Paediatric gastrointestinal endoscopy: Experience in Red Cross War Memorial Children’s Hospital, Cape Town, South Africa

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Background. Endoscopy is an important diagnostic and therapeutic mode of management in children with gastrointestinal disorders. Objective. To determine the indications, endoscopic yields and impact of the service on the ongoing health and complications among children who underwent gastrointestinal endoscopy at Red Cross War Memorial Children’s Hospital, Cape Town.

Methods. A 10-year (2007 - 2016) retrospective study of children <18 years old who underwent gastrointestinal endoscopy was undertaken using relevant patients’ variables obtained from their hospital medical records. Data were analysed using Stata 13.1 (p<0.05).

Results. A total of 402 children underwent a total of 695 gastrointestinal endoscopic procedures: 592 (85.2%) were gastroscopies, 78 (11.2%) combined gastroscopies with colonoscopies and 25 (3.6%) colonoscopy-only procedures, respectively. The main diagnostic indications for gastroscopy, gastroscopy combined with colonoscopy and colonoscopy-only were chronic abdominal pain (n=49; 12.2%), suspected inflammatory bowel disease (n=30; 7.5%) and rectal bleeding (n=13; 52.0%) respectively. The most common therapeutic indication for gastroscopy was change of a percutaneous endoscopic gastrostomy (n=143; 35.6%) while for colonoscopy 6 (5.8%) had polypectomy. Abnormal histopathological results were made from both macroscopically normal- and abnormal-looking tissues, though with no statistically significant relationship.

Conclusion. Endoscopy offers diagnostic and therapeutic options in children. Positive histological findings were obtained in some cases where gastrointestinal mucosae appeared normal. There is need to obtain biopsies from both macroscopically normal- and abnormal-looking gastrointestinal mucosae as positive histological findings could be made from them and hence improve diagnostic yield.
Such findings will help paediatric gastroenterologist(s) and by extension paediatricians, with interests in endoscopy services to expand and improve on the quality as well as outcome of their gastrointestinal endoscopy services.

The objectives of the study were to assess the presenting symptoms, indications, histological yields, impact on management and complications among children and adolescents who underwent medical gastrointestinal endoscopy at RCWMCH, Cape Town.

Method

Study setting
This study was conducted at RCWMCH, which is a tertiary paediatric hospital affiliated to the University of Cape Town, SA.

All gastrointestinal endoscopies in children in the hospital were done following standard protocols by either consultant paediatric gastroenterologist(s) or trainee paediatric gastroenterology fellows under supervision. All gastrointestinal endoscopies in the unit were done under general anaesthesia administered by anaesthetists. RCWMCH only treats patients up to 13 years of age unless they have a chronic illness, and then they are followed up until 18 years of age. At RCWMCH, cases of foreign body or caustic ingestions, oesophageal dilatations and laparoscopic percutaneous endoscopic gastrostomy (PEG) insertion were undertaken by the paediatric surgical team on separate endoscopy lists, and did not form part of this review.

Study design
This was a retrospective cross-sectional descriptive study undertaken among children and adolescents who underwent upper and lower gastrointestinal endoscopies performed by paediatric medical gastroenterologists from 1 January 2007 to 31 December 2016. This study did not include procedures performed by the paediatric surgeons in the centre.

Ethical approval
Study ethical approval was obtained from the University of Cape Town Human Research Ethics Committee (ref. no. 089/2017), while written permission was obtained from the RCWMCH research committee and management prior to the commencement of the study.

Inclusion criteria
All children who had an OGD and/or colonoscopy with complete medical records were included in the study.

Exclusion criteria
Patients who underwent gastrointestinal endoscopy but with incomplete medical records during the period under review were excluded.

Procedure
All gastrointestinal endoscopies were performed under general anaesthesia. At gastroscopy (OGD), multiple tissue biopsies were taken from the oesophagus, stomach and duodenum, even if the tissue macroscopically looked normal.

All colonoscopy biopsies were taken from multiple sites in the colon. The patients were usually admitted a day before the procedure, during which time they underwent standard bowel preparation using polyethylene glycol (GoLytely; PEG) at a dose of 80 mL/kg body weight, usually starting from ~13h00 on the day before the procedure, and given only a soft lunch and no supper. The PEG is usually given orally, and in infants and younger children who cannot drink effectively, it is given via a nasogastric tube in graded doses until the bowel is clear.

