



Mesenteric closure with polymer-ligating clips after right colectomy with complete mesocolic excision for cancer and mesentery-based ileocolic resection for Crohn's disease

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Abstract

Mesenteric closure following right colectomy remains controversial and, following the advent of laparoscopic surgery, many surgeons do not routinely close the mesentery after colorectal resection. Nevertheless, especially after the introduction of operations such as right colectomy with complete mesocolic excision and ileocolic resections with extensive mesentery removal for Crohn's disease, the wide mesenteric defect resulting from the dissections can certainly expose the patients to complications such as internal hernias or volvuli. In general, mesenteric closure requires intracorporeal suturing. We describe a simple technique for the closure of the mesentery after surgical resection using polymer-ligating clips. This novel technique seems to minimize the time, effort and risk inherent to the procedure, even after large mesenteric excisions.

Keywords Mesenteric closure · Polymer-ligating clips · CME · CD

Introduction

For many years, mesenteric closure (MC) has been considered necessary following bowel resections. Since the advent of laparoscopic surgery, routine MC has been considered futile and has become almost obsolete [1, 2]. Nevertheless, internal hernia (IH) can be a potentially devastating complication, especially if it results in acute small bowel obstruction or ischemia. The incidence of 5 cases per 1000 patients of IH following colorectal surgery, reported mostly by retrospective case series with short follow-up or case reports, is probably underestimated [3–5]. Furthermore, patients undergoing laparoscopic resection seem to be more prone to this complication and show a higher reoperation rate with a substantial risk of mortality [6, 7]. Moreover, no there has been no investigation of MC after right colectomy that encompass larger excisions of the mesentery, such as right colectomy with central mesocolic excision (CME) and mesentery-based ileocolic resection for Crohn's disease (CD) [8–14].

Opponents of MC maintain that it is a tedious, useless and risky step of the operation: suturing the mesentery, which, although simple in expert hands, is often considered prone to accident, as it comes at the end of a major surgical procedure when the surgeon's attention span is at its lowest. Laparoscopic MC is time consuming and certainly prolongs operative time; the bowel or other innocent bystanders can be injured during suturing and both mesenteric bleeding and hematoma formation might jeopardize blood supply to the bowel near the anastomosis. Treating larger defects after CME resections and thick mesentery in CD can be even more challenging. Thus, we propose a simple technique for a fast and safe closure of the mesenteric defect using polymer-ligating clips, which has successfully been employed in a consecutive series of patients undergoing right colectomy with CME and ileocolic resections with mesenteric excision for CD.

Materials and methods

All patients at our institution undergoing laparoscopic right colon resection with CME and all patients undergoing laparoscopic ileocolic resection for CD from January 2018 to December 2019 had MC using polymer-ligating clips. We prospectively recorded: longitudinal

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and transverse measures of the mesenteric defects; time required to complete MC; number of failures and subsequent need to stitch the mesentery; intraoperative complications such as bleeding; hematoma formation and intestinal or mesenteric tears. Postoperative and mid-term complications were also analyzed, with particular attention to leaks, bleeding, small bowel occlusions, internal hernias, volvuli and hospital readmissions.

Laparoscopic right hemicolectomy with CME for cancer (attached video: supplementary file)

We use a 4-port technique: three 12 mm trocars in the left flank and one 5-mm port in the right inguinal fossa. A mediolateral dissection starts at the level of the junction of the superior mesenteric vein (SMV) with the ileocolic vessels. The SMV is dissected to accomplish a central vascular ligation (CVL). The dissection follows the plane of the SMV from the ileocolic vessels until the division of the mesentery distally and toward the head of the pancreas and the first part of the duodenum cranially. The Henle's trunk is dissected and divided into cancers of the hepatic flexure. After the ileocolic resection, the neo-terminal ileum is dragged towards the transverse colon and a side-to-side ileocolic isoperistaltic anastomosis is fashioned. The ileum should form a sort of C-loop in the right flank (Fig. 1); the two flaps of mesentery can be grasped with the forceps and held together. The mesenteric defect is closed by affixing ligating clips every 1–2 cm along the edges of the mesentery (Fig. 2). Polymer-ligating clips are extremely resistant and easy to apply thanks to their V shape and anchoring hook. They are also easy to remove should they be misplaced.

