Robotic-Assisted One-Stage Resection of Colorectal Cancer with Liver Metastases

14

Graziano Ceccarelli, Aldo Rocca, Alberto Patriti, Walter Bugiantella, Fabio Ermili, Andrea Coratti, and Michele De Rosa

14.1 Introduction

Colorectal cancer (CC) is the third most common tumor in Western countries and the liver is the most common site of metastatic spread, with over 50% of patients developing liver metastases (LM) during the natural course of disease: synchronous and metachronous liver lesions are diagnosed in about 15–25% and 20–30% of patients, respectively [1]. Although synchronous disease is considered to have a less favorable biology and poorer prognosis compared to metachronous disease, surgery is nowadays the only therapy offering a potential cure. Although only 20% of these patients are eligible for surgery, radical resection of primary CC and LM may allow a 5-year survival rate ranging between 40–57%, compared to 3–9% of unresectable disease [2].

Supplementary Information The online version contains supplementary material available at https://doi.org/10.1007/978-3-031-33020-9_14.

G. Ceccarelli (✉) · W. Bugiantella · F. Ermili · M. De Rosa
General and Robotic Surgery Unit, San Giovanni Battista Hospital, Foligno (Perugia), Italy
e-mail: g.cecca2003@libero.it; dr.bugiantella@gmail.com; fabio.ermili@uslumbria2.it; michele.derosa@nhs.net

A. Rocca
Department Medicine and Health Sciences V. Tiberio, University of Molise, Campobasso, Italy
e-mail: aldo.rocca@unimol.it

A. Patriti
General and Oncological Surgery Unit, Ospedali Riuniti Marche Nord, Pesaro, Italy
e-mail: alberto.patriti@ospedalimarchenord.it

A. Coratti
Department of General and Emergency Surgery, Azienda USL Toscana Sud Est, Misericordia Hospital and School of Robotic Surgery, Grosseto, Italy
e-mail: corattian@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_14

14.2 Management of Synchronous Colorectal Metastatic Disease

A multidisciplinary approach is considered the correct management strategy. Three surgical options are available [3]: the "staged approach", with colorectal resection followed by adjuvant chemotherapy and finally liver resection, which has the advantage of a better control of bowel obstruction symptoms; the synchronous "one-stage resection" of both CC and LM; the "liver first approach". The best strategy for resectable synchronous colorectal LM is still a matter of debate [1, 2, 4]. The one-stage strategy is a safe and feasible option, especially when minor hepatectomies are performed, while for major live resections an increased risk of postoperative complications is reported [5]. A minimally invasive approach has demonstrated to be beneficial in both colorectal and liver surgery compared to the conventional open approach, with less intraoperative blood loss, quicker postoperative recovery, shorter hospital stays and fewer postoperative complications, especially if performed in high-volume centers. No difference in R0 resection margins and disease-free survival has also been reported [6]. Nevertheless, laparoscopy may prove to be a challenging procedure requiring two surgical teams or surgeons expert in minimally invasive colorectal and liver surgery.

14.3 Robotic Surgery for Synchronous Liver Colorectal Metastases

Robotic one-stage resection of synchronous CC and LM is reported in many case series worldwide [7–9]. With the last da Vinci Xi robotic platform, multiquadrant surgery is easier and re-docking of the device faster [10, 11]. The first case was published in 2008 by Choi et al. where a segment III and a low anterior rectal resections were performed robotically with a total operative time of 360 minutes [7]. Patriti et al. published in 2009 a series of seven laparoscopic and robotic procedures [8]. A systematic review by Garritano et al. in 2016 included 20 studies of laparoscopic and robot-assisted one-stage resections, concluding that the minimally invasive approach is advantageous over conventional open surgery, especially as regards short-term postoperative outcomes [12]. A systematic review published in 2018, examining over 1000 patients, showed how the robotic approach is safe and feasible for both minor and major resections [13]. Dwyer et al. reported a case series of six procedures with no conversions to laparotomy, a mean operative time of 401 min, an estimated blood loss (EBL) of 316 mL and a hospital stay of 4.5 days. One anastomotic leak and two pelvic abscesses, but no 30-day mortality were reported [14]. Soh et al. reported on four patients who underwent robotic rectal resection with an additional robotic hepatobiliary procedure, with no difference in length of stay and postoperative complications (anastomotic leak or bleeding) compared to a series of rectal resection alone [15]. In 2019 Navarro et al. published a series of 12 patients, and the liver surgery included six wedge hepatectomies, one caudate lobectomy, two right hepatectomies, one left hepatectomy, one left lateral segmentectomy, and one Associating Liver Partition and Portal vein ligation for Staged hepatectomy (ALPPS procedure). The mean operative time was 449 min with a mean EBL of 274.3 mL. There were no conversions to laparotomy, with two grade III complications, including one anastomotic leak and two liver abscesses [16]. The same year Giovanetti et al. reported a series of five patients undergoing robotic combined liver and colorectal resection with no 30-day mortality [17]. In a single-center series by Ceccarelli et al. in 2021, 28 patients with CC and synchronous LM were treated using a robotic procedure, demonstrating benefits especially for liver resection. Eighteen of 44 LM (40%) were located in posterior liver segments (4a, 7, 8 and 1), considered challenging locations for conventional laparoscopy; the mean operative time was 332 min, EBL 143 mL and length of stay 8 days; two conversions to laparotomy and three grade III–IV Clavien-Dindo complications were reported [18].

