

Intracorporeal versus extracorporeal anastomosis in laparoscopic right hemicolectomy

A retrospective study and review of literature



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Daniele Provenzano, Salvatore Lo Bianco, Guido Zanghì, Giulia Griggio, Francesco Sardo, Riccardo Morici, Antonio Biondi, Giuseppe Russo, Antonio Stracqualursi, Francesca Sardo

Department of General Surgery and Medical-Surgical Specialties, Policlinico "Vittorio Emanuele" Hospital, University of Catania, Italy

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INTRODUCTION: *Several studies have suggested that intracorporeal anastomosis (IC) has advantages over extracorporeal anastomosis (EC) in laparoscopic right colectomy. Scientific evidence is lacking. The aim is to define the possible benefits of intracorporeal anastomosis compared with extracorporeal anastomosis in elective surgery.*

METHODS: *A single-centre retrospective study was performed. The primary endpoint was duration of hospital stay. Secondary outcomes included operative time, bowel recovery, conversion to open surgery and postoperative complications.*

RESULTS: *In the IC group mean hospital stay was 7,100 days, mean age was 70,5 years, mean operating time was 233 minutes and mean time to restoration of digestive function was 3,950 days. In the EC group mean hospital stay was 9,455 days, mean age was 72,55 years, mean operating time was 183 minutes, mean time to restoration of digestive function was 5,364 days.*

CONCLUSION: *This study shows many clinical outcomes advantages for the intracorporeal anastomosis technique in laparoscopic right colectomy. IA was associated with earlier bowel recovery, decreased hospital stay and fewer complications; operative time was shorter in EA*

KEY WORDS: Anastomosis, Colon cancer, Laparoscopy, Hemicolectomy, Retrospective

Introduction

Colorectal carcinoma is the second most common form of cancer in western world. Right-sided hemicolectomy for right sided colonic cancer is a common performed procedure¹. General surgeons adopted laparoscopic techniques in the 1980s with subsequent utilization to colorectal surgery in 1991². Recent adoption by colorectal surgeons was the robotic approach in 2002³. Laparoscopy is the main surgical approach for elective colonic cancer resection^{4,26} and is a well-established technique for right colectomy surgery. However, despite introduction of laparoscopic surgery and enhanced recovery protocols, morbidity remains substantial. Large ran-

domized trials and national registry data show that the overall in hospital morbidity is still approximately 30 %⁵. The restoration of bowel continuity after minimally invasive colectomy can be performed in either an intracorporeal (IC) or extracorporeal (EC) anastomosis. There are no clear guidelines on the indications for performing each type of anastomosis, and the selection remains at the discretion of the surgeons. Current data suggest that IC is superior to EC, but findings are based on non-randomized studies. The purpose of this RCT was to compare the two surgical techniques, and to define the possible benefits of IC versus EA in patients undergoing elective right colectomy.

Methods

This single centre retrospective study was conducted in a centre with expertise in laparoscopic colorectal surgery.

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Correspondence to: Daniele Provenzano (e-mail: danieleprov@libero.it)*

The same team of two colorectal surgeons performed both types of anastomosis. Written informed consent was obtained from all patients.

The primary endpoint was duration of hospital stay, measured in days. The hospital stay was time from the first postoperative day at 08.00 hours and the final day, that was the day of medical discharge at 08.00 hours.

Secondary endpoints were duration of surgery, time to restoration of digestive function (first passage of stool), anastomosis methods, emergency surgery, conversion to open surgery, post-operative complications, were also considered.

Ten patients treated with primary open surgery and two patients, who underwent conversion to open surgery, were excluded. TNM seventh edition of the AJCC was the classification of choice for cancer staging⁶. All histological data fell into the category of T₁₋₃NxM₀.

All physicians adopted similar follow-up protocols that included outpatient visits every 3 to 6 months for physical examinations and routine blood tests. Follow up provided for Ultrasonography, CT in addition to colonoscopy every 1 to 3 years if necessary.

