

LAPAROSCOPICALLY ASSISTED COLORECTAL RESECTION IN HIRSCHSPRUNG'S DISEASE

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Abstract:

Background: Minimally invasive surgery (MIS) has been adapted to virtually every kind of abdominal operation. Colorectal resections of any extent are possible. The reduction in local and systemic surgical trauma in MIS suggests this method could be valuable for rectal resection for Hirschsprung's disease.

Method: Diagnostic work-up is similar to that in open surgery. Three trocars are sufficient, and a fourth may be helpful. Dissection encompasses the entire aganglionic segment and is extended orally to normal bowel. After complete dissection down to the pelvic floor the bowel is everted transanally, resected in due length and the coloanal anastomosis sutured from outside. Since 1996 four children out of nine (age 11 weeks – 18 years) have been operated laparoscopically at our institution.

Results: There were no intraoperative complications. Recovery time is impressively rapid. Oral intake may be begun on the first postoperative day and physical activity is rapidly restored. There are however problems typical to this method: anastomotic leakage, stricture formation, and the necessity of continuing dilation.

Conclusions: The feasibility of laparoscopic colorectal resections of any extent is unquestionable. Benefits for the patient seem evident. Prospective randomized studies to provide a higher level of evidence for the benefit of laparoscopy as compared to open technique are difficult to perform due to the small number of patients.

Key words: Hirschsprung's disease, minimally invasive surgery, rectal resection, laparoscopy

INTRODUCTION

Since Swenson reported on his first operation in the management of Hirschsprung disease 1948 [19] various techniques of rectal resection and reconstruction have been established. The corresponding results are known and differ with respect to success rate and complications [15]. As there are no fundamental differences in their overall evaluation, the choice of one of these methods mostly depends on the surgeon's preference. There is a trend toward operating children during the first postnatal week without a preliminary

colostomy being mainly introduced by Carcassone who has operated 98 infants treated in this manner [3, 20], and Tetelbaum [21].

Minimally invasive techniques for colorectal resections of any extent are possible. For treatment of Hirschsprung's disease those techniques were introduced during the last decade as one [11] or two stage operations [2, 17]. Georgeson [10], Curran and Rafensperger [4], along with Arany [1] have demonstrated that it is easy to remove all the defective aganglionic tissue with laparoscopic technique. De Lagausie has adapted the Duhamel procedure of side to side anastomosis in 30 cases to the laparoscopic technique [5, 6, 18]. Daily postoperative anorectal dilatation is necessary depending on the surgeons preference and the amount of aganglionic tissue left. Still another new technique achieves the entire resection, leveling of ganglion cells, and definitive pull-through via the anal canal without an abdominal incision [7].

This paper describes the experience in our center using a method similar to that reported by Georgeson.

METHOD

The assessment of the aganglionic section of the bowel is done by barium enema and endoscopy with biopsies in 2, 4, 6, 8, 10, 15, and 20 cm from the anal verge. Enzyme histochemistry and light microscopy often fail to demonstrate Hirschsprung's disease due to lack of submucosal tissue of sufficient depth. Thus full-thickness biopsies often are necessary to gain reliable information about the extent of the resection.

Bowel preparation is achieved by administering a cleaning solution via a nasogastric tube. Single-shot antibiotic prophylaxis is given prior to the beginning of the operation. The child is placed in lithotomy position, the legs being lowered horizontally for the laparoscopic part of the operation. Pneumoperitoneum is established in an open access; incision of the skin is made according to the diameter of the scope; the fascia is lifted by two Kocher clamps and followed by incision together with the peritoneum; the trocars are introduced under direct vision. The topography of the trocars depends on the area of intended dissection. For rectosigmoid resection, the optical trocar should be placed laterally in the right mid abdomen in order

