



Original Article

Laparoscopically Assisted Anorectoplasty: A New Definitive Repair of High Imperforate Anus

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Abstract:

Background/ Purpose: *Classically, high imperforate anus is treated in three stages with an initial diverting colostomy, subsequent posterior sagittal anorectoplasty, followed 3-6 months later by colostomy closure. Laparoscopic assisted anorectoplasty is a minimally invasive technique that aims at preserving the sphincters, placing sensate skin within the control of the sphincters, and shortening recovery. This study was carried out to report our initial experience using Laparoscopic assisted anorectoplasty.*

Materials & Methods: *Twenty four patients with high anorectal anomalies were included in this study. All patients had laparoscopically assisted anorectal pull-through (LAARP) for high imperforate anus. Hospital charts and surgical notes were reviewed and clinical characteristics tabulated.*

Results: *There were no complications related to the urinary system, also there was no wound infection, no hernia through the port sites, no anal stricture or anal retraction. Postoperative complications included rectal mucosal prolapsed (n=3), intestinal obstruction (n=1), and r retro-rectal abscess (n=1). The overall clinical assessment for continence of the cases showed that 55% had good outcome, 35% had moderate, and 10% had poor functional outcome.*

Conclusion: *The preliminary results of LAARP are encouraging, and with increased use of laparoscopy it might be the treatment of choice in high and intermediate anorectal anomalies in the near future.*

Index Word: *Imperforate Anus, Minimally Invasive Surgery.*

INTRODUCTION

Infants with high imperforate anus have been classically treated in three stages with an initial diverting colostomy, subsequent posterior sagittal anorectoplasty, followed 3-6 months later by colostomy closure.¹ Though this approach is cosmetically satisfactory, results regarding continence have been inconsistent.² It is possible that dividing the sphincters during dissection and lining the anal canal with insensate mucosa negatively influence continence. Additionally, the lack of a normally

functioning internal sphincter makes the attainment of complete fecal continence difficult to achieve. The deranged motility of the recto-sigmoid colon in these patients adds complexity to successfully restoring fecal continence.³

The desire to preserve the sphincters, place sensate skin within the control of the sphincters, and shorten recovery has led to the development of this minimally invasive surgical technique. This technique can be

performed in newborns as a single stage but currently it is preferred to perform an initial diverting proximal sigmoid colostomy that is left in place for 2-3 months after the laparoscopic assisted pull-through to allow for adequate dilation of the newly constructed anus.⁴

PATIENTS AND METHODS

Twenty four patients with high anorectal anomalies constitutes the material of this study, presented to the neonatal surgical unit, specialized children hospital Cairo University from March 2004 to April 2007.

All patients had laparoscopically assisted anorectal pull-through (LAARP) for high imperforate anus. Hospital charts and surgical notes were reviewed and clinical characteristics tabulated.

All patients underwent divided sigmoid colostomy at birth as an initial step. Patients had distal colostograms before anorectoplasty to define the site of communication of rectal fistulae with genitourinary structures.

Operative Technique: The technique described by Georgeson⁴ was used in every patient with some modifications. A small window is first developed in the mesorectum at the level of the peritoneal reflection with an electrocautery. The rectum is mobilized in a circumferential fashion. The dissection follows close to the muscle wall of the rectum. Caudal dissection at this step should not be too close to the bowel to avoid colotomy, and not too far away to avoid nerve or ureteric injury. As the fistula is visualized, it is dissected free, and clipped. The fistula closure was reinforced by an endoloop. Intra corporeal transfixion was used to close the fistula in some patients .

When the bowel is retracted cephalad out of the pelvis, this dissection allowed examination of the underlying levator muscles in the pelvic floor (Figs. 1,2). When present, the pubococcygeus muscle is visualized clearly. When there was insufficient muscle mass to clearly identify pubococcygeus, the midline is identified based on the position of the distal end of the divided fistula and urethra. Transperitoneal electro-stimulation of the levator ani muscle sling can be done by passing a muscle stimulator through a 10-mm trocar. The center of contraction of the levator ani muscle sling is visualized by direct muscle stimulation at a current intensity of 60 milliamps. Externally, the anal area of

the perineum was mapped using transcutaneous electro stimulation at an intensity of between 100 and 150 milliamps (Peña Muscle Stimulator). The anterior, lateral, and posterior limits of this anal area are marked with sutures, and a 10-mm vertical midline incision is made in the perineum at the site of the proposed anal orifice.