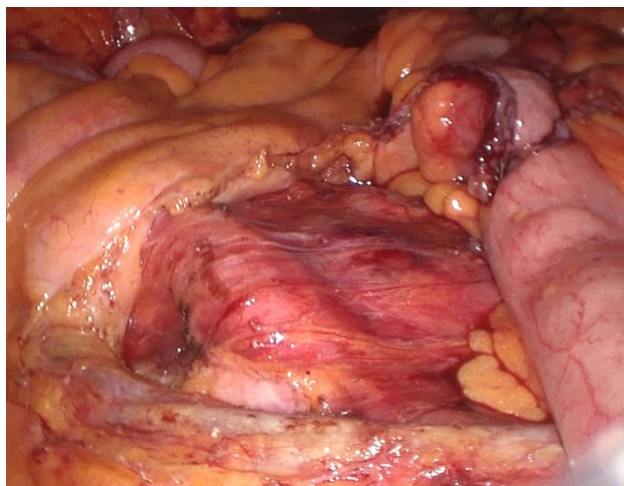


Fig. 1 Mesenteric defect after complete mesocolic excision and intracorporeal ileocolic anastomosis

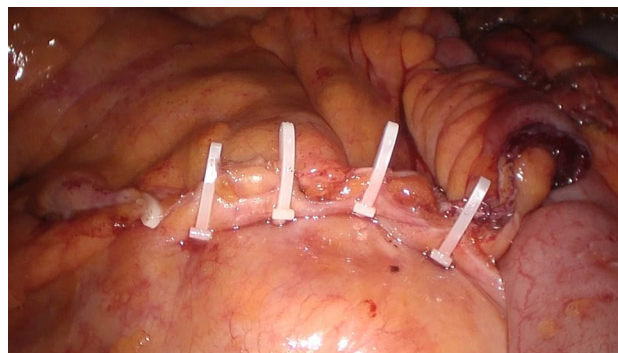


Fig. 2 Mesenteric closure with polymer-ligating clips

Laparoscopic ileocolic resection for CD (attached video: supplementary file)

Trocars placement is slightly different as often the first access is through the umbilicus. A second 12 mm port is inserted in the left iliac fossa, and a third 5 mm port is inserted in the left flank. If required, a fourth 5 mm port is placed in the right iliac fossa. Dissection is not as radical as in right colectomy with CME, but a sort of central mesenteric dissection is carried out also in CD ileocolic resections to obtain wider lymph node and mesenteric excision. We have employed this technique since 2019 with ligation of the ileocolic vessels 1–2 cm from the SMV and superior mesenteric artery. After division of the vessels, the ascending colon is transected possibly without mobilizing the right flexure and without dividing the gastrocolic ligament. The mesentery of the terminal ileum is divided into layers, if necessary, with the aid of an energy device. Once the ileum has been transected and the anastomosis fashioned, the MC is performed as described. Due to the thick mesentery and enlarged lymph nodes, it is not always easy to grasp the divided mesentery to bring together the two limbs. In this case, we found useful the use of the hook of the ligating clip to anchor the peritoneum of the mesentery to bring near the two edges. In CD surgery, it might be necessary to place one or two additional clips.

Results

Forty-one patients (28 with right colon cancer and 13 with ileocecal CD) were treated during the study period. Eighteen patients were male and 10 female, median age 42 years (range 18–67 years). It was possible to close the mesenteric defects with polymer-ligating clips in all patients; the median time required was 2.7 min (range 1.0–3.5 min) and there were no intraoperative complications. There was no

mortality in this small series. Regarding complications, in the right colectomy with CME group, two patients had anastomotic leaks requiring surgical revision: one patient developed an early leak due to an anastomotic defect and underwent a redo of the whole anastomosis; the second patient developed a leak on postoperative day 4, had wash-out of the abdominal cavity, suture of the anastomotic defect and protective ileostomy. In addition, in this group, one patient bled from the right colic vein in proximity of Henle's trunk the same day of the operation and was taken back to the operating theatre. One patient had a small abscess (postoperative leak according to the Italian consensus [15]) and was treated conservatively. Amongst the 13 patients with CD, one patient had a small radiologic leak that was treated conservatively. During follow-up (median duration 23 months; range 12–36 months), no long-term complications, such as obstructions, volvuli or internal hernias, were recorded. Results are shown in Table 1.

