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MULTIMEDIA ARTICLE

Robotic Right Hepatectomy with Portal Vein Thrombectomy for Colorectal Liver Metastasis (with Video)

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Abstract

Background Hepatectomy is the standard treatment for colorectal liver metastases. However, the high recurrence rate is a persistent problem that occurs in up to 65% of patients. Repeat hepatectomy is a feasible treatment and may offer favorable surviva but is technically demanding so minimally invasive repeat hepatectomy has been used in a few patients. Colorectal liver metastases are different from hepatocellular carcinoma and rarely present with macroscopic portal vein tumoral thrombus. To the best of our knowledge, minimally invasive approaches for this rare condition have not yet been reported.

Method We present here a video of a robotic right hepatectomy in a patient with single colorectal liver metastasis and macroscopic tumor thrombi in the right portal vein. A 61-year-old woman underwent open resection of a transverse colon cancer (T3N0M0) in December 2015. In March 2019, she underwent nonanatomical resection of a liver metastases located in segment 6 also via an open approach. She then underwent adjuvant chemotherapy. However, in September 2020, she presented with a local recurrence and a tumor thrombus in the right portal vein. She was then referred to us for treatment and a multidisciplinary team decided on upfront liver resection due to the risk of left portal vein progression. Liver volumetry showed future liver remnant of 52.5%. Right hepatectomy with portal vein thrombectomy was indicated. A robotic approach was proposed, and consent was obtained.

Results The Da Vinci system was used. The operation began with the division of adhesions from previous laparotomies. Intraoperative ultrasound was performed to locate the tumor and to confirm the portal vein invasion. Hepatic hilum was carefully dissected. The replaced right hepatic artery from the superior mesenteric artery was ligated and divided. The common bile duct was dissected and encircled with a vessel loop. The portal vein was dissected, and an enlarged right portal vein with a protruding tumoral thrombus was seen. The left portal vein and portal vein trunk were then temporarily clamped. The right portal vein was carefully transected with robotic scissors being careful not to displace the thrombus. A minimum stump was left to safely suture the portal vein. The portal vein was then closed with a running 5-0 prolene suture. The portal vein clamping was then released, and a patent anastomosis with no leakage was observed. Right liver ischemic discoloration was seen and confirmed with fluorescence imaging after indocyanine green injection. A future line of transection was marked along ischemic area. The liver was divided using bipolar forceps under saline irrigation until it was detached from the retrohepatic vena cava. A right hepatic vein was divided with a stapler to complete the right hepatectomy. The surgical specimen was removed through a suprapubic incision, and the abdominal cavity was drained with a closed-suction drain. The total operative time was 270 min with no transfusion. Pathology conformed the diagnosis with free surgical margins.

Conclusion Robotic right hepatectomy with tumor thrombectomy is feasible and safe even in the presence of lobar portal vein invasion. This video may help HPB surgeons perform this complex procedure.

Keywords Colorectal liver metastases · Portal vein thrombus · Robotic liver resection

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Hepatectomy is the standard treatment for colorectal liver metastases. However, the high-recurrence rate is a persistent problem that occurs in up to 65% of patients.[1] Repeat hepatectomy is a feasible treatment and may offer favorable survival.[1] Repeat hepatectomy is also technically demanding,

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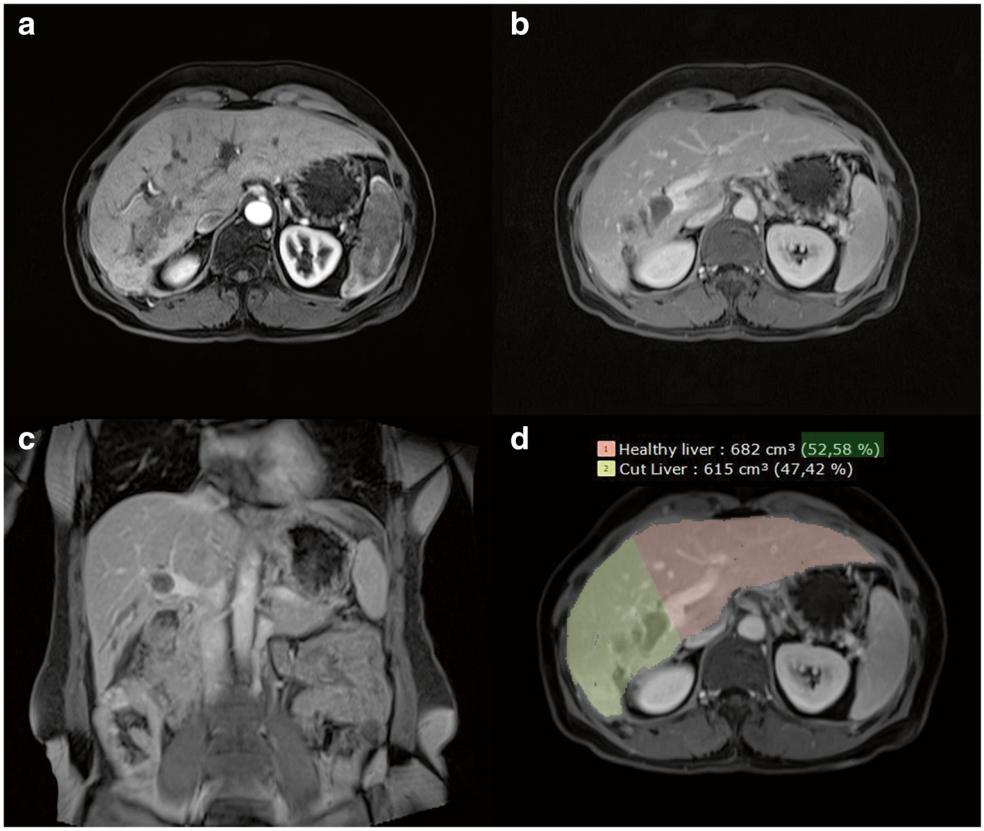

