcers that healed itself before the procedure was performed. These lacunae can be addressed by relook procedures in case of recurrence of overt or occult GI bleed being subjected to relook colonoscopic procedures. It is well agreed that the missed lesions on colonoscopy are variable ranging from 10 to 30%, depending on various factors including center expertise.<sup>16</sup> Ours being a tertiary gastroenterology teaching setup with annual rate of more than 2,000 colonoscopies is one of the possible reasons for a high rate of positive colonoscopy findings.

The most common causes of LGIB in children vary in different studies. The etiological profile revealed by colonoscopy in our study found polyps as the most common cause in 47.2% patients, followed by colitis in 27.2%, SRUS in 11%, and hemorrhoids in 5.4%. Various other studies showed polyps as the most common etiology ranging from 45 to 77%, <sup>12,17,18</sup> while Bhadauria et al<sup>11</sup> found polyps and colitis in 31% patients each. A recent study from the eastern part of India showed polyps to be 29% among causes of LGIB in children.<sup>19</sup> Our study has a starkly higher proportion of polyps compared to this study, but is similar to the observations by Yachha et al,<sup>20</sup> a reaffirmation of the fact that geographical and ethnic variations are real. The other reason in such a variation is possibly due to the definition of pediatric age group across centers. While we used the definition of  $\leq$  18 years, other studies varied in including less than 14 years,<sup>19</sup> less than 12 years,<sup>12,13</sup> and less than 13 years<sup>20</sup> in their study cohorts.

In our study, 28 polyps were found in 26 patients as 2 patients had 2 polyps each. Interestingly, our study found that 83% of all polyps were found in males, while only 17% of polyps were found in females. Thakkar et al<sup>21</sup> showed male predominance for colorectal polyps in their cross-sectional study with 58.3 versus 49% for males and females, respectively, with a statistically significant difference. Albasri et al<sup>22</sup> demonstrated a distribution of 2:1 in favor of males in colorectal polyps. Latt et al<sup>23</sup> and Roth and Helwig<sup>24</sup> demonstrated that 53 to 58% of patients with polyps had multiple polyps in the pediatric age group, unlike our study where only 8% patients had multiple polyps. In Poddar et al,<sup>13</sup> 16% of patients had multiple polyps. The most common location of polyps was the rectum (64%), followed by sigmoid colon (18%). Nearly three-fourths (71%) polyps were pedunculated. The mean age of the patients presenting with polyps was lower than those with other aetiologias (9.1 vs. 14.3 years, p < 0.001). The location of polyps in our study is in accordance with other studies, which have shown colorectal polyps to be the most common in the rectosigmoid region in the pediatric age group.<sup>13,25</sup> Khurana et al<sup>12</sup> opined that flexible sigmoidoscopy alone was adequate in ascertaining the cause of prolonged recurrent LGIB as 89% cases in their series were diagnosed on the basis of sigmoidoscopy alone without the need for complete evaluation of the colon. However, our study cohort, like other pediatric LGIB series, includes patients with single episodes of LGIB and not recurrent LGIB, and the need to perform a full colonoscopy cannot be overemphasized. This is true especially with a high incidence of multiple polyps as also for mapping of disease in case of IBD.

Histology reported 25 (89%) polyps to be juvenile retention polyps. We did not find adenomatous changes in any of our patients with juvenile or inflammatory polyps. Poddar et al<sup>13</sup> demonstrated 93% of polyps to be juvenile and adenomatous changes in 11% of juvenile polyps, more so in juvenile polyposis syndrome (59%) compared to solitary or multiple juvenile polyps less than five in number. Juvenile polyposis coli is an entity with more than five juvenile polyps<sup>26</sup> and is known to harbor a higher risk of dysplasia and subsequent colonic carcinoma and have a positive family history. None of our patients had more than five juvenile polyps, justifying the absence of adenomatous or dysplastic changes in histopathology in our series.

