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Ileo-colic Anastomoses – A Review

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Abstract

Background: Anastomosis between the small bowel and colon has been performed using a number of techniques. Despite a large number of trials and publications, a generally accepted optimal technique does not exist. There is a wide spectrum of procedures with variability in the technical details.

Data sources: The systematic literature search was performed by analysing the relevant databases – MEDLINE, EMBASE, Cochrane Library, and Google Scholar.

Conclusions: Guidelines regarding the ideal technical procedure for performing an ileocolic anastomosis are not currently available. Extracorporeal, stapled, side-to-side anastomosis with double-layer closure of the enterotomy is most commonly performed. Based on recent literature, laparoscopic/robotic right hemicolectomy with intracorporeal anastomosis currently seems to be the most promising technique.

Keywords: Ileo-colic anastomoses, techniques, review

Introduction

An ideal ileocolic anastomosis has a minimal risk of leak, does not bleed, leads to a rapid recovery of bowel function, and stenosis does not occur in the long-term. It reduces the risk of recurrence in nonspecific inflammatory bowel diseases. In recent literature, the risk of leak in this location is reported to be 3-10%.[1,2] Bleeding and stenosis are relatively rare, and reliable data are lacking. The situation varies in cases of Crohn's disease, where stenosis usually develops as a consequence of disease recurrence with an incidence reaching up to 60%.[3]

Anastomotic complications are associated with a number of more or less established risk factors. For the surgeon, the most important factors are those he can influence, primarily the surgical technique.

Anastomosis between the small bowel and colon has been performed by various techniques. The open surgical procedure was expanded to a minimally invasive technique at the end of the 20th century. This currently includes a wide spectrum of procedures ranging from laparoscopically-assisted procedures and hand-assisted laparoscopic procedures to totally laparoscopic and

robotic operations. There is also variability in the technical details (hand-sewn anastomosis, combined stapled and hand-sewn anastomosis, completely stapled anastomosis), or in the configuration of the anastomosis (end-to-end, end-to-side, side-to-end, side-to-side, Kono-S anastomosis, isoperistaltic, or antiperistaltic anastomosis). Different types of sewing materials are used, continuous or interrupted sutures, and various types of staplers with varying staple height. Evaluation of blood perfusion using indocyanine green or hyperspectral imaging is rarely used.

Despite the number of published studies, a generally accepted optimal technique of performing an ileocolic anastomosis does not exist. Heterogeneity in patient sets in studies, as well as technical variability of the procedure, complicate objective comparison. This results in a lack of clearly formulated and generally accepted guidelines, based on robust data.

The aim of this review is not, and cannot be, a recommendation of one universal method. The work summarizes current comparisons of the most commonly used techniques of ileocolic anastomosis in terms of the surgical approach (open, laparoscopic, robotic) and basic technical details.

Open, Laparoscopic and Robotic Surgical Technique

According to current data, laparoscopic right hemicolectomy offers a better postoperative course, lower risk of complications and similar oncological results as a conventional open procedure.[4] However, the quality of the laparoscopic complete mesocolic excision (CME) and the extent of lymph node dissection have been questioned.[5,6] The variability of blood supply to the right colon and the presence of critical structures (duodenum, venous trunk of Henle) makes the laparoscopic performance of CME technically demanding. Anania et al. reviewed 17 studies involving 2508 patients and reported that laparoscopic CME did not lead to a higher incidence of anastomotic leak when compared to the open approach, however, it was accompanied by a greater blood loss and higher frequency of conversion.[7] In 2021, the same group published a cohort of 5038 patients, confirming the benefits of a laparoscopic approach, especially in the early postoperative course with no difference in anastomotic complications.[8] Similar results are presented in other meta-analyses;[9,10] however, they often originate from specialized centres and their generalization is limited.

