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Laparoscopic Assisted Versus Robot Assisted Duhamel Pull-Through for Management of Hirschsprung's Disease

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1. Abstract

It is axiomatic to note that since the 1990's various laparoscopic procedures have become increasingly popular for Hirschsprung's Disease (HD) in order to achieve better results and to reduce post-operative pain and morbidity.

Full exposure of dissection field is the cornerstone for safe and accurate dissection of A ganglionic segment especially in deep pelvic region. The application of minimal invasive approach aims to overcome these obstacles and to preserve neighbouring pelvic structures.

Robot Assisted surgery and its application especially in pediatric surgical procedures provides excellent results with meticulous and precise dissection in deep regions like pelvis and also provides better magnification and 3 Dimensional vision during operative procedures. To further explore the application of Robot Assisted surgery in children, we performed a comparison between Robotic and Laparoscopic Assistance for Duhamel's Procedure.

2. Introduction

The treatment of Hirschsprung's Disease (HD) usually consists of multi-staged operations in terms of an initial diverting colostomy followed several months later by a definitive pull-through procedure with laparotomy [1]. In recent years, a number of investigators have reported success with a pull-through procedure utilizing Laparoscopy Assisted technique for HD that results in minimal complications, even in the neonatal period [2].

With advent of Robotic Assisted surgeries, especially in treatment of complex urological anomalies and urological reconstruction with its breakthrough advantages of hand-like movement and superior range of motion as compared to human hand, many pediatric surgeons are utilizing its application in different pediatric surgical procedures [3].

In consonance with this principle, we operated two cases of Classic type of Hirschsprung's Disease (HSD) who were comparable in terms of age, type of HSD, timing of presentation and history as also the site of diversion colostomy. Oone case was subjected to a Laparoscopic Assisted Duhamel Pull-Through (LADPT) and other case underwent a Robotic Assisted Duhamel Pull-Through (RADPT).

3. Patient and Methods

We had two cases, one female and one male with similar age (28 and 29 months) and weight (10.5 kg and 10.3 kg). The history too was similar in terms of full term infants with delayed passage of meconium in 3rd day of birth. They both displayed repeated attack of constipation, with passage of stool every three or four days after rectal stimulation. By the age of two years a severe attack of intestinal obstruction happened in terms of repeated attack of bilious vomiting, constipation and severe abdominal distention. All attempts at evacuation failed and both patients needed evacuation under anesthesia. Under general anesthesia both patients were subjected to the Gastrograffin enema under C-arm guidance, followed

by complete evacuation of cement like stool through rectal wash, and a full thickness rectal biopsy was been taken to confirm the diagnosis.

The rectal biopsy showed absence of ganglion cells and hypertrophy of nerve fibres confirming the diagnosis of HD.

After adequate counselling and parental consent, both patients underwent a right transverse colostomy in the right upper abdominal quadrant in view of the enormous dilatation of the colon.

Besides reducing the size of the distal colon, a diversion colostomy also helps in improving the general condition of the patient as well as leading to weight gain and positive nitrogen balance which helps them sustain the final definitive surgery in a much better way.

4. Operative Technique

Generally speaking, Patient position, ports sites, operative steps and dissection procedure are arguably the same in both procedures (Robotic assisted and Laparoscopic assisted Duhamel operation). The definitive surgery was done within 6-8 weeks post colostomy operation and under general anesthesia.

4.1. Patient Position

Lithotomy position and slightly head low and left up position. This position is helps in pelvic dissection and also helps in moving the small intestine away from the operative field and dissection site of the colon.

4.2. Port Sites

4.2.1. Camera port: In the right abdominal Lumbar region, just below and lateral to colostomy site and it is usually 10mm in size.

4.2.2. Two working ports: One port was in the left hypochondrium and other was in the right iliac fossa and they are 5mm in size. In Robotic assisted Duhamel a fourth 5mm port is placed in the epigastrium as an assistant port.

For robotic assisted technique we used Da Vinci Xi Robot that was docked by side docking method.