Two surgeons with extensive experience in laparoscopic and colorectal surgery performed all surgical procedures. The first steps of the procedure were the same. The surgeon used four trocars: a 10-mm trocar (Hasson trocar, camera port) in left paraumbilical position, a 5- to 12-mm working trocar in the left upper quadrant, a 5-mm working trocar in suprapubic position, and a 5-mm working trocar in the right upper quadrant. After the realization of the pneumoperitoneum, the next step was the identification and ligation of ileocolic vessels by medial to lateral dissection. Mesocolon dissection and colon mobilization completed first steps.

In the Extracorporeal anastomosis technique, a midline port incision was extended to serve as the extraction site. With the use of wound protectors, the surgeon made an extracorporeal anastomosis using standard open techniques.

In the Intracorporeal anastomosis technique, the terminal ileum was aligned with the transverse colon in isoperistaltic configuration. Before, a colostomy and enterotomy were created. After, the linear cutter stapler is placed and fired, creating the anastomosis; the enterotomy were closed by a double-layer absorbable intracorporeal suture.

The data has been processed using Software Statistica version 10. All statistical values were computed with 95% confidence intervals (CI), and the P value for statistical significance was set at ≤ 0.05 .

Results

We retrospectively reviewed the medical records of 54 patients who underwent total laparoscopic right hemicolectomy with use of isoperistaltic intracorporeal anas-

TABLE I - Number of patients enrolled and M/F ratio

	N.	%
N. patients	42	n.a.
Male	21	50
Female	21	50
M/F	1:1	n.a.

tomosis or extracorporeal anastomosis performed between April 2018 and June 2021. All patients underwent to routine investigations, total body CT, and colonoscopy and PET-CT. Patients affected by cancer of ileocecal, ascending colon, hepatic flexure of colon were included. Fifty-four patients were assessed for eligibility. Twelve patients were excluded from the study: four declined to participate and for eight patients open surgery was chosen. The total number of patients enrolled was 42: both groups consisted of 21 patients, named IC for Intracorporeal anastomosis technique and EC for Extracorporeal technique. No operations were converted to open surgery after randomization in either group, and no procedures in the IC group were converted to EC (Table I).

In IC group, 21 patients undergone to total laparoscopic right hemicolectomy with use of isoperistaltic intracorporeal anastomosis. The mean hospital stay was 7,100 days ($\pm 1,294$) (Fig. 1). The mean age was 70,5 years ($\pm 13,14$) (Fig. 2). The mean operating time was 233 minutes ($\pm 32,55$) (Fig. 3). The mean time to restoration of digestive function (first passage of stool) was 3,950 days ($\pm 0,826$) (Fig. 4). A complication occurred in 2 patients (9,5% of cases): one Pfannestiel site infection, treated with advanced dressings; one case of anemization (Hb 8 mg/DL) for bleeding from the anastomosis, resolved spontaneously on the second postoperative day. In EC group, 21 patients undergone to laparoscopic right hemicolectomy with use of isoperistaltic extracorporeal anastomosis. The mean hospital stay was 9,455 days ($\pm 2,444$) (Fig. 5). The mean age was 72,55 years ($\pm 9,054$) (Fig. 6). The mean operating time was 183 minutes ($\pm 30,77$) (Fig. 7). The mean time to restoration of digestive function (first passage of stool) was 5,364 days ($\pm 1,677$) (Fig. 8). Four patients presented post-operative complications (19% of cases): one surgical site infection, treated with advanced dressings. One case of bleeding from a terminal branch of the right colic vein, resolved spontaneously on the third postoperative day by the outflow guaranteed by the drainage positioned during the intervention. A case of moderate respiratory failure in patient with history of BPCO; he underwent to high flow oxygen therapy for two days in the intensive care unit, and subsequently readmitted to the surgical unit. A case of partial intestinal obstruction due to edema of the anastomosis, with consequent delay of the restoration of digestive function; the resolution of the oedema occurred during the sixth post-operative day,

