

Laparoscopically Assisted Anorectal Pull-Through for High Imperforate Anus—A New Technique

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Background/Purpose: This report describes a new technique of laparoscopically assisted anorectal pull-through (LAARP) for repair of high imperforate anus. The procedure utilizes minimal perineal dissection, preservation of the distal rectum, and accurate placement of the rectum within the levator ani and external anal sphincter muscle complex.

Methods: Sharp dissection and cautery was used laparoscopically to expose the rectal pouch down to the urethral or vaginal fistula, which was clipped distally and divided. The pelvic floor musculature was then assessed and the levator sling identified. Externally, electrostimulation was used to define the center of the anal dimple. An 8-mm skin incision was made, centered at the strongest cephalad contraction. Using a hemostat, minimal blunt dissection on the perineum was guided by transillumination from the laparoscopic light source. A trocar, consisting of a radially expandable sheath over a Vaess needle, was passed through this defined plane in the external sphincter muscle complex and advanced into the pelvis between the 2 bellies of the pubococcygeus muscle, guided by laparoscopic visualization. This perineal trocar therefore formed a passage through the center of the striated muscle complex and levators. The rectal fistula, which had been dissected out laparoscopically, was grasped using the perineal trocar and exteriorized to the perineum.

Anorectal anastomosis was performed with absorbable interrupted suture.

Results: Seven patients were treated with initial colostomy in the newborn period followed by delayed LAARP 2 to 12 months later. In 4 newborn infants, the LAARP was performed as a primary procedure without prior colostomy. Laparoscopic mobilization has been possible on all cases attempted. All of the patients have a brisk and symmetric anal contraction with perineal electrostimulation.

Conclusions: Lack of long-term follow-up precludes accurate assessment of the potential for fecal continence. However, short-term experience has been that this new method of pull-through for imperforate anus offers many advantages, including excellent visualization of the rectal fistula and surrounding structures, accurate placement of the bowel through the anatomic midline and levator sling, and minimally invasive abdominal and perineal wounds.

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INDEX WORDS: Imperforate anus, laparoscopically assisted anorectal pull-through, laparoscopy.

POSTERIOR SAGITTAL anorectoplasty (PSARP), popularized by de Vries and Peña¹ has become standard surgical management of imperforate anus. Patients with high imperforate anus typically have required laparotomy for diverting colostomy at birth, followed by PSARP after several months of growth. 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. Despite excellent exposure of the anatomy and exact placement of the distal rectum within the muscle complex, continence often is less than ideal. For instance, approximately half of boys with rectoprostatic fistulas have significant soiling, and only a quarter of such patients have normal fecal continence.² In an attempt to improve on these results, early PSARP without diverting colostomy in the newborn period was proposed recently to allow newborn infants to gain the experience of normal defecation without colostomy.³ We describe a new surgical repair that utilizes a laparoscopic vantage point to reduce the amount of posterior dissection required for accurate placement of the bowel into the muscle complex.

MATERIALS AND METHODS

Since October 1995, 11 patients have undergone laparoscopically assisted anorectal pull-through (LAARP) for high imperforate anus. Hospital charts and surgical notes were reviewed and clinical characteristics tabulated.

Seven patients (1 girl and 6 boys) underwent divided sigmoid colostomy at birth for high imperforate anus, and 4 boys underwent LAARP as a primary procedure. Patients who had colostomies underwent distal colostograms before anorectoplasty to define the site of communication of rectal fistulae with genitourinary structures. When performed as a primary pull-through procedure, cystoscopy was utilized at the time of operation to determine the level of the fistula. The bladder was decompressed by transurethral catheterization.