Fig. 1 Preoperative MRI. **a** Arterial phase shows signs of disturbed perfusion of right liver. **b** Axial view shows metastasis with tumor thrombus in the right portal vein. **c** Coronal view shows a tumor thrombus in the right portal vein and segmental biliary duct dilation. **d** Liver volumetry shows future liver remnant of 52.5%

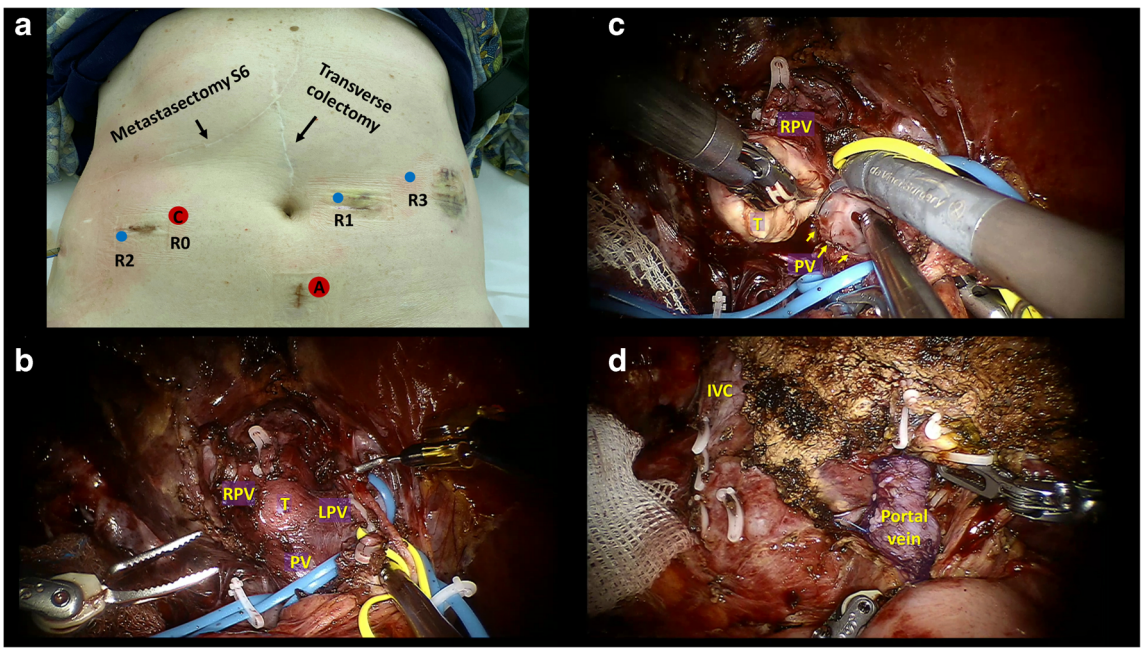

Fig. 2 Robotic right hepatectomy with portal vein thrombectomy for colorectal liver metastasis. **a** Intraoperative view before thrombectomy. *PV* portal vein trunk, *LPV* left portal vein, *RPV* right portal vein, and *T* tumor thrombus. **b** Intraoperative view during thrombectomy. *PV* portal vein trunk opened, *RPV* right portal vein, and *T* tumor thrombus. **c** Intraoperative view after right hepatectomy, portal vein thrombectomy, and portal vein suture. *IVC* inferior vena cava. **d** Postoperative photograph of the abdominal wall showing previous incisions, incisions for the robotic arms (R0–R3), and the auxiliary (A) port (12 mm). R0 (12 mm) was used for the robotic camera. R1–R3 (8 mm)

