

Therapeutic Colonoscopy in Children : Endoscopic Snare Polypectomy and Juvenile Polyps†

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= Abstract = Safety and efficacy of colonoscopic polypectomy without using general anesthesia in young children with juvenile polyps were studied. Between July 1987 and June 1993, seventy six colorectal polyps of up to 4.5cm diameter were removed by diathermy snare during 43 colonoscopic polypectomy sessions on 38 children aged from 6 months to 13 years (mean, 4.4 years). Thirty four children had single polyps. The remaining four children had more than two polyps. One of them was juvenile polyposis. General anesthesia was not used in any infant or child. In 31 (82%) patients, colonoscopic polypectomy was performed on an ambulatory basis. Most juvenile polyps (89%) occurred as a solitary lesion. In 76% of patients, polyps were located in the rectosigmoid region. Seventy nine percent of the polypectomized juvenile polyps were between 1 cm and 3 cm diameter in size. No complications related to medication, colonoscopy, or snare polypectomy were observed in any of the children. The major clinical manifestations of children with juvenile polyps were hematochezia (89%), abdominal pain (19%), mucoid stools or diarrhea (45%), and anemia (29%). These clinical symptoms disappeared soon after removal of polyps. In 18 of 33 patients with juvenile polyps, barium enema did not demonstrate any colonic polyps. More than 6 months' delay of diagnosis was noted in 40% of patients. Only 32% of patients were diagnosed to have juvenile polyps within 3 months from the onset of hematochezia. Sixteen patients (42%) were referred with a clinical impression of colon polyp. However, the remaining 22 patients had been treated before referral under various tentative diagnoses including dysentery-like infectious diarrhea (34%), anal fissure (11%), hemorrhoid (5%) and ulcerative colitis (5%). From the experience in the present study, it is concluded that colonoscopic snare polypectomy can be safely and effectively used at pediatric age for the treatment of juvenile polyps without using general anesthesia on an ambulatory basis.

Key Words: *Colonoscopy, Polypectomy, Children, Juvenile polyp*

INTRODUCTION

Polyps of the large bowel are common

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cause of rectal bleeding in children(Perisic 1987). Juvenile polyps are the most common form of tumor of the colon in children, accounting for more than 90% of colon polyps.

Although juvenile polyps are considered hamartomatous malformation, there have been isolated reports that juvenile polyps may have the potential to develop adenomatous changes (Grigioni *et al.* 1981; Lipper *et al.* 1981; Gryboski 1986). Concomitant adenomatous changes in

patients with juvenile colonic polyposis (Longo *et al.* 1990), and an adenocarcinoma arising from a juvenile polyp in a child (Liu *et al.* 1978) have been documented.

Some pediatricians, expecting spontaneous autoamputation, recommended observation of juvenile polyps in young children without anemia or pain. However, immediate removal is now widely recommended in symptomatic patients because of the potential risk to develop adenomatous changes and recent technical advancement of colonoscopic polypectomy.

With increasing use of colonoscopic procedure, colonoscopy in children has now been regarded as a safe and effective method to investigate the entire colon (Bartnik *et al.* 1986; Rossi 1988; Jalihal *et al.* 1992; Latt *et al.* 1993). However, barium enema has still been used widely as an initial procedure to investigate the entire colon in children because of limited use of pediatric colonoscopy which requires a high degree of training and technical expertise. Experience with colonoscopic polypectomy in children has been limited and standard polypectomy procedures including adequate premedication, proper type of anesthesia and an effective method of bowel cleansing in young children have not been well established until now.

The aims of the study in this paper are to evaluate the usefulness and safety of endoscopic snare polypectomy for juvenile polyps without using general anesthesia on an ambulatory basis, and to investigate the clinical characteristics of juvenile polyps in young children.

SUBJECTS AND METHODS

During the period from July 1987 to June 1993, 630 children between the age of 1 month and 15 years underwent endoscopic examination of colonic lesions for hematochezia, abdominal pain, chronic diarrhea and other gastrointestinal symptoms in the pediatric endoscopy room in Seoul National University Childrens' Hospital. Forty five patients were

found to have juvenile polyps in the colon, and colonoscopic polypectomy was performed in 38 of them.

