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Laparoscopic management of persistent complete rectal prolapse in children

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Rectopexy;
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Redundancy

Abstract

Background: Rectal prolapse is a relatively common condition in children. The multiplicity of surgical approaches used for rectal prolapse indicates that there is no single approach universally accepted and applicable to all cases. The laparoscopic approach promises to become the criterion standard for the management of full-thickness rectal prolapse in children. The aim of this study was to review our experience over the last 5 years and to evaluate the results that can be achieved by using laparoscopy in management of complete rectal prolapse in children.

Patients and Methods: Forty patients presented with complete rectal prolapse and fecal incontinence grades (3-4) according to Rintala scale (37 secondary to prolapse and 3 neuropathic) had been operated upon laparoscopically from August 2003 to August 2008. They were subjected to clinical examination, investigations, pre- and postoperative electromyogram activities for external sphincter, puborectalis, and pelvic floor muscles. The pathophysiologic changes for each case was identified and dealt with laparoscopically (laparoscopic suture rectopexy, laparoscopic mesh rectopexy, laparoscopic resection rectopexy, and laparoscopic levatorplasty).

Results: Among the 40 children with complete rectal prolapse, 22 were males and 18 females. Their median age was 9 years (range, 4-14 years). All cases (n = 40) showed a redundant rectosigmoid junction. Additional laxity of the pelvic floor was present in 32, rectoanal intussusception in 27, anterior wall rectoanal intussusception in 3, and rectosacral hernia in 5 cases. All procedures were completed laparoscopically. The median duration of surgery was 60 minutes (range, 50-70 minutes) for suture rectopexy, 90 minutes (range, 60-110 minutes) for mesh rectopexy, 110 minutes (range, 95-160 minutes) for resection rectopexy, and 120 minutes (range, 100-150 minutes) for laparoscopic levatorplasty. No intraoperative complications occurred in this study. Median postoperative hospitalization was 3 days (range, 2-5 days). Electromyogram studies showed statistically significant improvement during rest, minimal volition, and squeezing in all cases except those children with spina bifida and meningomyelocele. The only complications were postoperative constipation and external colonic fistula. Significant improvement of the continence score was achieved in all cases. The average follow-up time was 36 months. There were no recurrences.

Conclusion: The use of laparoscopy in the management of complete rectal prolapse is safe, effective, and associated with improved functional outcome. It saved the patients multiple operations and is associated with minimal postoperative pain and short hospital stay.

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Rectal prolapse is a relatively common condition in children. The peak incidence is between 1 and 3 years of age. Prolapse can be either partial or complete. In complete rectal prolapse, the full-thickness of the rectum is involved and 5 cm or more protrudes, and the prolapse is distinguished by the circular folds of mucosa [1]. Most of the children with rectal prolapse do not have any predisposing factors. Significant controversy exists regarding its surgical management [2]. Several less invasive operations have been described, including the Thiersch's procedure combined with stool softeners and sclerotherapy with 5% phenol, 30% saline solution, or 5% ethanolamine oleate injected into the retrorectal space. The specific goals of surgical management of full-thickness rectal prolapse are to eradicate the external prolapse of the rectum, improve continence, improve bowel function, and reduce the incidence of recurrence [3,4]. The growing body of literature supports the concept that laparoscopic surgical techniques can safely provide the benefits of low recurrence rates, improved functional outcome, less postoperative pain, short hospital stay, and early return of bowel function for patients with full-thickness rectal prolapse [3]. In this study, we reviewed our experience over the last 5 years using laparoscopy in the management of persistent complete rectal prolapse in children. The pathophysiologic changes for each case is identified and dealt with laparoscopically.

