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Technical Modification of the Georgeson Procedure for Hirschsprung's Disease

A 12 Years Experience with the Laparoscopic-Assisted Mesocolon Dissection

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ABSTRACT

Introduction: Actually the primary laparoscopic endorectal colon pull-through, reported by Georgeson, is the gold standard in the treatment of Hirschsprung's disease.

In this procedure the dissection of the aganglionic colon is performed laparoscopically.

We describe a technical modification of the Georgeson procedure: the laparoscopic-assisted mesocolon dissection.

Methods: A retrospective analysis was performed on all patients undergoing laparoscopic pull-through for Hirschsprung's disease, in our department, from September 2000 to March 2012.

A pneumatic anchorage Hasson type 10 mm port is used for the camera (umbilical) to allow the video-assisted procedure. The two or three operative access are small abdominal port (3-5 mm).

The distal ganglionic zone is initially identified by seromuscular biopsies, obtained exteriorizing the colon through the umbilical wound. A colon pedicle, preserving the marginal artery, is fashioned through a laparoscopic-assisted stage: the mesocolon dissection was performed not endoscopically, but exteriorizing the colon through the umbilical wound progressively. Then the rectal mobilization is performed transanally, using an endorectal sleeve technique. The anastomosis is performed transanally, 5 mm above the dentate line.

Results: 27 patients underwent laparoscopic colon pull-through sec. Georgeson for Hirschsprung's disease with a laparoscopic-assisted mesocolon dissection. Also patients

affected by Hirschsprung's disease long segment were treated with this video-assisted technique.

Patients treated with this technique were aged between 1 month and 1 year. Intraoperatively no complications occurred and the video-assisted dissection stage was easy to perform in all patients. The post-operative course was uneventful.

Conclusions: Laparoscopic-assisted colon pull-through, described by Georgeson, represents actually the gold standard in the treatment of Hirschsprung's disease, but the totally endoscopic mesocolon dissection is encumbered by technical complexity and a significant learning-curve for the surgeon. The laparoscopic-assisted mesocolon dissection allows to simplify this stage, decreasing the rate of intra-operative complications. Moreover, this technique is also feasible in patients affected by Hirschsprung's disease long segment.

1. Introduction

The primary laparoscopic transanal endorectal colon pull-through, firstly reported by Georgeson in 1995 (1), has become the most popular minimally invasive technique for the treatment of Hirschsprung's Disease (HSCR) (1-12).

The Georgeson procedure represents a minimally invasive Soave-type operation, because these techniques are based on similar technical principles (2).

With the Georgeson procedure, the sigmoid colon and proximal rectum are mobilized laparoscopically. A submucosal sleeve is developed transanally to meet peritoneal dissection. Once reached, the muscular rectal sleeve is divided circumferentially. The colon is pulled-down through the rectal sleeve and divided above the transition zone. Then the anastomosis with the anal mucosa is performed (1-12).

The laparoscopic endorectal pull-through is indicated for patients with HSCR confined to the left colon without: associated life-threatening anomalies, deteriorating general health, severe Hirschsprung-associated enterocolitis or severe distension of the proximal bowel. Using these criteria, about two-thirds of patients affected by HSCR could be treated with this procedure (1-4).

Nowadays the Georgeson procedure is considered the gold standard for the treatment of HSCR but as for any surgical procedure, especially those performed laparoscopically, adequate experience is needed.

In the Georgeson procedure, the mesocolon dissection is the key laparoscopic step. Also for a well-trained surgeon, the laparoscopic mobilization of the colon pedicle can be a technical challenge, encumbered by a significant learning-curve for the surgeon. Moreover, this step could be not free from complications (7, 8, 9, 11, 12).

Our experience with the Georgeson procedure started in 2000, but from the January 2007 the laparoscopic-assisted mesocolon dissection was introduced to simplify the laparoscopic step and it was successfully used instead of the conventional laparoscopic procedure.

With this technique the mesocolon dissection is performed outside the abdomen, after the exteriorization of the colon through the umbilical wound. Only if necessary, the complete dissection of the distal mesocolon is achieved laparoscopically.

The aim of this retrospective study is to report our experience and surgical outcomes with this technical modification of the Georgeson procedure for the treatment of HSCR.

2. Materials and Methods

Fig. 1: exteriorization of the colon through the umbilical wound; the aganglionic colon, the transition zone and the distal ganglionated colon were exteriorized (the colon is aganglionic in its narrowed portion and widens proximally in its transition zone and distal ganglionated portion).

A retrospective analysis was performed on all the medical files of patients undergoing laparoscopic pull-through for HSCR, in our department, from September 2000 to March 2012.

We evaluated: age, extension of the aganglionosis, surgical technique and complications.

We studied the technical details of the procedure used in the last 6 years characterized by the laparoscopic-assisted mesocolon dissection, assessing the feasibility and safety of this modified technique.