All the polyps were removed by a standard polypectomy snare. For snare polypectomy the PCF or CF Olymposcope and power supply for diathermy were used. Preparation of the colon was carried out by prescribing clear fluid diet for 24 hours, bisacodyl tablets on the afternoon before examination, and saline enemas until clear on the morning of the procedure. In young infants, 12 to 24 hours of clear liquids generally were sufficient.

Most of the juvenile polyps (Fig. 1) had a long stalk, and an attempt was made to grasp the polyp toward its neck leaving at least 1 cm of the stalk to avoid perforation. Polyps with short stalks were ensnared as close to their necks as was possible. Polypectomy was done using a combination of cutting and coagulating current in short bursts on average of 5 seconds. Before transection was started, an ensnared polyp was taken gently back and forth to tent the mucosa so that an excess amount of adjacent normal colonic mucosa was not caught in the loop. To reduce the risk of contralateral burn with a large polyp, special care was taken to make the area of point contact larger than that of the stalk (Fig. 2). Coagulating current was applied and slowly increased until local whitening was visible, followed by a cutting current to sever the polyp



Fig 1. Characteristic endoscopic findings of a juvenile polyp with a long stalk.

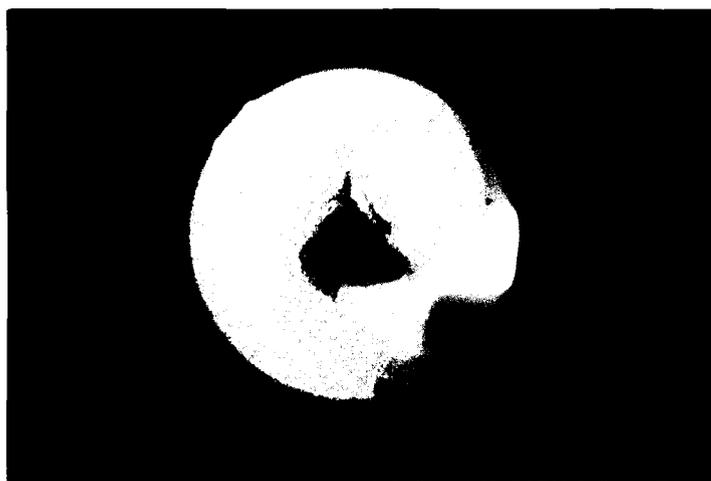


Fig 2. Grasping a large polyp with polypectomy snare: making the contact area larger than that of the stalk to reduce risk of contralateral burn.



Fig 4. Retrieval of the transected polyp with snare.

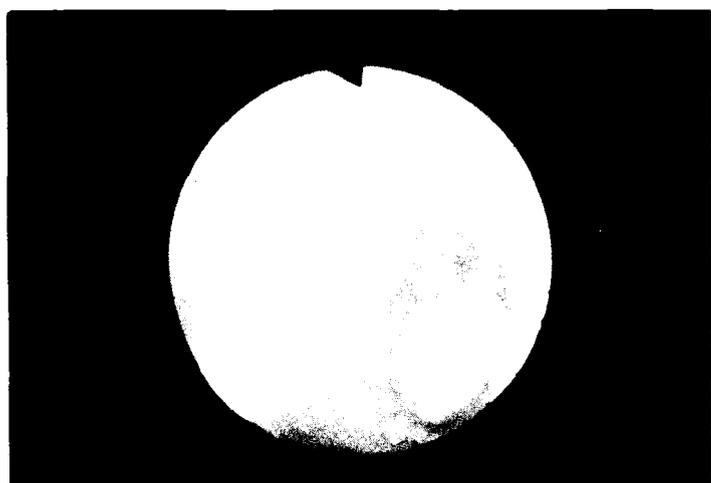


Fig 3. Transected polyp and a stalk with good coagulation.

(Fig. 3). The resected polyps were retrieved using retrieval forceps or diathermy snare (Fig. 4), and sent for histological examination. The average time for one polypectomy session was about 10 to 20 minutes.

