## **Research Article**

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# Laparoscopic assisted anorectoplasty in children: a prospective study

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## **ABSTRACT**

**Background:** Anorectal malformations are a spectrum of congenital defects that continue to represent a significant challenge for the paediatric surgeon. Development of minimally invasive surgery has probably been the biggest revolution in surgical practice in last two decades, which has gone through a period of rapid development during last 10 years; one of such changing procedure is LAARP for ARM. The aim of this study is to evaluate the clinical and functional outcomes in children with anorectal malformation treated by LAARP.

**Methods:** From Sep.2012 to June 2014, 16 patients with intermediate and high imperforate anus underwent LAARP. Inclusion criteria were children with ARM, age >3 months, stage I sigmoid colostomy, with no associated morbid anomaly, Operative procedure followed was that given by Georgeson KE (2000).

**Results:** 16 cases were included in this study out of which males were 87.5%. The most common ARM type was rectobulbar fistula (50%). The mean operative time was 2.75 hrs approx. and mean blood loss 24 ml approx. Conversion rate to APPT was 25%. The mean length of hospital stay was shorter (8 day's approx). Few postoperative complications were mucosal prolapse 6.25%, stenosis 12.5%, and peritoneal contamination with faecal matter 12.5%, temporary neurogenic bladder 12.5%.

**Conclusions:** Laparoscopically assisted anorectal pull-through has advantages, including shorter hospital stay, minimal blood loss and better functional outcome. Satisfactory rectal continence can be achieved in children with imperforate anus after LAARP. Shorter dissection of rectum in the intra-abdominal space may be helpful in preventing rectal mucosal prolapse.

**Keywords:** Laparoscopic assisted anorectoplasty, Anorectal malformations, Posterior sagittal anorectoplasty, Abdomino-perineal pull through

## INTRODUCTION

The development of minimally invasive surgery has probably been the biggest revolution in surgical practice in last two decades, which has gone through a period of rapid development during last 10 years. These minimal access techniques have changed the approach to many surgical procedures; one of such changing procedure is laparoscopically assisted anorectoplasty (LAARP) in

children which is receiving widespread interest from many general and paediatric surgeons.

Anorectal malformations (ARMs) are a spectrum of congenital defects that continue to represent a significant challenge for the paediatric surgeon. These defects are frequently associated with life-long debilitating sequelae such as faecal and urinary incontinence and sexual inadequacy. ARMs occur in approximately 1 in 4000 to 5000 live births, with imperforate anus being the most common variant.

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Over the past several years, techniques have evolved in the repair of these, starting with the abdominoperineal pull-through, sacroperineal pull-through and posterior sagittal anorectoplasty (PSARP).<sup>3</sup> PSARP is current standard of surgical care for ARMs. This operation provides excellent exposure of the anatomy and the precise placement of the distal rectum within the muscle complex.<sup>4</sup>

Though this approach is cosmetically satisfactory, results continence have been inconsistent. Additionally, the lack of a normally functioning internal sphincter makes the attainment of complete faecal continence difficult to achieve. The deranged motility of the recto-sigmoid colon in these patients adds complexity to successfully restoring faecal continence. 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 LAARP.<sup>5</sup> Benefits of the procedure include lack of division of the muscle complex, no need for laparotomy, decreased pain to the patient, and potentially perineal wound complications. advantages include repair of associated defect at operation (i.e., hernia, identification and repair of cryptorchid testes), superior pelvic visualization not possible with open surgery, and anatomic placement of the pull-through bowel by identifying the central portion of the puborectalis from inside and the external anal sphincter from outside the patient.<sup>6</sup> However, long term follow-up is necessary to compare the benefits of LAARP against PSARP.7

In the background of this, the present study was undertaken to evaluate whether laparoscopy is less invasive and achieves better functional results and to establish it as an alternative to conventional surgery.

#### **METHODS**

A prospective study conducted from September 2012 to September 2014 in Department of Paediatric Surgery IMS, BHU. Approval was obtained from ethical committee of university. Patients up to 2 years of age group, coming to surgical ward through surgical outpatient department of SS Hospital Varanasi, admitted as a case of anorectal malformation.

## Criteria for selection of cases

#### Inclusion criteria

- Patients with anorectal malformation willing for surgery by laparoscopic technique and fit for general anaesthesia.
- 2. Age >3 months.
- 3. Stage I sigmoid colostomy.
- 4. Intermediate and high types ARM.
- 5. No other associated morbid anomaly.

#### Exclusion criteria

- 1. ARM with associated syndrome.
- 2. Cloaca type ARM.
- 3. Low type ARM.
- 4. Associated morbid anomaly.
- 5. Age <3 months.