Study datasheet
Information retrieved for each patient included sociodemographic characteristics, initial presenting symptoms, type of gastrointestinal endoscopy performed (gastroscopy, combined gastroscopy with colonoscopy or colonoscopy only) with specific indication(s), macroscopic findings on endoscopy, complication(s) following endoscopy, histological diagnosis and impact on management following the endoscopic procedure.

The data were collected from the hospital’s medical records as well as the paediatric gastroenterology unit and endoscopy and histopathology databases, and captured on a study datasheet.

Diagnostic characteristics
Diagnostic yield of endoscopy in the current study was classified as either positive (presence of any macroscopic endoscopy and/or histological abnormality found, excluding mild inflammation on histology) or negative (no or minor abnormality/normal histology) effecting a positive contribution.[18,19]

Mild inflammation was not regarded as a positive histological outcome as the clinical significance of isolated mild histological findings is inconclusive.[18,19]

Endoscopy diagnostic yield was calculated for initial examination involving diagnostic indications for upper and lower endoscopy, respectively.

Socioeconomic class determination
Patients were classified as low (H0 or H1), middle (H2) or high (H3) socioeconomic class (SEC) according to their gross income per annum for the purposes of service fee determination, according to the uniform fee schedule regulations for healthcare services rendered by the Western Cape Province, Department of Health, SA, 2017.[20]

Data analysis
Data analysis was done using Stata 13.1 (Stata Corp, USA). Categorical variables were presented as frequency tables and charts, while numerical variables were presented as descriptive measures, expressed as median and range.

The association between categorical variables was assessed using the Pearson χ² test or Student’s t-test where appropriate. A p-value <0.05 was considered statistically significant.

Results

Characteristics of study participants
A total of 402 patients with complete medical records were studied. There were 220 (54.7%) girls, with a female-to-male ratio of 1:0.8. Their median age was 5.5 (range: 0.1 - 18) years, 394 (98.0%) were <13 years old and of normal weight (n=276; 68.6%), and most were of low SEC (n=307; 76.4%) (Table 1).

Endoscopic procedures
Of the total 695 gastrointestinal endoscopic procedures, 592 (85.2%) were gastroscopies, 78 (11.2 %) gastroscopies combined with colonoscopies and 25 (3.6%) colonoscopy only (Table 1). The median numbers of gastroscopies and colonoscopies performed per patient were 1 (range 1 - 12) and 2 (1 - 4), respectively.

Presenting symptoms
The presenting symptoms for gastroscopy, combined gastroscopy
with colonoscopy and colonoscopy only were as shown in Figs 1, 2 and 3, respectively.

The most common presenting symptoms in children undergoing gastroscopy (as shown in Fig. 1) were patients evaluated for PEG insertion for feeding (therapeutic gastroscopy) due to feeding difficulty/inco-ordinate swallowing in children with cerebral palsy \( (n=214; 53.2\%) \), and poor weight gain/failure to thrive \( (n=145; 36.1\%) \), followed closely by those with chronic abdominal pain \( (n=103; 25.6\%) \) and upper gastrointestinal bleeding \( (n=81; 20.1\%) \). In patients who had combined gastroscopy with colonoscopy, the most common presenting symptoms were chronic abdominal pain \( (n=37; 47.5\%) \), chronic bloody loose stools \( (n=35; 44.9\%) \) in older children and chronic diarrhoea \( (n=30; 38.5\%) \), as shown in Fig. 2.

In patients who underwent colonoscopy only, the most common presenting symptoms were rectal bleeding \( (n=13; 52.0\%) \) and chronic bloody loose stools \( (n=9; 36.0\%) \) (Fig. 3).

### Indications for endoscopy

#### Oesophagogastroduodenoscopy (OGD)

Among 592 gastroscopies performed, 179 \( (30.2\%) \) were diagnostic, 287 \( (48.5\%) \) therapeutic and 126 \( (21.3\%) \) for follow-up/surveillance.

The main diagnostic indications for gastroscopy were chronic abdominal pain \( (n=49; 8.3\%) \), upper gastrointestinal bleeding/portal hypertension with varices \( (n=43; 7.3\%) \) and gastritis/gastro-oesophageal reflux \( (n=30; 5.1\%) \), while the therapeutic indications for gastroscopy included insertion of PEG tube \( (n=87; 14.7\%) \), change of PEG to gastrostomy tubes \( (n=143; 24.6\%) \), variceal sclerotherapy of oesophageal varices \( (n=29; 4.9\%) \) and variceal band ligation \( (n=28; 4.7\%) \).

