Quality of colonoscopy in children with rectal bleeding in Egypt

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Background
Colonoscopy is the diagnostic evaluation of choice in cases of rectal bleeding (RB). Colonoscopy in children is different from that in adults, but the technique of the examination is similar. Colonoscopy is a technically demanding procedure with the potential for harm if performance is unsatisfactory, and thus assurance of quality is pivotal. A colonoscopy quality-assurance program was instituted in 2003.

Aim
The aim of this study was to determine the quality of colonoscopy in children with RB after introducing a colonoscopy quality-assurance program.

Patients and methods
The study was cross-sectional and hospital-based. It was undertaken between 2010 and 2013 on 107 children who underwent colonoscopy for the evaluation of RB.

Results
A total of 112 colonoscopies were assessed. A diagnosis was established in 69 (62%) colonoscopies and polyps were detected in 52%. Cecal intubation was achieved in 107 (90%). The main reason for an unsuccessful cecal intubation was poor bowel preparation. The adjusted completion rate was 97%. The mean time to reach the cecum was 16 min. The mean time for completion of the procedure was 31 min. Colon preparation was rated adequate in 63 (56%) colonoscopies. A total of 119 polyps were detected in 58 colonoscopies, with an average of two polyps per colonoscopy (range 1–7). In all, 113 polyps were excised. All polyps were judged to be completely removed in 52 (95%) colonoscopies. Polypectomy was not performed in three colonic examinations with solitary polyps. Five (4%) patients had postprocedural vomiting. There was one (1%) sedation-related complication (respiratory distress), but no procedure-related complications or mortality.

Conclusion
A high standard of colonoscopy in children with RB can be achieved by introducing a colonoscopy quality-assurance program.

Keywords:
children, colonoscopy, quality, rectal bleeding

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Introduction

Colonoscopy is the diagnostic evaluation of choice in cases of rectal bleeding (RB) because it allows examination of the entire colon and the potential excision of bleeding polyps when they are identified. The most common cause of RB in children older than 2 years is juvenile polyps, and this remains true until they become teenagers [1]. Juvenile polyps have been reported to be solitary and rectosigmoid in location in 80–90% of cases. However, other studies have shown that in a number of cases multiple polyps may be present (up to 40%) and may be proximally located [2]. This emphasizes the need for total colonoscopy in all cases.

Colonoscopy in children is different from that in adults [3–6]. Preparing children for colonoscopy can be difficult. Colonoscopy in children is generally performed under general anesthesia. Children 6–12 years old or weighing more than 25 kg can be examined using a standard adult colonoscope. A pediatric colonoscope is used for children 2–6 years old. A pediatric upper endoscope is used in children under the age of 1–2 years. The technique of the examination is similar to that in adults, but the bowel wall is thinner and may not withstand the formation of large loops. Furthermore, because of the child's small stature, angulations may be more acute. Meticulous attention to technique is required in children because of the thinness of the bowel wall and because anesthesia prevents patient feedback with respect to the pain and discomfort caused by an overstretched mesentery or overdistended bowel.

Colonoscopy is a technically demanding procedure with the potential for harm if performance is unsatisfactory, and thus assurance of quality is pivotal [7]. Quality assurance is the process of assessing specific quality metrics to determine areas of underperformance [8].

Quality assurance is setting a standard and investigating anything that falls below it [9].

Bolak Eldakror Hospital is a secondary-care governmental hospital in Giza (Egypt). The Gastrointestinal Endoscopy Unit was set up in 1999. A colonoscopy quality-assurance program was instituted in 2003 [10–13]. It initially involved setting standards of practice and designing an approved training program. Protocols and worksheets (medical and technical) were established. Documentation was regularly checked. Quality indicators were defined. Process or outcome indicators were used to evaluate and monitor the quality of endoscopic procedures. Audits were conducted. Benchmarking was used to detect shortcomings and deviations from standards.

Colonoscopy in children is usually undertaken in the New Children's University Hospital (Abo Elreesh), Cairo University, but because of a long waiting list for colonoscopy in that unit some patients with RB have been referred to our Endoscopy Unit since 2010.