1. Patients and methods

From August 2003 to August 2008, 45 children with complete rectal prolapse with grade 3 to 4 fecal incontinence presented to Al-Azhar University Hospitals and Health Insurance Hospitals were listed and evaluated. They were subjected to clinical examination, routine laboratory investigations, plain radiographs, barium enema, proctoscopy, and colonoscopy. Investigations included pre- and postoperative electromyogram (EMG) activities during rest, minimal volition, and squeezing for external sphincter, puborectalis, and pelvic floor muscles. Forty of 45 cases were selected. The inclusion criteria included cases with prolonged presentation needing manual reduction of their rectal prolapse, recurrent or persistent prolapse after previous trials of injection sclerotherapy, or surgery and marked weakness of the anal muscle complex extending to puborectalis and pelvic floor muscles, demonstrated by preoperative EMG studies. The exclusion criteria included children with weakness limited to the external and internal anal sphincters only, response to expectant treatment, cases with cystic fibrosis, and cases of rectal polyps. Fifteen of 40 cases had previously undergone 2 Thiersch's procedures, and 10 children had undergone 5 attempts of submucosal injection sclerotherapy with 5% ethanolamine oleate. The remaining 15 cases had persistent prolapse after combined sclerotherapy, linear cauterization, and circulage. Rectal prolapse was defined according to the Rintala and Pakarinen criteria [1]. Thirty-seven otherwise healthy patients had primary rectal prolapse, whereas rectal prolapse in 3 patients was secondary to spina bifida and meningomyelocele. All cases (n = 40) had a redundant rectosigmoid junction. Additional laxity of the pelvic floor was present in 32, rectoanal intussusceptions in 27, anterior wall rectoanal intussusceptions in 3, and rectosacral hernia in 5 cases (Table 1).

1.1. Operative details

The technique was approved by the ethical committee of our hospital. Written detailed informed consent was obtained from all parents. All patients were subjected to colonic preparation by twice daily saline enema for 3 days preoperatively. They received one dose of ceftriaxone, 50 mg/kg, and metronidazole in a dose of 7.5 mg/kg in the morning of surgery. All children were asked to strain to show their rectal prolapse immediately before the operation. If they failed, induction of rectal prolapse was done by transanal dragging of the rectum after induction of general anesthesia administered through an endotracheal tube. The patient was placed in the supine position while the rectum is prolapsing (Fig. 1). A 5-mm trocar was inserted at the umbilicus by using the open Hasson technique. Through this port, pneumoperitoneum was established to 10 to 12 mm Hg, and then, a 5-mm 30° scope was used. Two 3- to 5-mm accessory trocars were inserted under direct vision on the lateral edge of the right rectus muscle, one at the level of umbilicus with the other 5 cm below. A third accessory trocar was inserted on the lateral border of the left rectus muscle 5 cm above the level of the umbilicus Fig. 2. The laparoscopic procedure was started by assessment of redundancy of the rectosigmoid colon and laxity of the pelvic floor. Redundancy is assessed by measuring the rectosigmoid colon from the last branch of the inferior mesenteric vessel down to the pelvic floor. Pelvic floor laxity was assessed by grasping the distal rectum, dragging it upward and measuring the length (centimeter) of how much it could be dragged. We have compared redundancy of the rectosigmoid colon and laxity of the pelvic floor in normal children (n = 20) matched for the same age and sex subjected to other laparoscopic procedures apart from colorectal pathology with those with rectal prolapse (n = 40). In patients with rectal prolapse, the redundant rectosigmoid is 1.59 ± 0.07 times longer than in normal children. The statistical analysis of redundancy of the rectosigmoid colon is shown in Fig. 3. In healthy children, the rectum could be dragged only for 2.6 cm, whereas in patients

Table 1 Laparoscopic pathophysiologic findings

Pathologic finding	No. of cases
Redundancy of rectosigmoid junction	40 cases
Laxity of pelvic floor	32 cases
Rectoanal intussusception	27 (3 anterior wall)
Rectosacral hernia	5 cases

Fig. 1 Complete rectal prolapse.

with rectal prolapse and laxity of the pelvic floor, it could be dragged up to 4.57 cm. Based on these data, we consider that dragging 1.75 ± 0.2 times than normal represents significant pelvic floor laxity (Fig. 4). Laparoscopic technique included a retrorectal dissection in all cases (Fig. 5), starting from the peritoneal reflection on the right side of the rectum, extending