Following removal of the polyp, the scope was reinserted and the site of polypectomy was inspected (Fig. 5). The children were observed for a couple of hours until recovery from sedation and physical examination was done before leaving the hospital. For infants and very young children, hospitalization was occasionally needed in order to assess any possible complications.

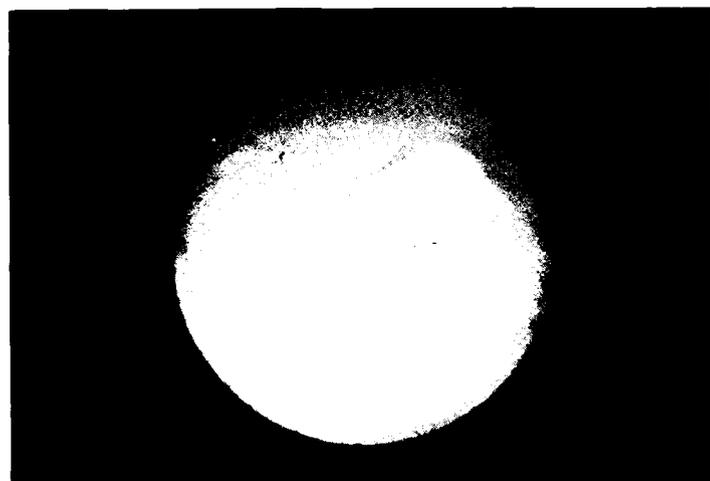


Fig 5. Following removal of the polyp, the scope was reinserted and the site of polypectomy was inspected: a long remnant stalk with good coagulation.

Thirty eight children who underwent colonoscopic polypectomy were investigated for clinical characteristics including tentative diagnoses on referral, clinical manifestations, size, and prevalent location of juvenile polyps.

RESULTS

Juvenile polyps and polypectomy profiles.

Among 630 children who underwent endoscopic examination of colonic lesions, 80 patients were found to have polyps in the colon (Table 1). Juvenile polyp was the most common and it accounted for 56% of colonic polyps.

Table 1. Incidence of juvenile polyps in 80 children with colon polyps

Polyps	No. of children(%)
Juvenile polyps [#]	43 (53%)
Juvenile polyposis [#]	2 (3%)
Inflammatory polyps	24 (30%)
Peutz-Jegher's polyps	5 (6%)
Hyperplastic polyps	3 (4%)
Malignant polyps [@]	2 (3%)
Lymphoid polyposis	1 (1%)
Total	80 (100%)

[#] Colonoscopic polypectomy was done in 38 of 45 Juvenile polyps

[@] Malignant polypoid mass was confirmed lymphoma by biopsy

The age and sex distribution of patients with juvenile polyps were shown in Figure 6.

Among the children with juvenile polyps, there were 23 girls and 15 boys with ages ranging from 6 months to 13 years (mean age, 4.4 years). Twenty nine children (76.3%) were under the age of 6 years and nine (23.7%) between 6 and 13 years.

Seventy six colorectal polyps of up to 4.5cm diameter were removed during 43 colonoscopic polypectomy sessions on 38 children (Table 2).

General anesthetic was not used in any infant or child for the performance of diagnostic and therapeutic colonoscopy. All patients successfully received the procedures with sedation only. For sedation, the combination of meperidine (1-2mg/kg) and either valium (0.3 mg/kg) or midazolam (0.2-0.3 mg/kg) were given to the patients either intravenously or intramuscularly. Colonoscopic polypectomy was performed on