The use of robots allows optimal access to all liver segments, even for the most demanding posterior or paracaval tumors, facilitating parenchymal-sparing surgery [19]. Masetti et al. reported a fully robotic ALPPS with simultaneous left colectomy for synchronous CC and LM [20]. One case of synchronous resection of rectal, liver and lung metastases was also described [21].

The average operative time for one-stage surgery depends on the complexity of the two surgical procedures and different scores were made to plan the complexity of minimally invasive liver resections [22]. Generally, the operating time is longer in robotic surgery due to the docking process. Mc Guirk et al. reported a mean operative time of 420 minutes, not statistically different from the laparoscopic series of Zhu et al. (320 min), and Spampinato et al. (495 min) [23–25]. Length of hospital stay depends on many different factors, such as complexity of hepatectomies or colorectal resections, patient conditions, adherence to enhanced recovery program, complications.

14.4 Technical Aspects

With the aim of maximizing time efficiency and minimizing the risk of conversion, we suggest starting the operation with the most challenging procedure between liver and colorectal disease. Generally, major hepatectomies, posterior/paracaval or bilateral segments require longer time, as well as low rectal resection in obese/male patients. Sometimes a hybrid laparoscopic-robotic technique may be considered.

14.4.1 Robotic Liver Resection

If the operation starts with the liver resection, the patient lays supine with legs apart and the operative table is placed in the reverse Trendelenburg position, tilted on the opposite side to the liver tumor. For posterior segments a lateral or semilateral position or a pillow under the flank may be useful and one robotic port may be placed in the intercostal space. A preliminary abdominal cavity exploration allows exclusion of peritoneal carcinomatosis. Intraoperative ultrasound liver evaluation is routinely performed to exclude or identify other lesions and to plan and guide the resection margins during the procedure. Operative ports are positioned according to the target. Additional trocars are inserted for the assistant placed between the patient's legs. The da Vinci Xi (Sunnyvale, CA, USA) robot is docked with the arms from the patient head according to the target area (Fig. 14.1) [18]. Hepatic pedicle encirclement with loop for inflow vascular control (Pringle maneuver) is recommended for major or demanding resections, using extracorporeal or intracorporeal approaches. Liver parenchyma transection is performed using the clamp-crushing technique with robotic bipolar forceps (Maryland) and curved scissors or using others laparoscopic devices. Vessels of 3–4 mm may be managed by bipolar or energy devices, larger vessels are preferably secured using metallic clips or hem-o-lok or stitches. Indocyanine green dye may be used for intraoperative real-time identification of biliary tree and vascular anatomy or, if injected one or two days before surgery, to highlight liver lesions. It may also be useful to plan the transection line and to check biliary stasis at the end of the operation.

14.4.2 Robotic Colorectal Resection

Robotic colorectal resection generally requires a re-docking of the cart. Additional ports may be necessary according to colorectal tumor location. Right colectomy may be usually managed with a single docking (Fig. 14.1) [26]. For left colectomy and rectal resection a re-docking and new table positioning is required. For the technique we refer to the specific chapters. When colorectal resection is the first step and a Pringle maneuver is planned, the anastomosis should be performed after liver transection. After rectal resection a diverting loop ileostomy is generally considered. The specimens are extracted into different bags using a Pfannenstiel incision (Fig. 14.2) [18].