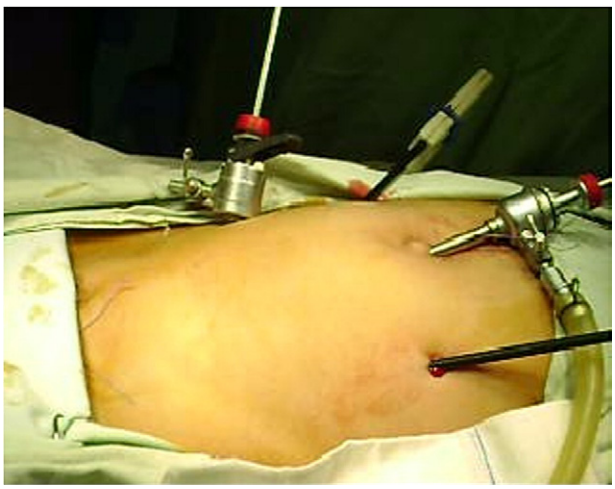

Fig. 2 Port sites.

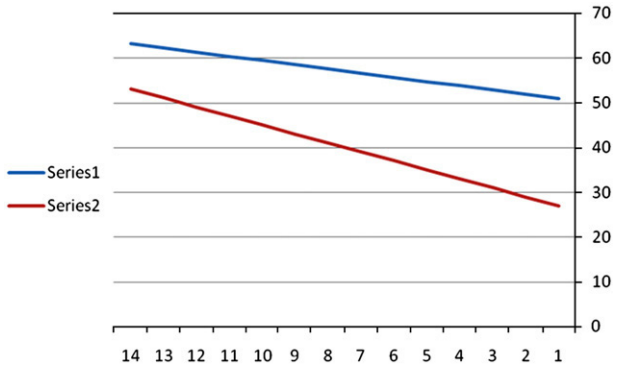

Fig. 3 Comparison between rectosigmoid lengths in rectal prolapse and normal children using best fit line equation $L = 0.93A + 51$, where L = the length of the rectosigmoid colon in rectal prolapse and A = age of the, where $L = 2A + 23$ is the rectosigmoid length best fit line equation in normal children, where series 1 = rectal prolapse cases and series 2 = normal children. t test = 1.08 E −8, indicating significant difference between both group ($P < .05$).

from the sacral promontory to the pelvic muscular floor in the rectosacral bloodless plain. In the absence of pelvic floor laxity, suture rectopexy to the sacral promontory and suture sigmoidopexy to the left lateral peritoneum were done without mesh. In cases with laxity and weakness of pelvic floor and in patients with neuropathic conditions (spina bifida and meningomyelocele), additional retrorectal Prolene mesh was applied (Fig. 6), whereas laparoscopic rectosigmoidectomy was applied in cases with idiopathic rectal prolapse with chronic constipation. The mesh was tailored to fit the retrorectal space, where it was snuggly placed and fixed to the rectum by 2 to 4 Prolene stitches. Then, the mesh and the rectum were dragged up and fixed to the sacral promontory with closure of the peritoneal defect. In 5 cases with rectosacral hernia, additional laparoscopic levatorplasty was done.

1.2. Statistical analysis

Data were analyzed using Excel Microsoft Office 2003. Data were expressed as median for continuous variable and comparison between these variables in 2 groups using F test

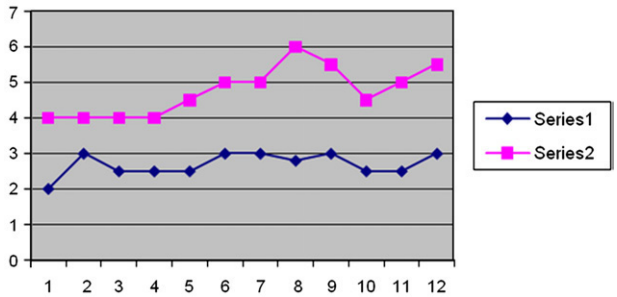

Fig. 4 Laxity of pelvic floor in cases with rectal prolapse in comparison to normal. Statistical comparison showed that in laxity, dragging of pelvic floor is 1.75 ± 0.2 times than in normal.