so minimally invasive repeat hepatectomy has been utilized in limited numbers of patients.[2] Adhesions from previous operations may increase operative time, complications, and conversion—especially in patients with previous open surgeries.[2] Laparoscopic repeat hepatic resections can be performed safely especially in patients with previous laparoscopic resections.[3] Colorectal liver metastases are different from hepatocellular carcinoma and rarely present with macroscopic portal vein tumoral thrombus.[4] According to Tada et al., this may be seen in 2.8% of cases, and anatomic liver resection may provide long-term survival.[4] To the best of our knowledge, minimally invasive approaches for this rare condition have not yet been reported.

We present here a video of a robotic right hepatectomy in a patient with single colorectal liver metastasis and macroscopic tumor thrombi in the right portal vein. A 61-year-old woman underwent open resection of a transverse colon cancer (T3N0M0) in December 2015. In March 2019, she underwent non-anatomical resection of a liver metastases located in segment 6 also via an open approach. She then underwent adjuvant chemotherapy. However, in September 2020, she presented with a local recurrence and a tumor thrombus in the right portal vein (Fig. 1). She was then referred to us for treatment, and a multidisciplinary team decided on upfront liver resection due to the risk of left portal vein progression. Liver volumetry showed future liver remnant of 52.5% (Fig. 1). Right hepatectomy with portal vein thrombectomy was indicated. A robotic approach was proposed, and consent was obtained. This study was approved by the review board of the Department of Surgery of our institution.

The Da Vinci system was used, and four robotic arms (three 8 mm and one 12 mm trocars) were placed along with one additional laparoscopic port (12 mm) (Fig. 2). The surgeon was seated at the robotic console, and the assistant surgeon stood on the patient's left side to perform suction, irrigation, clipping, stapling, and to change the robotic instruments. The operation began with the division of adhesions from previous laparotomies. Intraoperative ultrasound was performed to locate the tumor and to confirm the portal vein invasion. Hepatic hilum was carefully dissected. The replaced right hepatic artery from the superior mesenteric artery was ligated and divided. The common bile duct was dissected and encircled with a vessel loop. The portal vein was dissected, and an enlarged right portal vein with a protruding tumoral thrombus was seen (Fig. 2). The left portal vein and portal vein trunk were then temporarily clamped. No heparin was given at that time. The right portal vein was carefully transected with robotic scissors being careful not to displace the thrombus (Fig. 2). A minimum stump was left to safely suture the portal vein. The portal vein was then closed with a running 5-0 prolene suture. The portal vein clamping was then released, and no bleeding was observed in the suture line (Fig. 2).

Right liver ischemic discoloration was seen and confirmed with fluorescence imaging after indocyanine green injection. A future line of transection was marked along the ischemic area. The liver was divided using bipolar forceps under saline irrigation until it was detached from the retro-hepatic vena cava. A right hepatic vein was divided with a stapler to complete the right hepatectomy. Intraoperative doppler ultrasound showed a patent left portal vein with adequate flow. The surgical specimen was removed through a supra-pubic incision, and the abdominal cavity was drained with a closed-suction drain. The total operative time was 270 minutes with no transfusion. Pathology conformed the diagnosis with free surgical margins. On the 5th postoperative day, the patient presented with moderate ascites. A CT scan showed acute non-tumoral thrombosis of the portal vein, mesenterico-portal axis, and splenic vein. Liver function remained normal. She was treated with systemic heparin for 10 days until recanalization of the portal vein. She was then discharged on the 16th postoperative day with oral anticoagulants (apixabana) for 6 months. Patient is well with no evidence of the disease 3 months after the procedure. Postoperative portal vein thrombosis after hepatectomy is not rare, ranging from 2.1 to 9.1% according to recent reviews.[5,6] Risk factor for this feared complication is right-sided hepatectomy (due to portal vein kinking), portal vein segmental resection, and long duration of Pringle's maneuver. Early detection and establishment of anticoagulation therapy, as occurred in the present case, is key for the good outcome. To improve kinking of the portal vein and make it straight, Kuboki et al.[5] described a new operative procedure, suturing the posterior wall of the portal vein with the anterior wall of the inferior vena cava and observed decrease in postoperative portal vein thrombosis. Mortality rate of patients with postoperative portal vein thrombosis is 2.6%.[7]

Robotic right hepatectomy with tumor thrombectomy is feasible in highly experienced hands even in the presence of lobar portal vein invasion. This operation may carry an increased risk for postoperative portal vein thrombosis and anticoagulation prophylaxis is highly recommended.

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Author contribution 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.

Declarations

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

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