#### Procedure

A Standard proximal sigmoid colostomy is performed in the newborn. After 3 months patient is posted for laparoscopic anorectoplasty, Patient is positioned in lithotomy at the end of table, a bladder catheter is placed. Pneumoperitoneum to a pressure of 8 to 12 cm H<sub>2</sub>O is established using a Veress needle inserted at umbilicus. This incision is then used for placement of a 5 mm trocar for umbilical port. A 3 mm trocar is placed in the right anterior axillary line just below liver. A 3 mm trocar is placed in right anterior axillary line just above anterior superior iliac spine.

Laparoscopic rectal dissection is begun at the peritoneal reflection. Using hook cautery, the distal mesorectum is divided and bipolar scissor cautery dissection continued anteriorly and laterally on the rectal wall. As the rectum tapered distally, the fistula to the urethra or vagina is identified, cauterized at the insertion on the posterior urethra, and sharply divided and not ligated. When the bowel is retracted cephalad out of the pelvis, this dissection allows examination of the underlying levator muscles in the pelvic floor. When present, the pubococcygeus muscle is visualized clearly. When there is 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. Externally, the anal area of the perineum is mapped. This area of maximal contraction and ventrocephalad elevation of the perineum is noted. The anterior, lateral and posterior limits of this anal area are marked with sutures, and 1 cm vertical midline incision made in the perineum at the site of the proposed anal orifice. The intrasphincteric plane is dissected bluntly from below to the level of the levator sling using laparoscopic backlighting. A radially expanding trocar over 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. If the needle is inaccurately passed to either side of the midline, it gets readily apparent because of laparoscopic surveillance and easily corrected before radial dilation of the tract. The tract is then dilated radially to 10 mm and the divided rectal fistula grasped and pulled onto the perineum while removing the trocar. No attempt is made to suture rectum to the levator musculature. The anastomosis between rectum and anus is completed with interrupted 3-0 polyglycolic acid suture. The rectum is retracted cephalad laparoscopically.8



Figure 1: Neonate with anorectal malformation.



Figure 2: Fistula to the prostatic urethra seen.



Figure 3: Rectal fistula pulled onto the perineum.



Figure 4: Completed anorectoplasty.

#### Criteria for evaluation of this technique as follows;

- 1. Stay at hospital.
- 2. Duration of surgery.
- 3. Per-op parameters:
- a. Injury to vas.
- b. Injury to urethra.
- c. Injury to gut.
- d. Blood loss.
- e. Transfusion required.
- f. Conversion rate.
- g. Peritoneal contamination.
- 4. Post operative complications:
- i. Mucosal prolapse.
- ii. Anal stenosis.
- iii. Port site hernia.
- iv. Port site sepsis.
- v. Neurogenic bladder.
- vi. Incontinence.
- vii. Functional outcome.
- viii. Morbidity.

## **RESULTS**

Table 1: Distribution of cases according to age group (n=16).

Age group	Number of cases	% of cases
3-9 months	5	31.25%
10 –15 months	6	37.50%
16 –22 months	5	31.25%
Total	16	100.00

Distribution of patients was done in the three age groups. Group 1 of 3 to 9 months old comprised 5 patients (31.25%). Group 2 of 10 to 15 months old comprised 6 patients (37.50%) and Group 3 of 16 to 22 months old comprised 5 patients (31.25%). Almost equal number of patients was observed in all age groups, with 10 to 15 months age group showing slight predominance.

Table 2: Distribution of cases according to sex.

Sex	Number	% of
	of cases	cases
Male	14	87.50%
Female	2	12.50%
Total	16	100.00

Majority of patients with anorectal malformations were male 14 (87.50%), while there were only 2 (12.50%) female patients in the present study.

Mean weight of the study group was 7.68±2.67 (range 5-12) kg, with equal number of patients (50%) in each, 5 to 7 kg and 8 to 12 kg weight groups respectively.

Table 3: Distribution of cases according to body weight.

Body weight	Number of cases	% of cases
5-7 kg	8	50%
8-12 kg	8	50%
Total	16	100 %

Table 4: Distribution of ARM with respect to site of fistula.

ARM defect	Number of cases	% of cases
Rectoprostatic fistula	a 6	37.50%
Rectobulbar fistula	8	50%
Rectovaginal fistula	2	12.50%
Total	16	100 %

The most common ARM defect observed in the study was rectobulbar fistula, 8 patients (50%), followed by rectoprostatic fistula, 6 patients (37.50%) and rectovaginal fistula, 2 patients (12.50%).

Table 5: Operative data of LAARP.