The feasibility has been evaluated underlining some technical details that have to be considered in older patients.

We also evaluated the effectiveness of this technique in all the left colon aganglionosis: both rectosigmoid forms and descending colon ones.

Technique

The day before the surgery, the patient is prepared by irrigations of the colon with saline. An intravenous dose of cephalosporin and gentamicin is administered at the entrance of the patient in the operating room.

Fig. 2: the mesocolic dissection starts from the mesentery of the distal ganglionic zone and in this portion a window is made.

The procedure is performed with the patient under general anesthesia.

The patient is placed at the end of the table, initially is supine (laparoscopic step) then in a lithotomy position (perineal dissection).

During the laparoscopic procedure, the surgeon used to stay on the right side of the patient and the cameraman in front of the surgeon.

A pneumatic anchorage Hasson type 10 mm port, for the 5-10 mm camera 0°, is inserted through an umbilical incision, using an open technique. We use a 10 mm port to allow the video-assisted procedure.

The pneumoperitoneum with an endoabdominal pressure of 8-10 mmHg and a flow of 0.5-1 L/minute is established.

Two or three 3-5 mm operative ports are placed respectively in the right and left flank (paraumbilical position) and, if necessary, the third one is positioned in the right hypochondrium and the camera is moved into this port. The third one is positioned, during the procedure, only when the distal mesocolic dissection needs to be completed endoscopically.

Fig. 3: laparoscopic-assisted mesocolon dissection completed in a neonate affected by rectosigmoid aganglionosis (“classic form”).

The transition zone is recognized visually and the colon proximal to the transition zone is grasped and exteriorized through the umbilical access, removing the respective port (Fig. 1). Then a seromuscolar biopsy is obtained outside the abdomen and the distal ganglionic zone is identified. The seromuscolar biopsy is obtained through a video-assisted technique not only to simplify the procedure, but also to ensure a good sample size.

The mesocolon dissection is performed not endoscopically, but exteriorizing the colon and its mesentery through the umbilical wound progressively. The dissection, always performed close to the colon wall, starts from the mesentery of the distal ganglionic zone and in this portion a window is made (Fig. 2). Then the dissection proceeds distally.

In “classic forms” of HSCR only the rectosigmoid mesocolon is dissected to allow adequate mobilization of the colon for the pull-through procedure (Fig. 3).

In descending colon aganglionosis, the mesocolon dissection starts more proximally and proceeds distally. The mesentery could be managed in the same above-mentioned manner, exteriorizing progressively the portions of the colon and the respective mesentery (Fig. 4).

Fig. 4: laparoscopic-assisted mesocolon dissection completed in a neonate affected by HSCR “long segment” (in this figure is also shown the marginal artery preserved to maintain the blood supply of the colon pedicle).

At the end of the video-assisted mesocolon dissection, we perform a laparoscopic exploration and, if the mesentery is completely mobilized, only the rectal peritoneal reflection is circumferentially transacted (neonates and infants) (Fig. 5).

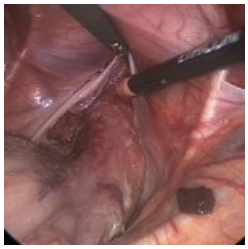

Fig. 5: In neonates and infants, once the laparoscopic-assisted mesocolic dissection has been performed, only the rectal peritoneal reflection has to be endoscopically transacted.

The superior rectal vessels are preserved to maintain a good blood supply to the rectal cuff.

Fig 6: Laparoscopic-assisted mesocolon dissection performed in a 6 year-old child: the mesenteric dissection proceeds until the distal exteriorization of the colon is possible.

In older patients, the distal mesenteric dissection is not completed by the video-assisted procedure because the exteriorization of the distal colon through the umbilicus could be difficult (Fig. 6). Therefore, at this time, if necessary, not only the peritoneal reflection is endoscopically transacted, but also the complete dissection of the distal Mesocolon is achieved laparoscopically (Fig. 7).

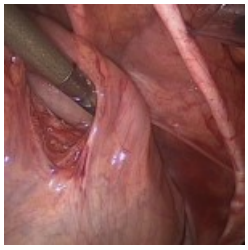

Fig 7: Laparoscopic view of the distal mesocolon (in the 6 years-old child) that has to be dissected laparoscopically.

The last laparoscopic exploration is done to verify the absence of bleeding and the adequate mobilization of the colon for the endorectal pull-through. The colon pedicle should be long enough to reach deep into the pelvis without tension. The length of the pedicle is evaluated by grasping the colon above the transition zone and pushing this segment down into the pelvis.

The patient is moved in a lithotomy position to start with the endorectal dissection. The endorectal dissection is performed as in the conventional procedure described by Georgeson.

The surgeon moves at the patient's feet and the assistant is on the right of the surgeon.

