



The utility and safety of paediatric endoscopy in a district general hospital in Southeast England

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Abstract

This study was done to evaluate the appropriateness, diagnostic yield, and quality of paediatric gastrointestinal endoscopy in a large DGH with tertiary paediatric gastroenterology services. It was a retrospective cohort study of children who had at least one gastrointestinal endoscopy during 31 months (May 2018–Dec 2020) in a district general hospital in Southeast England. The participants were children (2–17 years). Two hundred ninety-three procedures were performed in total, 80% were diagnostic and 20% for surveillance. The median age was 12 years and 52.5% were males. Oesophago-gastro-duodenoscopy (OGD) corresponded to 79.5% of procedures, ileo-colonoscopy (IC) to 7.2% and the remaining had both procedures. The main diagnostic indication was persistent abdominal pain in 33.5% of cases, followed by suspected GORD (14.8%), recurrent vomiting (14.3%), dysphagia (9.1%) and blood loss per rectum (8.6%). A total of 64.7% showed abnormal macroscopic findings, and 69.2% showed histopathological signs of disease. The most common histological diagnosis was gastritis in 23% followed by coeliac disease in 13%, reflux oesophagitis in 12.2% and inflammatory bowel disease in 9.6%. Procedures were performed with utmost safety with two reported cases of complications, which were appropriately managed. The completion rate of diagnostic IC was 87%. A waiting time of 6 weeks was achieved in 50.4% of cases.

Conclusion: Paediatric endoscopy can be safely performed in a district general hospital with the right setup and can aid in the management of gastrointestinal disease in the paediatric patient. It is important to monitor and regularly audit such practices to improve the quality of specialist services.

What is Known:

- Paediatric endoscopy is predominantly performed in large tertiary centres and included in the diagnostic algorithm for many paediatric gastrointestinal conditions.
- There are recommendations on clinical indication endorsed by ESPGHAN and key quality indicators published jointly by JAG and BSPGHAN.

What is New:

- Paediatric endoscopy can be appropriately and safely performed in district general hospital by trained professionals, decreasing the workload in larger tertiary paediatric centres.
- Adoption of regular audit practices is essential to ensure and improve quality and appropriateness of this specialist service.

Keywords Paediatric endoscopy · Quality indicator · Terminal ileal intubation · Complications

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Introduction

Gastrointestinal symptoms are common among school-going children [1]. Most of them are benign and somatic; however, one-fifth of them are persistent and require evaluation [2]. Not only can the aetiology of gastrointestinal symptoms be difficult to explain, they can also pose a diagnostic challenge based on solely clinical assessment. Paediatric endoscopy is included in the diagnostic and management algorithm for many paediatric gastrointestinal conditions and yet it is predominantly performed in large tertiary centres. This invariably increases workload in these centres leading to increased waiting times. It also creates a degree of inconvenience for patients who live far from such centres. An appropriately trained paediatrician can perform the procedure in children of all ages, enabling them to confirm the diagnosis both macroscopically followed by histologically. They can provide treatment if required at endoscopy or immediately afterward, monitor the progress of disease and tailor future management plans.

The use of paediatric endoscopy has been increasing worldwide in the last few decades, parallel to the improvement of experience and knowledge [3]. This is due to their easy accessibility, low complication rate and rise in recognition of paediatric gastroenterology as a speciality [3]. In a study conducted in Japan, the number of institutes showing paediatric gastrointestinal endoscopy use was 4.6 times higher than that stated in the previous reports, and the number of paediatric gastrointestinal endoscopies performed was five times higher [4]. However, the rate of adverse events was also higher than that previously reported [4]. In addition, there has been growing concern about the appropriateness and cost-effectiveness of these procedures [5].

The European Society for Paediatric Gastroenterology Hepatology and Nutrition (ESPGHAN) has provided a consensus-based and evidence-based review of clinical indications for endoscopy to help standardise the utility and practice leading to the appropriateness of care [6]. The British Society of Paediatric Gastroenterology, Hepatology and Nutrition (BSPGHAN) and JAG (Joint Advisory Group in Endoscopy Paediatric Global rating scale) have published recommendations with key quality indicators and auditable outcomes [7]. These include an agreed pathway for diagnostic procedures, three monthly audits of adverse events, an annual patient feedback survey, the completion rate of colonoscopy, documented waiting time and an endoscopy reporting system to capture immediate procedural and performance data.