Robotic technique utilising a 3D view and instruments with EndoWrist® technology may reduce the technical difficulty of right hemicolectomy. According to the literature, the robotic approach is best at decreasing the number of conversions,[11] in the quality of CME,[12] and allows easier anastomosis construction[11,13] compared to laparoscopic surgery. Milone et al. did not find a difference in the frequency of leaks when comparing identical techniques of intracorporeal ileocolic anastomosis performed laparoscopically versus robotically.[14] Guadagni et al. in their analysis of 30 studies involving 2066 patients reported a significant reduction in anastomotic bleeding when using the robotic stapler (SmartClamp®Technology) compared to the laparoscopic stapler;[15] however, high quality RCT's with a sufficient number of patients are still lacking.

Extracorporeal vs. Intracorporeal Anastomosis

There are two technical variants when performing the ileocolic anastomosis during laparoscopic right hemicolectomy– extracorporeal and intracorporeal. The intracorporeal technique has certain potential advantages. Bowel mobilisation in the abdominal cavity and traction to the mesentery are less extensive, the risk of unwanted bowel twisting is reduced, mesenteric defects are more easily closed, and it is possible to select the most advantageous area for removing the resected specimen. Extracorporeal anastomosis may be technically difficult in obese patients with a thick abdominal wall, or in patients with a broad or shortened mesentery. Disadvantages of an intracorporeal anastomosis are longer operating times, technical difficulty, and the potential risk of contamination when opening the bowel lumen inside the abdominal cavity.

Results of studies are not unanimous. Some authors have not confirmed significant differences between the two techniques.[16,17] Most recent works, including meta-analyses, report that patients with intracorporeal anastomosis have a more rapid functional recovery of the gastrointestinal tract, less pain, decreased morbidity, lower number of surgical site complications, shorter hospital stay and a better cosmetic results.[18-22] Cleary et al.[23] used propensity score matching to compare 379 intracorporeal and 650 extracorporeal anastomoses in a set of laparoscopically and robotically performed right hemicolectomies. In cases of intracorporeal anastomosis, longer operation time, shorter hospital stays, and less gastrointestinal and surgical site complications

were reported. In 2021, in a meta-analysis of 30 studies (1948 totally laparoscopically, 2369 laparoscopically-assisted), Zheng et al. presented a similar incidence of anastomotic complications, but a more rapid recovery of bowel function, less surgical site complications, and shorter hospital stay for patients with an intraabdominal anastomosis.[24] Hajinbandeh et al.[22] and Creavin et al.[21] used the same 4 RCT's in their meta-analysis (199 intracorporeal anastomoses, 200 extracorporeal anastomoses). They did not find a difference in the incidence of anastomotic complications, reported less postoperative pain and shorter hospitalization for the intracorporeal technique in the entire patient set, as well as in the subgroup of patients with cancer. There were fewer bleeding complications and a lower incidence of postoperative bowel obstruction at the cost of a longer operating time in patients with intracorporeal stapled side-to-side anastomosis. In addition, Creavin et al. also presented a significantly lower risk of postoperative gastrointestinal tract dysfunction in patients with intracorporeal anastomosis in their meta-analysis.[21]

Isoperistaltic vs. Antiperistaltic Ileocolic Anastomosis

In the literature, not much attention is paid to the configuration of the ileocolic anastomosis. The antiperistaltic side-to-side anastomosis is referred to as a functional end-to-end anastomosis by some authors. Advantages include eliminating the risk of bowel twisting and a lower incidence of postoperative gastrointestinal tract dysfunction. However, it requires more extensive bowel mobilization than isoperistaltic anastomosis, which according to its supporters also limits the risk of twisting and eliminates possible traction. In isoperistaltic configuration, the enterotomy is closed by suture; the antiperistaltic configuration allows closure to be done by stapler. Recent randomized studies failed to establish that the configuration of the anastomosis influenced the incidence of leaks,[25-27] both have similar results in terms of safety, complications, and functions, including quality of life.[26]