The follow-up/surveillance indications for OGD were mainly for previous upper gastrointestinal bleeding secondary to oesophageal varices, 204 \( (50.7\%) \) (Table 2).

#### Combined OGD with colonoscopy

Of the 78 combined gastroscopy and colonoscopy procedures, the majority \( (n=68; 87.2\%) \) were for diagnostic indications, which included probable inflammatory bowel disease (IBD; \( n=30; 38.5\%) \), chronic diarrhoea \( (n=12; 15.4\%) \), suspected intestinal tuberculosis (TB; \( n=10; 12.8\%) \), chronic abdominal pain \( (n=8; 10.3\%) \), chronic iron deficiency anaemia of unknown aetiology \( (n=3; 3.8\%) \) and IBD screening in those with autoimmune hepatitis \( (n=3; 3.8\%) \). The follow-up/surveillance indications were for inflammatory bowel disease \( (n=10; 12.8\%) \) (Table 2).

### Table 1. Sociodemographic and endoscopic characteristics of study subjects \( (N=402) \)

| Characteristic | \( n (%)* \) |
|---------------|-------------|
| Age (years), median (range) | 5.5 (0.1 - 18.0) |
| Sex | |
| Male | 182 (45.3) |
| Female | 220 (54.7) |
| Socioeconomic class | |
| Low | 307 (76.4) |
| Middle | 57 (14.2) |
| High | 38 (9.5) |
| Weight for age z-score | |
| \(-1 < z < 0 \) (normal) | 276 (68.6) |
| \(-2 < z \leq -1 \) (marginal underweight) | 23 (5.7) |
| \(-3 < z \leq -2 \) (moderately underweight) | 42 (10.4) |
| \(< z \leq -3 \) (severely underweight) | 61 (15.2) |
| Endoscopy performed | |
| Total gastroscopy and colonoscopy (patient encounters) | 695 (100.0) |
| Gastroscopy only | 592 (85.2) |
| Combined gastroscopy and colonoscopy | 78 (11.2) |
| Colonoscopy only | 25 (3.6) |

*Unless otherwise indicated.

![Fig. 1. Presenting symptoms of participants who underwent endoscopy: gastroscopy only \( (n=592) \). (PEG = percutaneous endoscopic gastrostomy; GI = gastrointestinal.)](image-url)
Colonoscopy

Of 25 (100%) colonoscopy-only procedures undertaken, 13 (52%), 6 (24%) and 6 (24%) were for diagnostic, therapeutic and follow-up/surveillance indications, respectively. Six (24%) therapeutic colonoscopy procedures were performed for polypectomy, while in another 6 (24%) cases, colonoscopies were undertaken for IBD follow-up/surveillance cases (Table 2).

Terminal ileum intubation and caecal examination rate

Terminal ileum intubation was attempted in diagnostic colonoscopy procedures undertaken as combined gastroscopy and colonoscopy or colonoscopy-only procedures as follows: 68 (87.2%) diagnostic combined gastroscopy with colonoscopy, 13 (52%) diagnostic and 6 (24.0%) follow-up/surveillance colonoscopy-only procedures, totalling 87 patient procedures.

Of the 87 diagnostic colonoscopies (68 diagnostic combined gastroscopy with colonoscopy, and 13 colonoscopy only), multiple tissue biopsies were taken for histology (n=25; 24.3%) and had normal histological findings, and IBD was found in 19 (18.4%) cases, of which 10 (9.7%) were Crohn’s disease and 9 (8.7%) ulcerative colitis.

Abnormal histopathological results were seen in biopsies taken from macroscopically normal-looking gastrointestinal mucosa (n=15), for diagnostic gastroscopies (n=15/179; 8.4%), combined gastroscopy and colonoscopy (n=6/68; 8.8%) and colonoscopies only (n=2; 15.4%) of the diagnostic procedures.

However, there was no statistically significant relationship between positive histological findings from tissue biopsies taken from macroscopically normal and abnormal gastrointestinal mucosa during gastroscopy (χ²=6.419; p=0.526) and combined gastroscopies and colonoscopies (χ²=5.142; p=0.275), respectively (Table 3).