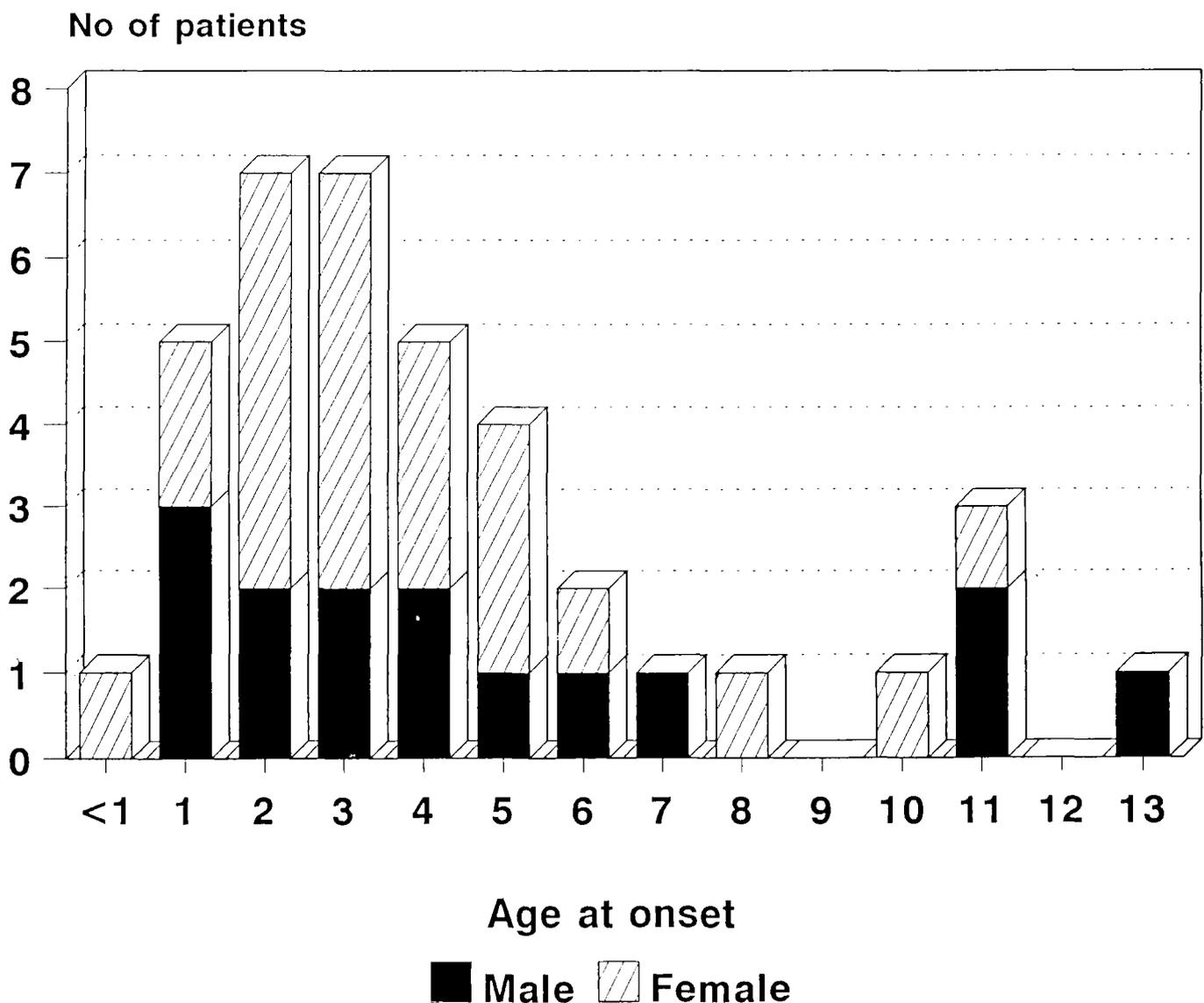


Fig 6. Age at onset of 38 children with colonoscopic polypectomy.

Table 2. Colonoscopic polypectomy in 38 children with juvenile polyps

Polypectomy profiles	No. of patients
No. of polypectomy (No. of session)	
one (1 in each Pts.)	34
two (1 in each Pts.)	2
five (2 times)	1
thirty three (5 times for 3yr Fu)	1
General anesthesia	none
Sedation with	
valium(or midazolam) with	
or without demerol	38
Polypectomy at endoscopy room	
without hospitalization	31
with hospitalization	7
Complication	
Perforation	none
Transmural burn	none
Bleeding	none [#]

[#] A small amount of bleeding from a transected stalk, immediately after polypectomy in one patient, spontaneously relieved without any specific management



Fig 7. Multiple juvenile polyposis in a 10 year-old boy who underwent 33 polypectomies during 5 sessions for 3 years' follow-up.

an ambulatory basis in 31 (82%) children. Seven patients who were very young were hospitalized for a polypectomy procedure.