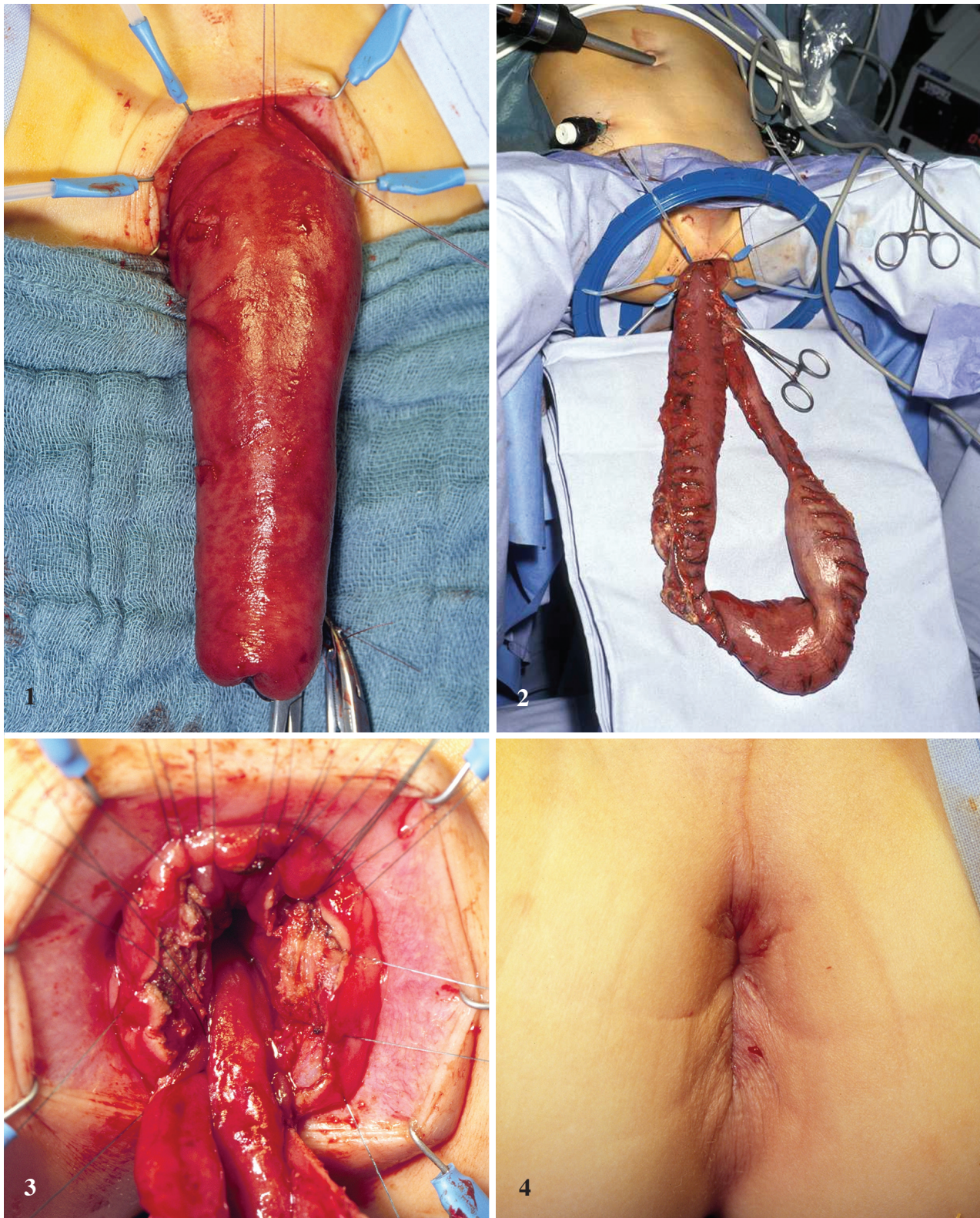


Fig. 1. Mobilized rectum pulled through the anus; everted.

Fig. 2. The rectum is completely divided and the healthy colon lies in the anal canal.

Fig. 3. Series of stitches for the anastomotic sutures is placed and fixed in Kelly clamps.

Fig. 4. The anus turns back into its normal shape.

to have enough distance to the structures to be visualized. In larger children or adolescents, the navel may be chosen for cosmetic reasons. The working trocars

are best introduced in a V-shape position, one in the right inguinal region, the other one in the epigastrium or right hypogastrium. If a fourth instrument is need-

ed, the trocar can be placed in the left upper abdomen.

