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A retrospective study long term complications and outcome of Ano rectal malformation following LAARP (Laparoscopic Assisted Ano Rectal Pull through) procedure

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Abstract---Background: The laparoscopic procedure has many added advantages of being less time consuming, early discharge from the hospital, less tissue damage, and better visualization of the pelvic structures. Objective: to study the complications and outcomes in ARM patients following LAARP. Methods: This study was conducted on 55 ARM patients in the Raichur Institute of Medical Sciences RIMS/ RGSSH (OPEC) Raichur Karnataka. The study period is from Dec 2016 to Dec 2020. Results: All the fifty five patients who are operated for anorectal malformation, they underwent first surgery (high sigmoid loop colostomy) within the second and third day of neonatal period, and second surgery the LAARP within the six weeks to three months of the first surgery, a Demographics, type of ARM, and age at pull-through. All LAARP surgery was done by single surgeon, there were no anaesthetic complications. Conclusion: This study emphasizes the emerging laparoscopic technique for management of anorectal malformations. Using this approach it is possible to achieve better continence rates as the extent of perineal dissection is minimal, hence inflicting minimal neural and sphincter injury.

Keywords---LAARP Procedure, Complications, outcomes, anorectal malformation.

Introduction

Anorectal malformation is a congenital malformation in which the terminal portion of the hindgut lies partially or completely outside the sphincter mechanism. There may be an associated fistula or other associated defects, such as those of the VACTERL association. Significant advances have been made in the management of this complex condition in recent years.

Anorectal malformations (ARMs) affect about 1 in 5000 live born infants. For those with high or intermediate defects (supra-levator or levator-level defects), colostomy in the newborn period is life-saving. However, long-term quality of life after construction of a neo-anus and colostomy closure is still unsatisfactory. In many cases, this can be attributed to complexity of the lesion, a high rate of associated malformations. The more recent 'Krickenbeck' conference further clarified definitions and a standardized ARM classification as well as standardizing the method of post operative assessment. Subsequently, Georgeson introduced the laparoscopic-assisted anorectoplasty (LAARP) in 2000, which involves less dissection and improved visualization of the rectal fistula. The LAARP has gained popularity mainly in the management of prostatic or bladder-neck fistulae, that would otherwise require laparotomy. Pulling the rectum in the proper anatomical site is the keystone step in the definitive reconstruction. Laparoscopic approach gives the advantage of visualization of the puborectalis muscle sling. The laparoscopic procedure has many added advantages of being less time consuming, early discharge from the hospital, less tissue damage. Its role in the management of lower lesions remains controversial. But in posterior sagittal anorectoplasty rectal mobilization for 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. Using the laparoscopic technique, there have been no problems in gaining enough length for the pull-through.

Materials & Methods: This study is conducted in the Raichur Institute of Medical Sciences (RIMS) /Rajiv Gandhi Super Speciality Hospital(RGSSH(OPEC) Raichur Karnataka. The study period is from Dec 2016 to Dec 2020.

Inclusion Criteria: All patients undergoing Laparoscopic pull through for ARM.

Exclusion criteria:

1. Low ARM patients.
2. Patients of ARM with pouch colon.
3. Patients of ARM who have undergone redo procedure.
4. Patients who have undergone Primary PSARP.

5. Patients of cloaca.

Procedure

LAARP(Laparoscopic Assisted Ano rectal Pull through)---Following the institution of general anaesthesia and administration of preoperative antibiotics, The patient is positioned transversely at the foot of the operating table, and the child's entire torso, groin, perineum, and lower extremities are prepared. Per urethral catheterization will be done carefully and watch for the easy draining of urine; this gives evidence that the catheter bulb is in urinary bladder and not in fistula or in the rectum. In our set up we use three (most of the time) to four ports for this surgery.

We take periumbilical stay sutures with heavy silk (2,0) at 9 and 3 o'clock position. Umbilical incision made with sharp 11 no blade and 5mm port inserted, after entering the abdomen pneumoperitoneum created by carbon dioxide pressure maintained at 8 to 10mmHg. Zero degree camera inserted through the port and look for any injury occurred during port insertion. Then 3mm port is placed in left upper quadrant in mid clavicular line and the third port (3mm) inserted at right hypochondrium in mid clavicular line. All the ports are inserted under vision and control, fourth port inserted only when necessary for retraction of redundant bowel.

