Updates in Surgery

Graziano Ceccarelli
Andrea Coratti *Editors*

Robotic Surgery of Colon and Rectum

Springer

Updates in Surgery

Graziano Ceccarelli • Andrea Coratti
Editors

Robotic Surgery of Colon and Rectum

Springer

Contents

Robotic Right Colectomy: The Bottom-Up Approach

6

Giampaolo Formisano, Adelona Salaj, Luca Ferraro, Francesco Toti, Giulia Di Raimondo, Simona Giuratrabocchetta, and Paolo Pietro Bianchi

6.1 Introduction

The benefits of minimally invasive surgery in terms of 30-day postoperative outcomes for the treatment of colonic cancer are well known, with equivalent long-term oncological results [1–3].

Technological advances in surgery in recent decades have been mostly driven by the development and introduction of robotic surgical platforms that could potentially overcome the limitations of conventional laparoscopy, increase the uptake of minimally invasive colorectal resection and shorten the learning curve [4–8].

The most debated and controversial issues in right colectomy are still represented by the extent of oncological resection (complete mesocolic excision vs. standard resection) and the fashioning of the anastomosis (intracorporeal vs. extracorporeal).

The principle of complete mesocolic excision (CME) [9] with central vascular ligation with complete exposure and lymphadenectomy along the superior mesenteric axis may potentially increase the technical difficulties of minimally invasive surgery, especially when dealing with right colon cancer and its related highly variable vascular anatomy in the peripancreatic area [10].

Supplementary Information The online version contains supplementary material available at https://doi.org/10.1007/978-3-031-33020-9_6.

G. Formisano (✉) · A. Salaj · L. Ferraro · F. Toti · G. Di Raimondo · S. Giuratrabocchetta · P. P. Bianchi
ASST Santi Paolo e Carlo, Division of Minimally-Invasive and Robotic Surgery, Department of Health Sciences, University of Milan, Milan, Italy
e-mail: giampaolo.formisano@unimi.it; adelona.87@gmail.com; lucaferraro.md@gmail.com; ftoti27@gmail.com; giulia.diraimondo@unimi.it; simonagiura@live.it; bianchippt@gmail.com

G. Ceccarelli, A. Coratti (eds.), *Robotic Surgery of Colon and Rectum*, Updates in Surgery, https://doi.org/10.1007/978-3-031-33020-9_6

Moreover, conventional laparoscopy has unresolved questions on the type of anastomosis that should be performed for the reconstructive phase (intracorporeal vs. extracorporeal), even though evidence from the literature in favor of intracorporeal fashioning (more technically demanding) of the anastomosis is constantly growing [11, 12].

Herein, we present our surgical technique of robotic right colectomy with CME, intracorporeal anastomosis and bottom-up approach, as performed with the da Vinci Xi robotic platform (Intuitive Surgical, Sunnyvale, CA, USA).

6.2 Patient Positioning, Operating Room Setup, and Trocar Layout

The patient is placed on the operating room table in supine position, with arms tucked and legs closed. After induction of pneumoperitoneum using a Veress needle at Palmer's point, a 12-mm trocar for the assistant is inserted in the left flank, about 10–15 cm above the left iliac spine; four robotic trocars are inserted along a transverse suprapubic line, about 3 to 4 cm above the pubis (three 8-mm trocars and one 12-mm trocar for the robotic stapler in the left iliac fossa). Trocar layout is shown in Fig. 6.1.

The table is placed in a Trendelenburg position with a slight angle (5–10°) and left tilt (5–10°). The robot is then docked from the patient's right side and a da Vinci

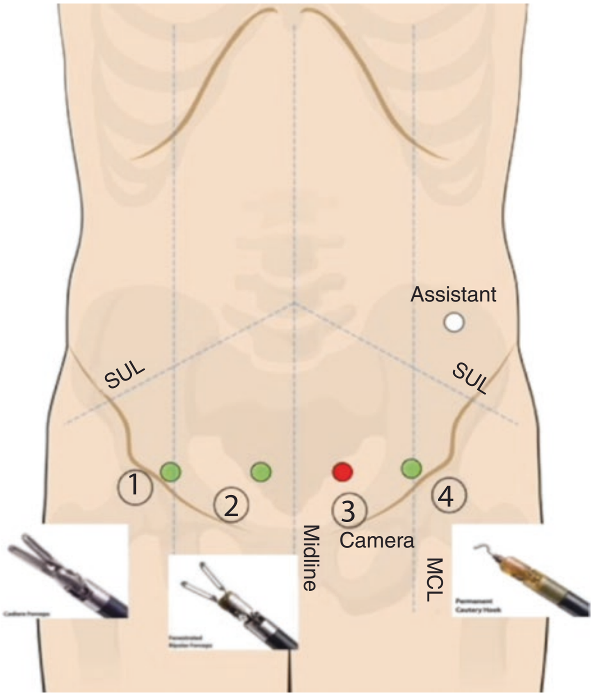

Fig. 6.1 Trocar layout with da Vinci Xi system: (1) Cadiere forceps; (2) bipolar forceps; (3) camera; (4) monopolar hook