4.3. Operative Steps

- Pneumoperitonium was created after insertion of camera port by open technique. All other ports were inserted under vision.
- Three biopsies were taken from the rectosigmoid, mid sigmoid and upper sigmoid and were sent for frozen section for histopathology to detect the site of normal ganglion cells.
- The colon hitched to the anterior abdominal wall in two site rectosigmoid and descending colon sites using 2-0 Vicryl suture trans-abdominally to facilitate the dissecting process.
- 5 mm Vessel sealing device handle was used for dissection in Laparoscopic assisted procedure and Monopolar Scissor for the Robot Assisted procedure was used.
- The dissection was started at the pelvic brim near the peritoneal reflection of the rectum.
- Retrorectal space was entered and dissection continued distally till the anal verge while preserving the rectal blood supply, avoiding pelvic nerve injury and without jeopardizing the ureters, ovaries, broad ligaments and vas deferens in female and male patients respectively till the anal verge was reached as confirmed on Digital Rectal Examination.
- The dissection was then extended proximally to the level of normal colonic ganglia depending on the fresh frozen biopsy results. Laparoscopic Endo GI-stapler was used to divide the rectum just distal to the peritoneal reflection to form the rectal pouch of Duhamel technique
- A transverse incision is then made about 0.5-1cm above the dentate line with fine dissection till the retrorectal space is entered under vision from the Abdominal Telescope.
- The mobilized colon is pulled through the anal incision after removing the hitching stitches, till the site of normal ganglionated colon, the A ganglionic segment was removed and linear stapler(55mm) are used for forming common pouch between the pulled colon and rectal pouch.
- Intra-abdominal drain was inserted from the right iliac fossa port and lastly, quite exploration was done to make sure no bleeding, normally oriented pulled colon, the ports are removed and the port sites were sutured.

4.4. Postoperative Course

Both patients had uneventful postoperative course with little postoperative pain at port sites and minimal discomfort. All postoperative events are illustrated. The patient who underwent Laparoscopic Assisted Duhamel pull-Through had an unexplained fever which was investigated and there was no evidence of anastomotic leak or rectal/colonic ischemia. He did develop loose motions after the stoma started to function. In other words, the prolonged hospital stay was unrelated to surgery itself but associated with medical issues.

5. Discussion

Minimal invasive surgical procedures in pediatric surgery have become increasingly popular and definitely hasten postoperative recovery, thus minimizing the hospital stay and also reducing the overall cost. Laparoscopic Assisted Pull-through for treatment of HSD is now a popular approach ever since it was introduced in 1994[4].

Despite its popularity, the inherent limitation of Laparoscopic instruments continues to be a hindrance leading to increased operating time and decreased visualization during deep pelvic dissection areas which is essential to avoid pelvic nerve bundles, ureters, fallopian tubes, ovarian blood supply and vas deference. These limitations are overcome by the Robot and Robotic Assisted surgical procedures [5, 6].

The Da Vinci Surgical Robot was 1st used for a pediatric patient in 2001 and it offers many advantages over conventional laparoscopy with an array of innovative features like intuitive hand-eye coordination, greater freedom of movement as compared to laparoscopic method, three-dimensional visualization as well as depth perception while also filtering out the physiological hand tremors and enables a precise dissection especially in deep areas like the pelvis [7, 8, 9].

We decided to do a Robot Assisted Duhamel Pull-through for treatment of Classic type of HSD and compare the two approaches in terms of overall outcomes. Both procedures had the same estimated blood loss (about 50 ml for each procedure) and same operative time (150 minutes in both procedures inclusive of about 20 minutes for docking in Robotic Assisted procedure).

In this direct and simple comparison between the two approaches where we used age and weight matched patient, we cannot prove that RADPT is superior to LADPT. However, there are definite advantages of the Robot over the Laparoscopic approach but it needs further validation with a large case series.

6. Conclusion

All HSD related surgical procedures depend on complete resection of A ganglionic segment which involves meticulous dissection in the pelvic cavity which is best done with minimal invasive techniques, either laparoscopic or Robotic. After successfully completing the first RADPT in literature to our knowledge, it is our opinion that this approach adds a different dimension to HSD surgery and definitely adds value in terms of ease of dissection and visualization in 3 Dimension especially in the pelvic cavity. And though it's an accepted fact that the Robot offers a superior experience for the operating surgeon there is yet no consensus regarding its superiority in comparison with laparoscopic approach, which needs further evaluation.

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