Thirty four children had single polyps.

Table 3. Number of polyps per patients

No. of polyps	No. of children (%)
Solitary	34 (89%)
Two	2 (5%)
Five	1 (3%)
Mutiple [#]	1 (3%)
Total	38 (100%)

[#] Juvenile polyposis in a 10 year old boy

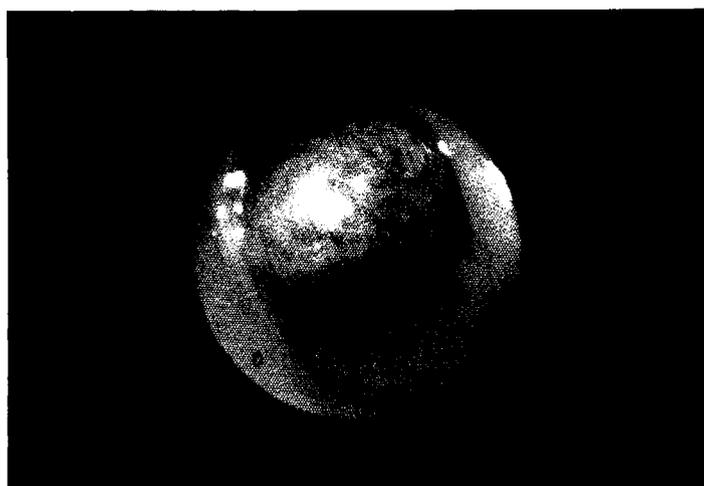


Fig 8. A large juvenile polyp obstructing the lumen of the colon in a 2 year-old boy with constipation and abdominal distension.

Four children had more than two polyps. Two polyps were found in two children and five polyps in a 10 year old girl. In a 10 year old boy with juvenile polyposis (Fig. 7), mutiple polyps were noted in the entire colon and 33 polyps were removed at 5 sessions during the 3 years follow-up period (Table 2 and 3). All the polyps were removed by snare polypectomy. No technical difficulty was encountered. No complications related to medication, colonoscopy, or snare polypectomy were observed in any of the children. There was no serious bleeding, no signs of transmural burns, nor perforation. One patient showed a small amount of bleeding from a resected stalk immediately after polypectomy. But it stopped in a couple of minutes without any specific management and no further bleeding was noted during follow-up observation.

2) Characteristics of resected juvenile polyps and clinical profiles.

Juvenile polyps were pedunculated red to brown, mostly nonlobulated tumors with superficial ulceration and were frequently covered by mucus (Fig. 1 and 8). Histological examination revealed that such polyps consisted of distended mucus-filled glands, inflammatory cells and an edematous lamina propria. The most characteristic feature was the dilated cystic gland lined by tall columnar goblet cells. The microscopic appearance of a juvenile polyp is shown in Figure 9. None of the juvenile polyps appeared to have the potential for malignant degeneration.

The size and site of the polyps removed are presented in Table 4 and Table 5. The size of the polypectomized juvenile polyps were between 1 cm and 3 cm in 79% of children. The biggest one was 4.5 cm in diameter. Most

Table 4. Size of the polypectomized juvenile polyps

Size (cm) #	No. of patients (%)
< 1	2 (5%)
1 - 1.9	14 (37%)
2 - 2.9	16 (42%)
3 - 3.9	4 (11%)
4 - 4.9	2 (5%)
Total	38 (100%)

If there were more than two polyps in a patient, the largest polyp was measured.

Table 5. Location of juvenile polyps

Location	No. of children (%)
Rectum	15 (39%)
Sigmoid colon	11 (28%)
Descending colon	7 (18%)
Transverse colon	1 (3%)
Sigmoid colon & Rectum	2 (6%)
Transverse & Transverse colon	1 (3%)
Rectum, Sigmoid, Descending, Transverse colon & Cecum	1 (3%)
Total	38 (100%)

polyps were found in the left colon; 29 patients (76%) had polyps in the rectum or sigmoid colon. The most proximal polyp (1cm in diameter) was found in the cecum.

