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Robotic partial resection of the caudate lobe for recurrent colorectal liver metastasis after open left hepatectomy and open rectosigmoidectomy

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Repeat hepatectomy is often required for primary and metastatic tumors. Open abdominal surgery usually results in postoperative adhesions, which may prolong the operative time of subsequent surgeries because adhesiolysis is required. In addition, these patients are at increased risk for bowel injury and other complications. Modern oncologic treatment of colorectal liver metastases often results in resectable recurrent metastatic disease. In this case, resection of the liver is indicated and has a positive impact on survival [1]. Recurrent colorectal metastases are usually small and localized and therefore not very difficult to resect. However, many patients undergo open surgery because they have had a previous incision rather than because of the difficulty of the procedure. The first study reporting the benefits of the minimally invasive approach was published by Belli et al. and focused on recurrent hepatocellular carcinoma in cirrhotic patients [2]. Other larger studies have shown that minimally invasive repeat liver resections can be performed safely, especially in patients with prior laparoscopic resection [3]. However, the indication criteria for the use of the minimally invasive approach for repeat hepatectomy are not clear and are likely to be used only in selected cases. This video demonstrates the technical aspects of robotic caudate lobe resection for recurrent colorectal liver metastases after multiple open abdominal procedures, including left hepatectomy and resection of segment 8. A 70-year-old female patient underwent exploratory emergency laparotomy at another institution for acute obstructive abdomen. An obstructive sigmoid tumor with

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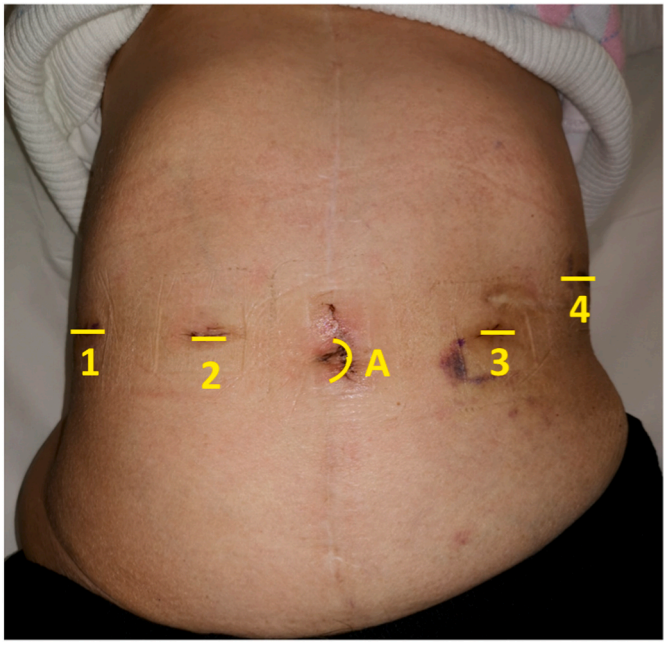

Fig. 1. Port placement for robotic hepatectomy. The photograph was taken 2 weeks after the procedure. Port 1 was used as the surgeon's left auxiliary arm (Cadière instrument). Port 2 was used as the surgeon's main left hand (bipolar forceps). Port 3 was used for the robotic camera. Port 4 served as the surgeon's right hand (robotic scissors and needle holder). Port A was used by the surgeon at the bedside for irrigation, aspiration, and clipping. It was also used to remove the surgical specimen (after a small enlargement of the incision).

synchronous liver metastases was found. She then underwent rectosigmoidectomy with protective colostomy. The patient underwent systemic chemotherapy with FOLFOX6, to which she had a partial response according to RECIST 1.1, and was referred for surgical treatment. She underwent open left hepatectomy, resection of the S8 metastasis, and closure of the colostomy during the same procedure. Two years later, an elevated CEA level was noted at follow-up, and imaging showed a solitary recurrence in liver segment 1. The multidisciplinary team decided to perform a robotic resection of segment 1. The Da Vinci Xi system was used and four robotic arms (four 8 mm trocars) were placed along with an additional laparoscopic port (12 mm). The surgeon sat at the robotic console, and the assistant surgeon stood on the left side of the patient to perform suction, irrigation, clipping, and change of robotic instruments (Fig. 1). The total operation time was 150 minutes. Adhesiolysis took 46 minutes and resection of segment 1 took 90 minutes. An abdominal drain was not placed. We are very liberal about the use of an abdominal drain. It can be exteriorized through a robotic trocar incision and removed early in the postoperative period. We do not use it in cases where the raw liver area is small and there is no concern for bile leak. In major liver resections, there may be fluid accumulation around the liver (causing pleural effusion) even if there is no evidence of bile, so we use it for a few days. Recovery was uneventful and the patient could be discharged on postoperative day 3. Pathology confirmed a 1.4 cm adenocarcinoma with free surgical margins. The patient is doing well and has no signs of the disease 4 years after the robotic surgery. In any major liver resection or resection involving the inferior vena cava (IVC) or the major hepatic veins, we advocate the use of central access to monitor central venous pressure (CVP). However, the pneumoperitomeum itself can affect the measurement of CVP, and sometimes the aspect of the IVC (flat or ingurgitated) can give us a better idea of CVP. In general, we maintain a low CVP in all of our liver resections (with the exception of minor resections). During partial resection of the caudate lobe, the IVC is in close contact with the liver and venous branches from the caudate lobe may be accidently transected or torn off, resulting in bleeding that is dangerous if not properly controlled. In this situation, the first thing you should do is compress the bleeding area with gauze and notify the anesthesiologist to reduce PEEP and watch for massive blood loss. No suctioning of any kind should be done. Irrigation is helpful to identify the bleeding site without decreasing pneumoperitoneum pressure, which may increase bleeding. Increasing the pneumoperitoneum pressure to 16 or 18 mmHg may be useful if the bleeding site is not found quickly. A needle holder and suture material should be ready. A clamp can facilitate suturing the tear, but we prefer to use one of the robotic arms to temporarily close the IVC. In this video, we see a tear in the IVC that could be repaired without risk. The bipolar forceps was used to partially close the IVC and the Cadière instrument was replaced with a needle holder to facilitate suturing. In conclusion, the robotic approach is safe and suitable for rehepatectomy after an open approach and for resection of the caudate lobe. The robotic platform allows easy and safe resolution of adhesions. The use of a robotic system can improve certain steps of minimally invasive repeat liver resection [4,5]. The magnified three-dimensional view allows better definition of the surgical field, which has been altered by previous operations, and thus better recognition of the structures of the liver hilum, allowing selective control of inflow. In a limited workspace, as is usually encountered in a repeat liver resection, the use of wrist instruments allows precise dissection and suturing whenever needed. This video shows the various steps (Fig. 2) required to perform this complex operation.