The perineal dissection starts exposing the anal mucosa. This is achieved by placing circumferentially 6-8 traction sutures through the anal mucosa (outward the dentate line) and the perineal skin. The transanal dissection of the rectal mucosa begins 5 mm above the dentate line. A circumferential submucosal plane is developed by blunt and sharp dissection. The

mucosa dissection is extended proximally until the previously dissected rectum prolapsed; that means that the transanal submucosal dissection has reached the endoabdominal rectal dissection.

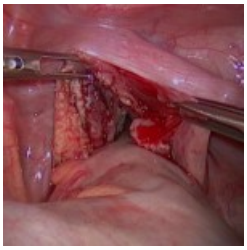

Fig 8: Laparoscopic exploration to verify the nonrotated position of the colon, to check the absence of bleedings and of tension of the bowel end (in this figure is also shown the muscular rectal sleeve split medially in its anterior portion).

The rectal muscle is circumferentially divided at the distal point of the endorectal dissection. The muscular rectal sleeve is medially split both anteriorly and posteriorly to allow more room for the pulled-through colon. Then the bowel is pulled-through the muscular rectal sleeve until the ganglionated bowel is reached, that is over the seromuscolar biopsy performed at the beginning of the procedure. The aganglionic colon is transacted and the anastomosis is performed, suturing the ganglionated colon with the anal mucosa 5 mm above the pectinate line.

The last evaluation is done by a final laparoscopic exploration to verify the nonrotated position of the colon, to check the absence of bleeding and of tension of the bowel end (Fig. 8).

3. Results

In our department from September 2000, we have treated 49 patients affected by HSCR with the primary laparoscopic transanal endorectal colon pull-through sec. Georgeson.

The Georgeson procedure is applied to all patients with HSCR confined to the left colon, without severe colonic distension (then generally without colostomy), associated life-threatening anomalies, deteriorating general health and severe enterocolitis.

Typical clinical aspects of HSCR conduced to the diagnosis in all cases: delayed passage of meconium, abdominal distension or constipation in neonatal age and chronic constipation in infants and children. None at the clinical onset was started with Hirschsprung-associated enterocolitis.

Colic nursing starts at the beginning of the clinical manifestation and feeding was allowed in all patients except in case of enterocolitis HSCR-associated.

Barium enema was done in all cases and definitive diagnosis was made with rectal suction biopsies. Only in doubtful cases a seromuscolar biopsies were obtained through a laparoscopic-assisted procedure.

No patient had previous abdominal surgery.

Between September 2000 and January 2007, we performed 22 primary laparoscopic transanal endorectal colon pull-through sec. Georgeson.

From January 2007 to March 2012, 27 patients underwent a laparoscopic transanal endorectal colon pull-through for HSCR and in all of these patients we performed a laparoscopic-assisted mesocolon dissection.

Of these patients, 23 suffer from a "classic form" of HSCR (interesting the rectosigmoid) and in 4 patients the aganglionosis interested also the descending colon (3 neonates and 1 infant).

The video-assisted mesocolon dissection was applied in 10 neonates, 8 infants (< 12 months) and in 9 children (age ranged from 2 years to 9 years, mean 3,6 years).

In all neonates and infants, the laparoscopic-assisted mesocolon dissection was easy to perform and completed by this way. Only the peritoneal reflection was endoscopically circumferentially transacted.

Also in the 4 patients (3 neonates and 1 infant) affected by a HSCR "long segment", the mesocolon dissection was completed by the video-assisted procedure.

Like in neonates and infants, in all children, we start with the mesocolic dissection outside the umbilical wound and we proceeded distally by this way until the exteriorization of the colon was possible. Only in children, the dissection of the distal portion of the mesentery was completed endoscopically.

We don't report conversions to open laparotomy (as for the first 22 patients treated with the conventional Georgeson procedure) and the perineal dissection was easy to perform in all cases.

The laparoscopic control performed at the end of the procedure did not showed tension of the pulled-through colon into the pelvis.

The average operation time was 190 minutes (range: 150 – 300 minutes) for the group of patients treated with the laparoscopic-assisted mesocolon dissection. The average operation time was 230 minutes (range: 180-360 minutes) for the group of patients treated with the conventional Georgeson procedure.

With this modified technique we report neither intra-operative nor post-operative complications (as for the first 22 patients treated with conventional Georgeson procedure).

Oral feeding was restarted at time of resumption of bowel function (1 to 3 days post-operatively) and patients were discharged home on days 4 to 10 (mean 5,6 days).

Anal dilations were begun on days 14 and continued for the next 4-6 months.

Follow-up ranged from 3 months to 12, 8 years (mean 5,6 years).

Nowadays 25 patients (51%) have regular bowel movements (one-two times per day), 20 patients (40,8%) have periods of occasional constipation that we treat with oral therapy and colic nursing. 4 patients (8,2%), recently treated, are suffering from the classical prominent soiling (8-10 bowel movements per day) that characterized the early post-operative period.