A Veress needle is passed through the intrasphincteric plane and advanced between the 2 bellies of the pubococcygeus muscle in the midline using laparoscopic guidance, just posterior to the urethra. The rectum is grasped with Babcock clamp and then brought out behind the trocar to the perineum. Care is taken to ensure that the rectum is not twisted. The rectal fistula and the fistulous tract are sutured to the edges of the skin incision with interrupted absorbable sutures (Fig. 3).

Pelvic MRI and EMG of the external anal sphincter are done for each baby to assess the position of the rectum in relation to the muscles, and the degree of muscle hypoplasia present. This was done for each patient before closure of colostomy.

Evaluation for fecal continence was done two months following colostomy closure. Each mother was asked to record a defecation diary for a period of 7 days. Items for recording include: the day, time, amount of stool (large, average, small, or staining of clothes), and the consistency of stool either solid or liquid. Patients were classified into the following groups. Good: low number of motions per day (1-3) with large volume of stool per motion, the patient is clean between motions, with no staining. Moderate: moderate frequency of motions daily (4-6) and infrequent staining between motions. Poor: frequent motions per day 7 and more, with small volume of stool per motion with frequent staining of clothes between motions.

RESULTS

Laparoscopically assisted anorectoplasty (LAARP) was done for 24 patients; 21 males and 3 females. The age at surgery ranged between 4 and 14 months; mean 6.5 months. Twelve patients had rectoprostatic fistula, five patients had rectobulbar fistula, three had recto-bladder neck fistula, two recto vaginal, one cloaca and one pouch colon syndrome.

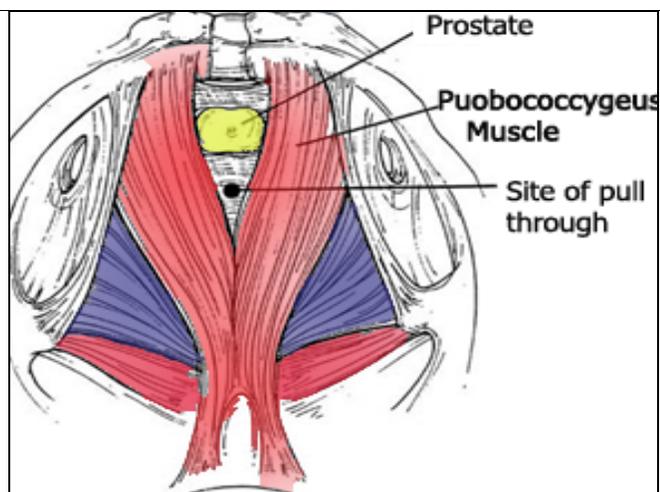


Fig 1. Laparoscopic visualization of the pelvis after dissection of the rectum out of the pelvis.

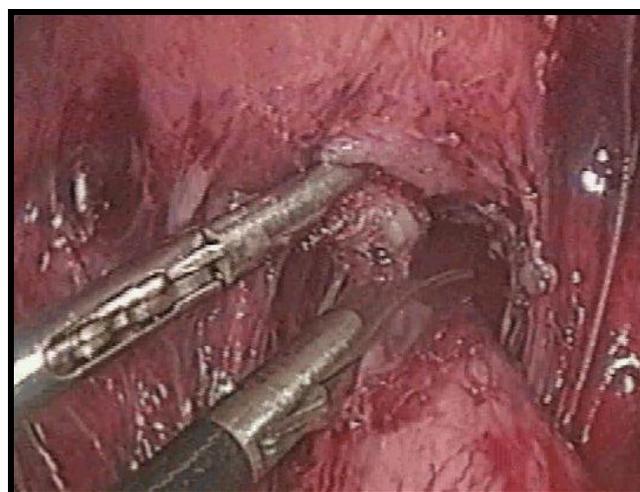


Fig 2. Sharp division of the fistula.