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Laparoscopy was performed as described by Georgeson et al.⁴ Pneumoperitoneum to a pressure of 8 to 12 cm H₂O was established using a Veress needle (Endopath UV120, Ethicon, Inc, Somerville, NJ) inserted approximately 3 cm above and to the right of the umbilicus. This incision is then used for placement of a 4-mm trocar (product #30115, Karl Storz Instruments, Germany). Two additional 4-mm trocars were placed in the midline, 2 cm cephalad to the umbilicus and 2 cm to the left of the umbilicus. A 5-mm trocar (Step SL75, InnerDyne Corporation, Salt Lake City, UT) was placed in the left hypogastrium. Laparoscopic rectal dissection was begun at the peritoneal reflection. Using hook cautery, the distal mesorectum was divided and bipolar scissor (Evershears LP; Everest Medical, Minneapolis, MN) cautery dissection continued anteriorly and laterally on the rectal wall. As the rectum tapered distally, the fistula to the urethra or vagina was identified, clipped (Ligaclip Allport AL326, Ethicon Endosurgery, Cincinnati, OH) at the insertion on the posterior urethra, and was sharply divided. When the bowel was retracted cephalad out of the pelvis, this dissection allowed examination of the underlying levator muscles in the pelvic floor (Fig 1). When present, the pubococcygeus muscle was visualized clearly. When there was insufficient muscle mass to clearly identify pubococcygeus, the midline was identified based on the position of the distal end of the divided fistula and urethra. Externally, the anal area of the perineum was mapped using transcutaneous electrostimulation (Peña Muscle Stimulator, Radionics Corporation, Burlington, MA). This area of maximal contraction and ventrocephalad elevation of the perineum was noted. The anterior, lateral, and posterior limits of this anal area were marked with sutures, and an 8-mm vertical midline incision was made in the perineum at the site of the proposed anal orifice. The intrasphincteric plane was dissected bluntly from below to the level of the levator sling using laparoscopic backlighting (Fig 2). A radially expanding trocar over a Veress needle was 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. If the needle was inaccurately passed to either side of the midline, it was readily apparent because of laparoscopic surveillance and easily corrected before radial dilation of the tract. The tract was then dilated radially to 10 mm and the divided rectal fistula grasped and pulled onto the perineum while removing the trocar (Figs 3A and B). No attempt was made to suture rectum to the levator musculature. The anastomosis between rectum and

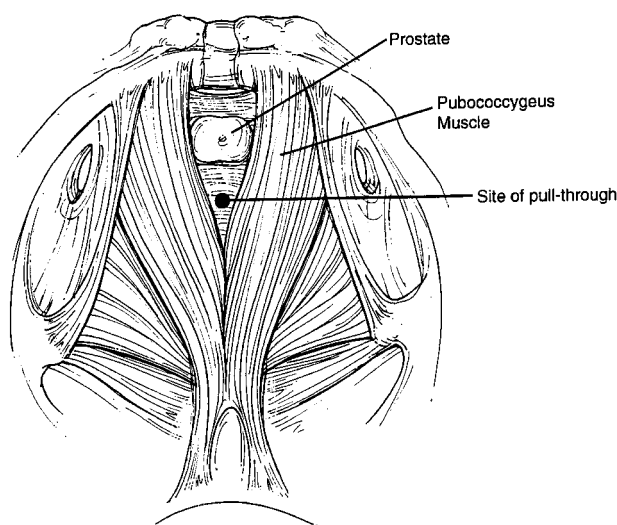


Fig 1. Laparoscopic visualization of the pelvis after dissection of the rectum out of the pelvis in a typical boy with high imperforate anus and rectourethral fistula.

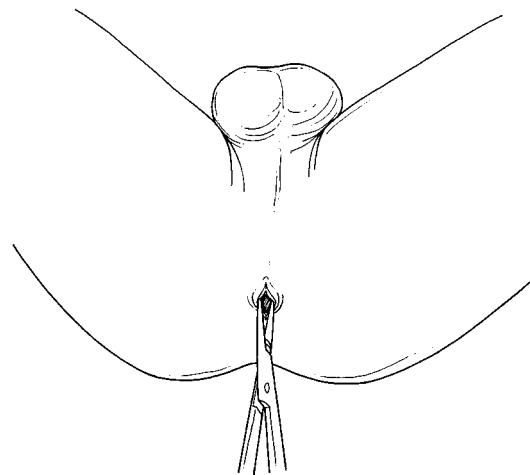


Fig 2. Perineal dissection after transcutaneous electrostimulation. Blunt dissection toward the laparoscopic light source facilitates accurate placement of a trocar through the external sphincter muscle complex.

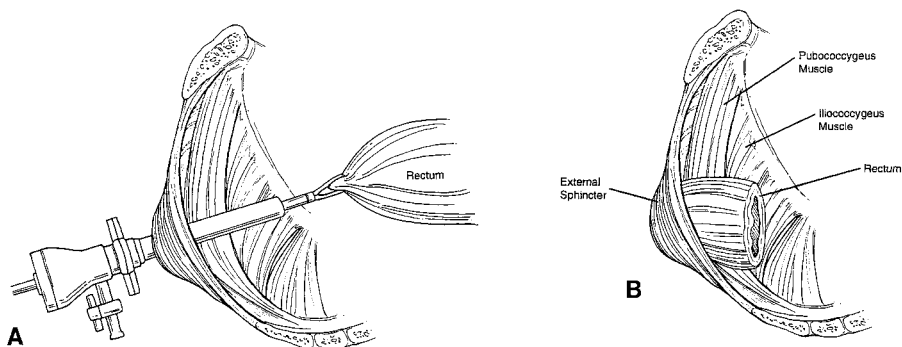
anus was completed with interrupted 3-0 polyglycolic acid suture. The rectum was retracted cephalad laparoscopically and secured to the presacral fascia with 2-0 silk sutures (D8015 SKI Taper EN-S needle, Ethicon Corp, Somerville, NJ). This fixed retraction lengthened the skin-lined anal canal (Fig 4).