To critically assess the appropriateness of paediatric endoscopy at a district general hospital, we performed a retrospective cohort study of paediatric endoscopy between May 2018 and December 2020 based on the ESPGHAN and BSPGHAN guidance.

Methodology

This was a retrospective descriptive study based on data of paediatric cases who had at least one gastrointestinal endoscopy at the Maidstone and Tunbridge Wells NHS foundation trust. The duration of the study was for 31 months from May 2018 to Dec 2020. This included cases during the COVID-19 pandemic as well, and hence, there might be some selection bias in the quantity and quality of cases. The endoscopies were performed by paediatric consultants with a special interest in gastroenterology and trained to perform endoscopies in children. The source of data was the Microsoft access database maintained by the department for these cases. This included demographic data, procedure date, indications, type of procedure, the extent of colonoscopy, complications, macroscopic diagnosis and insertion of pH probe if this was done. There were 20 cancellations during the period. One child had severe autism and was difficult to engage. The second one had severe anxiety before procedures and hence cancelled. Three did not attend due to symptomatic improvement prior to procedures. There were 14 cancellations and postponements due to the covid pandemic. None of these are included in the analysis as they did not have the procedures. Two hundred forty-one children had 293 procedures including diagnostic and surveillance. Only those who had the first diagnostic endoscopy were included in the analysis of outcomes. The histological diagnosis of patients who had diagnostic endoscopy was collected from the electronic record system and added to the database. These diagnoses were made by the on-duty pathologist as a part of their day-to-day clinical practice and not as a part of this study. These findings were reviewed by the senior pathologist only if the on-duty pathologist had a concern. As this is a retrospective observational study, the events were calculated as frequencies and presented in this article. Statistical analysis was made with SPSS® Statistics v26.0.

Results

Between May 2018 and Dec 2020, 293 gastrointestinal endoscopies were performed of which 230 were diagnostic, two therapeutic (percutaneous gastrostomy insertion) and remaining surveillance. Table 1 illustrates the baseline characteristics of the children and young people who had the procedures. The median age was 12 years (range 2–17 years), 154 (52.5%) were males and 139 (47.5%) were females. The average caseload was 9.5 per month and the ratio of diagnostic to surveillance endoscopy was 3.8:1.

Table 2 and Fig. 1 illustrate the initial indication based on the ESPGHAN recommendations. The majority had endoscopy due to abdominal pain which led to seventy-seven

Table 1 Basic characteristic of cases who had paediatric endoscopy

	Diagnostic	Surveillance
Total cases	232*	61
Age		
2–5 years	33	6
6–12 years	103	22
13–17 years	96	33
Gender		
Male	115	39
Female	117	22
Types of procedure		
OGD	193	40
IC	6	15
OGD +IC	33	6

*There were 2 procedures for PEG placement

diagnostic procedures with identification of an organic cause in 74%. Chronic GORD led to thirty-four procedures (14.8%) with histological abnormalities in 64% of them. Recurrent vomiting was the indication in thirty-three endoscopies (14.3%) with evidence of an abnormality (macroscopic and microscopic) in 70%. Table 3 compares the endoscopic abnormalities based on indications.

All patients who had diagnostic endoscopy underwent biopsies. Table 4 provides a breakdown of diagnosis among all the procedures performed; 64.7% showed macroscopic findings and 69.2% had a histological diagnosis. The final diagnosis was gastritis in 23% of cases followed by coeliac disease (13%) and reflux esophagitis (12.2%). Inflammatory

Table 2 Indications of diagnostic endoscopy in our cohort of 232 patients

Indication	Cases (n = 230)	Percentage
Abdominal pain with suspicion of an organic disease	77	33.47
Chronic GORD	34	14.78
Recurrent vomiting with unknown cause	33	14.34
Dysphagia or odynophagia	21	9.13
Rectal blood loss	20	8.66
Unexplained chronic diarrhea	16	6.95
Weight loss, failure to thrive	12	5.21
To exclude other diseases	12	5.21
Coeliac disease in family	3	
Type 1 diabetes mellitus	4	
Suspected coeliac	3	
Trisomy 21	1	
Possible Hirschsprung disease 1		
Unexplained anaemia	3	1.3
Polyposis syndromes	2	0.8