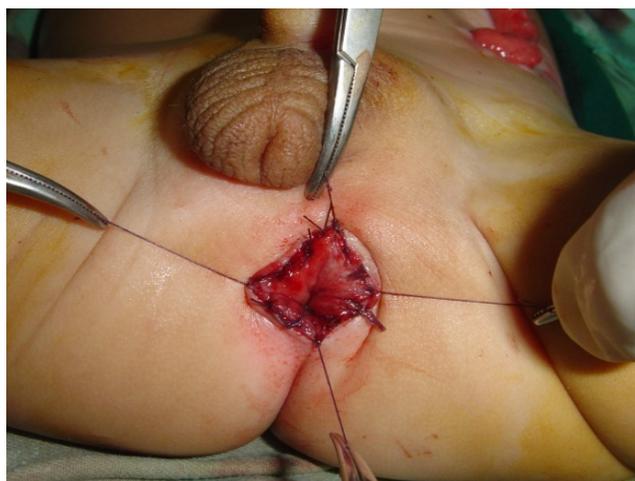


Fig 3. Anoplasty.

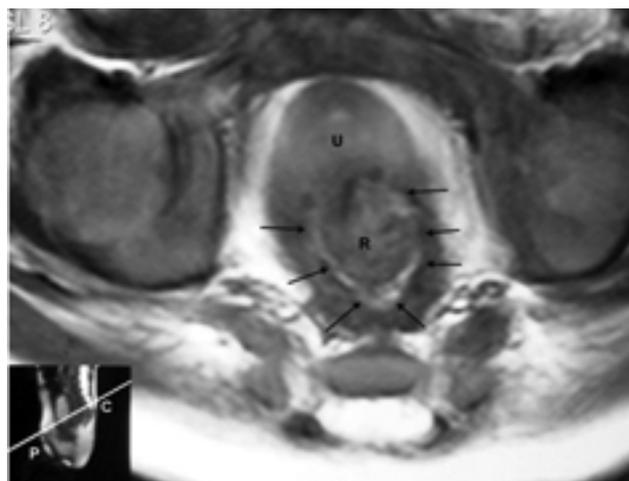


Fig 4. MRI: Puborectalis at level of P-C line.

Post operative complications occurred in four patients; three developed rectal mucosal prolapse; that required mucosectomy before colostomy closure. One patient had adhesive intestinal obstruction, which necessitated a laparotomy for adhesiolysis three weeks later. The small bowel loops were found adherent down in the pelvis. In one patient with rectal prolapse there was additional retro-rectal abscess that was diagnosed two weeks postoperatively and was drained through a laparotomy approach.

There were no complications related to the urinary system such as retention of urine, urinary incontinence, urethral stricture, or recurrence of recto

urogenital fistula. Also there was no wound infection, no hernia through the port sites, no anal stricture or anal retraction. Table 1 summarizes the post-operative complications.

Result of Pelvic MRI: In 21/24 patients the rectum was centralized in the three levels of transverse sections at levator ani, muscle complex, and external anal sphincter. In all the 24 patients there was no urethral diverticulum.

In one patient the rectum was mal-positioned in the lower most level where it was anterior in relation to the external anal sphincter. This patient had later limited anoplasty to push back the rectum within the

external sphincter. In two more patients the rectum was deviated to the right side at the level of the muscle complex, but higher at the level of puborectalis, and lower at the level of the external sphincter it was well centralized (Fig.4).

EMG study showed that 22 patients had preserved integrity of the EAS, two patients had no activity at 12 o'clock and the muscle was disturbed at this site. The results of EMG are shown in the Table 2.

Evaluation: The overall clinical assessment for continence of the cases showed that 55% had good outcome, 35% had moderate, and 10% had poor functional outcome.

Table 1. Post operative complications.

Complication	No of Patients
Rectal prolapse	3
Adhesive obstruction	1
urinary incontinence	0
Wound infection	0
Hernia through port site	0
Neoanus complications	0
Total	4

Table 2. Table 2: Results of EMG.

EMG findings	No of patients
EAS integrity:	
Preserved	22
Disturbed	*2 patient no activity at 12 o'clock
EAS activity:	
Normal activity	8
Partial denervation and re innervation	16 (11 mild weakness and 5 severe weakness)

* This patient had deficient anterior part of EAS detected by MRI.