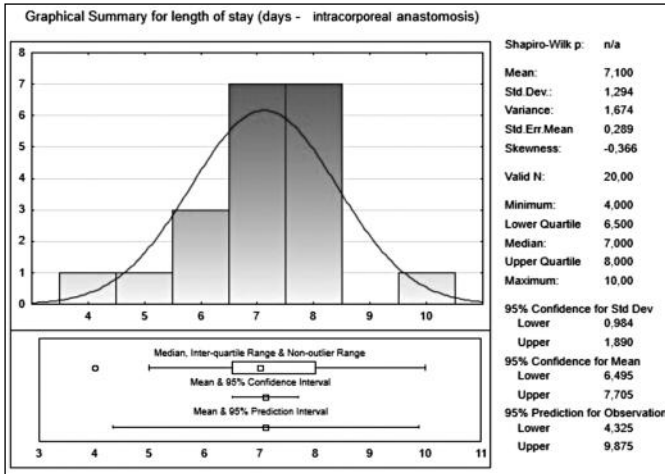


Fig. 1: Length of stay in IC group.

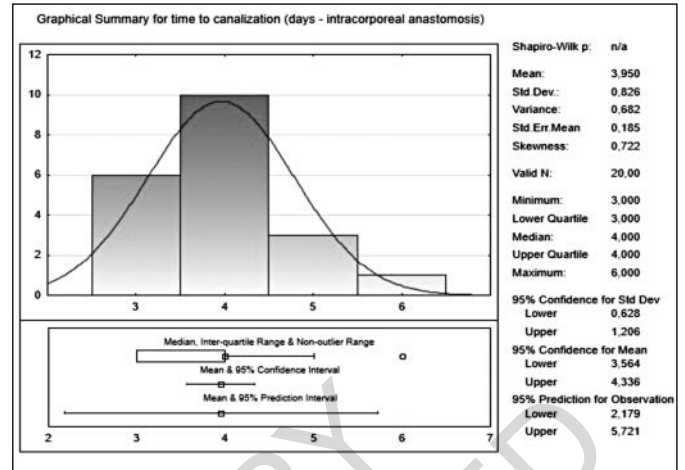


Fig. 4: Time to canalization in IC group.

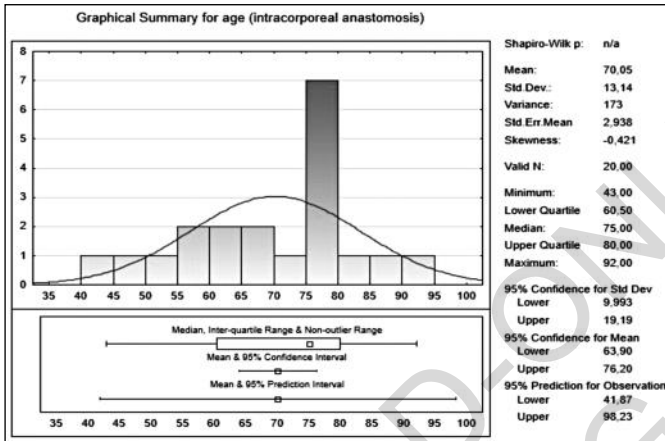


Fig. 2: Age in IC group.

