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CASE REPORT

Robotic left hepatectomy with revision of hepaticojejunostomy

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Summary Laparoscopic hepatectomy and hepaticojejunostomy remain a surgical challenge despite the recent advances in minimally invasive surgery. A robotic surgical system has been developed to overcome the inherent limitations of the traditional laparoscopic approach. However, techniques of robotic hepatectomy have not been well described, and a description of robotic major hepatectomy with bilioenteric anastomosis can be found only in two previous reports. Here, we report a 33-year-old man with a history of choledochocyst resection. The patient experienced repeat cholangitis with left hepatolithiasis during follow-up. Robotic left hepatectomy and revision of hepaticojejunostomy were performed smoothly. The patient recovered uneventfully and remained symptoms-free at a follow-up of 20 months. The robotic approach is beneficial in the fine dissection of the hepatic hilum and revision of hepaticojejunostomy in this particular patient.

1. Introduction

Laparoscopic hepatectomy (LH) is one of the last frontiers in the field of minimally invasive surgery, although more and more expert centers have published series with promising results. For the complex dissection of the hilar structure, the difficulty of ensuring an efficient hemostasis in this highly vascularized organ has made laparoscopic anatomical hemihepatectomies even more challenging. Indeed, most published series of LH were subsegmental or segmental resection for tumors less than 5 cm in diameter.[1] The indication of tumor location for LH is limited to the anteriolateral segments (S2–S6) of the liver except in some sporadic series.[2]

With articulating instruments, intrinsic assistant arm, three-dimensional vision, and stable view, a robotic

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surgical system has been developed to overcome the limitations of traditional laparoscopic surgery. The application of a robotic surgical system has proved beneficial in fine dissection and suturing in a limited space. However, details of the utilization of this approach in hepatic surgery are scant in the literature.[3–5] Sporadic reports of advanced robotic hepatic surgery including live liver donation and major hepatectomy with bilioenteric anastomosis could be found.[6–8] However, most of the series of robotic hepatectomy (RH) still included tumors within traditional indications for LH.[9–12]

2. Case report

A 33-year-old male patient was admitted for left hepatolithiasis and repeat cholangitits. He had a history of choleodchocyst and common bile duct stone, and received excision of choledochocyst and hepaticojejunostomy 6 years prior to this admission. After an intravenous antibiotic treatment for cholangitis, he was referred to the surgical clinic for surgery. In the preoperative physical examination, there was no jaundice or abdominal pain. An upper midline scar and a right subcostal surgical scar were noted.

Laboratory findings revealed normal hemogram, slightly elevated liver enzymes (aspartate transaminase 27 IU/L, alanine transaminase 38 IU/L), and normal bilirubin level (bilirubin-T 0.7 mg/dL, bilirubin-D 0.2 mg/dL). The ICG (indocyanin green) retention rate at 15 minutes was 7%. Dilated confluence of the hepatic duct with large stones in the lumen and multiple left hepatolithiasis were noted in the magnetic resonance cholangiopanreatography image (Figs. 1 and 2).

A robotic left hepatectomy with revision of hepaticojejunostomy was proposed. The patient was placed in

Figure 1 Magnetic resonance cholangiopancreatography showing the dilated hepatic duct confluence and impacted large stones.

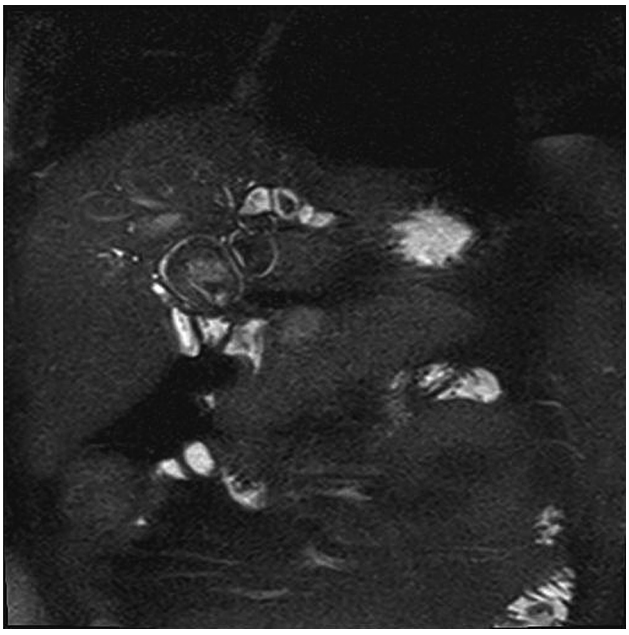

Figure 2 Magnetic resonance showing multiple stones in the left hepatic duct.