Once position, access, and exposure have been achieved, rectal dissection follows, incising the peritoneum at the peritoneal reflection with hook cautery. Electrocautery then used circumferentially to dissect the mesorectum off the rectum and dissection is carried distally, making sure to stay right on the rectal wall. If the bladder obscures the surgeon's field of vision, a stitch can be passed through posterior wall of the bladder and back out of the abdominal wall to temporarily suspend the bladder anteriorly. It is important to identify the ureters and vas deferens bilaterally to avoid injury to these structures during the rectal dissection. As the rectum tapers into the fistula. The recto genitourinary fistula is then transected and dissected without clipping. The rectum is then reflected cephalad and the pelvic floor is examined. The space from the apex of the pubococcygeus muscle extending posteriorly is identified and developed. This will be the space through which the rectum will be passed. The vas deferens medially points to the prostate, which aids the surgeon in locating the urethra so to avoid inadvertently injuring it, the lateral attachments of the colon may need to be mobilized in order to allow the rectum to reach the perineum,

Attention is then paid to the perineum where the center of superficial anal sphincter is mapped with a muscle stimulator. The area of maximal contraction is marked at its anterior and posterior limits. The patient's hips are flexed in such a fashion that the knees are directed up to the patient's shoulders. This position straightens the path for the pull-through and neo anus.

A 10mm sagittal incision is made sharply in the center of the sphincter and the subcutaneous tissue are dissected bluntly, making every effort to stay in midline. The laparoscopic transillumination is then seen at the site of perineal dissection and a long curved artery forceps passed through that tract. Once artery

forceps enters the pelvis in normal position between the sphincter, under vision the distal end of the rectum is fed to the artery forceps, which is then pulled out toward the perineum, care should be taken while pulling the rectum down that there should not be any twist and then anoplasty is carried out. The abdominal cavity and pelvis are inspected laparoscopically for hemostasis, the pneumoperitoneum is released, and all the ports are removed. The lenea alba at the level of umbilical port is reapproximated with 3/0 vicryl figure of eight sutures and all the abdominal skin incisions are closed with single horizontal mattress sutures.

All patients underwent colostomy closure at six weeks to six months post LAARP surgery.

Patient Work Up

1. A written informed consent is taken from the patient before enrolling them for the study.
2. Detailed history and Kelly's Scoring of all the patients noted.

Clinical examination. Perineal examination and Digital rectal examination.

Table 1: Kelly's Score

Contenance	
Normal, no soiling	2
Occasional accidents, feces /flatus escape	1
No control, frequent accidents	0
Staining	
Always clean	2
Occasional staining	1
Always stained	0
Sphincter	
Strong and effective squeeze	2
Weak and partial squeeze	1
No contraction	0

Overall Score 5-6 – Good, 3-4 – Fair.

0-2 – Poor.

Results

Total of 55 ARM patients underwent LAARP at Raichur Institute of Medical sciences RIMS/ RGSSH(OPEC), Raichur. All the patients who are operated for anorectal malformation, they underwent first surgery (high sigmoid loop colostomy) within the second and third day of neonatal period, and second surgery the LAARP within the six weeks to three months of the first surgery, a Demographics, type of ARM, and age at pull-through, are shown in **Table 2**

Table 2: Demography of Patients

Type of ARM	LAARP
Recto vesical fistula	11
Recto prostatic urethral fistula	26
Recto bulbar urethral fistula	11
No fistula	7

All LAARP surgery was done by single surgeon, there were no anaesthetic complications, Surgical complications are listed in **Table 3**

Table 3: Surgical complications

Per operative	LAARP
Urethral injury	0
Vas iniury	0
Conversion to laparotomy	0
Early post operative	
Wound Sepsis(sub cutaneous level)	2
Wound dehiscence	9
Retraction	5
Laparotomy needed	0
Late post operative	
Mal placed anus at fallow up EUA	2
Anal stenosis/stricture	0
Mucosal prolapse	5

Full thickness prolapse	2
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Postoperatively, complications included, superficial wound infection, anal strictures, cases of prolapse, rectal retraction, and case where the neo-anus was not centred within the sphincter complex.