DISCUSSION

Historically, the surgical techniques used for correction of anorectal malformations can be divided into 3 periods according to the surgical aims. The first period lasted until 1948, when Rhoads achieved first major

success with the abdominoperineal pull-through operation. During that period, the priority and only possible aim was to restore intestinal continuity.⁵ The second period of about 30 years focused on the reconstruction of the anorectal sphincter.⁶⁻⁸ Fecal incontinence represented the main postoperative problem. After the introduction of posterior sagittal anorectoplasty (PSARP) according to Peña and De Vries in 1982, the problem of sphincter reconstruction changed remarkably.¹

The PSARP involves incision from coccyx to perineal body, to widely expose the external sphincter, the levators, the rectum, and distal fistula to facilitate surgical repair.⁹ It is possible that dividing the sphincters during dissection and lining the anal canal with insensate mucosa negatively influence continence.⁴ Georgeson et al⁴ described a new surgical repair for high imperforate anus that utilizes a laparoscopic technique to reduce the amount of posterior dissection required for accurate placement of the bowel into the muscle complex. The desire to preserve the sphincters, place sensate skin within the control of the sphincters, and shorten recovery has led to the development of this minimally invasive surgical technique.⁴

The timing for LAARP primarily is determined by the surgeon's preference. Primary advantages of performing the procedure in the newborn period without a colostomy include the avoidance of the complications of multiple procedures and the potential neuro-developmental superiority of the infant stooling through the anus soon after birth.¹⁰ On the other hand the benefits of performing a proximal sigmoid colostomy with a staged pull-through include more complete decompression of the recto-sigmoid colon for the pull-through procedure, having time to gradually dilate the preserved anal fistula after pull-through and the added safety of diversion when performing the LAARP.⁴ In review of ten cases of LAARP by Georgeson, the age of patients ranged between 1 day and 1 year. Four Patients were treated with primary LAARP in the newborn period without prior colostomy; one of them had perineal infection around the neoanus 3 weeks after LAARP and this required a diverting sigmoid colostomy in order to control the infection.⁴ In this work definitive operation (LAARP) was done at a mean age of 6.5 months, with a range between 4 and 14 months.

Pulling the rectum in the proper anatomical site is the keystone step in the definitive reconstruction. Laparoscopic approach gives the credit of visualization of the puborectalis muscle sling. Moreover direct

stimulation of this muscle can be done by passing the muscle stimulator via a 10 mm port. These methods proved accurate as confirmed by the post operative MRI examination.

In posterior sagittal anorectoplasty gaining length is done by circumferential per rectal dissection with division of the vessels that hold the rectum. The rectum will depend on the intra-mural blood supply. If the rectal wall is injured, this blood supply is damaged and ischemia may occur. In cases of recto-bladder neck fistula, a laparotomy, in addition to the posterior sagittal approach is mandatory.¹¹ using the laparoscopic technique, there have been no problems in gaining enough length for the pull-through. No patients have shown ischemia or stricture at the anorectal anastomosis.

Postoperative complications after LAARP occurred in four patients (16.6%) rectal prolapse in three (12.5%) and adhesive intestinal obstruction in one patient (4.1%). There were no wound infection, no incisional hernia through the port opening.

In this work, no intra-operative injury to genitourinary organs occurred and there were no urinary incontinence or retention of urine after catheter removal.

Most of the reported urinary injuries after an imperforate anus repair in male patients, result from of denervation or damage provoked by the operation. Some of these patients may suffer from urinary incontinence.¹² The evaluation of the position of the rectum after pull-through is best done by MRI. Yamataka et al used the Postoperative MRI in three patients with high imperforate anus repaired by LAARP and confirmed that the rectum was located in the center of the levator ani muscle sling and muscle complex.¹³ Wong et al performed post operative MRI for ten patients after LAARP and when compared with conventional PSARP patients, a significantly lower proportion of LAARP patients had sphincter asymmetry (40% vs. 100%, $p < 0.05$) and peri-rectal fibrosis (40% vs. 87.5%, $p < 0.05$). The positioning of the rectum was, however, central for both groups (90% vs. 87.5%).¹⁴

In this study post-operative MRI was done for all cases. The rectum was centralized in relation to the muscles of continence in 87.7% of patients (21/24). One had anterior position of the rectum in relation to the EAS. The other two had deviation of the rectum to the right of the muscle complex.