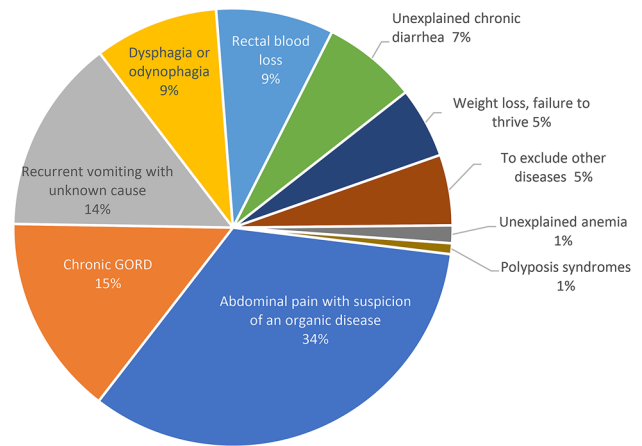


Fig. 1 Indication of diagnostic endoscopy in our cohort (%)

bowel disease contributed to 9.6% of cases out of which eleven were ulcerative colitis, nine were Crohn’s disease, and two cases of inflammatory bowel disease were unclassified. There were 18 (7.8%) cases of eosinophilic oesophagitis. pH study was performed in 58 (25%) procedures, out of which the majority (76.4%) were performed in cases of chronic GORD.

Among those who had a histological diagnosis of gastritis (n = 53), 13 were labelled as acute and remaining as chronic gastritis. *Helicobacter pylori* was positive in 7 cases and gastric ulcers were seen in 9 children. Data were not categorised based on type of gastritis into lymphocytic, collagenous or eosinophilic, etc. However, we can acknowledge that there was high incidence of lymphocytic infiltrate in histology of gastritis. All cases for whom the pathologist had the impression of gastritis were included in the analysis and none were excluded irrespective of the degree, location and type of inflammation present. Hence, a histological diagnosis of gastritis in our cohort may not necessarily mean endoscopy done to look for causes of abdominal pain has found a treatable and significant pathology. Half of the cases of gastritis (n = 26) were started on treatment following endoscopy. However, the outcome of the treatments was not analysed in this study but we can comment that most cases with a histological diagnosis of “gastritis” did not directly lead to treatment change as we recognise that a vast majority of these patients are more likely to be treated based on endoscopic findings and history.

Among the major gastrointestinal diagnosis, we also tried to see if there is a correlation between histological findings and endoscopic appearance. Eighty-three of endoscopies were reported as normal by the practitioner; however, histologically, 73 were reported as normal. It is worth mentioning that we have included all histologic diagnoses for analysis as long as the pathologist has reported. There were 18 cases of EOE diagnosed microscopically out of which

Table 3 Frequency of abnormalities based on indications

Indications	Cases	Endoscopic abnormalities	Histologic abnormalities	Percentage
Abdominal pain with suspicion of an organic disease	77	50	57	74.02
Chronic GORD	34	20	22	64.70
Recurrent vomiting with unknown cause	33	15	23	69.69
Dysphagia or odynophagia	21	17	16	76.19
Rectal blood loss	20	14	14	70
Unexplained chronic diarrhea	16	15	13	81.25
Weight loss, failure to thrive	12	7	6	50
To exclude other diseases	12	8	11	91.66
Unexplained anaemia	3	2	3	100

14 were suspected based on macroscopic appearance. Out of 30 cases of coeliac disease, only 9 were suspected by endoscopy. There was a good correlation in the diagnosis of inflammatory bowel disease. All 9 cases of Crohn's disease were picked up by Endoscopy. In the case of ulcerative colitis ($n = 11$), 10 were suspected on macroscopic appearance and the remaining 1 had a normal appearance on endoscopy. There were 2 cases of indeterminate colitis, one of which was reported as a normal endoscopic finding and the second was suspected as possible Crohn's.

In terms of the age distribution of diagnosis, coeliac disease was most diagnosed in the age group 6–12 years of age, whereas inflammatory bowel disease and eosinophilic esophagitis were more common over 12 years of age (Fig. 2).