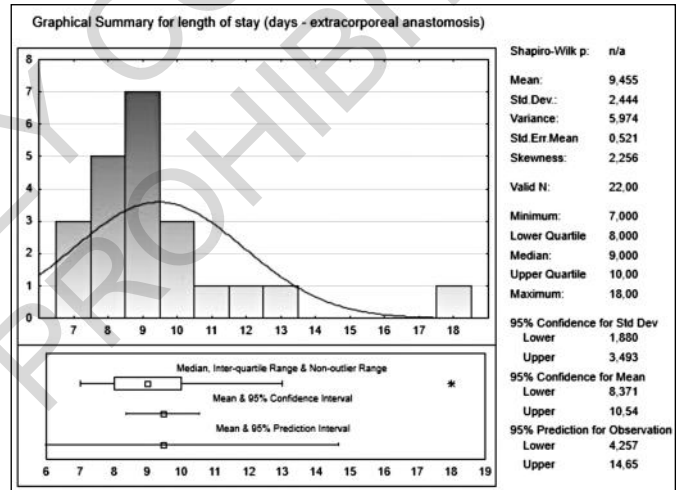


Fig. 5: Length of stay in EC group.

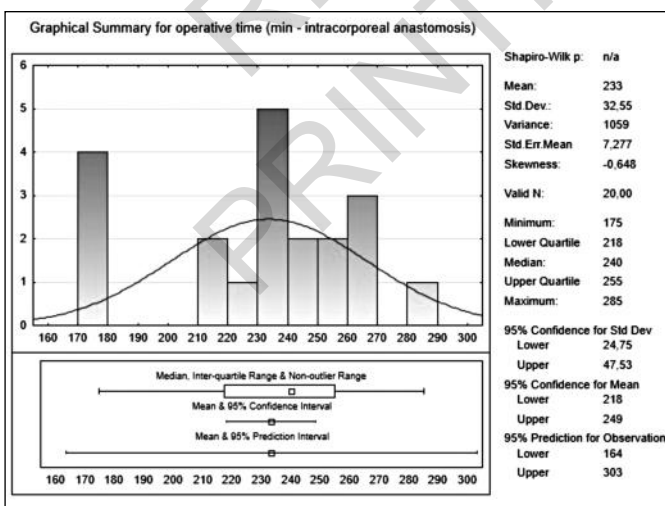


Fig. 3: Operative time in IC group.

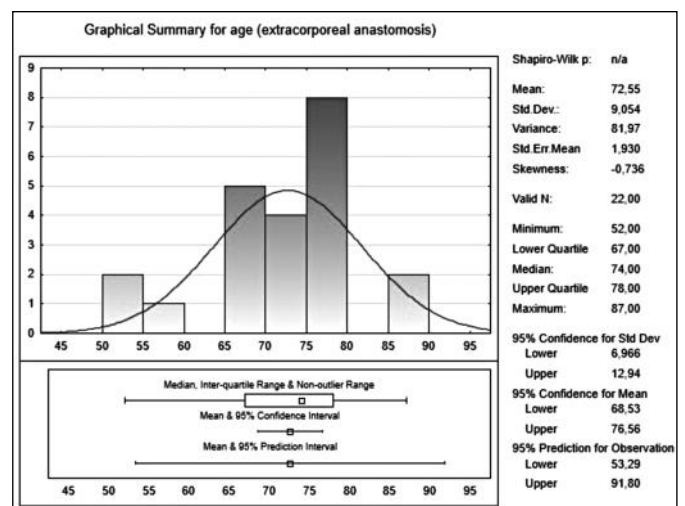


Fig. 6: Age in EC group.

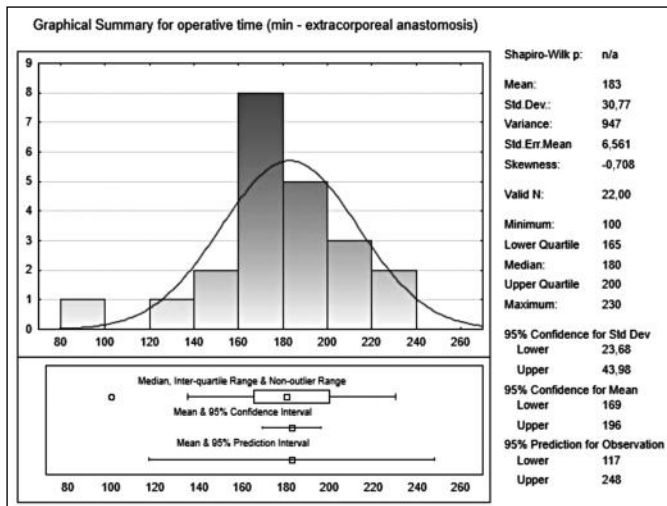


Fig. 7: Operative time in EC group.