Barium enema reports and/or films were compared with the final results of colonoscopy

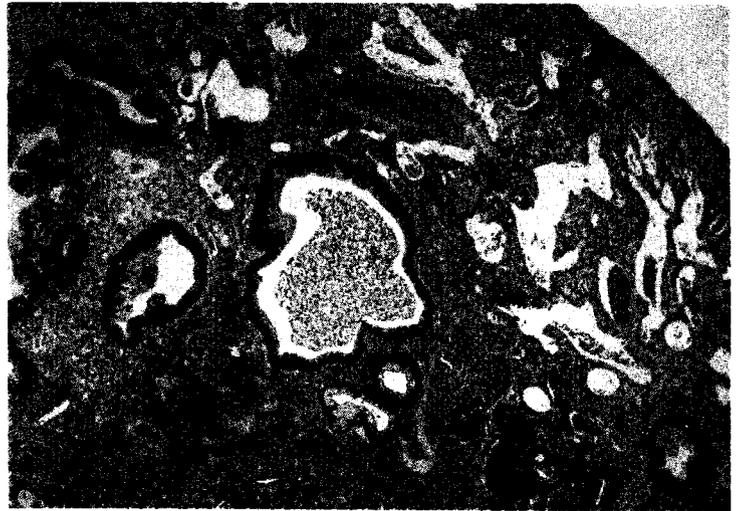


Fig 9. Characteristic features of the dilated cystic gland lined by tall columnar goblet cells.

Table 6. Detection rate of colon X-ray study for the juvenile polyps

Colon study	No. of children (%)
Polyps (+)	15 (46%)
Polyps (-)	18 (54%)
Total	33 (100%)

Table 7. Clinical impressions # on referral

Impression	No. of children (%) @
Infectious diarrhea	13 (34%)
Ulcerative colitis	2 (5%)
Anal fissure	4 (11%)
Hemorrhoid	2 (5%)
Aerophagia	2 (5%)
Meckel's diverticulum	4 (11%)
Irritable bowel syndrom	2 (5%)
Lower GI bleeding, unknown cause	1 (3%)
Colon polyp	16 (42%)

Patients were referred with one or more clinical impressions

@ Calculated as ratio to 38 patients

in 33 children (Table 6). There was diagnostic agreement in 15 patients (46%), and in the remaining patients barium enema did not demonstrate any colonic polyps.

All patients were referred from a primary private clinic, small hospitals, or university hospitals usually with one or two tentative diagnoses under which they had been treated for some period (Table 7).

Sixteen patients were referred for colonoscopic confirmation or management with a clinical impression of a colon polyp. However, 13 of the remaining 22 patients had a medical history of receiving antibiotics under the impression of dysentery-like infectious diarrhea. More than 6 months' delay of diagnosis was noted in 40% of patients (Table 8).

The major clinical manifestations of children with juvenile polyps were hematochezia (89%), abdominal pain (50%), mucoid stools or

diarrhea (45%), and anemia (29%) (Table 9). Six patients with relatively larger polyps developed constipation (Fig. 8). These clinical symptoms disappeared soon after removal of polyps.

DISCUSSION

A juvenile polyp is the most common cause of painless rectal bleeding in the young child who is well grown and otherwise well, and it is the most common colorectal tumor in children (Cucchiari *et al.* 1983; Mestre 1986; Jalihal *et al.* 1992; Latt *et al.* 1993). In the present series of patients juvenile polyp was the most common colonic polyp in 80 children who were found to have polyps during 6 years of colonoscopic examinations for 630 children (Table 1). It accounted for 56% of colonic polyps. Excluding inflammatory polyps (pseudopolyps), which were mostly associated with Crohn's disease, ulcerative colitis and tuberculosis, it accounted for 82% of colon polyps in children.