The aim of this study was to determine the quality of colonoscopy in children with RB after introducing the colonoscopy quality-assurance program.

Patients and methods

All children referred for the evaluation of RB from the year 2010–2013 were assessed. Children under 6 years of age were not accepted because a small-caliber pediatric colonoscope was not available. All children had persistent or recurrent painless bright red RB with no identifiable cause.

The bowel preparation for colonoscopy was explained to the parents or guardians. All patients were prescribed a standard regimen consisting of a low-residue diet for 48 h, with clear fluids only for the last 24 h, and a purgative (castor oil) to be taken for the last 12 h before the procedure. An enema was given twice at night and immediately before the procedure. The risks and benefits of colonoscopy were reviewed with the family at the time of the procedure. All colonoscopies were performed under general anesthesia (propofol or ketamine). Anesthesia was given by an anesthetist who attended all procedures.

Full and continuous monitoring was performed during the procedure. Supplemental oxygen was administered to all patients during the procedure. A competent endoscopist or supervised trainee performed all colonoscopies. The endoscopist had received supervised training for his first 200 diagnostic colonoscopies and had performed 30 polypectomies. Procedures were performed once weekly. At the beginning of this new service, an expert in pediatric colonoscopy attended the procedures. Two adult colonoscopes (Olympus CF-230L/I, and CF-EL; Olympus, Tokyo, Japan) were used. Polypectomy was performed with a diathermy snare and electrosurgical unit (Olympus PSD-20). Pure coagulation current was used for polypectomy. Removal, retrieval, and collection of polyps were performed with a snare, cold biopsy for diminutive polyps, polyp retriever, and polyp trap. Pathological examination was performed by two expert pathologists. Patients were followed up 1 month after colonoscopy.

The study was cross-sectional and hospital-based. It was undertaken between 2010 and 2013 on 107 children who underwent colonoscopy for the evaluation of RB. A total of 112 colonoscopies were assessed over a period of 3 years. Predetermined quality parameters for colonoscopy have been prospectively employed to evaluate and monitor the standard of endoscopic procedures in these patients using standard quality indicators: complete examination of the colon (cecal intubation rate ≥90% overall), documentation of quality of preparation with 90% or more bowel preparation described as excellent or adequate, and routine polypectomy for all polyps identified [14].

A standardized data collection form (sheet) was completed for each child. Recorded information included demographic data (age and sex), indications for endoscopy, endoscopic findings, and polypectomy. Histopathological results were also recorded. Recorded quality parameters included the status of the endoscopists (competent or trainee), cecal intubation rate, image documentation of claimed cecal intubations, time to reach the cecum, withdrawal time during negative colonoscopies, total time for completion of the procedure from insertion to scope removal, quality of colon preparation, complete polyp description (location, size, number, and gross morphology), endoscopic polypectomy rate, complete polyp removal rate, retrieval rate of all excised polyps for histological analysis, adverse events, and both immediate and 30-day complications. Only the visualization of the ileocecal valve and/or intubation of the terminal ileum were taken to indicate successful cecal intubation. The adjusted completion rate was calculated by excluding factors beyond the endoscopists' control.

The quality of bowel preparation was graded as excellent (completely clear), good (clear liquid aspirable stool), fair (semisolid debris, adhering to the colonic mucosa and not allowing adequate vision of the whole mucosa), or poor (solid stool, not allowing adequate progression of the endoscope and leading to

subsequent termination of the procedure) [14]. The quality of bowel preparation was graded as follows: 'excellent' or 'good' for adequate bowel preparation, and 'fair' or 'poor' for inadequate bowel preparation [15]. Microsoft Access and Excel were the databases used for storage and analysis of the data.

Between 2010 and 2013 annual quality-assurance reports were transmitted to an independent experienced endoscopist with particular interest in quality assurance for comment and advice.

Results

A total of 112 colonoscopies were performed on 107 children with RB. The mean age was 8 years, with a range of 6–18 years. Fifty-nine percent were boys and 41% were girls. Colonoscopies were repeated in five (4%) procedures. The reasons of repeating colonoscopies were poor preparation in two (2%), rebleeding in two (2%), and missed solitary polyp in one (1%). Fifty-seven (51%) colonoscopies were diagnostic only and 55 (49%) were therapeutic (polypectomy). A diagnosis was established in 69 (62%) colonoscopies and polyps were diagnosed in 58 (52%) (Table 1).