The first step is the exploration of the bowel. Usually there is no distinct border between the distended part of the colon, the aganglionic segment and the proximal part with normal innervation. Full-thickness biopsies are taken of the antimesenteric wall at three areas of the bowel corresponding with the radiologically described transitional zone (orally, distally and in between) in order to determine the extent of resection. The defects are closed by extramucosal running sutures (4.0 polyglactine). While the specimens are examined by the pathologist, dissection begins at the peritoneal adhesions of the sigmoid colon on the left pelvic wall, extended if necessary along the white line cephalad around the splenic flexure. Mobilization is not requisite down to the roots of the vessels like as in oncologic surgery. Transection of the mesentery may be performed in proximity to the bowel wall or below the arcade of the vessels. This is best done with ultrasonic scissors; alternatively the tissue can be divided with the electric hook and the vessels clipped.

Beginning at the level of the promontorium, the transection line is directed closely to the wall of the rectum. From this region down to the anus, dissection follows the muscularis propria circumferentially leaving the complete paraproctium in situ. This is mandatory to protect the autonomous nerves from damage. Traction to the bowel cephalad offers good exposition, and changing the direction brings tension to the structures next to be transected.

A decision has to be made concerning the oral extent of resection. This depends on the result of the pathology. This area of the prospective anastomosis is brought down tentatively to the pelvic floor to ensure that mobilization of the left colon is sufficient; otherwise it is lengthened as necessary. Once the transection of the mesentery reaches from the resection line down to the anus and mobility of the bowel has been assessed, the laparoscopic part of the operation is achieved. Nevertheless, the trocars are left in place.

The legs are lifted in lithotomy posture. An anal retractor is applied that everts the anal canal. With atraumatic clamps the rectum is grasped from inside the lumen and pulled down perianally (Fig. 1). Resection begins with an incision at the ventral circumference about five to ten millimeters oral to the dentate line. All layers of the rectal wall are cut until the rectum is completely divided and the healthy colon lies in the anal canal (Fig. 2).

The movement of the bowel through the abdomen can be observed easily with the laparoscope to confirm that no torsion or undue tension occurs. With the specimen exteriorized completely, the anterior part of the colonic wall is transected, then a series of stiches for the anastomotic sutures (polyglactine or polydioxanone 4.0 or 5.0 depending from the size of the child) is placed and fixed with Kelly clamps (Fig.3)

In the same way the dorsal circumference is transected and sutures are strung together. Now all the sutures are tied, the anastomosis is complete. After release of the anus by removing the retractor it returns back into its normal shape (Fig.4).

Closure of the trocar sites finishes the operation. A

urinary catheter may be inserted through the coloanal anastomosis for two or three days to relieve the colon of gas and secretion.

RESULTS

Since 1996 we operated nine children, four of them laparoscopically (Table 1). Reasons for an open procedure were extended operations prior to the definitive resection, accompanying malformations in the pelvic region or reservations of the parents. A conversion from laparoscopic to open operation never was necessary. No intraoperative complications occurred, but during the postoperative period distinct problems were encountered. All of them developed in one child which suffered from a severe enterocolitis (Table 2).

Table 1. Data of the patients with Hirschsprung's disease.

n	9
laparoscopic	4
m : f	7 / 2
laparoscopic	2 / 2
age	11 weeks – 18 years
mean	3 years 4 months
laparoscopic	11 weeks – 18 years
mean	1 year 9 months
follow-up	14 months – 5 years 8 months

Table 2. Postoperative complications in one child with laparoscopic bowel resection (rectum and complete sigmoid).

anastomotic insufficiency	1
enterocolitis	1
ileus	1
stricture due to scars	1

It was necessary to form a transverse loop colostomy and dilate the anus with Hegar bougies.

Problems of incontinence were not seen. Constipation ceased in every case.

DISCUSSION

Minimally invasive procedures have become established methods in pediatric [12] as well as in adult surgery. Furthermore, even reconstructive techniques in cases of congenital malformations such as esophageal atresia [22] have been performed. Nevertheless, there are at least two major differences in comparison to adult surgery: The smallness of the structures and the delicacy of the tissue require a subtlety in handling which normally is not postulated in adults. Secondly, the rarity of most of the pediatric laparoscopic operations causes a limitation of experience and routine; so expertise takes more time to develop and often is restricted to surgeons in centers.

Both objections do not argue against adoption of minimally-invasive techniques in pediatric surgery. Thorough education and performance with a high sense of duty are prerequisites. However, colorectal resections and rectopexy can be regarded as standard indications for MIS [16].