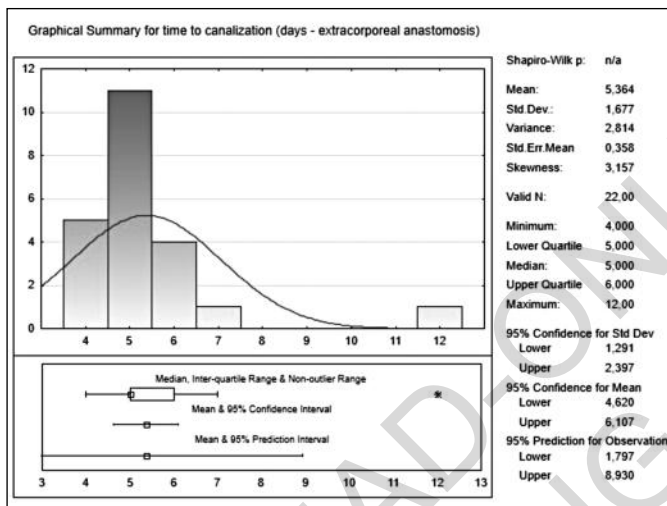


Fig. 8: Time to canalization in EC group.

TABLE II - P-value between IC group and EC group

	p-value
Operative time	0.001
Length of stay	0.004
Time to canalization	0.001
Significative for p<0.05	

with resumption of the canalization. The difference in operative time, length of stay and time to canalization between IC group and EC group was significant for $p \leq 0.05$ (Table II).

Discussion

A right hemicolectomy is one of the most common resections performed for colon cancer, with morbidity rates

of 38% being reported⁷. Minimally invasive colectomy is the standard of treatment for colonic disease in many centres⁸. About the minimally invasive right colectomy, one of the important technical aspects is the technique used for restoration of bowel continuity in either an IC or EC manner. At present, however, there is no standardized technique, and intracorporeal and extracorporeal anastomosis are both used.

Some surgeons think the EC anastomosis may help confirm healthy and soft bowel for anastomosis and confirm appropriate margins for oncologic resections. However, in order to exteriorize is necessary to mobilize more bowel and mesentery, with risk of traction injury. This may result in serosal injuries, bleeding and devascularisation of bowel and mesentery, that may contribute to post-operative ileus⁹. Furthermore, the mid-line site is associated with higher rate of infection site and incisional hernias (8-12%)^{10,11}.

The main advantage of IC anastomosis technique is that it does not require additional traction and mobilization. This decrease the risk for mesenteric bleeding, serosal injuries, and may result in less ileus⁸. The operator can remove the specimen from any surgical port; this reduce the incidence of incisional hernia⁹. Some author consider a disadvantage the impossibility to palpate the bowel. Although no studies demonstrate an increase risk in surgical site infections and sepsis, the enterotomies for the anastomosis expose the peritoneum to potential intraluminal contamination¹². Chang et al. described the use of atraumatic intracorporeal bulldogs to minimize faecal spillage when performing an IA. Since the included studies heterogeneously reported on intraabdominal abscesses and/or interventions, we cannot conclude that the IA has a significant influence on deep abdominal abscesses compared to standard EA¹³. Tolerance of a solid diet has also been reported to occur earlier in patients with an IA¹⁴⁻¹⁶.

Another difference that may explain the higher incidence of complication in the extracorporeal anastomosis technique may be the method of performing the anastomosis. While in IC anastomosis were stapled, approximately half of the EC anastomosis was hand sewn. In a Cochrane review were noted a higher rates of anastomosis leakage after hand-sewn compared to stapled ileocolic anastomosis¹⁷.