Xi system (Intuitive Surgical, Sunnyvale, CA, USA) is used. Targeting is completed at the level of the middle transverse colon. Cadiere forceps, bipolar forceps and monopolar hook (monopolar scissors can be used according to the operating surgeon's preference) are mounted on robotic arm 1 (R1), robotic arm 2 (R2) and robotic arm 4 (R4), respectively. The 30-degree down optical system is mounted on robotic arm 3 (R3). If necessary, the scope can be mounted on R2 to allow for better visualization of the mesenteric root/superior mesenteric vessels during the first steps of bottom-up dissection.

6.3 Surgical Technique

The procedure starts with the dissection of the mesenteric root of the last ileal loop from the posterior plane: this is obtained by suspending anteriorly and cranially the cecum with the robotic graspers in R4 and the last ileal loop (20 to 30 cm from the ileocecal valve) with the assistant's instrument. After mobilization of the cecum, dissection continues cranially to separate the ascending mesocolon and the mesenteric root from Gerota's fascia, paying great attention to preserve the integrity of the posterior proper mesocolic fascia and thus respecting the embriologically based principles of CME; the duodenum and the head of pancreas are thus easily reached in the cranial aspect of the dissection, as well as the superior mesenteric axis on the medial aspect. Dissection at the level of the mesenteric root should be performed as far cranial and medial as possible in order to achieve adequate mobilization of the posterolateral aspect of the mesenteric axis, thus maximizing the potential benefit of this approach in terms of central lymphadenectomy. A gauze is placed underneath the mesentery and above the third portion of the duodenum as a landmark; the cecum and the last ileal loops are then pulled back towards the right iliac fossa in their anatomical position.

The Cadiere forceps can be alternatively used to lift the transverse mesocolon or the ileocolic vessels, according to the different steps of the procedure (Fig. 6.2). When used for ileocolic vessel traction and exposure, the root of the transverse mesocolon is lifted up by the assistant's graspers to highlight the prominence of the superior mesenteric axis.

The ileocolic pedicle is lifted with the Cadiere forceps in R1 and the transverse colon is thus pulled cranially by the assistant. The peritoneal sheath just below their prominence is incised to obtain easy access to the plane that has been previously developed with the bottom-up mesenteric root detachment. The anterior surfaces of the superior mesenteric vein and the superior mesenteric artery are exposed and then an extended central lymphadenectomy is performed up to the posterolateral border of the superior mesenteric axis.

The ileocolic vessels (Fig. 6.3), right colic vessels (when present) and the superior right colic/middle colic veins/accessory veins (according to the anatomical variations that are commonly encountered in this area) are isolated at their roots and divided between self-locking clips after having obtained a complete exposure of the pancreatic head, Henle's trunk and its branches (bifurcated vs. trifurcated, right gastroepiploic vein, anterior superior pancreaticoduodenal vein, superior right colic