The recommended waiting time of fewer than 6 weeks for diagnostic endoscopy was achieved only in 117 (50.4%) cases. Forty-one children (18%) had to wait for more than 12 weeks for the procedure. Terminal ileal intubation, which is one of the quality indicators, was achieved in 34/39 procedures, providing a completion rate of 87.2%. The reasons for the lack of terminal ileal intubation were poor bowel preparation in four

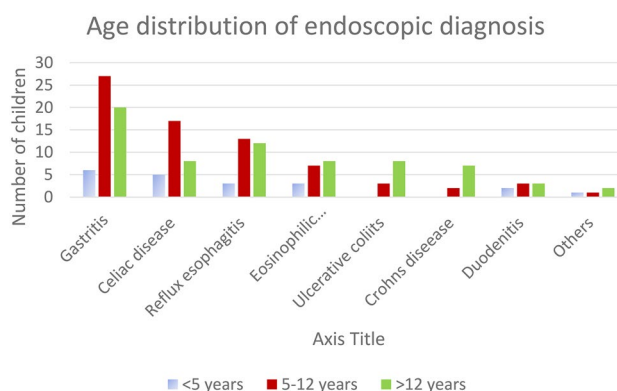
cases and fragile mucosa with bleeding points in one case. General anaesthesia was used for all procedures. There were two complications noted during the period. The first case was 16 years female with Crohn's disease who had a small perforation in the terminal ileum. She was admitted within 72 h of endoscopy, reviewed by surgeons, and managed conservatively. The second complication was related to anaesthesia in a 5-year-old male who had fallen in the recovery room. He sustained a mild head injury which was managed conservatively.

Discussion

There is a significant role of endoscopy in the diagnosis of various gastrointestinal conditions including coeliac disease, gastro-oesophageal reflux disease, inflammatory bowel disease, and eosinophilic esophagitis. The complication rate for this procedure is near zero in most studies [8]. Most district general hospitals provide adult endoscopy services but very few provide paediatric endoscopy. In addition to paediatric endoscopists, it also requires paediatric anaesthetics, ideally a play therapist, paediatric specialist nurses, and paediatric surgical support. Regarding the paediatric gastroenterology department at Maidstone and Tunbridge Wells Hospital, the

Table 4 Frequency of diagnosis (both macroscopic and histological)

Diagnosis	Endoscopy diagnosis ($n = 230$)	Histology diagnosis ($n = 230$)	Percentage
Normal	83	73	31.73
Gastritis	60	53	23.04
Coeliac disease	10	30	13.04
Reflux esophagitis	21	28	12.17
EOE	23	18	7.82
UC	10	11	4.78
Crohn's disease	11	9	3.91
Duodenitis	12	8	3.47
Indeterminate	0	2	0.8
Gastric heman-gioma	1	-	0.4
Polyp	1	-	0.4

**Fig. 2** Age distribution of endoscopic diagnosis

team has the above staff/skillsets and has been performing endoscopies for the last 20 years.

With the improved rate of diagnosis of paediatric gastrointestinal conditions, there has been a concern about the proportion of normal results with increased use [5]. The main aim of this cohort study was to critically assess the appropriateness of endoscopy practice in a district general hospital, diagnostic yield and quality indicators. The word appropriateness is difficult to define, quite subjective and a concern that is appropriate for one clinician might not be the same for other. Hence, this study has tried to see the indication for endoscopy based on guidelines endorsed by ESPGHAN [6]. However, most indications are based on a subjective review of documents in our electronic database. Having said that, it might not reflect the complexities of evaluating the patient who presents with more than one gastrointestinal symptom to a clinician.

Considering the indications in Table 1, the most common indication was abdominal pain with the view to rule out organic disease. This contributed to 33.5% of the total procedure in our cohort with macroscopic findings in 65% and histological findings in 74%. This presenting complaint contributing to endoscopy has remained variable in different studies. Franciosi et al. demonstrated a significant increase in the rate of endoscopy done for chronic abdominal pain from 23 to 43% over 20 years [3]. This may be due to an increase in accessibility of paediatric endoscopy, especially when considering the contribution by gastrointestinal bleeding reduced from 34 to 5% at the same time [3]. Miele et al. studied the impact of ROME II paediatric criteria on the appropriateness of paediatric endoscopy and found 49.7% of paediatric endoscopies were performed due to abdominal pain and this number could be reduced by one-fourth if the ROME II criteria are used appropriately to assess them [9]. The other common indication for performing the procedure in this cohort were GI bleed in 32.9% of cases and GORD in 19.7% of cases [9]. In a similar study like ours conducted by Sheiko et al. in 2013, abdominal pain was the indication in 28.8% of OGD followed by chronic GORD in 11.7% and failure to thrive in 9.5% [10].