RESULTS

The experience in this series represents all cases done to date using this technique. Eleven patients have undergone LAARP including 1 girl and 10 boys. Ten of these patients presented with evidence of a high anorectal malformation, including 1 girl with a vaginal fistula, and 1 boy with rectal atresia without fistula. One boy with a perineal fistula was treated with LAARP. Clinical characteristics of the patients are summarized in Table 1. Most patients were treated initially with divided colostomy in the newborn period, followed 3 weeks to 9 months later with LAARP. Using this technique there have been no problems gaining enough length for pull-through, regardless of whether the patients had undergone prior colostomy. No patients have shown ischemia or stricture of the anorectal anastomosis. Patient 5, who was treated with primary LAARP as a newborn without prior colostomy, had perineal infection around the neoanus 3 weeks after LAARP because of inadequate parental dilatation. This cleared up without stricture after a diverting sigmoid colostomy was constructed. This colostomy subsequently has been taken down, the neoanus is well healed, and the patient has 3 to 4 bowel movements per day.

Patient 1, the oldest patient in this series, is now 4 years of age and was born with a severe caudal regression syndrome with a high vaginal fistula, poor gluteal development, tethered spinal cord, and absence of the right leg. She is not continent of feces but has had satisfactory results from her bowel management program. The other

Fig 3. (A) Sagittal view of the trocar through the external sphincter and levator ani and pull-through of the rectum. (B) Position of the rectum after pull-through to the perineal wound.



patients are as yet too young to evaluate for continence, but have symmetric anal contraction to stimulation and strong squeeze on digital rectal examination. None of the patients has had rectal mucosal prolapse.

DISCUSSION

The technique of LAARP bears some similarities to the now infrequently used procedures that combined laparotomy with a minimal perineal dissection. Over the years, surgeons have made major contributions to our knowledge of the normal anorectal anatomy⁵ and the anatomy of anorectal malformations.⁶ Stephens,⁷ Rehbein,⁸ and Kiesewetter,⁹ to name a few, appreciated the concept of placement of the rectum into the levator sling mechanism, and developed the abdominoperineal and later the sacroabdominoperineal approaches to high imperforate anus repair. These surgeons also believed in the concept that surgical section through the sphincter muscles

could be detrimental to future continence. However, in their zeal to do no harm to the muscles of fecal continence, clinical results suffered most from the fact that with these techniques, there is inadequate visualization and identification of the levators and external sphincter muscle complex. Even though addition of the sacral incision was supposed to facilitate identification of the pubococcygeus and accurate tunneling of the rectum to the perineum, the exposure essentially was tangential to the plane of the structures that needed to be seen, and results of these operations were unsatisfactory. This problem was remedied by the realization of deVries and Peña¹ that adequate visualization of the sphincteric mechanism could be achieved with the posterior sagittal approach, dividing the external sphincter and levators in the midline to expose the bowel and associated genitourinary fistula. There was no dependence on blind palpation of the appropriate muscle plane. The PSARP exposes the muscles responsible for continence, but also divides the constricting mechanism of the muscle complex. There also is a "learning curve" for this operation, and keeping the dissection in the midline can be challenging, even for experienced pediatric surgeons.

The greatest benefit of LAARP derives from the fact that it allows the surgeon to treat a high lesion essentially like a low lesion. The basic concept is that of fistula transfer from the urethra or vagina 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. For our initial patients treated with LAARP, colostomy was performed in the newborn period. Although primary colostomy is not absolutely necessary for this procedure, it seems prudent as initial experience is gained or if there is any concern about bowel viability, contamination, or quality of the anorectal anastomosis. This approach conserves bowel, and by securing the fistula to the perineum, preserves distal bowel wall,