Constipation was defined as less than three spontaneous bowel movements per week, rectal impaction, and/or an abdominal fecal mass.¹⁵ Constipation is a major complication in patients who have undergone posterior sagittal anorectoplasty (PSARP) for a high anorectal malformation. In 1995, Peña presented a very critical and detailed analysis of 245 patients examined postoperatively. Chronic constipation occurred with a rate of 55.5% in cases of bulbar fistulae but in the higher anorectal malformations with prostatic or bladder neck fistulae the rate was 41.4% and 18.2% respectively.² In a study by Chen et al, constipation was noted shortly after anorectoplasty in 18 of 25 (72%) high and intermediate anomalies treated with PSARP, but in none of 5 high and intermediate anomalies treated with Rehbein's mucosa-stripping endorectal pull-through. It was concluded that anorectal function in patients with repaired imperforate anus seems to be more affected by the extent of endopelvic dissection.¹⁶

All of our twenty four patients were passing stools daily and none had constipation over the follow up period that ranged between 6 and 14 months with a mean of 8 months.

In a study by Lin et al aimed to evaluate clinically and manometrically the anorectal function of patients with imperforate anus after repair with LAARP, as compared with posterior sagittal anorectoplasty, a positive recto-anal inhibitory reflex was detected in 88.9% (8/9) of the LAARP patients, and in only 30.8% (4/13) of the PSARP patients ($p < 0.01$). They concluded that in the early postoperative stage, patients repaired with LAARP had more favorable findings in anorectal manometry than patients repaired with PSARP.¹⁷

Control of defecation after surgical correction of high and intermediate types of congenital anorectal malformations is difficult.¹⁸ the results of Stephens with 26 patients with a supralelevator anomaly operated by him and examined over a long period were promising. Out of 22 patients with a sacroperineal pull-through, 64% showed good, 32% satisfactory and one child poor results. The results of sacro-abdominoperineal pull-through were slightly poorer.¹⁹ The primary results of Kiesewetter and Chang with the Rehbein techniques were similar to those of Stephens. A series of post-treatment studies performed from 1962 to 1970 and from 1971 to 1984 showed fecal incontinence in 57% and 50%, respectively, of the patients with high atresia.²⁰

In one study, forty one patients with high and intermediate congenital anorectal anomalies were

treated by Mulder et al Between 1979 and 1992. In 16 patients a pull-through operation (Kiesewetter-Rehbein) was performed. After 1984, the posterior sagittal anorectoplasty (PSARP) was used in 25 patients as the primary operation. After the pull-through operation six out of 16 patients (37.5%) were continent, versus 40 % (10/25) following the PSARP. Patients with a sacral defect were continent only in 16% as compared to 44% of the patients with a normal sacrum. They concluded that the PSARP for high and intermediate anorectal malformations does not give better functional results than the pull-through operation.¹⁸

Regarding the technique of LAARP the number of series in the literature is still small to draw statistical significance. However, Lin et al used the number of motions per day for the early clinical assessment of nine cases of high imperforate anus after LAARP. Seven of nine LAARP patients had an acceptable frequency of one to four bowel openings per day.¹⁷

In this study we mainly relied upon the number of motions per day and the presence of soiling in between motion in the assessment of patients for continence. The overall result of our study as regard continence showed that 55% had good, 35% moderate and 10% poor results.

The basic concept of LAARP is that of fistula transfer from the urethra through the levator sling and external anal sphincter muscle complex to the anal surface. There is no need to divide the muscle complex from below, because the pubococcygeus can be visualized and targeted from above, and immediately after the procedure, strong and symmetric contraction of the sphincter around the neoanus provides reassurance that the bowel was accurately brought through the sphincters.

This approach conserves bowel, and by securing the fistula to the perineum, preserves distal bowel wall, which may contain muscle fibers of internal sphincter function.⁴

The preliminary results of LAARP are encouraging, and with increased use of laparoscopy it might be the treatment of choice in high and intermediate anorectal anomalies in the near future.

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