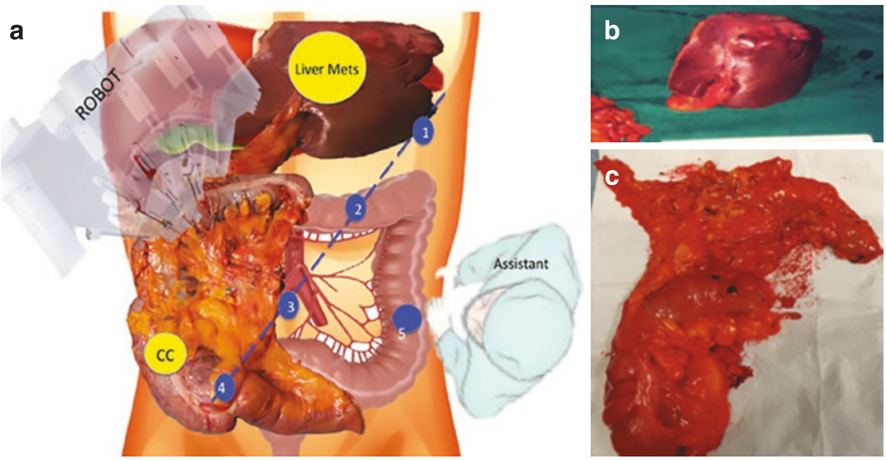

Fig. 14.1 (**a**) Single robotic docking for liver resection and right colectomy. (**b**, **c**) Specimens (left hepatectomy and right colectomy)

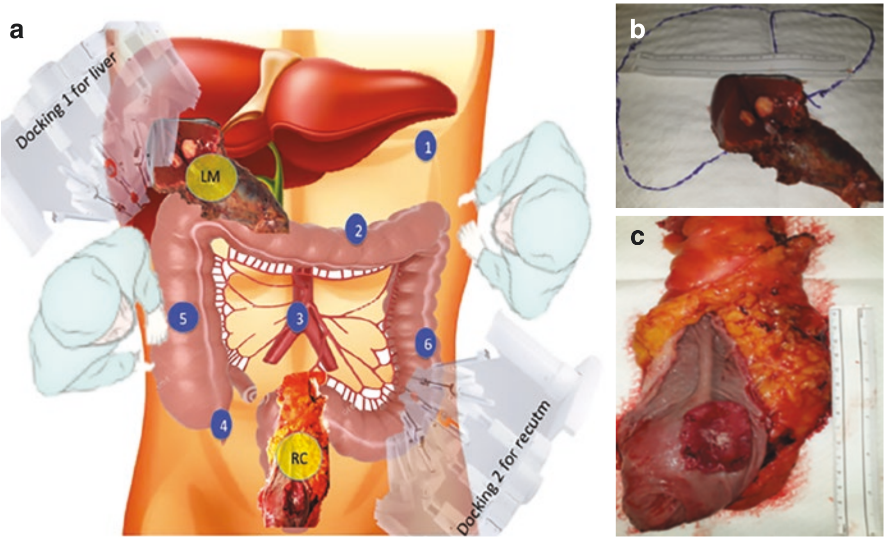

Fig. 14.2 (**a**) Double docking for liver resection (segment 5) and rectal resection (rectal cancer). (**b**, **c**) Specimens

14.5 Conclusions

The diffusion of robotic platforms has recently expanded their application for multivisceral-multiquadrant surgery and one-stage resection of LM. Compared to laparoscopy, robotic technology offers better accuracy in fine dissection and micro-suture and a better vascular management, facilitating parenchymal-sparing surgery especially for posterior segments, with a shorter learning curve. Conversion rates to open surgery seem to be reduced with robotic surgery. The hybrid approach (laparoscopy and robotic) may reduce overall operative time, reserving the robotic technology for the most challenging procedures. Randomized controlled trials are necessary to fully demonstrate the advantages of this technology, especially in terms of reduction of morbidity.

References

1. Manfredi S, Lepage C, Hatem C, et al. Epidemiology and management of liver metastases from colorectal cancer. Ann Surg. 2006;244(2):254–9.
2. van Amerongen MJ, van der Stok EP, Fütterer JJ, et al. Short term and long term results of patients with colorectal liver metastases undergoing surgery with or without radiofrequency ablation. Eur J Surg Oncol. 2016;42(4):523–30.
3. Siriwardena AK, Mason JM, Mullamitha S, et al. Management of colorectal cancer presenting with synchronous liver metastases. Nat Rev Clin Oncol. 2014;11(8):446–59.
4. Gavriilidis P, Sutcli RP, Hodson J, et al. Simultaneous versus delayed hepatectomy for synchronous colorectal liver metastases: a systematic review and meta-analysis. HPB (Oxford). 2018;20(1):11–9.