a modified lithotomy position. The four-arm technique was applied. Five ports were set up in a 12-8-8-8-5 mm fashion in additional to a 12-mm periumbilical camera port. The port size and position are illustrated in Fig. 3. Adhesiolysis was performed first. Then, the da Vinci robotic surgical system (Intuitive Surgical, Sunnyvale, CA, USA) was docked, and dissection of the hepatic hilum followed. The left hepatic artery and the portal vein were isolated and divided, respectively. Intraoperative ultrasonography was performed to define the intrahepatic ductal and vascular anatomy. Then, the hepaticojejunostomy was opened to remove the stones in the confluence of the hepatic duct (Fig. 4). After securing the right hepatic duct, parenchymal transection proceeded with harmonic scalpel and bilopar diathermy. The left hepatic vein was divided and the left hepatectomy completed. Revision of hepaticojejunostomy was performed by robotic intracorporeal suturing (Fig. 5). Two Jackson—Pratt drains were placed in the right and left subhepatic spaces, respectively. The specimen was placed in a retrieval bag, then fragmented and removed through an extended, 3-cm-long umbilical wound. The operation time was 390 minutes, and the blood loss was 300 mL. No blood transfusion was required during the operation.

The patient recovered uneventfully and was discharged on postoperative Day 9. He remained symptoms-free at a follow-up of 20 months.

3. Discussion

Since the introduction of robotic surgical systems in the late 1990s, they had been advocated in many different surgical specialties to facilitate fine dissection and suturing especially in limited spaces. However, their application in hepatic surgery was still limited. Most series of RH in the literature included patients with tumors within traditional

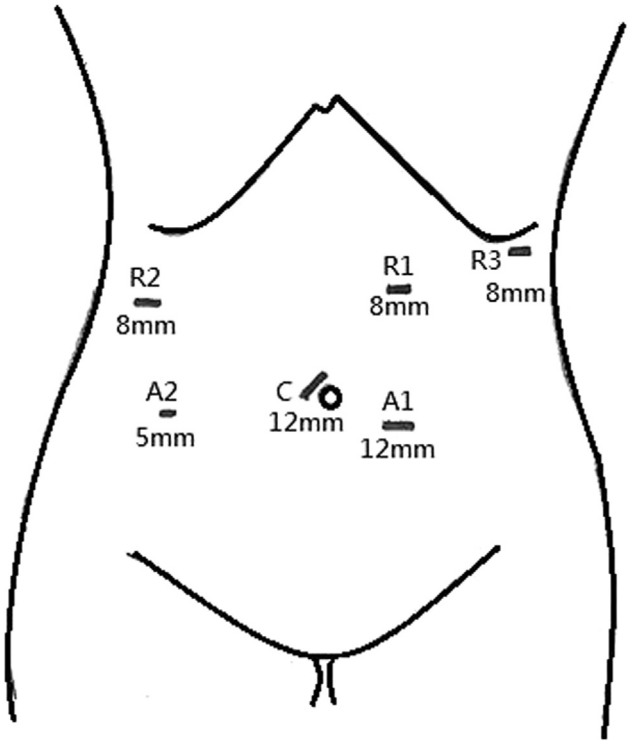

Figure 3 Port size and positions. A1, A2 = assistant ports for bedside surgeon; C = camera port; R1, R2, R3 = robotic ports.

indications for LH. Recent cohort studies and literature reviews demonstrated comparable hospital stay, surgical margin for cancer, and perioperative recovery.[3,11–13] However, the operation time was typically longer and blood loss was greater by the robotic approach in most series except one.[8] Indeed, robotic left lateral sectionectomy was found to have inferior perioperative results when compared to the traditional laparoscopic approach.[14] These results may reflect the learning curve effect during the early phase of adopting a robotic surgical system and the relatively established role of laparoscopic left lateral sectionectomy.