Total cases	16
Mean operative time	2.75±0.51 (range 2-3.5)
(hours)	
Mean blood loss (ml)	24.37±13.76 (range 10-50)
Conversion to open	4 (25%)
surgery	
Mean hospital stay	8.12±3.59 (range 5-14)
(days)	
Blood Transfusion	6 (37.50%)

In the present study mean operative time was 2.75 hours and mean blood loss was 24.37 ml. Conversion rate was 25%, with two cases each of rectobulbar fistula and rectoprostatic fistula. Mean hospital stay of patients was 8.12±3.59 (range 5-14) days, while 37.5% patients needed blood transfusion.

Table 6: Post-operative data of LAARP.

Complication	Number of cases	% of cases
Mucosal prolapsed	1	6.25%
Urethral injury	0	0%
Anal stenosis	2	12.50%
Peritoneal contaminat	ion 2	12.50%
Temporary neurogenic bladder	c 2	12.50%
Morbidity	5	31.25%
Conversion	4	25%
Vas injury	0	0%
Total	16	100%

Postoperative complications observed were mucosal prolapse in 1 patient (6.25%), anal stenosis in 2 patients (12.50%), peritoneal contamination in 2 patients (12.5%),

temporary neurogenic bladder in 2 patients (12.50%). Conversion to open conventional surgery was done in 4 patients (25%). Overall morbidity was seen in 5 patients (31.25%).

Table 7: Functional outcome of patients according to Kelly's clinical score.

Kelly's clinical score	Number of cases	% of cases
K3	4	25 %
K4	8	50%
K5	4	25 %
Total	16	100%

In the present study, functional outcome of patients was defined according to Kelly's clinical score. The information concerning fecal incontinence and fecal staining was gained from children's parents and digital rectal examination. Mean KCS was observed to be 3.75± 0.68. Half of the patients (50%) were assigned Kelly's clinical score of 4, followed by 25% with K5 and 25% K3. Constant staining/smearing soiling/accidental defection after LAARP were observed in 2 patients each respectively. Also, 1 patient each had constant bout of constipation and diarrhoea. 8 patients were observed with occasional staining/smearing and 6 patients with soiling or accidental defection. 4 patients had occasional constipation and 1 patient had diarrhoea.

Table 8: Functional outcome based on Kelly's clinical score.

FO	None	Occasional	Constant
Staining/smearing	6	8	2
Soiling/accidental defecation	8	6	2
Constipation	11	4	1
Diarrohea	1	1	1

Table 9: Strength of puborectalis on DRE.

Strength of puborectalis			
Strong	Weak	None	
7	6	3	

On digital rectal examination seven patients 43.75% had strong anal sphincteric tone; six patients (37.51%) had weak anal sphincteric tone. Three patients (18.75%) had no anal sphincteric tone.

## **DISCUSSION**

The main objective of any surgery for ARMs is to achieve a socially accepted quality of life as well as having the affected children develop into healthy adults. Therefore, the long-term results should be evaluated in terms of bowel function, urinary function, sexual function, and social activity. The surgery of the social activity.

Over the past several years, techniques have evolved in repair of high and intermediate anorectal malformations (ARMs), starting with abdominoperineal pull-through, sacroperineal pullthrough, and posterior sagittal anorectoplasty (PSARP) and now moving toward the recently reported laparoscopically assisted anorectal pull-through (LAARP) procedure.<sup>3</sup>

Ever since laparoscopic-assisted anorectal pull-through(LAARP) procedure for repair of high imperforate anus has been described, the role of laparoscopy in management of ARMs is expanding <sup>8</sup>. This is because of many perceived benefits of the technique, including minimal perineal dissection, excellent visualization of the rectal fistula and surrounding structures, and preservation of the distal rectum with accurate placement of the rectum within the levatorani and external anal sphincter muscle complex.<sup>3</sup>

Taking all these facts in consideration, the present prospective study was conducted for a period of two years in the Department of Pediatric Surgery IMS, BHU. Sixteen patients with anorectal malformation of intermediate/high type ARM with no other associated morbid anomaly willing for surgery by laparoscopic technique were taken up as subjects of this study.

Mean age observed in present study was 11.2 months (range 3-22). When compared with other studies Tong et al observed mean age of 33 patients undergoing LAARP to be 5.3 (range 3-10) months. 11 Jung et al in their study of 25 male subjects, who underwent LAARP for rectourethral or rectovesical fistula, observed the mean age to be 2.7 months. 12

Table 10: Comparison of age with different studies.