Eight (9.9%) out of 10 probable cases of intestinal TB were diagnosed on histology. Chest radiographs showed evidence of healed TB (fibrosis and/or calcification) in 6 patients, and active pulmonary TB (presence of acid-fast bacilli in induced sputum) in 2 patients. Ulcerated areas and nodular friable mucosa were the most common lesions on colonoscopy. Mycobacterium tuberculosis was only cultured from three of the biopsies.

Histology

The majority (n=107; 18.1%) of tissue biopsies taken during gastroscopies had normal histological findings, although 33 (5.6%) showed chronic gastritis, 9 (1.5%) EoE and 7 (1.2%) Helicobacter pylori-associated gastritis (Fig. 4).

Normal histological findings were found in 25 (30.9%) diagnostic colonoscopies. IBD
Impact of gastrointestinal endoscopy on management

The various endoscopic procedures showed differing impacts on the management of cases in various ways. Out of 592 gastroscopies, 87 (14.7%) were done in patients with cerebral palsy or other neurological disorders with failure to thrive, and required PEG insertion. In 78 patients who underwent combined gastroscopy and colonoscopy procedures, 35 (44.9%) had addition of new medication(s) to their treatment, 5 (6.4%) were prescribed nutritional therapy using exclusive enteral nutrition for Crohn's disease/minimal fat diet, 2 (2.6%) change of medication(s) for differing gastrointestinal conditions, and 36 (46.1%) had no change or further treatment post colonoscopy based on review of histology and other results.

In 25 colonoscopies, 8 cases (32%) had change of medication(s) for different gastrointestinal conditions, and 5 (20%) addition of new medications. Six cases (24%) had polypectomy, and another 6 (24%) no change or no further treatment post colonoscopy, with review of histology and other results.

PEG insertion/change

Of the total of 230 PEG procedures performed during the period under review, 87 (37.8%) were PEG insertions, while 143 (62.2%) had change of the initial PEG to gastrostomy tube. The indications for PEG insertion were feeding difficulty/inco-ordinate swallowing (mainly in children with neurological deficits, particularly cerebral palsy and traumatic brain injury) with failure to thrive/poor weight gain (n=85; 21.1%) and inco-ordinate swallowing at risk of poor medication (anti-retroviral) adherence, 2 (0.5%) in patients with AIDS. PEGs were changed to a gastrostomy tube after a mean period of 3.7 (range 3 - 12) months. In 2 (1.4%) patients aged 7 and 10 years, respectively, initial PEG tubes were later changed to a MIC-KEY type of gastrostomy tube on request of the attending caregivers. There was significant increase in patients' weight upon their feeding using gastrostomy tubes post insertion. Among the 87 (37.8%) participants who had PEG insertion, the pre-PEG insertion mean weight was 11.4 kg, and increased to 13.5 kg at the time of change of PEG to gastrostomy tube (p<0.001).

Safety/complications

Endoscopic procedures undertaken among study participants were safe. Of a total of 695 endoscopies (592 gastroscopies, 78 combined gastroduodenoscopies with colonoscopies and 25 colonoscopies alone), complications occurred in 7 (1.0%). Most of these complications were related to the cardiovascular/respiratory system and anaesthetic. Complications occurred post gastroscopy: pneumo-peritoneum in 1 patient (0.2%) post PEG insertion, desaturation in 1 (0.2%) and 1 (0.2%) failed extubation.

Among those who underwent combined gastroscopy with colonoscopy procedures, out of 78 procedures, there were 3 complications: 1 child (1.3%) had stridulous breathing on extubation and another bradycardia/hypotension, while in participants who had colonoscopy only (n=25), 1 case (4%) of bradycardia/hypotension was observed.

Discussion

Recent advances in endoscopy designs and devices have made endoscopy an invaluable tool in diagnosis, therapy and follow-up/surveillance of most gastrointestinal disorders in paediatric and child health practices. Literature is scarce on paediatric gastrointestinal endoscopy in sub-Saharan Africa. It is hoped that experience gained in the present study will guide practice in many centres in the region and other parts of the developing world in setting up a paediatric gastrointestinal endoscopic service.

The present study is a comprehensive clinical audit of paediatric gastrointestinal endoscopy service undertaken by paediatric...
gastroenterologists and trainees in a paediatric specialist centre in Cape Town, SA.

Most patients in the current study were young, with only 2% (8) of them aged >13 years. The hospital’s cut-off for seeing new patients is age 13 years, and special permission must be sought to treat or continue to care for children >13 years old in the centre.