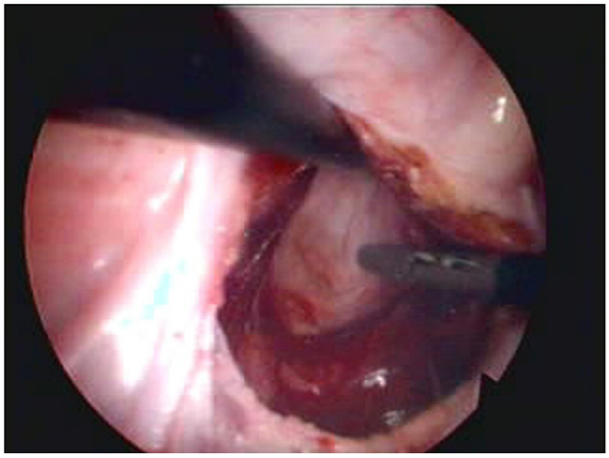

Fig. 5 Retrorectal dissection.

where *P* values less than .05 indicate a statistically significant deference.

2. Results

Forty children with complete rectal prolapse were operated upon laparoscopically. There were no conversions. Definite pathophysiologic changes with complete rectal prolapse were identified and are shown in Table 1. The median duration of surgery was 60 minutes (range, 50-70 minutes) for suture rectopexy, 90 minutes (range, 60-110 minutes) for mesh rectopexy, 110 minutes (range, 95-160 minutes) for resection rectopexy, and 120 minutes (range, 100-150 minutes) for laparoscopic levatorplasty. No intraoperative complications occurred in this study. Median postoperative hospitalization was 3 days (range, 2-5 days). The postoperative EMG studies showed statistically significant improvement during rest, minimal volition, and squeezing in all cases except those with spina bifida and meningomyelocele where the only insignificant EMG activity was detected for puborectalis activity at rest (Table 2). The complications included postoperative constipation and temporary external colonic fistula in one case with sigmoid resection. Both responded to conservative measures. In all patients, except in those with spina bifida or meningomyelocele, the Rintala continence score improved from grade 3 to 4 to grade 1. Operations performed are shown in Table 3. All patients were available for follow-up for 36 months for assessment of recurrence, continence degree, constipation, and anal EMG if indicated.

3. Discussion

Most children experiencing rectal prolapse do not have any predisposing factors. Complete rectal prolapse is the result of a complete circumferential intussusception starting 6 to 8 cm from the anal verge and continuing through the anal canal, everting onto the perineum. Support for this theory is found in articles that note that patients with rectal prolapse have lower basal and squeeze pressures on anorectal manometry than normal control subjects [5,6]. Surgery is indicated in rare cases with intractable rectal prolapse and may be considered in patients who are not spontaneously cured in 12 to 18 months of follow-up. Patients older than 4 years require surgery more often than younger children [1]. There are several methods that have been used to successfully treat recurrent rectal prolapse. Recently, there have been many reports addressing the success of different laparoscopic approaches for complete rectal prolapse, namely, suture rectopexy, posterior mesh rectopexy, and resection of the sigmoid colon, with or without rectopexy and levatorplasty [3]. The main advantages of the laparoscopic approach include rapid return of intestinal function, early discharge from hospital, improved cosmetic result, low morbidity, and low recurrence rate. The fecal continence score and the functional outcome are improved. Moreover, both diagnosis and treatment of rectal prolapse can be done in the same setting [7-11]. Laparoscopic full posterior rectal mobilization and fixation to the sacrum alone, without mesh or sigmoid resection, is the corner stone for success of those operations. It gives results close to those observed after more extensive operations and may be the major component of success. In addition, it has a high rate of success with a low mortality and morbidity and has a lower risk of sepsis as well. The use of the harmonic scalpel and a laparoscopic suturing device (Endo Stitch) for laparoscopic suture rectopexy shortened and simplified the operation and improves the outcome [12-14]. Saxena et al [15] used laparoscopic simple suture rectopexy to secure the rectum to the presacral fascia in a 22-month-old child who presented with recurrent rectal prolapse. In the present study, laparoscopic retrorectal dissection and suture rectopexy to the sacral promontory and suture sigmoidopexy to the left lateral peritoneum without mesh was applied in 8 children without laxity of pelvic floor. It solved the problem of redundancy of the rectosigmoid junction, whereas slinging