All patients with juvenile polyps except 7 received colonoscopic polypectomy; two patients had a pacemaker with congenital heart disease, and the other 5 patients had associated diseases or debilitating conditions which made polypectomy not urgent. In Peutz-Jegher syndrome, multiple endoscopic polypectomies were done for gastric and colonic polyps (Park *et al.* 1993). Two patients with colon polyps were found to be lymphoma on colonoscopic biopsy and surgically treated. Most patients with inflammatory polyps showed numerous small polyps in the entire colon and they were treated medically.

Juvenile polyps were traditionally considered to be benign with no potential for malignancy. However, juvenile polyps with concomitant adenomatous changes have been documented. Juvenile polyposis, defined as 10 or more juvenile polyps in the colon (Jass *et al.* 1988), is now considered as a precancerous condition because patients with juvenile polyposis are prone to developing colon malignancies (Haggitt and Pitcock 1970;

Table 8. Interval between onset of the symptom and diagnosis of the juvenile polyp

Interval	No. of patients(%)
1 mo - 3 mo	12 (31%)
4 mo - 6 mo	11 (29%)
7 mo - 11 mo	9 (24%)
1 yr - < 2 yr	3 (8%)
2 yr - < 3 yr	2 (5%)
over 3 yr	1 (3%)
Total	38 (100%)

Table 9. Clinical manifestations of 38 children with colonoscopic polypectomy

Symptoms	No. of children (%)#
Hematochezia	34 (89%)
Abdominal pain	19 (50%)
Mucoid stool or diarrhea	17 (45%)
Anemia	11 (29%)
Constipation	6 (16%)
Prolapse of polyp	3 (8%)
Tenesmus	2 (5%)
Abd distension	2 (5%)

Calculated as ratio to 38 children

Sandler and Lipper 1981; Giardiello *et al.* 1991). A juvenile polyp with adenomatous change in a 4-yr-old child and in a cluster of polyps removed from a segment of the left colon in an eight year-old boy have been reported. A case of adenocarcinoma arising from a juvenile polyp has also been reported (Liu *et al.* 1978).

Because there is a small possibility that an adenomatous polyp will arise either simultaneously with or from a juvenile polyp, it may be wise to remove colonic polyps. In addition to malignant potential, most patients with a juvenile polyp showed chronic rectal bleeding ranging from streaks on stools to a significant amount causing iron deficiency anemia, which disappeared completely after polyp removal as in our cases.

Before the advent of colonoscopy and snare polypectomy, polyps located beyond the reach of the sigmoidoscope could only be removed through laparotomy and colotomy. However, it was found that colotomies in children carried a 15% rate of serious complications. As a result, conservative management with observation was usually recommended expecting spontaneous autoamputation, and this was uncomfortable for patients because of recurrent bleeding episodes with anemia and repeated X-ray follow-ups.

An experienced endoscopist can examine the colon to the cecum without significant difficulty or risk. With adequate precautions and colon preparation, endoscopic polypectomy using an electrocautery snare can be performed safely (Williams *et al.* 1982; Cucchiari *et al.* 1983). It has been used widely in adults, and is the procedure of choice for removal of colon polyps.

In our hospital, colonoscopy is recommended as an initial study for hematochezia and endoscopic snare polypectomy is performed immediately if any polyps are detected.

Successful results in the present study, as those of others (Bartnik *et al.* 1986; Jalihal *et al.* 1992; Latt *et al.* 1993) have shown that colonoscopic snare polypectomy can be safely and effectively used at pediatric age and

should replace surgical treatment for colorectal polyps in children.

In the present study, the juvenile polyps in children, were found to usually have a long and thin stalk. They were easy to snare and safely polypectomized with coagulation current only without danger to the thin bowel wall. There were no juvenile polyps, the stalk of which was so broad and short as to make polypectomy unsuccessful.

However, the existence of reports of perforation following colonoscopic polypectomy in children suggests that such procedures should only be undertaken by an endoscopist with extensive experience.

The type of medication during the procedure is an important aspect of pediatric polypectomy. While in some centers the diagnostic and therapeutic colonoscopy is conducted with sedation only, in others general anesthesia or intravenous ketamine is preferred, particularly in younger patients. Experience in the present study suggests that colonoscopic procedures can be safely performed in children with only sedation with demerol and midazolam. None of our patients needed general anesthesia for polypectomy and colonoscopic polypectomy could be carried out on an out-patient basis.