Most gastrointestinal disorders present with nonspecific signs and symptoms, making definitive diagnoses difficult without endoscopy.

### Table 3. Relationship between histological yield in normal and abnormal macroscopy in children undergoing diagnostic endoscopy

| Endoscopic modality                  | Indications for endoscopy         | Positive histology from abnormal macroscopy, n/N (%) | Positive histology from normal macroscopic tissues, n/N (%) | p-value (Fisher’s exact) |
|--------------------------------------|-----------------------------------|------------------------------------------------------|-------------------------------------------------------------|--------------------------|
| Gastroscopy                          | Chronic abdominal pain            | 31/49 (63.3)                                         | 5/49 (10.2)                                                | 0.526                    |
|                                      | Upper GI bleeding*                | 3/43 (7.0)                                           | 0/43 (0.0)                                                 |                          |
|                                      | Gastritis/GERD                    | 15/30 (50.0)                                         | 2/30 (6.7)                                                 |                          |
|                                      | EoE                               | 6/17 (35.3)                                          | 3/17 (17.6)                                                |                          |
|                                      | Chronic diarrhoea                 | 9/17 (52.9)                                          | 1/17 (5.9)                                                 |                          |
|                                      | Coeliac disease                   | 5/9 (55.6)                                           | 1/9 (11.1)                                                 |                          |
|                                      | Recurrent aspiration              | 2/5 (40.0)                                           | 1/5 (20.0)                                                 |                          |
|                                      | Cyclical vomiting                 | 1/3 (33.3)                                           | 1/3 (33.3)                                                 |                          |
|                                      | Miscellaneous*                    | 3/6 (50.0)                                           | 1/6 (16.7)                                                 |                          |
|                                      | Total                             | 75/179 (41.9)                                        | 15/179 (8.4)                                               |                          |
| Gastroscopy and colonoscopy          | Probable IBD                       | 14/30 (23.3)                                         | 2/30 (6.7)                                                 | 0.275                    |
|                                      | Abdominal TB                      | 7/10 (70.0)                                          | 1/10 (10.0)                                                |                          |
|                                      | Chronic diarrhoea                 | 8/13 (61.5)                                          | 0/13 (0.0)                                                 |                          |
|                                      | Chronic abdominal pain            | 3/8 (37.5)                                           | 2/8 (25.0)                                                 |                          |
|                                      | Chronic iron deficiency anaemia   | 2/3 (66.7)                                           | 1/3 (33.3)                                                 |                          |
|                                      | Autoimmune hepatitis with IBD     | 3/3 (100)                                            | 0/3 (0)                                                    |                          |
|                                      | Total                             | 37/68 (54.4)                                         | 6/68 (8.8)                                                 |                          |
| Diagnostic colonoscopy only (n=13)  | Unexplained lower GI bleeding     | 7/13 (53.8)                                          | 2/13 (15.4)                                                | -                        |
|                                      | Total                             | 7/13 (53.8)                                          | 2/13 (15.4)                                                |                          |

GI = gastrointestinal; GERD = gastro-oesophageal reflux disease; EoE = eosinophilic oesophagitis; IBD = inflammatory bowel disease; TB = tuberculosis.
*Histology was done only in 3 cases of upper GI bleeding/portal hypertension (gastroscopy) as most were varices and diagnoses made macroscopically with histology of tissue biopsies.
†Miscellaneous: recurrent sore throat (n=1); cyclical vomiting (n=2); non-steroidal anti-inflammatory drugs/steroid use (n=1).