4. Discussion

The primary laparoscopic transanal endorectal colon pull-through sec. Georgeson has become the most popular minimally invasive technique for the treatment of HSCR and nowadays is the gold standard for HSCR confined to the left colon.

In this procedure, the sigmoid colon and proximal rectum are mobilized laparoscopically. Then the endorectal dissection is performed transanally (1-12).

Laparoscopic devascularisation and mobilization of the aganglionic segment is the key step of the Georgeson endoscopic procedure. The endoscopic mobilization of the colon pedicle is encumbered by a surgical complexity and a significant learning-curve for the surgeon. Antao et al. reports 6 patients treated with the Georgeson procedure and 2 cases convert to open procedure due to 'difficulty mobilizing the colon in the pelvis' (8). So the Georgeson procedure should be performed when the surgeon is skilled in laparoscopy (11).

Moreover the complications related to the endoscopic mobilization of the colon pedicle are rare but reported in the Literature (7,9,12). Even if bowel injuries (thermal burns, lacerations due to scissors or grasping forceps) during the laparoscopic procedure are uncommon complications, these events are usually associated with high morbidity and could be life-threatening events. The colon in pediatric age is typically very thin and vulnerable to grasping forceps manipulation, so damages of colic tissues during the laparoscopic procedure could happen. Recently, some cases of colon perforation during laparoscopic mesocolon dissection with secondary free peritonitis are described (7,9). Wang et al. Also describes a case of recto-urinary fistula after a pull-through, probably due to thermal injury to the colon, the bladder or both during the laparoscopic dissection (7). In 2011 Turial et al. reports a minor injury of an iliac vein, by inadvertent slippage of an electrocautery hook, that required subsequent laparotomy (12).

The laparoscopic-assisted mesocolon dissection arises to reduce the technical difficulties of the laparoscopic mobilization of the colon pedicle that characterized the Georgeson procedure, without loose the advantages of the minimally invasive approach.

At the beginning, we started with the laparoscopic-assisted seromuscular colon biopsies (10) not only to simplify this procedure but also to ensuring a good sample size. Then we extended the video-assisted approach to the treatment of the colon mesentery: 'if the exteriorization of the colon through the umbilical wound is so easy to obtain samples, why not perform the mesocolon dissection by this way?'.

Moreover the video-assisted surgery, applied for many surgical, pediatric procedures, has gained more and more popularity: pieloplasty, appendectomy, treatment of Meckel's diverticulum, small bowel atresia and intestinal duplications (13, 14, 15, 16).

The goal of this surgical approach is to combine the advantages of laparoscopic methods with those of traditional surgery.

From our experience the laparoscopic-assisted mesocolon dissection has proved to be easy (as also showed by the operative times). This is particularly true in the neonates and infants where the mesocolon dissection could be entirely completed by this way. This is significant because nowadays more than 90% of HSCR are treated in the neonatal age (4).

On the contrary, in children the laparoscopic-assisted mesocolon dissection has to be completed endoscopically because the distal colonic exteriorization through the umbilicus is not possible. But only the dissection of the distal mesentery is done endoscopically.

Not considering the age of the patient, an important technical aspect is to perform a wide umbilical incision (for the 10 mm Hasson port) to exteriorize/reintroducing colon and mesentery easily from/into the abdomen. Also the relaxation of the abdominal wall helps these maneuvers.

The mesocolon has to be divided up to a point that allowed adequate mobilization of the colon for the pull-through procedure (1). So the mesocolon dissection has to be extended enough to allow an easy colon pull-through. With the laparoscopic-assisted technique we don't report any difficulties during the pull-thorough procedures, also in patients affected by HSCR "long segment".

On the contrary, during the dissection is mandatory to maintain the marginal artery for the blood supply of the ganglionated pulled-through colon. With the laparoscopic-assisted procedure, we don't report cuff abscess, neither leak nor strictures of the anastomosis and these complications are related to tension of the anastomosis or ischemia of the pulled-through segment (6).

In conclusion, in our hands, this modified technique has simplified the conventional Georgeson procedure, maintaining the advantages of a minimally invasive surgery.

This technical modification is particularly easy to perform in neonates and infants and nowadays most of HSCR are treated exactly in the neonatal age. But also in children, the laparoscopic-assisted mesocolon dissection has simplified the laparoscopic step of the Georgeson procedure, bearing in mind that in children this procedure has to be completed endoscopically.

The laparoscopic-assisted mesocolon dissection ensures a safe and effective colon pedicle mobilization and does not restrict the indication of the Georgeson procedure, ensuring also the treatment of HSCR located in the left colon.

So, as happened to other procedures, the video-assisted approach can be considered as an evolution of the laparoscopic one.

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