5. Jones TJ, Murphy AE, Tameron A, et al. Trends and outcomes of synchronous resection of colorectal metastasis in the modern era-analysis of targeted hepatic NSQIP database. J Surg Res. 2019;238:35–40.
6. Pan L, Tong C, Fu S, et al. Laparoscopic procedure is associated with lower morbidity for simultaneous resection of colorectal cancer and liver metastases: an updated meta-analysis. World J Surg Oncol. 2020;18(1):251.
7. Choi SB, Park JS, Kim JK, et al. Early experiences of robotic-assisted laparoscopic liver resection. Yonsei Med J. 2008;49(4):632–8.
8. Patriti A, Ceccarelli G, Bartoli A, et al. Laparoscopic and robot-assisted one-stage resection of colorectal cancer with synchronous liver metastases: a pilot study. J Hepato-Biliary-Pancreat Surg. 2009;16(4):450–7.
9. Giulianotti PC, Bianco FM, Daskalaki D, et al. Robotic liver surgery: technical aspects and review of the literature. Hepatobiliary Surg Nutr. 2016;5(4):311–21.
10. Sullivan KM, Fong Y. Multivisceral resection in robotic liver surgery. Cancers (Basel). 2022;14(2):355.
11. Morelli L, Di Franco G, Guadagni S, et al. Full robotic colorectal resections for cancer combined with other major surgical procedures: early experience with the da Vinci xi. Surg Innov. 2017;24(4):321–7.
12. Garritano S, Selvaggi F, Spampinato MG. Simultaneous minimally invasive treatment of colorectal neoplasm with synchronous liver metastasis. Biomed Res Int. 2016;2016:9328250.
13. Tsilimigras DI, Moris D, Vagios S, et al. Safety and oncologic outcomes of robotic liver resections: a systematic review. J Surg Oncol. 2018;117(7):1517–30.
14. Dwyer RH, Scheidt MJ, Marshall JS, Tsoraides SS. Safety and efficacy of synchronous robotic surgery for colorectal cancer with liver metastases. J Robot Surg. 2018;12(4):603–6.
15. Soh JS, Joo JI, Park YH, Lim SW. Robotic rectal cancer surgery simultaneously performed with combined abdominal surgeries. Asian J Surg. 2019;42(12):1024–7.
16. Navarro J, Rho SY, Kang I, et al. Robotic simultaneous resection for colorectal liver metastasis: feasibility for all types of liver resection. Langenbeck's Arch Surg. 2019;404(7):895–908.
17. Giovannetti A, Sucandy I, Dinallo A, et al. Combined robotic colon and liver resection for synchronous colorectal liver metastasis: a movement toward a new gold standard. Am Surg. 2019;85(8):e374–6.
18. Ceccarelli G, Rocca A, De Rosa M, et al. Minimally invasive robotic-assisted combined colorectal and liver excision surgery: feasibility, safety and surgical technique in a pilot series. Updat Surg. 2021;73(3):1015–22.
19. Casciola L, Patriti A, Ceccarelli G, et al. Robot-assisted parenchymal-sparing liver surgery including lesions located in the posterosuperior segments. Surg Endosc. 2011;25(12):3815–24.
20. Masetti M, Lombardi R, Romboli A, Jovine E. Fully robotic ALPPS and simultaneous left colectomy for synchronous colorectal liver metastases. J Laparoendosc Adv Surg Tech A. 2020;30(10):1106–9.
21. Xu JM, Wei Y, Wang XY, et al. Robot-assisted one-stage resection of rectal cancer with liver and lung metastases. World J Gastroenterol. 2015;21(9):2848–53.
22. Wakabayashi G. What has changed after the Morioka consensus conference 2014 on laparoscopic liver resection? Hepatobiliary Surg Nutr. 2016;5(4):281–9.
23. McGuirk M, Gachabayov M, Rojas A, et al. Simultaneous robot assisted colon and liver resection for metastatic colon cancer. JSLS. 2021;25(2):e2020.00108.
24. Zhu DX, He GD, Mao YH, et al. Efficacy analysis on laparoscopic simultaneous resection of primary colorectal cancer and liver metastases [article in Chinese]. Zhonghua Wei Chang Wai Ke Za Zhi. 2020;23(6):584–8.
25. Spampinato MG, Mandalá L, Quarta G, et al. One-stage, totally laparoscopic major hepatectomy and colectomy for colorectal neoplasm with synchronous liver metastasis: safety, feasibility and short-term outcome. Surgery. 2013;153(6):861–5.
26. Guerra F, Giuliani G, Saccucci G, Coratti A. Simultaneous, single-docking robotic resection for right colon cancer with synchronous liver metastases. Surg Oncol. 2022;43:101816.