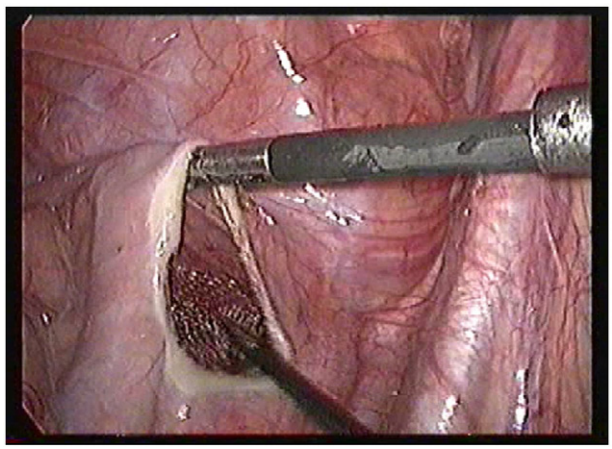

Fig. 6 Showing retrorectal mesh insertion.

Table 2 Showing EMG activities pre and postoperative

EMG site and activity	Preoperative activity	Postoperative activity	F test	*P*
External sphincter at rest	102.2 ± 9.5	355 ± 15.5	0.0041	<.05 [b]
External sphincter at minimal volition	113.5 ± 10.1	367.1 ± 12.5	1.36 E−13	<.05 [b]
External sphincter at maximum squeezing	189.3 ± 46.2	468.1 ± 11.4	0.004	<.05
Puborectalis at rest	126.4 ± 12.8	392.4 ± 52.2	0.209	>.05 [a]
Puborectalis at minimal volition	137.1 ± 18.7	380.4 ± 6.33	2.7 E−09	<.05 [b]
Puborectalis at maximum squeezing	235.3 ± 19.9	488 ± 7	0.001	<.05 [b]
Levator ani at rest	117.8 ± 11	377.1± 17.9	2.46 E−13	<.05 [b]
Levator ani at minimal volition	142.6 ± 18.67	386.8 ± 32.3	7.412 E−09	<.05 [b]
Levator ani at maximum squeezing	239.9 ± 27.8	477.5 ± 10.7	9.33 E−08	<.05 [b]

[a] Insignificant.
[b] Significant.

the rectum to the sacral promontory solved the problem of rectoanal intussusception (Figs. 7 and 8). Redundancy is a predisposing factor for rectoanal intussusception and postoperative constipation because of kinking of the sigmoid colon over the edge of the mesh. Rectosigmoid redundancy is an initiating factor for rectosigmoid intussusceptions (Fig. 9). Left lateral fixation of the sigmoid colon in a smooth curve is mandatory to prevent this complication. The reported recurrence rate was 6.9% at 5 years and 10.8% at 10 years. Recurrent cases can be treated by laparoscopic resection and rectopexy with or without mesh [17,18]. Based on our excellent results, we strongly recommend retrorectal dissection and slinging the rectum to the left lateral peritoneum because neither slinging alone without retrorectal dissection nor retrorectal dissection only is a sufficient procedure for treatment of rectal prolapse. The choice of the laparoscopic technique is based on the pathophysiologic changes present. In 22 patients with laxity, weakness of the pelvic floor and neuropathic conditions (Spina bifida and meningomyelocele) additional retrorectal Prolene mesh was added with good results. However, Rintala and Pakarinen [1] prefer laparoscopic suspension of the rectum to the anterior sacrum without mesh, and they claimed that this approach was successful in several patients. Hernández in 2008 [19] added mesh to rectopexy in 15 cases with good results. The role of constipation as an etiologic factor is controversial; only 3% of patients experiencing severe constipation have rectal prolapse [1]. Koivusalo et al [20] reported 2 patients with postoperative constipation. They added that constipation is the only postoperative problem and is frequently worsened. In our series, the low number of children with postoperative constipation may be attributed to the routine correction of rectosigmoid redundancy by left lateral fixation and to routine resection rectopexy for children with preoperative intractable constipation and prolonged total colonic transit time. It appears that patients have less constipation and incontinence if the lateral rectal ligaments can be preserved; however, this requires further analysis [21]. In 2006, Kariv et al [22] reported a 35% incidence of constipation after laparoscopic rectopexy. In 2005, Demirbas et al [23] reported that the colonic transit times were reduced postoperatively in about 50% of patients who had experienced constipation. We reported one case of postoperative constipation that responded to conservative treatment. Laparoscopic colorectal resection with rectopexy remains controversial. It is preferable in patients with history of intractable constipation and prolonged total colonic transit time because it is unwise to fix the rectum by any means against chronic straining in those cases [8,12]. Laparoscopic colorectal resection is a safe technique with short recovery and good functional results with low recurrence rates. It reduces anal incontinence and constipation [8,11,24-26]. We fully support laparoscopic resection rectopexy because it eliminates the risk of volvulus, has a low morbidity, and has a low recurrence rate. Ten