Various benefits confirm this:

- technical feasibility has been proven sufficiently
- visualization of structures is better than in open surgery
- exploration of the abdominal cavity is possible and is not limited by the (open) access
- dissection can be performed completely down to the pelvic floor as necessary
- complete resection of the aganglionic segment is achievable
- single-stage procedure
- the abdomen stays closed
- no contamination of the peritoneal cavity
- decreased trauma to the abdominal wall
- decreased trauma to the peritoneal surface
- better cosmetic outcome

Most of these topics are essential aspects of MIS in general. With respect to resection of the compromised gut in Hirschsprung's disease, visualization, subtle dissection, and preserved integrity of the abdominal wall despite extended procedures are of specific value. Furthermore when comparing the one-stage laparoscopic procedure to the two-stage Duhamel procedure there was a tremendous reduction in hospital costs [2].

Limitations of a laparoscopic operation are an enterocolitis because of the inflammatory reaction of the tissue or scar formation. Thus the time point of operation should be chosen according to local conditions. A

long megacolon and/or massive distension of the bowel may restrict the free space in the abdominal cavity and thereby alter the possibility to perform the dissection under good exposition. A third limitation – probably the most important – is the personal expertise of the surgeon. This is true for open procedures as well, but the specific demands of MIS add to this principal aspect. Careful consideration must be given to the question when and if to convert to laparotomy.

Open questions refer to the timing of resection: primary or secondary. This mostly is influenced by the time of admission of the child and the degree of bowel distension that has already developed. Presence of enterocolitis is a further factor in the decision.

Choice of method (Swenson, Duhamel, Soave, Rehbein) depends on the preference of the surgeon as well as study data. The technique described here essentially is an adaption of the Swenson method of MIS – or the adoption of MIS to the Swenson method. It is the merit of [11] to have perceived the benefits of a minimally invasive dissection in children with rectal aganglionosis. This led to a very elegant technique for removing the rectum and a large part of colon without a significant degree of damage to the abdomen and probably a systemic stress which are unavoidable in open surgery. In Table 3 the early postoperative results and intraoperative complications of four major published series with 214 laparoscopic procedures are presented which are comparable or less to those reported to open procedures [9] proving the overall feasibility and safety.

The superiority of laparoscopic techniques in comparison to laparotomy still has to be proven. There is substantial lack of data which demonstrates the postulated benefits with scientific accuracy. Nevertheless, it

Table 3. Major intraoperative and postoperative complications of four published laparoscopic series.

Paper	N	Number of centers	Complications
De Lagausie et al 1999 [8]	30	1	Converted 3 (10%) Anastomotic leak 1 (5%) Retrorectal abscess 1(5%) General sepsis from central line 1 (5%) Reoperation 2
Georgeoson et al.1999 [10]	80	6	Converted 2 (2.5%) Enterocolitis 6 (7.5%) Chronic Diarrhea 6 (7.5%) Anastomotic leak 2 (2.5%) Bleeding 1 (1%) Recurrent constipation (1%) Reoperation 4
Kumar et al. 2003 [14]	42	1	Converted 0 Enterocolitis 2 (4,7%) Malone procedure 2 (4,7%)
Wang et al. 2004 [23]	62	1	Anastomotic leak 2 (3.2%) Colon perforation 1 (1.6%) Enterocolitis 13 (21%) Salmonella sepsis 1 (1.6%) Reoperation 6 (9.6%)

will be difficult to overcome this problem because controlled randomized trials on this subject can only be achieved in multi-center studies which is a common prerequisite; yet the problem of randomisation is more troublesome. MIS has created facts (and opinions) that make it difficult to explain to a patient or to parents for her child that a method should be applied for scientific benefit which they think to be obsolete. Furthermore the "real good" results which could demonstrate the superiority of one surgical technique to another in Hirschsprung's disease requires a follow-up time of 15 years and more after the operation [13] and includes the stooling pattern, sexual dysfunctioning and quality of live which is difficult to fulfil in a randomised trial. The data of the present paper are far away from providing enough evidence on this subject.

In summary, laparoscopic resection of the bowel in Hirschsprung's disease has been shown to be safe and feasible with the same reconstructive outcome as open procedures and offering the common advantages of minimally invasive surgery. Nevertheless, this conclusion is a result of clinical observation and few studies. Valid prospective trials still must confirm the suggested superiority of this method.

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