Two endoscopists carried out all colonoscopies. The endoscopist performed 53 (47%) colonoscopies. The trainee was involved in 59 (53%) colonoscopies under the guidance of a senior staff endoscopist with assistance during the procedure in 26 (44%).

Cecal intubation was achieved in 101 (90%) colonoscopies. The reasons for unsuccessful cecal intubation were poor preparation in seven (6%) procedures, repeat colonoscopy and detection of a lesion (polyp) in two (2%), acute angulation in one (1%), and respiratory distress in one (1%). When excluding factors beyond the endoscopists' control, poor preparation and respiratory distress, the completion rate was 97%. Documentation with photographs or videotape was achieved in 98% of claimed cecal intubations. The mean time to reach the cecum was 16 ± 8 (4–35) min. The mean withdrawal time during negative colonoscopies was 7 ± 3 (2–13) min. The mean time for completion of the procedure, including biopsies and polypectomies, was 31 ± 13 (7–65) min. The quality of colon preparation was graded as excellent in 39 (35%) colonoscopies, good in 24 (21%), fair in 42 (38%), and poor in seven (6%).

A total of 119 polyps were detected in 58 (52%) colonoscopies, with an average of two polyps per colonoscopy (range 1–7). Complete polyp description was documented in all colonoscopies in which polyps were detected (Table 2). In all, 113 polyps were excised. All polyps were judged to be completely removed in 52 (95%) colonoscopies and retrieval of all excised polyps was successful in 50 (91%). Histology of polyps is shown in Table 1. Polypectomy was not performed in three colonic examinations with solitary polyps. Polyps were missed during withdrawal in two colonoscopies and because of equipment failure (malfunction of the electrosurgical unit) in one colonoscopy. Five (4%) patients had postprocedural vomiting. One (1%) patient developed sedation-related complication (respiratory distress), but there were no procedure-related complications or mortality during the study period.

Discussion

Colonoscopy is a technically demanding procedure with the potential for harm if performance is unsatisfactory. It is highly operator-dependent and standards vary greatly [7]. There is strong evidence that colonoscopy

Table 1 Colonoscopy findings in children with rectal bleeding (number of colonoscopic examinations = 112)

Endoscopic findings	Incidence [*N* (%)]
Polyps[a]	58 (51.79)
No diagnosis was established	38 (33.93)
Procedure was aborted[b]	5 (4.46)
Solitary rectal ulcer[c]	5 (4.46)
Mild colitis (erythema)[c]	4 (3.57)
Site of autoamputated polyp	2 (1.79)
Enterobius vermicularis identified macroscopically[d]	23 (20.54)

[a]Histological examination: 41 (71%) juvenile, 5 (9%) hyperplastic, and 12 (21%) histological results were not available; [b]Procedure was aborted immediately after insertion because of bad preparation; [c]Histological examination: nonspecific; [d]Concomitant with other endoscopic findings.

Table 2 Description of polyps detected during colonoscopy in children with rectal bleeding (number of colonoscopic examinations with detected polyps = 58)

Polyp descriptions	Incidence [*N* (%)]
Number	
Range (mean)	1–7 (2)
Solitary	37 (64)
Multiple	21 (36)
Location	
Rectum	27 (46.6)
Left colon (sigmoid and descending colon)	22 (37.9)
Whole colon	9 (15.5)
Morphology	
Pedunclated	38 (65.5)
Sessile	7 (12.1)
Sessile and pedunclated	13 (22.4)
Size (mm)	
<10	31 (53.5)
10–20	21 (36.2)
>20	6 (10.3)

performance varies between different centers and endoscopists [15]. To enhance the diagnostic and therapeutic yield of colonoscopy, measurement of quality parameters and benchmarking is essential to identify areas for improvement [16]. Quality assurance in endoscopy has become an important topic in recent decades.