Tong et al <sup>11</sup>	3-10 months
De Vos C <sup>13</sup>	2-18 months
Jung et al <sup>12</sup>	2.7 months
Present study	3-22 months

Mean age is higher in present study when compared to other studies since most of laparoscopic anorectoplasties are done as second stage procedure following a protective colostomy in neonatal period. Moreover due to poor socioeconomic status patients come late in follow-up. Also Primary LAARP is technically difficult in neonates although such procedures have been tried a few centers with success.

In the present study, male patients (87.50%) dominated the studied group with a male:female ratio of 7:1. Tong et al observed male dominance in their study of 33 patients with male:female ratio of 9:2. Stephens and Smith and Rintala et al also reported that in Western communities there is a male preponderance, with 55 to 70% of patients in larger series being male. The more severe malformations tend to be more common in male patients.

**Table 11: Comparison of sex (M/F).** 

Stephens and Smith <sup>14</sup>	7:3
Rintala et al <sup>15</sup>	7.3
Tong et al <sup>11</sup>	9:2
De Vos C <sup>13</sup>	1.6:1
Present study)	7:1

It has been observed that there is a male preponderance, with 55 to 70% of patients in larger series being male. In present study 87.50% were male. High incidence in present study could be due to fact that commonest type in female is vestibular type and they do present late in early infancy ,moreover cloacal type were excluded in our study which could be an additional factor.

Mean weight observed in present study was 7.68±2.67 kgs which is similar to study of Tong et al who observed mean body weight of 6.8±1.4 kgs in his study. <sup>11</sup> Jung et al observed mean body weight of 5.7±1.6kgs. <sup>12</sup>

Table 12: Comparison of mean weight.

Tong et al <sup>11</sup>	6.8±1.4 kgs
Jung et al <sup>12</sup>	5.7±1.6 kgs
Present study	$7.68 \pm 2.67 \text{kgs}$

Weight of more than 6 kilograms was found in both the studies. It is technically easier to do in infants than neonates, so at most centers it is done when infant weighs more than six kgs.

The most common ARM defect observed in the present study was rectobulbar fistula (50%), followed by rectoprostatic fistula (37.50%) and rectovaginal fistula (12.50%). De Vos et al, observed in his study rectoprostatic fistula (7.3%), rectobulbar fistula (48%), rectovesical fistula (2.43%) and rectovaginal fistula (14.63%). Tong et al, 11 reported most common type of imperforate anus as rectoprostatic fistula (66.67%), followed by rectobulbar fistula (18.18%), rectovaginal fistula (12.12%) and rectovesical fistula (3.03%). Iwanaka et al found in their study that the most common type of ARM in male patients was prostatic (30.6%), followed by rectourethral and bulbar. 16 Rectovaginal ARM was most common in females, occurring in 8.9% patients (8.9%), followed by cloacal and vestibular. Jung et al, 12 in their study of 25 male subjects observed the most common type of anorectal malformation was rectoprostatic urethral fistula (64%), followed by rectovesical fistula (24%) and rectobulbar fistula (12%).

In present study recto bulbar fistula has been the commonest type, whereas recto prostatic fistulas have been found to be more common in other studies. Statistical variation has been observed in most studies regarding type of fistula this variation could be explained due to smaller sample size and short study period.

Geographical variation can also result in statistical differences.

Table 13: Comparison of ARM defects with respect to site of fistula.

Study	Recto prostatic	Rectob ulbar	Recto vesical	Recto Vagin al
Iwanaka et al <sup>16</sup>	30.6%	-	8.9%	_
Tong et al <sup>11</sup>	66.67%	18.18%	3.03%	12.12%
De Vos C et al <sup>13</sup>	7.3%	48%	2.43%	14.63%
Jung et al <sup>12</sup>	64%	12%	24%	_
Present study	37.50%	50%	0%	12.5%

In the present study, mean operative time was  $2.75\pm0.35$ (range 2-3.5) hours and mean blood loss was 24.37 (range 10-50) ml with 37.5% patients needing blood transfusion. Conversion rate to open conventional surgery was 25%, while mean hospital stay of patients was 8.12±2.3 (range 5-14) days, transfusion was required in 6 (37.50%) patients. Tong et al, 11 reported mean operative time for patients as 112.5±12.4 minutes and mean blood loss as 10.2±5.8 ml, while mean length of hospital stay was 11.3±1.2 days with no conversions to laparotomy. Jung et al, reported in their study the median length of postoperative hospitalization was 8 days (range: 6 - 42 days) and the mean operation time was 3.9±1.3 hours. 12 The operation time was longest in the first LAARP patient. Ming AX gave a comparison study showing mean operative time of LAARP 1.62±0.40, Hospital stay was significantly shorter 5.8±0.6 days. 17

Table 14: Comparison of mean operative time, mean blood loss, conversion and hospital stay.