There are a lot of studies published in paediatric gastroenterology literature in terms of the diagnostic yield of paediatric endoscopy. In our study, among the 230 children who had initial diagnostic endoscopy, macroscopic findings were seen in 64.4% of cases and microscopic abnormalities were seen in 69.2% of cases. So, around one-third of endoscopies were normal. In those that were abnormal, it guided management options. In those that were normal, it helped to provide reassurance to parents and did help in the management in that sense. A study by Mike et al. in a tertiary paediatric unit in the UK revealed a final diagnostic yield of around 40% for all procedures [11]. Similar data were revealed in a study by Malik et al. in 2019 who documented

a diagnostic yield of 45% in diagnostic OGD [12]. Miele who classified diagnostic yield into that for OGD and IC presented evidence of 54% and 61%, respectively [9]. The macroscopic and microscopic diagnoses were made in 34.7% and 40.4% of children who had OGD in a study conducted by Sheiko et al. [10]. Thakkar who selectively evaluated patients with abdominal pain was able to demonstrate a diagnostic yield of only 38% [13]. A similar evaluation of OGD for abdominal pain by Emre revealed a diagnostic yield of 56.2% [14]. However, in our study, in those presenting with abdominal pain, histological diagnosis was made in 74% of cases. One important reason for the variation of diagnostic yield in different studies could be practices related to the interpretation of histological findings in different part of the world as well as significance given to it by the clinical team. In our study, we have included all the histological diagnoses as mentioned by the pathologist for analysis and hence could have contributed to this high diagnostic yield.

In terms of quality indicators of paediatric endoscopy, terminal ileal intubation (TII) is considered one of them, as it helps in the assessment and differentiation of inflammatory bowel disease. Colonoscopists should aspire to achieve 95% caecal intubation [15]. The rate of TII in our centre was 87.2% for an initial diagnostic endoscopy. However, this was favourable in comparison to a TII of 42.5% in a similar audit done before (August 2016–December 2017) in our centre. This indicates increasing expertise among the endoscopist in our centre. Thompson was able to demonstrate a TII of 98% in a tertiary Paediatric gastroenterology centre in the UK [11]. The author has commented that this must be due to a greater experience of operators and a more focused training environment. Singh et al. found a TII of 92.4% in an Australian centre [16] and Lee et al. could only demonstrate TII of 68.4% in a low volume centre in Asia [17]. In North America, an analysis of data from a multicentre consortium published in 2016 revealed that the range of TII is much variable among centres anywhere between 30 and 90% [18].

Endoscopy itself is an invasive procedure and can have serious complications if not performed systematically. The complications could be related to procedures or anaesthesia. The procedural complication includes perforation, bleeding and postoperative pain [19]. In an experienced hand, the complications are rare. In our centre, endoscopies are performed under the care of the Paediatric anaesthetic team. There were two complications (0.7%) noted in the study period of 31 months. The first was perforation and the second was a mild head injury in the recovery room. Both were managed conservatively. Rothbaum also found a complication of less than 1%, like our study [20]. However, in a retrospective study done in Malaysia by Lee et al., they found a complication rate as high as 5.8% [19]. They were all minors, two-thirds were procedure-related including perforation and bleeding; one-third were related to

anaesthesia including prolonged sedation, bronchospasm and post-procedural fever. In this Asian centre, the endoscopy was performed by a variety of professionals including adult gastroenterologists, paediatric surgeons and paediatric gastroenterologists.

Waiting time for elective procedures has remained a problem in most of the specialities and this is true for paediatric endoscopy and the current recommendation is to offer endoscopy within 6 weeks of initial referral [7]. In our centre, our waiting time of 6 weeks was met only in 50.4% of cases. The average wait time was 67 days. A part of this has been contributed by the COVID-19 pandemic as the wait times were significantly higher following Covid Lockdown. The average wait time in the pre lockdown period and post lockdown period was 51 days and 83 days, respectively.

Conclusion

Our study was able to prove the appropriateness of paediatric endoscopy even in the setting of district general hospital with a diagnostic yield of 69%. We were able to demonstrate a completion rate of 87.1% and a complication rate of as low as 0.68%. The main indication for performing endoscopy was abdominal pain to rule any organic cause and a histological diagnosis was reached in 74% of them.

Authors' contributions RG conceived the study. RG, SS, and HR designed the methodology. SS and HR coordinated and collected the data. SS analysed the data, drafted the manuscript and revised this for publication. SS, HR, RG, SK and BB critically appraised and approved the manuscript.

Availability of data and material Data is available on appropriate request to the author.

Declarations

Ethics approval Not applicable.

Consent to participate Not applicable.

Consent for publication Not applicable.

Conflict of interest The authors declare no competing interests.

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