Table 3 Types of operations performed

Operation	No.
fsResection rectopexy	10 cases
Suture Rectopexy (without mesh)	8 cases
Mesh rectopexy	22 cases
Levatorplasty (additional to mesh rectopexy).	5 cases (of 22-mesh rectopexy)

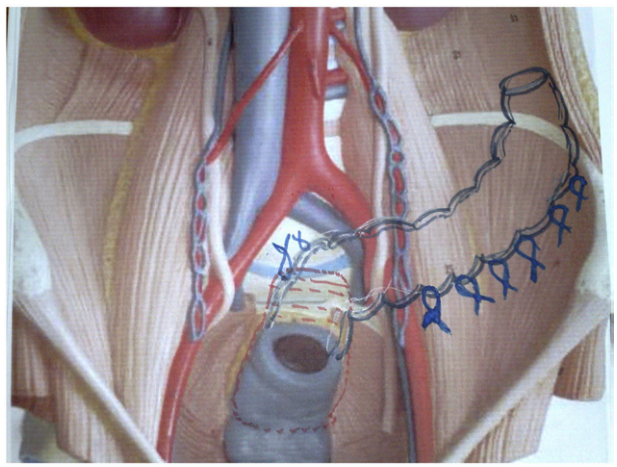

Fig. 7 Illustrating retrorectal fixation of mesh and sigmoidopexy to the left lateral peritoneum.

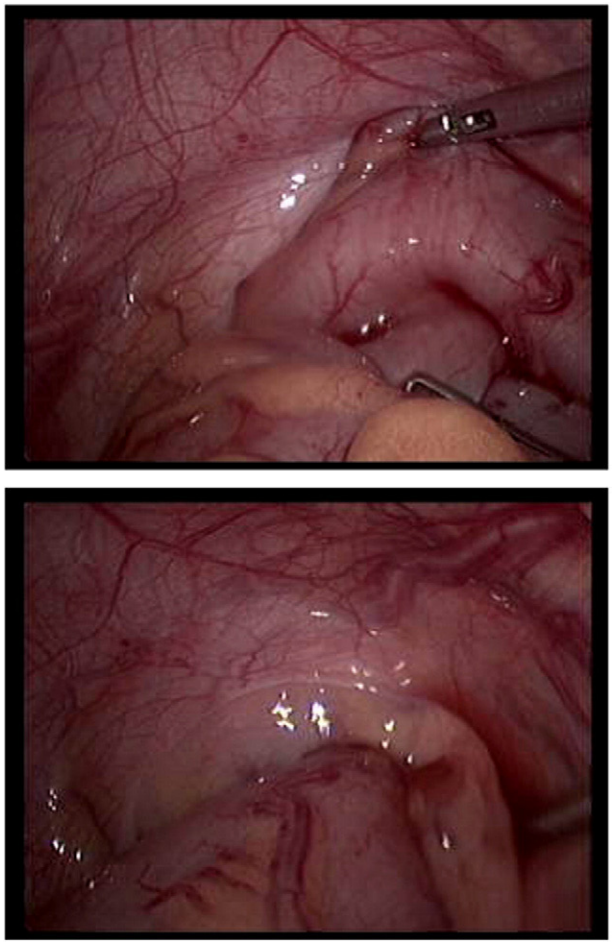

Fig. 8 Rectoanal intussusception during laparoscopic reduction.