Stapled and Hand-sewn Ileocolic Anastomosis

In the literature, the stapler technique is often compared to hand-sewn ileocolic anastomosis. In a systematic review of 441 stapled and 684 hand-sewn ileocolic anastomoses presented in the Cochrane Database of Systematic Reviews from 2010 by authors Choy et al.,[28] it was reported that when the stapler was used, there was a significantly lower incidence of leaks in the entire patient set (2.5% vs. 6.1%), as well as in the subgroup of patients operated for cancer (1.3% vs. 6.7%). The stapled anastomosis is recommended by authors as the standard for comparing anastomotic techniques. The following studies, however, led to differing results. Milone et al. did not find a difference between hand-sewn and stapled anastomosis in their work focussing primarily on enterotomy closure during laparoscopic or robotic intracorporeal side-to-side anastomoses.[18] The same risk of anastomotic leak (8.1%) in a set of 3208 patients was published in a prospective multicentric international audit by the European Society of Coloproctology collaborating group. When considering risk factors, the frequency of anastomotic leak in hand-sewn anastomoses was surprisingly significantly lower than when a stapler was used.[29] A higher risk of leaks for stapled ileocolic anastomoses (7.8%) was also reported by the Spanish national study ANACO (3.4%) including 52 centres comprising 1102 patients.[30] In addition, other recent multicentric studies state that the use of a stapler for a right hemicolectomy is a risk factor of anastomotic leak.[29-32] Nonetheless, generally, the stapled anastomosis is used demonstrably more often.[29,30]

The use of a linear stapler is associated with the need to close the enterotomy by optimal technique. Guadagni et al. evaluated the frequency of bleeding or leak with regard to the technique of enterotomy closure in robotic and laparoscopic right hemicolectomies. The authors did not confirm a significant difference between using a stapler or closing the enterotomy by a one-layer or a two-layer suture.[15] A different conclusion was reached by Milone et al. in their set of laparoscopically and robotically performed ileocolic anastomoses. Two-layer enterotomy closure led to a significantly lower risk of leak, with no difference in bleeding and with no stenosis.[14] The advantage of two-layer enterotomy closure was also confirmed by Reggio et al.[33]

Over-sewing the staple line is common in resections of the upper GI tract (esophagus, stomach), where the staple line is exposed to higher pressure. The usefulness of this step in the case of ileocolic anastomosis is ambiguous. Stapler manufacturers do not recommend over-sewing the staple line for risk of ischemia. In the already-mentioned prospective multicentric international audit of the European Society of Coloproctology collaborating group, over-sewing the staple line did not lead to better results[32] and similar conclusions have also been reached by other authors.[34]

Ileocolic Anastomosis in Crohn's Disease

The issue of ideal ileocolic anastomosis in patients with Crohn's disease is slightly different. In addition to the above-mentioned complications, such as anastomotic leak, bleeding, or stenosis, there is also the risk of local disease recurrence. Although attention has long been paid to the technical performance of an ileocolic anastomosis in Crohn's disease, we still do not have an ideal technique and the presented results are controversial. A reduction in anastomotic leak in stapled side-to-side anastomoses compared to other types was confirmed by Similis et al.,[35] as well as according to a meta-analysis by authors Feng et al., with no difference in the frequency of recurrence.[36] Better results, including a reduction in the number of recurrences, were obtained after stapled side-to-side anastomosis compared to hand-sewn end-to-end anastomosis reported in the meta-analysis by He et al.[37] In a retrospective, multicentric observational study of the Italian Society of colorectal surgery focussing on patients with Crohn's disease (427 patients), Celentano et al. reported higher usage of the laparoscopic technique (72.8%), more frequent side-to-side configuration of the anastomosis (89%), and stapler preference (67%). Anastomotic leak was not dependent on the technique used for anastomosis.[38] Side-to-side configuration of the anastomosis helped reduce the risk of recurrence[38] and wide-lumen stapled anastomosis is recommended by certain surgical societies.[39] Contrarily, a better quality of life and lower frequency of re-hospitalizations are noted in end-to-end ileocolic anastomosis.[40] It has been established that neither staples nor non-absorbable suture material increase the risk of fistulas and recurrence.[38] Currently, the mesentery is studied as a potential source of recurrence. There are basically two types of surgical approaches: an extended mesentery resection proposed by authors Coffey et al.,[3] and the technique of side-to-side antimesenteric anastomosis described by Toru Kono in 2011 named the S-Kono anastomosis.[41] Robust data are still lacking.