In this study we assessed the quality of colonoscopy in children with RB after introducing the colonoscopy quality-assurance program. A total of 112 total colonoscopies were performed. A diagnosis was established in 62% of colonoscopies. It was reported that after total colonoscopy in children with RB a diagnosis was established in 64–70% of children [17,18]. Polyps were the most common endoscopic diagnosis (52%). Polyps were detected in 54–63% of children who had endoscopic examination for RB [19,20].

Cecal intubation rate was 90%. When excluding factors beyond the endoscopists' control, the completion rate was 97%. The mean time taken to reach the cecum was 16 ± 8 min. The mean time for completion of the procedure was 31 ± 13 min. Our completion rates and completion times are similar to that reported by others. In children, the reported completion rates of colonoscopy to the cecum were 93–97%, the mean completion time to the cecum was 12–27 min, and mean time for completion of the procedure was 38 min [6,21].

Colon preparation was rated adequate in 56% of colonoscopies. Failure of completion due to poor bowel cleansing was documented in 6%. Poor preparation was due to the type of preparation used, lack of compliance with instructions, and noncooperation. We tried to improve the quality of bowel preparation by adding magnesium citrate (12 sachets twice daily on the previous day of the procedure) but this was also not successful. The quality of preparation in our patients could be better with the use of more modern proprietary formulations using polyethylene glycol. Polyethylene glycol preparations and sodium phosphate are not available in the hospital. In children, adequate colon preparation was achieved in 91–93% of colonoscopies [6,22].

A total of 119 polyps were detected from 58 colonoscopies. All polyps were judged to be completely removed in 95% of colonoscopies. It has been reported that successful snare polypectomy in children is possible in 96% of cases [23]. Polypectomy was not performed in three colonic examinations with solitary polyps. Polyps were missed during withdrawal in two inadequately prepared patients, and equipment failure (malfunction of the electrosurgical unit) occurred during the procedure in one patient. The patients were advised to repeat colonoscopy after proper preparation and repair of the electrosurgical unit. Colonoscopy was repeated in one patient and the polyp was detected and removed during insertion. The other two patients did not attend the repeat colonoscopy. Two (2%) patients rebled after colonoscopy. Repeat colonoscopy revealed missed polyps, which were subsequently removed and the bleeding stopped. Polyps, even large polyps, may occasionally be missed during colonoscopy. A systematic review to obtain summary estimates of the polyp miss rate revealed that the pooled miss rate for polyps of any size was 22% (370/1650 polyps) [24]. Careful examination is required in order not to miss lesions. Diminutive polyps, proximal to the rectum, seen during insertion, should be removed at that time as they may not be identified again during withdrawal. Larger polyps, on the other hand, are probably best removed on withdrawal, unless they are distal, and negotiation of the sigmoid has been rapid and uneventful. There was one (1%) sedation-related complication (respiratory distress). Five (4%) patients had postprocedural vomiting. There were no complications attributed to the procedure itself or to mortality during the study period. Complications in pediatric colonoscopy are rare [3]. Perforation is the most serious complication of colonoscopy in children and it is usually related to polypectomy [2]. Postpolypectomy perforation was reported in 0.5–5% of colonoscopies in children [3,22].

This study was performed in a community hospital in daily clinical practice and it has assessed the application and adaptation of several quality parameters to a specific context to evaluate the quality of the colonoscopy quality-assurance program. Colonoscopy performance met the accepted standards [16]. Colonoscopy completion rates, completion times, and polypectomy rates are comparable to other reports of colonoscopy and polypectomy in children [6,21]. The study also shows defects in practice. More efforts are needed to improve performance. We have previously reported the outcome of introducing a colonoscopy quality-assurance program in adults showing improved cecal intubation rates, patient comfort, endoscopic polypectomy, detection rate of microscopic colitis, and the yield of histological sampling in patients with suspected colorectal cancer [10–13].

Real-time, practice audit for endoscopic procedures is feasible and valuable in clinical practice. Performance assessment improves the quality of colonoscopy procedures. The introduction of a quality-assurance program can generate a high standard of practice in this specialist area. In conclusion, a high standard of colonoscopy in children with RB can be achieved by introducing a colonoscopy quality-assurance program.

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Conflicts of interest

There are no conflicts of interest.

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