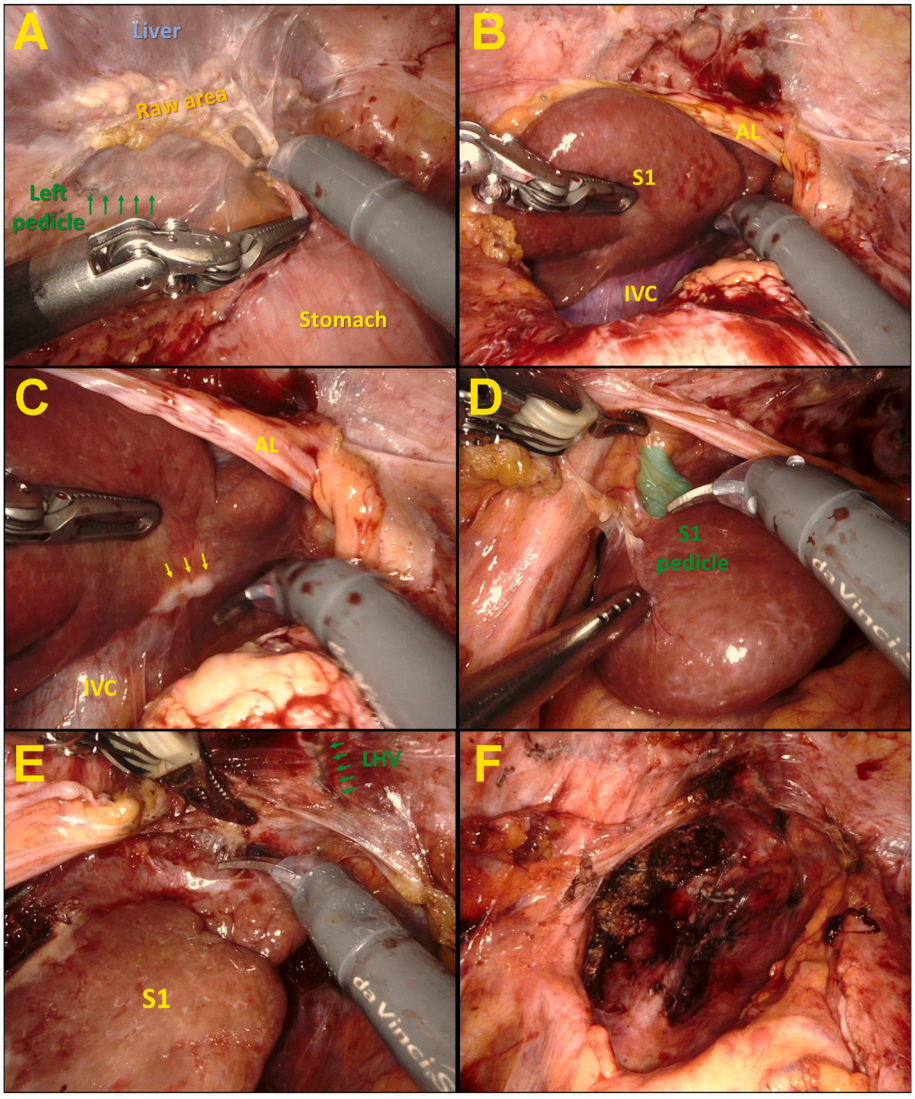

Fig. 2. Robotic repeated hepatectomy. Resection of S1 after previous open surgery.
A. Intraoperative view showing previous staple line on the left pedicle, scar on the previously transected liver (raw area), and adhesions to the stomach.
B. Intraoperative view showing segment 1 (S1), IVC (inferior vena cava), and Arantius ligament (AL).
C. Intraoperative view showing liver metastases (arrows), IVC (inferior vena cava), and the Arantius ligament (AL).
D. Intraoperative view shows the Glissonian S1 pedicle (highlighted in green).
E. Intraoperative view shows the previous staple line at the left hepatic vein (LHV). Segment 1 (S1) is already ischemic after ligation of the corresponding pedicle.
F. Intraoperative view: final view after completion of liver resection of S1.(For interpretation of the references to colour in this figure legend, the reader is referred to the web version of this article.)

Disclosure

Drs. Machado, Mattos, Lobo Filho and Makdissi have no conflicts of interest or financial ties to disclose.

Authorship statement

All authors have made substantial contributions to all of the following: (1) the conception and design of the study, or acquisition of data, or analysis and interpretation of data, (2) drafting the article or revising it critically for important intellectual content, (3) final approval of the version to be submitted.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.suronc.2023.101985.

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