The mean hospital stay was shorter in the IC group, probably because of the smaller extraction site incision that was associated with less postoperative pain. A recent randomized trial confirmed that less postoperative pain (assessed by measuring several markers including interleukin-6, C-reactive protein, procalcitonin, white blood cell count within the first 5 days) is associated with an earlier gastrointestinal recovery^{18,19}.

This study found no significant differences in the conversion rate in either group. The mean operative time in the IC group was longer than EC group, in agreement with some reviews¹⁹.

From an oncological point of view, both IC and EC interventions are safe, and the number of nodes harvested is similar with both approaches. Total mortality did not statistically differ.

Anastomotic leaks are one of the most feared complications in colorectal surgery, and recent studies reporting a 7,4 % rate of anastomotic leakage in right hemicolectomies⁷. EC technique is associated with a significantly anastomotic leak rate; in fact studies have suggested that exteriorization of the bowel leading to compromised vascular supply and contribute to higher incidence of this complication²⁰⁻²³. In our study there were no cases of anastomosis leak.

Potential new techniques for extraction include transvaginal colectomy, a form of natural orifice specimen extraction (NOSE). This might even decrease surgical trauma, although data and randomized evidence is lacking^{23,25}. A small Pfannestiel is still the best option. Currently, the available data are insufficient to make any statements regarding safety and efficacy of natural orifice transluminal endoscopic surgery (NOTES) for laparoscopic right hemicolectomy.

There is a paucity of literature comparing robotic and laparoscopic minimally invasive approaches for IC and EC. Studies showed favourable outcomes for the robotic approach and the IC technique appears to be the responsible for the favourable outcomes²⁶⁻²⁹. IC with the robotic platform is likely available to more surgeon skill sets than laparoscopic IC because of robotic articulating instruments and ergonomic advantages

Conclusion

IA and EC anastomosis techniques proved to be safe and effective. This study demonstrates several outcomes advantages for the intracorporeal anastomosis in laparoscopic right hemicolectomy. IA was associated with reduced short-term morbidity and decreased length of hospital stay suggesting faster recovery. EA approach shows shorter operation duration, and both groups had comparable rates of conversion rate. These data may guide surgeons focused on upgrading minimally invasive training efforts and those choosing minimally invasive options for colectomies.

Riassunto

INTRODUZIONE: Diversi studi hanno suggerito che l'anastomosi intracorporea (IC) presenta vantaggi rispetto all'anastomosi extracorporea (EC) nella colectomia destra laparoscopica. Mancano, però, prove scientifiche. L'obiettivo è definire i possibili benefici dell'anastomosi intracorporea rispetto all'anastomosi extracorporea nella chirurgia elettiva.

METODI: Presso la nostra UOC è stato eseguito uno stu-

dio retrospettivo monocentrico. L'endpoint primario era la durata della degenza ospedaliera. Gli outcomes secondari includevano tempo operatorio, recupero intestinale, conversione in chirurgia a open e complicanze postoperatorie.

RISULTATI: Nel gruppo IC la degenza ospedaliera media è stata di 7,1 giorni, l'età media era di 70,5 anni, il tempo medio operatorio era di 233 minuti e il tempo medio per il ripristino della funzione digestiva era di 3,95 giorni. Nel gruppo EC la degenza ospedaliera media è stata di 9,455 giorni, l'età media era di 72,55 anni, il tempo medio operatorio era di 183 minuti, il tempo medio per il ripristino della funzione digestiva era di 5,364 giorni.

CONCLUSIONI: Questo studio mostra molti vantaggi in termini di risultati clinici per la tecnica di anastomosi intracorporea nella colectomia destra laparoscopica. Il gruppo IA era associato a un precoce recupero della funzione intestinale, diminuzione della degenza ospedaliera e minori complicazioni; il tempo operatorio era più breve nel gruppo EA.

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