![Fig. 4. Histological yields among study participants who underwent diagnostic gastroscopy (n=179). (EoE = eosinophilic oesophagitis; GERD = gastro-oesophageal reflux disease.)](image-url)
and variceal band ligation (in older children), in managing cases diagnosed from histopathology on biopsy specimens taken on the oesophageal surface (confirmed on histology), and longitudinal linear furrows and patches of small, white papules gastric varices, EoE with concentric ring formation/trachealisation were made macroscopically during endoscopy, e.g. oesophageal and with the aid of endoscopy, as in the current study. Some diagnoses were the benchmark for the diagnosis and follow-up of various gastrointestinal disorders have been diagnosed in some cases.\[8,18\] However, there is a need to apply local experience and standard expert societal guidelines in centres running paediatric endoscopic services so as to improve diagnostic yields, which will ultimately impact on patient management. Abdominal pain was the most common indication for endoscopy among participants in the present study, which has been corroborated by authors in most similar studies.\[14,19\] Also, evaluation for PEG insertion in children with feeding difficulties/inco-ordinate swallowing and poor weight gain/failure to thrive were the prevalent therapeutic indications for gastroscopy. PEG tubes were mainly inserted for improved feeding in cases of inco-ordinate swallowing due to neurological disorders. Sclerotherapy or band ligation for oesophageal varices were the second-most common indications for therapeutic gastroscopy in the current study. Rectal bleeding and chronic bloody loose stools were the two leading indications for colonoscopy in the present study, and this has also been corroborated by other studies.\[21,22\] The experience in the current study also corroborates the recommendations by key expert societal guidelines on common indications for performing endoscopy in children,\[13\] based on the presenting symptoms, and underscores the need to adhere to them for utmost endoscopic impacts and outcomes. Combined gastroscopy and colonoscopy procedures are the benchmark for the diagnosis and follow-up of some paediatric gastrointestinal disorders, particularly IBD (Crohn's disease, ulcerative colitis or indeterminate IBD), polyposis and eosinophilic colitis, among others,\[21,24\] as found in the present study.

Endoscopy is an important diagnostic and therapeutic tool in children. Various gastrointestinal disorders have been diagnosed with the aid of endoscopy, as in the current study. Some diagnoses were made macroscopically during endoscopy, e.g. oesophageal and gastric varices, EoE with concentric ring formation/trachealisation and longitudinal linear furrows and patches of small, white papules on the oesophageal surface (confirmed on histology),\[25\] while others were diagnosed from histopathology on biopsy specimens taken during endoscopy. Some therapeutic endoscopy procedures were employed, including sclerotherapy (in the younger infants/toddlers) and variceal band ligation (in older children), in managing cases of upper gastrointestinal bleeding from oesophageal varices and polypectomy for juvenile polyps.

In addition, follow-up scopes were done in cases of IBD to assess disease remission and relapses. Follow-up surveillance was done in cases of multiple juvenile polyposis for monitoring of development of colorectal carcinoma, as there is a 15% incidence of such malignancy in patients <35 years of age.\[22,23\]

Overall endoscopic yield for the various modalities of upper and lower endoscopy in the present study was high. The high endoscopic yield observed may be due to the appropriate selection of cases with correct indications for endoscopy using standard societal guidelines,\[26\] pre-procedure preparations including standard bowel preparations, as well as obtaining of biopsies at the time of endoscopy from both macroscopically normal- and abnormal-lookiing gastrointestinal mucosa. High diagnostic yields have equally been reported for OGD and colonoscopy in similar studies.\[16,17,27,28\]

Using standard societal guidelines, including the European Society for Paediatric Gastroenterology, Hepatology and Nutrition (ESPGHAN) and North American Society for Paediatric Gastroenterology, Hepatology and Nutrition (NASPGHAN), the correct indications for endoscopy will lead to a high impact rate on management of children with various gastrointestinal symptoms/disorders. Significant impacts on patient management were seen in patients with PEG insertions for feeding difficulties.

Improved oral intake allowed these children to meet their recommended dietary allowances, with attendant improved growth as evidenced by an increase in median weight-for-age z-scores (–2 - 0).

Similar findings have been reported in other studies.\[29,30\] Children with portal hypertension and oesophageal varices causing upper gastrointestinal bleeding also benefited from either sclerotherapy or variceal band ligation, with good results depending on their age.\[31\]

In addition, a few of the patients in the current study with juvenile polyposis had snare polypectomy and subsequent follow-up/surveillance for possible development of associated malignancies.

There were cases in the present study where changes in treatment were made based on endoscopy. In cases of IBD with relapsing or
worsening disease activity based on either paediatric ulcerative colitis activity index scores (25) or Crohn’s disease activity index scores (26). Escalation of medical therapy was required to improve the clinical outcome.

In a study by Thakkar et al. (38,39), a 42% change in patients’ management was made in their study, made up of a 20% change in management immediately following endoscopy and 18% post histology review, and 9% after both, respectively. In their study, management changes were mainly the addition of new medication(s) in children with IBD, particularly those with Crohn’s disease, with improvement in their overall treatment outcomes, similar to the experience in the present study. Other benefits of endoscopies in our study participants included eradication of H. pylori in cases diagnosed on histology, and culture of the gastric antrum biopsies, as well as polypectomies of juvenile polyps, among others. Most of these gastrointestinal endoscopic impacts on management have been corroborated by researchers in similar studies (25).