There were no per operative complications in LAARP group, Early post perative complication considered here are superficial wound infection at the sub cutaneous level, seen in 2(3.63%) cases, which is due to the surgical site haematoma, and managed conservatively with simple saline wash and oral antibiotics. 9(16.36%) cases had wound dehiscence at the neo anal site of which 5 had complete wound dehiscence and remaining 4 had partial dehiscence which were managed conservatively without the need for any surgical intervention, and in post recovery healed status there was no retraction of the neo anus, . Retraction of the neo anus is seen only 5(9.09%) patients, these are the patients with recto vesical fistula and these complications has occurred in early periods of Lap Pull through procedure started by the surgeon. All the patients underwent redo surgery(PSARP) in later date. These are the patients they presented later to us with features of bowel incontinence and were managed with rectal wash and MACE(malones antigrade continent enema). Ectopically placed neo anus is seen in 2(3.63%) patients, the cases done in early residency period and later these patients underwent ASARP(Anterior Sagittal Ano rectoplasty), these patients had intermittent incontinence in later follow up period. Mucosal prolapse is seen in 7 cases of the study group, 5(9.09%) had partial and 2(3.63%) had full thickness prolapse, all the cases of prolapse underwent mucosal excision, these are the patient yet to be followed for incontinence.

In terms of long-term continence, 70% of patients were eligible for evaluation, and mean age 3.8 years. Only 60 percentage of cases reported voluntary bowel movements. Ten percent of the cases depended on rectal washouts through per rectum to achieve social continence and soiling is better, most of the patients with high fistula specially the rectovesical fistula presented with history of soiling, and severe constipation was seen in 2% of patients, **Table 4**

Table 4: Outcome of Kelly's score.

Type of ARM	LAARP(avg kelly's score)
Rectovesical fistula	4.25
Recto prostatic urethral fistula	4.12
Rectobulabar urethral fistula	5.68
No fistula	4.19

Discussion

Anorectal malformations are associated with significant morbidity because of problems with fecal continence after surgical correction. The earliest correction of

ARM by an abdominoperineal approach was by Rhoads¹ in 1948. Studies by Stephens² added considerably to the understanding of the anatomy of these malformations, and the surgical procedure was modified to an abdominosacroperineal approach in 1953. Traditional descriptions according to the Wingspread classification have been largely superseded by the classification of Pena³, which should allow more meaningful comparison of outcome data. This study provides contemporary data on both early functional and QOL (Quality Of Life) outcomes in children with ARMs.

The technique of LAARP bears some similarities to abdomino perineal pullthrough procedure previously practiced. Over the years, surgeons have made major contributions to our knowledge of the normal anorectal anatomy⁴ and the anatomy of anorectal malformation⁵. to name a few, appreciated the concept of placement of the rectum into the levator sling mechanism, and developed the abdominoperineal and later the sacroabdomino perineal approaches for treatment of high ARM. These surgeons also believed that surgical dissection through the sphincter muscles could be detrimental for future continence. Clinical results suffered most due to the fact that adequate visualisation and identification of the levators and external sphincter complex was not possible in the above techniques. Even though addition of the sacral incision was supposed to facilitate identification of 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 de Vries and Pena, where adequate visualisation of the sphincteric mechanism could be achieved through posterior sagittal approach by division of the external sphincter and levators in the midline to expose the bowel and the associated genito urinary fistula. There was no dependence on blind palpation of the appropriate muscle plane.

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 the vagina through the levator sling and external anal sphincter muscle complex to the perineal surface. There is no need to divide the muscle complex from below, because the pubococcygeus can be visualised and center of the two bellies are easily targetted from above with the help of laparoscope and laparoscopic muscle stimulator. Immediately after the procedure, strong and symmetric contraction of the sphincter around the neoanus provides reassurance that the bowel has accurately been brought down through the sphincters. This approach also conserves the bowel, and by securing the fistula to the perineum, preserves the distal bowel wall, which may contain muscle fibres recruitable for internal sphincter function⁶.

Various scores including those of Kelly⁷, Templeton and Ditesheim⁸, Kiesewetter and Chang⁹, Holschneider¹⁰, and Wingspread¹¹ have been used. The Kelly score requires a digital examination, whereas the Holschneider scores requires anorectal manometry.