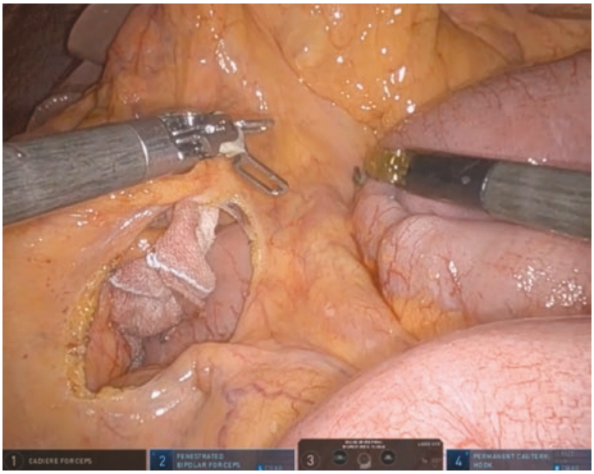

Fig. 6.2 Exposure and traction on ileocolic vessels and transverse mesocolon

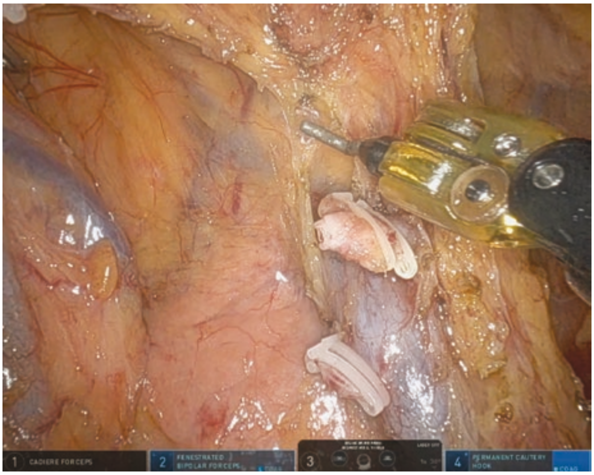

Fig. 6.3 Identification and transection of ileocolic vessels

vein) (Figs. 6.4 and 6.5). Identification of gastroepiploic vessels/mesentery can be performed and completed with a supramesocolic approach after having gained access to the lesser sac, leaving a gauze as a landmark. A robotic clip applier is commonly used and mounted on R4. A common laparoscopic clip applier can be also used, taking into account the expertise of the table assistant and the suboptimal angle for straight-stick clip applier. The transverse mesocolon is pulled caudally by the assistant, the greater omentum is lifted up by the robotic forceps in R1 and divided; the lesser sac is then entered in its medial aspect.

For cancers of the cecum and ascending colon, the right branch of the middle colic artery is clipped and divided after having identified the main trunk of the middle colic artery. The common trunk of the middle colic artery is usually divided at its root when dealing with hepatic flexure, proximal and middle transverse colon

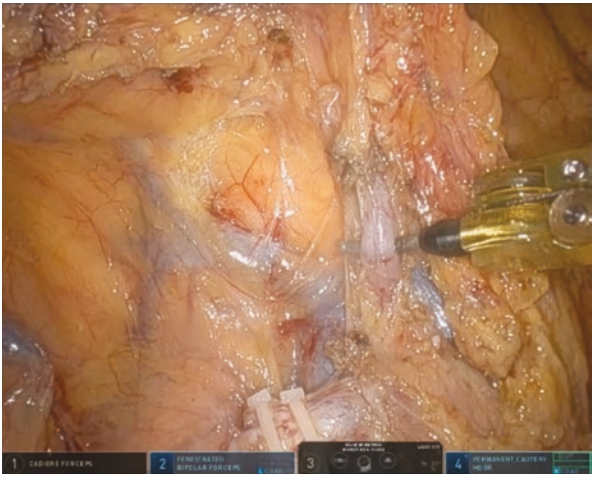

Fig. 6.4 Henle trunk dissection and identification of its branches. Middle colic artery is identified and dissected free at its root

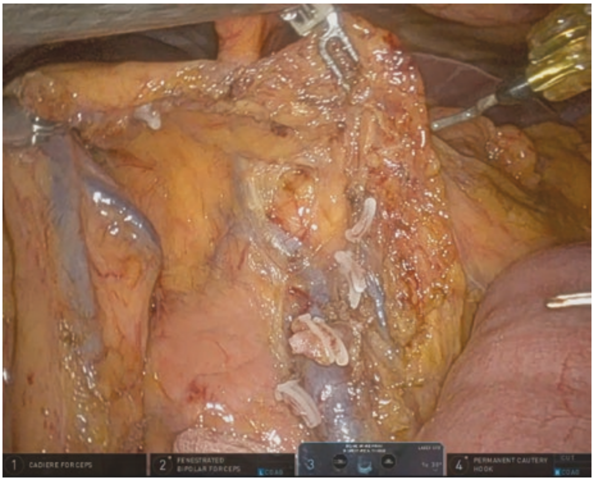

Fig. 6.5 Final view after vascular control. Middle colic artery is clipped and divided at its origin in case of extended right colectomy

cancer thus performing an extended right colectomy. Moreover, in these clinical scenarios, a vessel-preserving lymphadenectomy of the right gastroepiploic vessels is carried out after opening of the lesser sac, when dealing with locally advanced tumors at these locations.

Frontal visualization of the transverse mesocolic root and middle/distal transverse colon is another potential advantage of the suprapubic bottom-up approach, since it allows for optimal vascular exposure as well as easier fashioning of the intracorporeal anastomosis in cases of extended right colectomy, when compared to the conventional medial-to-lateral approach.

Hepatic flexure/ascending colon mobilization is then performed and completed. The transverse mesocolon and the mesentery of the last ileal loop are then divided with the Vessel Sealer device (Intuitive Surgical, Sunnyvale, CA, USA) mounted on R4.