Juvenile polyps are usually solitary. Most reports indicate that 80-90% of the polyps were located in the rectum or sigmoid (Mestre 1986; Jalihal *et al.* 1992; Latt *et al.* 1993). Seventy six percent of our patients had polyps in the rectum and sigmoid colon and 90% of the polyp were single. In this respect our series has confirmed earlier reports of other authors. But polyps were noted also in the descending, transverse, ascending colon, and cecum. Therefore, total colonoscopy is essential in patients with bleeding to avoid missing polyps.

Polyps can be visualized by rigid sigmoidoscope or barium enema. Barium enema X-rays are equivocal. Douglas (1980) reported 5 cases of colorectal polyps diagnosed by colonoscopy in which barium enema X-rays were positive in 3 cases and were reported as

normal in two. The detection rate of barium enema for colon polyps was very low (46%) in the present study. This may be associated with the fact that few children were investigated for polyps with air-contrast barium enema. Because of the low detection rate of barium enema and unavailability of pediatric colonoscopic investigations in other hospitals, only 42% of our patients were referred with a clinical impression of a colon polyp. Thirty four percent of patients who showed mucoid stools with fresh blood were treated with antibiotics under the impression of dysentery-like infectious diarrhea. In children with hematochezia early colonoscopic investigation should be recommended to make an accurate diagnosis and avoid unnecessary treatment. It can also reduce the delay of diagnosis; only 32% of patients were diagnosed to have juvenile polyps within 3 months from the onset of hematochezia.

The major clinical manifestations of the patients in this series were similar to those previously reported (Rau *et al.* 1984; Jalihal *et al.* 1992; Latt *et al.* 1993). Nearly all patients had hematochezia. Less common symptoms included lower abdominal pain, mucoid diarrhea, anemia, constipation, and prolapse of the polyp through the rectum.

Complications of colonoscopic polypectomy are hemorrhage, perforation, side effect of premedication, vasovagal attack, transmural burn and explosion of gas. A review of a large series of diagnostic and therapeutic colonoscopic procedures indicates the incidence of the major complications to be between 0.1 to 1 per cent of adult cases (Macrae *et al.* 1983; Nivatvongs 1988).

Hemorrhage is a serious complication and one of the most common occurrences during colonoscopic polypectomy, being reported in 0.77% to 2.24% of cases in large surveys. It can occur from 24 hours to 21 days after polypectomy although delayed hemorrhage usually occurs 5 to 7 days after the procedure. In the present polypectomy cases, no serious hemorrhage was noted. One patient showed

transient minute bleeding from the resected stalk which stopped in a couple of minutes without any specific management.

Perforation is the most common serious complication of colonoscopic polypectomy, occurring in 0.29% to 0.42% in several large surveys. A five percent perforation rate has been encountered in young children, following polypectomy (Williams *et al.* 1982; Hassal 1984). However, as in our cases perforations seem to be few in polypectomy for juvenile polyps, which usually have a long and thin stalk.

Clinical manifestations of hypotension, bradycardia, and cold clammy skin after polypectomy suggest vasovagal attack.

Transmural burn injury should be suspected in patients with abdominal pain, leukocytosis, and fever without evidence of free air or diffuse peritoneal signs. Rau *et al.* (1984) reported one pediatric case of delayed perforation due to transmural burn in their polypectomy series of 16 children with colonic polyps. Explosion of flammable gases is rare and can be avoided by good bowel preparation and by frequent insufflation and aspiration of gas during colonoscopic polypectomy.

No complications were seen during or after colonoscopic polypectomy and the immediate and long term results were excellent in our children after polypectomy.

In conclusion, colonoscopic snare polypectomy can be safely and effectively used in the pediatric age group without using general anesthesia on an ambulatory basis for the treatment of juvenile polyps. The experience in the present study also suggests that in children with hematochezia, early colonoscopic investigation should be recommended to make an accurate diagnosis and to avoid unnecessary treatment caused by delay of diagnosis.

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