In paediatric endoscopies, it is advised to take biopsy specimens from both macroscopically normal- and abnormal-looking gastrointestinal mucosae for histology. This is because some gastrointestinal mucosa may appear macroscopically normal on endoscopy, but show pathology/abnormal histology. It has been reported that in ~20% of macroscopically normal upper gastrointestinal mucosa, biopsies reveal various pathological conditions on histology, thereby improving the rate of endoscopic yields in such cases (26).

Limitations exist in gastroscopy and colonoscopy (diagnostic) in the evaluation of various gastrointestinal complaints in children, as some studies have reported no histological abnormalities in up to 60% of the sites biopsied, and in ~65%, no macroscopic abnormalities observed during endoscopy (26). Negative histopathological findings on biopsies are useful in excluding pathology and thus reassuring and relieving anxiety in patients and their families, (28) as well as averting the need for further investigations, with resulting lowered economic costs in patient management. Considering the potential complications and costs of gastrointestinal endoscopy under general anaesthesia as in the current centre, appropriate clinical judgement and guidelines should be applied in selecting patients with the right indications for endoscopy (25).

Terminal ileum intubation is an important indicator of complete colonoscopy. It is invaluable in the diagnosis of some specific gastrointestinal disorders, including IBD, intestinal TB and chronic diarrhoea, among others, that affect the gut (26,30).

The terminal ileum intubation rate of 97.7% observed in the current study appears to be much higher than findings in similar studies (26,30) and could have played a significant role in the overall outcome of the study. It is possible that the high level of bowel preparations in patients who underwent colonoscopy as well as the endoscopic skills of the experienced gastroenterologists resulted in the high rate of terminal ileum intubation. The histopathology of terminal ileal biopsies was essential in distinguishing gastrointestinal disorders, including distinguishing intestinal TB from Crohn’s disease, in which the former occurs commonly in the ileo-caecal gut. Most cases of intestinal TB (n = 8; 9.9%) seen in the present study had histological features of the disease. TB is endemic in SA and is treatable, with good outcomes using anti-tuberculous agents for 6 months (26). Patients with Crohn’s disease may have coexisting latent TB, which is important to exclude as IBD immunosuppressive treatment could result in reactivation of latent TB and further disseminated TB. Intestinal TB needs to be excluded in our setting before starting immunosuppressive treatment in IBD cases.

There was a low complication rate recorded in the present study, with no mortality attributable to the endoscopic procedures reported. RCWMCH has an experienced anaesthetic department, and all paediatric gastrointestinal endoscopies were performed under general anaesthesia. Though a few cases of anaesthetic-related minor complications were reported, no mortality was recorded compared with use of intravenous sedation for endoscopy.

The majority of the complications (n = 5 (7; 71.4%)) reported in the current study were anaesthetic related, as has been observed by other studies (26,41). It is plausible that the use of standard expert societal guidelines in selecting patients for endoscopy in the current study improved pre-endoscopic preparations of patients, and that performance of the procedures by a gastroenterologist and/or trainee fellows under general anaesthesia administered by a consultant anaesthetist accounted for the low complication rate observed.

Conclusion

Endoscopy offers diagnostic and therapeutic options in children. Positive histological reports were recorded in some cases where gastrointestinal mucosa appeared normal. There is a need to obtain biopsies from both abnormal-looking and macroscopically normal mucosa, as significant histology could be made from these, hence improving diagnostic yield.

One limitation of the present study is that the retrospective nature of a longitudinal study might have revealed long-term outcomes of some of the cases.

Declaration

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Author contributions

CBE: conceptualisation of the study, literature review/proposal writing, acquisition of data, data analysis, initial manuscript draft and critical editing of the manuscript for important intellectual content. EAG: conceptualisation of the study, supervision and critical editing of the manuscript for important intellectual contents. RAB and RJD: supervision and critical editing of the manuscript for important intellectual content.