Indocyanine green (ICG) is administered intravenously (10 mg) and both the ileal and colonic stumps are evaluated for perfusion with the integrated ICG fluorescence imaging system and sectioned with a 60-mm robotic stapler with blue cartridge (SureForm 60, Intuitive Surgical, Sunnyvale, CA, USA).

A side-to-side isoperistaltic ileocolic anastomosis is then performed with the SureForm 60 stapler with blue cartridge. The monopolar cautery in R1 is then replaced with a needle driver. The remaining enterotomy is subsequently closed with a robotically hand-sewn double-layer running suture using absorbable barbed suture (V-Loc, Covidien). We do not routinely close the mesenteric defect. Conventional 60-mm laparoscopic staplers can be also used for bowel transection and intracorporeal anastomosis.

The specimen is then extracted using an endobag through a small suprapubic incision performed by conjoining the two paramedian 8-mm suprapubic port sites. The advantages of intracorporeal anastomosis are minimal mesenteric and mesocolic traction, limited chance for anastomotic twisting and the possibility to choose the specimen extraction site (according to the patient's history of prior abdominal surgery). Intracorporeal anastomosis is beneficial especially in obese patients with short and thick mesentery.

Once the specimen is removed, the pneumoperitoneum is re-established for a final check of the operative field. No drain is routinely left in place.

6.4 Conclusions

Robotic right colectomy with CME and bottom-up suprapubic approach may potentially allow for a safe extended lymphadenectomy by providing high-quality surgical specimens and intact visceral embryological envelopes. Further data and highlights will be provided by multicenter prospective ongoing studies.

References

1. Green BL, Marshall HC, Collinson F, et al. Long-term follow-up of the Medical Research Council CLASICC trial of conventional versus laparoscopically assisted resection in colorectal cancer. Br J Surg. 2013;100(1):75–82.
2. Colon Cancer Laparoscopic or Open Resection Study Group, Buunen M, Veldkamp R, Hop WC, et al. Survival after laparoscopic surgery versus open surgery for colon cancer: long-term outcome of a randomised clinical trial. Lancet Oncol. 2009;10(1):44–52.
3. Clinical Outcomes of Surgical Therapy Study Group, Nelson H, Sargent DJ, Wieand HS, et al. A comparison of laparoscopically assisted and open colectomy for colon cancer. N Engl J Med. 2004;350(20):2050–9.
4. Bhama AR, Obias V, Welch KB, et al. A comparison of laparoscopic and robotic colorectal surgery outcomes using the American College of Surgeons National Surgical Quality Improvement Program (ACS NSQIP) database. Surg Endosc. 2016;30(4):1576–84.
5. Tam MS, Kaoutzanis C, Mullard AJ, et al. A population-based study comparing laparoscopic and robotic outcomes in colorectal surgery. Surg Endosc. 2016;30(2):455–63.

6. Al-Mazrou AM, Chiuzan C, Kiran RP. The robotic approach significantly reduces length of stay after colectomy: a propensity score-matched analysis. Int J Color Dis. 2017;32(10):1415–21.
7. Altieri MS, Yang J, Telem DA, et al. Robotic approaches may offer benefit in colorectal procedures, more controversial in other areas: a review of 168,248 cases. Surg Endosc. 2015;30(3):925–33.
8. Al-Temimi MH, Chandrasekaran B, Agapian J, et al. Robotic versus laparoscopic elective colectomy for left side diverticulitis: a propensity score-matched analysis of the NSQIP database. Int J Color Dis. 2019;34(8):1385–92.
9. Hohenberger W, Weber K, Matzel K, et al. Standardized surgery for colonic cancer: complete mesocolic excision and central ligation–technical notes and outcome. Color Dis. 2009;11(4):354–64; discussion 364–5.
10. He Z, Yang C, Diao D, et al. Anatomic patterns and clinical significance of gastrocolic trunk of Henlé in laparoscopic right colectomy for colon cancer: Results of the HeLaRC trial. Int J Surg. 2022;104:106718.
11. Trastulli S, Coratti A, Guarino S, et al. Robotic right colectomy with intracorporeal anastomosis compared with laparoscopic right colectomy with extracorporeal and intracorporeal anastomosis: a retrospective multicentre study. Surg Endosc. 2015;29(6):1512–21.
12. Selznick S, Levy J, Bogdan RM, et al. Laparoscopic right colectomies with intracorporeal compared to extracorporeal anastomotic techniques are associated with reduced post-operative incisional hernias. Surg Endosc. 2023;37(7):5500–8.