	мот	MB	С	HS (days)
Tong et al <sup>11</sup>	1.5±0.2 hours	10.2±5.8 ml	0%	11.3±1.2
Jung et al <sup>12</sup>	3.9±1.3 hours	_	_	8
Ming AX <sup>17</sup>	1.62±0.4 hours	_	_	5.8±0.6
Present study	2.75±0.3 5 hours	24.37±13.76 ml	25%	8.12±2. 3

Mean operative time and mean blood loss has been found more in present study compared to study of Tong et al, and Ming AX although similar to Jung et al, study. 11,12,17 Conversion rate has been found higher as compared to other studies. This could be attributed to learning curve and due to reason that laparoscopic anorectoplasty has been done for first time in our institute and further improvement in our skill is needed to match results of other studies.

Postoperative complications observed were mucosal prolapse (6.25%), temporary neurogenic bladder, anal stenosis, peritoneal contamination (12.50%). Conversion rate (25%) with overall morbidity of (31.25%) was observed. Tong et al,11 reported that 3 (9.09%) patients encountered postoperative mucosal prolapse after undergoing LAARP. However, there were no severe postoperative complications, such as incontinence or urethral injury. Jung et al, 12 reported in their study that the immediate postoperative complications occurred in only 12% patients, including a urinary tract infection in a vesicoureteral reflux patient. De Vos 2011<sup>13</sup> in his study observed mucosal prolapse in 10% of patients, anal stenosis in 15%, and peritoneal contamination in 14% with conversion rate of 10% and urethral injury in 5% of patients.

Table 15: Comparative analysis of post-op complication.

	De Vos 2011 <sup>13</sup>	Ming et al, 2014 <sup>17</sup>	Present study
Mucosal Prolapse	10%	7.5%	6.25%
Urethral injury	5%	-	0%
Anal stenosis	15%	-	12.50%
Peritoneal contamination	5%	-	12.50%
Temporary neurogenic bladder	-	-	12.50%
Morbidity	-	12.5%	31.25%
Conversion	10%	-	25%
Vas injury	5%	-	0%

Compared to other studies incidence of mucosal prolapse, anal stenosis and peritoneal contamination is similar to present study, however higher rates of temporary neurogenic bladder, conversion to open surgery and morbidity have been observed probably due fact that we didn't ligate fistula instead cauterized it, this could also explain some damage to vesical neural plexus. Conversion to open conventional technique has been more due to lack of laparoscopic trained staff, inadequate facilities and learning curve we are going through which could also explain increased morbidity in our study.

In the present study, functional outcome of patients was defined according to Kelly's clinical score. The information concerning fecal incontinence and fecal staining was gained from children's parents and digital rectal examination. Mean KCS was observed to be 3.75± 0.68. Half of the patients (50%) were assigned Kelly's clinical score of 4, followed by 25% with K5 and 25% with K3. Tong et al, 11 in their study observed mean KCS  $3.52\pm1.42$ . Constant staining/smearing soiling/accidental defecation after LAARP was observed in 2 patients each respectively. Also, 1 patient each had constant bout of constipation and diarrhoea. 8 patients were observed with occasional staining/smearing and 6 patients with soiling or accidental defection. 4 patients

had occasional constipation and 1 patient had diarrhoea. On digital rectal examination 7 patients had strong anal sphinteric tone, 6 patients had weak anal sphenteric tone and 3 patients had no anal sphinteric tone.

Table 16: Comparison of Kellys score.

Tong et al <sup>11</sup>	3.52±1.42
Present study	3.75±0.68

Mean Kelly's clinical score done after 2 years of surgery was higher in present study as compared to other study. This could be due to the fact that subjective variation can occur on digital rectal examination for sphincter tone. Moreover parental judgement of faecal staining and smearing could vary, leading to exaggerated score

#### **CONCLUSION**

On the basis of observations made and their analysis it that laparoscopy-assisted concluded anorectoplasty is anatomically sound. There is minimal perenial dissection, no division of muscle complex, excellent visualization of rectal fistula and surrounding structures, preservation of distal rectum and accurate placement of rectum within levator ani and external anal sphincteric muscle complex. There is shorter hospital stay with better functional outcome. However Intraoperative complication, Operative time and conversion to open surgery is relatively high, most of which can be attributed to a 'learning curve' and improper patient selection which should not be discouraging for training residents to undertake such procedures at teaching institutes.

However Long-term follow-up for continence is needed for further evaluation of this technique and to establish it as an alternative to conventional surgery.

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