Discussion

Mesenteric hernias are rare but important complications of laparoscopic colorectal surgery. The evidence does not support routine closure of mesenteric defects in all cases, but it is possible that long-term complications due to internal hernias are under reported. Furthermore, it is important to remember that some advantages of the laparoscopic approach, such as early mobilization and reduced formation of intraperitoneal adhesions, can facilitate the formation of internal hernias.

Many centers have insisted on MC at the time of colorectal resection as a preventive measure against the problem of internal herniation.

It is the authors' opinion that there are two situations in laparoscopic colorectal surgery in which MC can be considered somewhat challenging: (A) right hemicolectomy with CME and (B) mesentery-based ileocolic resection for CD.

(A) The complete excision of the meso-structure, which is the primitive dorsal mesenterium, an embryological "envelope" made of a double-layered mesenchymal fibrofatty tissue and also route for cancerous diffusion, seems to be crucial to enhance clearance of the surgical field and to avoid local recurrence. CVL permits an extensive lymph node dissection, limiting regional recurrence and systemic dissemination, possibly providing improved survival in stage I–III colon cancer [16–21]. After this operation, the whole retroperitoneal space of the right abdomen is left bare, from the vena cava to the right flank. To fashion the ileocolic anastomoses, the neo-terminal ileum, anchored to the root of the mesentery, will be necessarily translated heterotopically to the right flank, occupying the space freed by the right colon and it will reach the transverse colon creating an almost closed loop, leaving behind a large triangular space. Clearly, after the CME and associated CVL, to close the mesentery, the edges of the fibrofatty tissue and peritoneum on the left side of the SMV should be overlapped and sutured to the mesentery of the terminal ileum, making this MC technically more challenging due to the tension on the tissues and the vicinity of vital structures. Furthermore, it is possible that the large opening left after the CME dissection could facilitate the sliding, through the mesenteric defect, of loops of small bowel in the retroperitoneal space, over the head of the pancreas and Morrison's space.

(B) In recent years, Coffey et al. have reported a significant reduction in surgical recurrence after ileocolic resection for CD by adopting a more radical, "mesentery based" surgical approach [9]. Despite the impressive results presented, the study has been criticized and perplexity still remains

Table 1 Results

	Right hemicolectomy with CME (28 patients)	Ileocecal resection (13 patients)
Length of mesenteric defect (cm), mean \pm SD, (range)	12.3 \pm 1.6 (9–15)	8.4 \pm 1.2 (7–11)
Closure time (minutes), mean \pm SD (range)	2.7 \pm 0.5 range (1–3.5)	
Need of mesentery stitching, <i>n</i>	0	0
Successful clip mesentery closure, <i>n</i> (%)	28 (100)	(100)
Intraoperative complications, <i>n</i>	0	0
Complications, <i>n</i> (%)	4 (4.3)	1 (7.7)
Bleeding	1 (3.6)	0
Anastomotic leak	2 (7.1)	1 (7.7)
Abdominal abscess	1 (3.6)	0
Mortality, <i>n</i>	0	0
Follow-up (months), mean \pm SD, range	23 \pm 7.1 (12–36)	

CME complete mesocolic excision

[22]. Since 2019, we have adopted a new approach (presented at the Italian Group for Inflammatory Bowel Disease meeting [IG-IBD] in 2020 and currently objective of a prospective trial: Clin. Gov. NCT04623476) based on the pathophysiology of CD recurrence. This approach entails resection of all nodes draining the affected bowel along with the bowel itself, with a medial-to-lateral approach, following established principles for oncologic resection in colorectal surgery (Fig. 3) [23].

As for MC, some considerations also apply to abdominal CD surgery. In fact, dealing with the mesentery of CD patients is always challenging due to the inflammation of the fat tissue, characteristic of the disease. The recent tendency to enlarge the surgical excision of the mesentery during ileocolic resection, might lead, in CD surgery as well, to a wider defect after ileocolic resection. As previously mentioned, the handling of such an inflamed tissue requires special care during closure and the laparoscopic stitching could certainly become troublesome.