Four studies compared LAARP to PSARP in patients with high or intermediate ARM. These studies included 47 patients. Only one study was prospective in

nature¹², and none were randomized comparisons. These 4 studies compared patients with regard to the following outcomes: stool frequency, continence, anatomical position of pullthrough rectum, sphincter function, and symmetry using different postoperative modalities as manometry, anal endoultrasonography, magnetic resonance imaging (MRI), Kelly's score, and continence evaluation questionnaire. The 4 studies unanimously concluded that LAARP seems to be superior to PSARP for patients with high/intermediate ARM. All 4 studies uniformly concluded that long-term follow-up is necessary to assess fecal continence. In the study by Lin et al¹³, defecation status and anorectal manometry of 9 patients with high/intermediate imperforate anus repaired with LAARP and 13 age-matched patients repaired with PSARP were assessed and compared during the first year of postoperative follow-up evaluation. The study concluded that patients repaired with LAARP had more favorable findings with regard to anorectal manometry than patients repaired with PSARP.

Wong and colleagues¹⁴ conducted a retrospective review of 10 children with high/intermediate-type imperforate anus who underwent LAARP between May 2000 and December 2002. Magnetic resonance imaging of the pelvis was performed postoperatively, and a semiquantitative score was used to assess the degree of sphincter symmetry, perirectal fibrosis, and the position of the pull-through rectum. Defecation status was also recorded. Eight patients who had previously undergone PSARP served as a control group. The study concluded that LAARP allows for more optimal anatomical reconstruction in patients with high/intermediate-type imperforate anus.

In a study by Kudou and associates¹⁵, LAARP was performed in 13 patients with high-type imperforate anus between 2000 and 2002, and the clinical data were compared with 7 patients who underwent PSARP before 2000. Anorectal function of these patients was evaluated using the Kelly's score and manometry at the ages of 3 to 5 years (LAARP) and 5 to 6 years (PSARP). The midterm follow-up of this study revealed that satisfactory fecal continence can be achieved in patients with high-type imperforate anus after LAARP and can be a good alternative in this patient population.

In a prospective nonrandomized comparative study by Ichijo et al¹⁶, 24 cases of high/intermediate-type imperforate anus were studied. Within the group, 15 underwent LAARP, and 9 underwent PSARP. All subjects had anal endoultrasonography and MRI postoperatively. A 5-parameter CEQ questionnaire was administered to 16 of 24 subjects followed up for more than 3 years (9 LAARP, 7 PSARP). Surgical stress was assessed using mean febrile period, duration of elevated white blood cell count, and peak C-reactive protein level. When CEQ were compared annually, scores for LAARP were generally higher throughout the study but only statistically significant at 3 and 4 years after surgery. LAARP appeared to provide better outcomes based on CEQ scores.

The timing for LAARP primarily is determined by the surgeon's preference. It can be done either as primary pull through procedure without diverting colostomy or as a second stage definitive procedure 6-8 months following a diverting colostomy. We performed LAARP as a second stage in all patients. The primary advantages of performing the procedure in the new born period without a colostomy includes

avoidance of the complications and multiple procedures associated with colostomy and the potential neuro developmental superiority of the infant stooling through the anus soon after the birth. The benefits of performing a proximal sigmoid colostomy with a staged pull through include more complete decompression of the rectosigmoid colon for the pull through procedure; and gradual anal dilatation with a protective colostomy. Colostomy is indicated in high risk patients with high ARM who have other major surgical problems, or patients who have anatomic features that need further study for adequate definition.

In our study Functional outcome of high lesions after LAARP is not uniformly good, still further study need to be continued. Our results compare favourably with these reports, the reason for the low average Kelly's score in PSARP group compared to LAARP group may be due to the division of the muscle sphincter complex, and an identified nerve injury, similarly we can explain for the fair to good Kelly's score in LAARP, It is because of not touching the muscle sphincter complex and the rectal pull through was done under vision by making tunnel in the center of the sphincter complex.

In case of cost effectiveness, previously it was thought that the LAARP is costlier than the PSARP, but in our study no much cost difference was detected, keeping in mind post operative morbidity, complications and functional outcome the LAARP is superior. But still further follow up study is required to conclude the superiority of LAARP in terms of functional outcomes.

Conclusion: Using this approach it is possible to achieve better continence rates as the extent of perineal dissection is minimal, hence inflicting minimal neural and sphincter injury. With the laparoscopic approach it is possible to visualize the fistula better and even the higher vesical fistulae can be dealt easily. The aesthetic appearance following LAARP is better and complication rates are less.

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