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Conflicts of interest

None.
25. Thomson M, Sharma S. Diagnostic yield of upper and lower gastrointestinal endoscopies in children in a tertiary centre. J Pediatr Gastroenterol Nutr 2017;64(6):903-908. https://doi.org/10.1097/mpg.0000000000001582
26. Thakker K, Holub JI, Gilger MA, et al. Quality indicators for pediatric colonoscopy: results of a multi-center retrospective study. J Pediatr Gastroenterol Nutr 2016;63(3):533-541. https://doi.org/10.1097/mpg.0000000000001624
27. Wu CT, Chen CA, Yang YJ. Characteristics and diagnostic yield of pediatric colonoscopy in Taiwan. Pediatr Neonatol 2015;56(5):234-238. https://doi.org/10.1016/j.pedneo.2015.01.005
28. Wu FY, Wu JF, Ni YH. Long-term outcome after percutaneous gastrostomy in children. Pediatr Neonatol 2013;54(5):326-329. https://doi.org/10.1016/j.pedneo.2013.04.010
29. Sharma R, Williams AN, Zaw W. Timing of gastrostomy insertion in children with a neuro-disability: A cross-sectional study of early versus late intervention. J Pediatr Gastroenterol Nutr 2018;67(3):414-430. https://doi.org/10.1097/mpg.0000000000002490
30. Isha S, Yachha SK. Endoscopic outcome beyond esophageal variceal eradication in children with extrahepatic portal vein obstruction. J Pediatr Gastroenterol Nutr 2006;42(2):196-200. https://doi.org/10.1097/01.mpg.0000150681.61954.1b
31. Kerur B, Litman HJ, Stern JB, et al. Correlation of endoscopic disease severity with pediatric ulcerative colitis activity index score in children and young adults with ulcerative colitis. World J Gastroenterol 2017;23(18):3322-3329. https://doi.org/10.3748/wjg.v23.i18.3322
32. Hyams J, Markowitz J, Otley A, et al. Evaluation of the pediatric Crohn Disease Activity Index: A prospective multicenter measure. J Pediatr Gastroenterol Nutr 2005;41(4):416-421. https://doi.org/10.1097/01.mpg.0000183350.46795.42
33. Lin CH, Wu RSC, Lin WC, Wu SE, Chen AC. Colonic polypancy of colorectal polyps in children under general anaesthesia. Ko roshusted J Med Sci 2009;25(2):70-76. https://doi.org/10.1016/j.kjms.2008.04.007
34. Eke CB, Brown RA, De Lacy RJ, Pillay K, Goddard EA. Collagenous gastri tis: An unusual cause of generalised oedema in a child. J Tropical Pediatrics 2019;65(3):305-308. https://doi.org/10.1016/j.tropmed.2018.08.022
35. Shafi MA, Feinstein JA, Campbell SC, Kranz RE. Diagnostic yield of oesophagogastrroduodenoscopy in children: A retrospective single centre study of 10,000 cases. Gastroenterol Nutr 2013;7(1):47-54. https://doi.org/10.1016%2Fj.gntn.2013.03.016
36. O’Loughlin EV, Dutt S, Kamath R, Gaskin D, Doney S. Prospective peer-review audit of paediatric upper gastrointestinal endoscopy. J Paediatr Child Health 2007;43(4):551-554. https://doi.org/10.1111/j.1440-177x.2007.01132.x
37. Oliva S, Thomson M, de Ridder L, et al. Endoscopy in pediatric IBD: A position paper on behalf of the Porto IBD Group of the European Society for Paediatric Gastroenterology, Hepatology and Nutrition. J Pediatr Gastroenterol Nutr 2007;44(7):978-981. https://doi.org/10.1097/mpg.0000000000000131
38. Lee WS, Tew CW, Koay ZL, et al. Quality indicators in pediatric colonoscopy in a low-volume center: Implications for training. World J Gastroenterol 2019;25(49):1013-1021. https://doi.org/10.3748/wjg.v25.i49.1013
39. Keane J, Gershon S, Wise RP, et al. Tuberculosis associated with infliximab, tumour necrosis factor alpha-neutralizing agent. N Engl J Med 2001;345(15):1098-1104. https://doi.org/10.1056/nejmoa011110
40. Abdul Karim SS, Churchyard GJ, Abdool Karim QM, Lawn SD. HIV infection and tuberculosis in South Africa: An urgent need to escalate the public health response. Lancet 2009;374(9693):921-933. https://doi.org/10.1016%2Fj.lancet.2009.06.015
41. Ammar MS, Pfefferkorn MD, Goiffe J, Gupta SK, Corkins MR, Fitzgerald JE. Complications after outpatient upper gastrointestinal endoscopy in children: 30-day follow-up. Am J Gastroenterol 2003;98(7):1508-1511. https://doi.org/10.1111/j.1572-0241.2003.007524.x

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