When assessing the pros and cons of MC, we must consider the risks of mesenteric hemorrhage, devascularization of the bowel and kinking of the anastomosis. Using polymer-ligating clips, we have had no intra- or postoperative complications attributable to the technique, but it is reasonable to suppose that the proposed technique may potentially result in complications such as hematoma, bleeding or ischemia and can be responsible for formation of adhesions due to foreign body reaction or migration [24, 25]. However, the perceived impression is that of a simple technique: it is certainly necessary to pay attention to where the clips are placed to avoid vessels occlusion, but, in case of misplacement, these clips can be removed without much effort and repositioned after accurate alignment of the two limbs of tissue.

MC with clips needs to be confronted with the current MC techniques. MC is generally accomplished by means of running absorbable suture. Sometimes, to avoid the purse-string effect of a running closure, interrupted sutures are placed instead. The surgeon be careful not to injure vessels

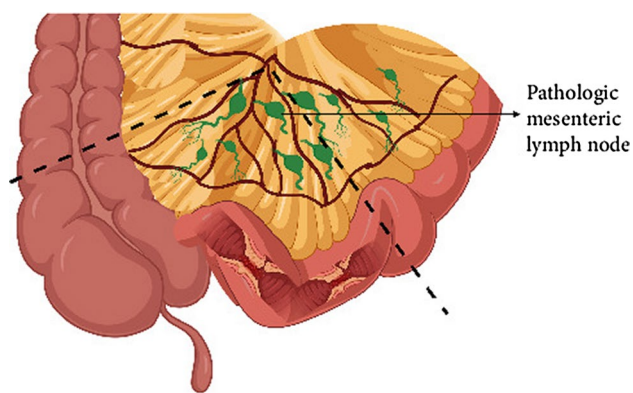


Fig. 3 Pathophysiological excision for Crohn's disease

of the mesentery, or to place sutures over afferent vessels to the anastomotic site. Another risk is common to all laparoscopic suturing in the abdominal cavity: the handling of the needle and the risk of injury to innocent bystanders and more specifically the potential risk of intestinal tears or vascular injury. In the last years, the so-called “barbed” sutures were developed to ease the intracorporeal laparoscopic suture. A barbed suture is a type of knotless surgical suture that has barbs on its surface. While tissue is sutured, these barbs penetrate inside the tissue and lock it into place, eliminating the need for knots to tie the suture. Barbed sutures make MC faster, but they can be used only in continuous sutures, they are difficult to remove once tightened, and they seem somewhat more accident prone in the above-mentioned settings [26–28].

Other, less employed, options include Fibrin glue (1 ml Tisseel[®], Baxter, Deerfield, IL, USA), applied with a spraying device (Duplospray[®] MIS Applicator, Baxter) after abrasion/rubbing of the peritoneum with a sponge and staples, using the Multifire Endo Hernia[™] Stapler (Covidien, Norwalk, CT, USA).

Mesenteric suture certainly requires some laparoscopic surgical skills; it comes at the end of the demolition and reconstruction phases and is time-consuming. Furthermore, when the two limbs of tissue that require stitching are far apart, inflamed, or thickened, this straightforward laparoscopic procedure, can become more difficult.

The present report is a simple case series, therefore, there is no comparison with other MC techniques and this is certainly a major drawback. However, we believe this technique to be a simple and effective solution to close a mesenteric defect after right hemicolectomy in all cases in which this procedural step is considered necessary.

Conclusions

In this case series, polymer-ligating clips have been employed for MC after right colectomy with CME and mesentery-based ileocolic resection for CD. The technique described seems easy, safe and effective. No specific technique-associated complications were observed in the perioperative period, nor in mid-term follow-up.

Supplementary Information The online version contains supplementary material available at <https://doi.org/10.1007/s10151-021-02493-w>.

Declarations

Conflict of interest The authors declare no conflict of interest.

Ethical approval The study was conducted according to the guidelines of the Declaration of Helsinki. Ethical approval was not requested as

for local policy on retrospective study conducted exclusively on datasets where involved subjects are not identifiable.

Informed consent Patients included in the study formally and individually gave consent for the procedure.

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