Fifteen (27.2%) patients had mucosal erythema, ulcerations, and friability suggestive of colitis localized in rectum and sigmoid in 11 patients, while pancolitis was found in only 4 (7.2%) patients. All of them were managed medically without any need for surgical referral.<sup>27</sup> A rectosigmoid biopsy was done and on further follow-up, 4 of 15 colitis patients (7.2%) were diagnosed with IBD, while 11 had acute infective colitis, which resolved completely with conservative medical management with antibiotics. Our finding (7%) is in close agreement with previous studies showing similar proportions of patients with LGIB being subsequently diagnosed as IBD by Panda et al  $(6.5\%)^{19}$  and Moravej et al (6.47%).<sup>15</sup>

We did not encounter lymphoid nodular hyperplasia (NLH) as a cause of LGIB as described by Panda et al.<sup>19</sup> NLH is a vague entity and often an incidental finding in colonoscopy and encountered more in children in the first decade. The highly variable prevalence of NLH is often attributed to underreporting in colonoscopy.

In accordance with the known fact that patients with infective colitis present more commonly with fever as compared to patients with IBD, our study also showed that patients with infectious colitis had higher incidence of fever and lesser incidence of previous similar events. The most common infectious causes described in the pediatric age group include *Salmonella*, *Shigella*, *Campylobacter*, *Escherichia coli*, and *Clostridium difficile*.<sup>28</sup> However, in our unit, we do not routinely recommend stool culture examination for LGIB in immunocompetent individuals with index LGIB.

Hemorrhoids as a cause of LGIB is not a common feature in children compared to adults and we report a minute proportion of the same similar to Poddar et al.<sup>13</sup>

No complications due to diagnostic or therapeutic colonoscopy were reported in the study. Colonoscopy is a safe procedure in the pediatric age group with serious complications like bleeding with diagnostic procedure (0.008-0.1%), bleeding following polypectomy (0.26-2.5%), and risk of perforation (0.06-0.3%)<sup>29</sup> being uncommon. The profile of LGIB is different in the present study and, compared to previously highlighted studies, has a lower proportion of patients with multiple polyps, and a significantly higher proportion of boys affected.

To the best of our knowledge, so far, all Indian studies, except one study from central India, on LGIB in the pediatric age group are from north India. Our study is the only one that comes from western or southern India pertaining to the etiologies of LGIB in the pediatric population. However, all the studies of north India predominantly show polyps followed by colitis as the major cause of LGIB. Our study shows a somewhat similar result but in a different population.

The study has a few limitations, which include the retrospective design of the study and small sample size. The selection method possibly resulted in selection bias as only patients with more critical illnesses were referred to our center, while there may be many patients who had selflimited bleed and did not report to any tertiary center and thus were never evaluated. Also, there may be some patients who were directly taken for surgical interventions, for example, intussusception, volvulus, severe necrotizing colitis, etc., who must have been missed.

Another limitation of this study is that we do not have data about how many children presented with LGIB who could not undergo endoscopic evaluation as these patients are primarily admitted either in pediatric intensive care unit (ICU) or surgical ICU.

## Conclusions

To conclude, colonoscopy has a significant yield in LGIB in the pediatric population, especially in those with significant LGIB. Polyps are the most common cause of LGIB in patients aged  $\leq$ 18 years, and the most commonly juvenile with symptom non-recurrence, following one-time excision. The therapeutic advantage of prevention of further episodes of LGIB by tackling the source of bleed, namely, endoscopic polypectomy for polyps and specific medical therapy for infective, IBD, and SRUS, highlights the utility of colonoscopy in this patient group. Colonoscopy is a safe diagnostic and therapeutic modality for assessment of LGIB in the pediatric population.

Statement and Declarations

The submitted work is original and has not been published elsewhere in any form or language.

This retrospective chart review study involving human participants was in accordance with the ethical standards of the institutional and national research committee and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards. Ethical approval was waived by the local ethics committee in view of the retrospective nature of the study and all the procedures being performed were a part of the routine care.

#### **Author Contributions**

All the authors contributed substantially to the study conception and design, analysis and interpretation of data, drafting the work or revising it critically for important intellectual content, and approved the final version of the manuscript to be published. Funding None.

Conflict of Interest None declared.

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