patients with prolonged total colonic transit time and intractable constipation were successfully treated in this series by laparoscopic rectosigmoidectomy without mesh, with excellent results and no recurrence of either rectal prolapse or constipation. Only one case developed a temporary external colonic fistula, which was managed successfully with conservative measures. The role of laparoscopic resection rectopexy for symptomatic rectal intussusception was assessed by Von Papen et al [27] in 2007. Sixty percent of their patients reported an overall improvement in function after surgery, and 53% of the patients reported an improvement in bowel frequency and relief of constipation. Sixty-seven percent with incontinence before surgery showed improvement. Köhler and Athanasiadis [28], in 2001, stated that posterior levatorplasty is an easy and efficient operative procedure in the treatment of a complete rectal prolapse accompanied by disabling anorectal incontinence. Tsugawa et al [29] added posterior plication of the rectum and upward suspension through the entire thickness of the bony sacrum. In the present study, we used laparoscopic posterior levatorplasty for repair of rectosacral hernias in 5 cases, where the pelvic floor was lax. We treated rectal prolapse as if it were a true hernia where the muscular hiatus posterior to the rectum was coapted with intracorporeal sutures to narrow the space, and the posterior rectum was suspended from the cut edge of the sacrum so that it cannot prolapse downward again (Fig. 9). Koivusalo et al [20], in 2006, reported a median operative time of 80 minutes (range, 62-90 minutes) for laparoscopic suture rectopexy, and the median hospital stay was 6 days (range, 3-8 days) [20]. In the present study, the median duration of surgery was 60 minutes (range, 50-70 minutes), 90 minutes (range, 60-110 minutes), 110 minutes (range, 95-160 minutes), and 120 minutes (range, 100-150 minutes) according to the technique, which is comparable with other studies. The median hospitalization stay was 3 days (range, 2-5 days). After a mean follow-up period of 36 months, no recurrence was reported. In the present study, surgical correction of rectal prolapse based on the pathophysiologic laparoscopic findings resulted in statistically significant improvement of EMG values at rest, during minimal volition and squeezing in all cases except in those with spina bifida and meningomyelocele. The only insignificant EMG activity was detected for puborectalis activity at rest. We attributed this to the small number of cases in the sample (Table 3). Continence score improved from grade 3 to 4 to grade 1 in all cases (Rintala scale), and our result coincided with that of Snooks and Neill [30-32]. Snooks et al [31] studied innervation of the puborectalis and external anal sphincter muscles in 12 patients with idiopathic (neurogenic) fecal incontinence with complete rectal prolapse, using transcutaneous spinal stimulation, transrectal pudendal nerve stimulation, single fiber EMG, and anorectal manometry. The single fiber (EMG) density was increased in the puborectalis muscle in 60% and in the external anal sphincter in 75% of patients. An increased pudendal nerve

Fig. 9 Muscles of the pelvic floor. Weaknesses in the floor can lead to herniation as is illustrated in several locations: (1) anterior perineal hernia through the urogenital diaphragm; (2) posterior perineal hernia through the levator ani muscle; (3) posterior perineal hernia between the levator ani and coccygeus muscles [16].

terminal motor latency was found in 68% of patients. They concluded that different innervations of the puborectalis and external anal sphincter muscles are damaged in patients with anorectal incontinence. Neill et al [32] and Cheong et al [33] proved that single fiber electromyographic studies and anal reflex latencies were abnormal, indicating damaged innervation of the pelvic floor musculature in all the patients with fecal incontinence, with or without rectal prolapse [32,33]. Farouk et al [34] reported inhibition of the EMG activities of the internal anal sphincter and a fall in anal pressures in all patients with prolapse but not in controls or those with neurogenic incontinence. These waves were abolished after successful resection rectopexy. Recovery of continence occurs by abolition of high-pressure rectal waves, which produce maximal inhibition of sphincter activity before operation [34]. In the present study, EMG activities of the anal muscle complex improved during the follow-up period in both level of the muscle affected extending from pelvic floor to the external anal sphincter and activities during rest, straining, and squeezing. In conclusion, laparoscopic management of rectal prolapse in children is safe, effective, and associated with minimal postoperative pain and a short hospital stay. The choice of procedure should be individualized to the patient's condition and based on the pathophysiologic changes present. The fecal continence score and the functional outcome are improved, and the cosmetic results are excellent.

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