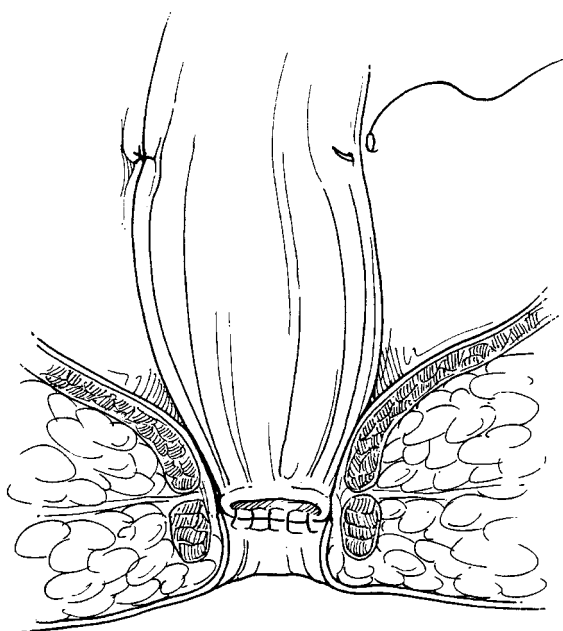


Fig 4. The neoanus is formed by anorectal anastomosis and the skin-lined anal canal is deepened by securing sutures to presacral fascia.

Table 1. Patient Characteristics

Patient No.	Age	Age at LAARP	Fistula	VACTERL	Colostomy*
1	4 yr	8 mo	Vaginal	VSD, horseshoe kidney, tethered cord, right leg agenesis	Yes
2	2 yr	2 d	Prostatic	Renal dysgenesis	Yes
3	18 mo	9 mo	Prostatic	AV canal, UPD16, bronchotracheomalacia	Yes
4	18 mo	9 mo	Prostatic	VSD, tethered cord, left renal agenesis	Yes
5	7 mo	2 d	Prostatic	VSD, VUR	No
6	8 mo	6 mo	Prostatic	Tracheal stenosis req tracheostomy	Yes
7	3 mo	3 wk	Perineal	Right renal agenesis	Yes
8	10 mo	2 d	None		No
9	8 mo	2 mo	Prostatic		Yes
10	7 mo	1 d	Prostatic		No

Abbreviations: VSD, ventricular septal defect; AV, atrioventricular; VUR, vesicoureteral reflux; UPD, uniparental disomy.

*Sigmoid colostomy was done before LAARP.

which may contain muscle fibers recruitable for internal sphincter function.¹⁰

The timing for LAARP primarily is determined by the surgeon's preference. We performed 4 pull-through procedures in the newborn period without a diverting colostomy. The other 7 procedures were performed from 1 month to over a year after diverting colostomy. The technical aspects and safety of the procedure were similar regardless of the age of the patient.

The primary advantages of performing the procedure in the newborn period without a colostomy include the avoidance of the complications and multiple procedures associated with a colostomy and the potential neurodevelopmental superiority of the infant stooling through the anus soon after birth. 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. The authors are divided among themselves in their opinion regarding the best timing for this procedure.

Colostomy is indicated in high-risk patients with high imperforate anus who have other major medical or surgical problems, or patients who have anatomic features that need further study for adequate definition.

For patients with anorectal malformations, laparoscopy provides a unique and excellent opportunity for inspection of the condition of the pelvic musculature from above. In particular, the pubococcygeus muscle, through which the rectum should normally pass, can be easily visualized. The center of the 2 arches of this muscle can then be targeted for precise pull-through of the distal rectum, using minimally invasive abdominal and perineal incisions.

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Discussion

A. Peña (New Hyde Park, NY): I want to congratulate Dr Inge, Dr Georgeson, and Dr Albanese for this paper

that shows us that ingenuity has no limits when we try to progress.

I find this technique particularly applicable for those patients who have a rectobladder neck fistula. But that happens 10% of the time, and that is the only indication for a laparotomy in a patient. When you make a good diagnosis, you only have to open the abdomen in boys 10% of the times. The rest of times you do everything via the perineum.

I still feel resistant to accept to change a totally extraabdominal procedure into a transabdominal operation and then rather than being minimally invasive it will become maximally invasive, because we do not need to open the abdomen 90% of the time.

I believe that laparoscopy is here to stay, and we should continue looking for better and less traumatic ways to treat children.

And finally, for all these new approaches, including the transanal approach, neonatal approaches with no colostomy, now we know that they are feasible, that is a great advance. The big question is still, is this the best in the long term for the patients? And all those who are doing this have the moral obligation to report to us what happens to all these patients in the future.

T. Inge (response): Thank you for your comments. We also will certainly be following up with these patients with keen interest.