Discussion

Almost 30 years have passed since the first right hemicolectomy was performed by laparoscopic technique.[42] At first, only mobilization of the terminal ileum and colon were performed laparoscopically. Vessel ligation, resection, and anastomosis were performed openly via mini-laparotomy.[43] In 2004, Senagore et al. described the technique of mediolateral mobilization, including vessel ligation, laparoscopically. The subsequent resection and extracorporeal anastomosis were performed by open procedure.[44] Technical difficulties with the extracorporeal anastomosis, especially in obese patients and those with a shortened mesentery, as well as efforts to minimize trauma to the abdominal wall, led to the development of a totally laparoscopic procedure. An intracorporeal laparoscopic ileocolic anastomosis was first mentioned by Roberto Bergamaschi in 1992[45] and has also been performed robotically since 2002.[46] Less frequent techniques of right hemicolectomy include hand-assisted laparoscopic resections; operations from one port or incision (SILS – Single Incision Laparoscopic Surgery); or procedures without mini-laparotomy, during which the resected specimen is usually extracted transvaginally (NOSE – Natural Orifice Specimen Extraction).

The minimally-invasive approach is generally characterized by a more favourable postoperative course with the same long-term and oncological results. The frequency of laparoscopically performed right hemicolectomies differs in the Western world. In Holland or Denmark, up to 75% of elective colorectal resection operations are performed laparoscopically. In other areas of Western Europe and in the USA, the frequency of laparoscopically performed hemicolectomies ranges between 30–50%.[47,48] An audit performed by the European Society of Coloproctology regarding right hemicolectomy stated that 54.6% of the procedures were performed laparoscopically.[29]

Isoperistaltic and antiperistaltic orientation of the anastomosis do not differ in safety or functionality (26). Although recent data question the superiority of a stapled anastomosis to hand-sewn, especially with regard to risk of leak,[29-33] a stapler is most frequently used during construction of the ileocolic anastomosis.[29,30] Intracorporeally performed ileocolic anastomosis also provides other potential benefits for the patient, such as less pain, more rapid recovery of bowel function, less complications, reduced surgical site infection rate, and better cosmetic effect.[49-54] This technique is not currently generally widespread. The situation is beginning to rapidly change with the use of the robotic approach. The robotic technique is safe, reduces the difficulty of a laparoscopic operation, reduces the number of conversions, and shortens the surgical training time. Short-term results of the robotic technique compared with laparoscopic right hemicolectomy are the same,[55] or in certain parameters

slightly better.[56,57] Long-term results are also comparable.[58,59] Disadvantages include high acquisition and operational costs of the robotic system. However, the number of studies is still low and robust data are lacking.

Conclusions

Guidelines regarding the ideal technical procedure for performing an ileocolic anastomosis are not currently available, despite a number of published studies. Extracorporeal, stapled, side-to-side (isoperistaltic or antiperistaltic) anastomosis with double-layer closure of the enterotomy is most commonly performed.

Based on recent literature, laparoscopic/robotic right hemicolectomy with intracorporeal anastomosis currently seems to be the most promising technique. A number of interacting factors limit the reliability of results from randomized studies. Another method of data analysis (neural networks) could help find associations and support the surgeon in selecting the optimal technique for ileocolic anastomosis for each specific patient.

Conflict of Interest Disclosure Statement

The author has no conflict of interest to declare.

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