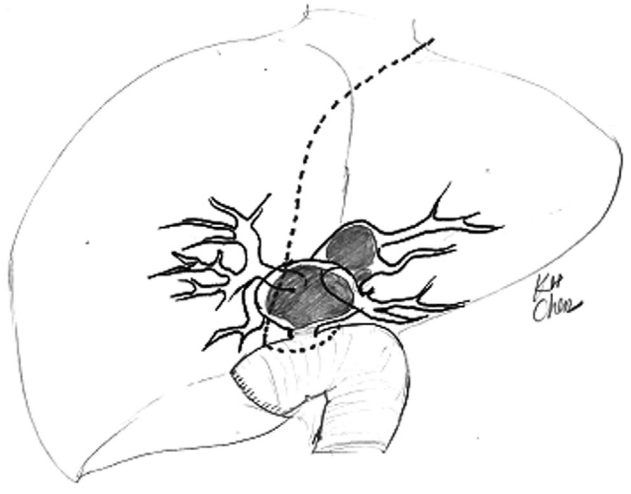

Figure 4 Illustration of hepaticojejunostomy revision.

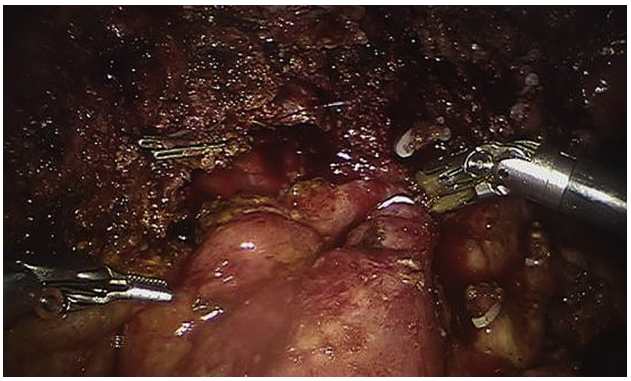

Figure 5 Intraoperative view of hepaticojejunostomy to be revised.

Almost all cohort studies of RH confirmed the safety and feasibility of this approach. In some recent reviews, more anatomical major hepatectomies could be found in the robotic group.[11–13,15] This may reflect the fact that using the robotic surgical system may facilitate hilum dissection and hepatocaval dissection. The open conversion rate and perioperative complications are comparable to traditional LH.[3,11,12,15,16] However, the direct cost of RH was higher.[14] Robotic parenchyma sparing hepatectomy for lesions in posterosuperior segments were also reported.[17,18]

To utilize the potential benefits of the robotic surgical system, a robotic resection of hilar cholangiocarcinoma with bilioenteric anastomosis had been performed successfully in two patients.[6,8] This application is an extremely demanding technique not only for traditional laparoscopy, but also by the robotic approach. Another case report included robotic left hepatectomy, hepatic ductal plasty, and T-tube placements for a primary liver carcinoma with tumor thrombi in the bile duct.[19]

For malignant lesions, a comparable margin status and short-term survival could be achieved with a robotic-assisted approach.[20] Long-term results are not available in the literature to date. Although current series come from a few expert surgeons experienced in advanced robotic liver surgery, series of robotic major liver resection had been reported.[21]

In the present patient, adhesion in the hepatic hilum could be expected and surgical dissection might be difficult by laparoscopic instruments without articulation. Furthermore, the dissection of hepaticojejunostomy and bile duct confluence was also critical to avoid injuring the right hepatic artery and duct. Finally, use of the robotic surgical system facilitated revision of hepaticojejunostomy, which is even more challenging when using the traditional laparoscopic approach.

The robotic surgical system facilitated fine dissection and suturing, which proved to be beneficial in this patient. Robotic assistance may increase an experienced surgeon's confidence for advanced liver surgery and for tumors not fit in the traditional indications for LH. Hence, the indication of minimally invasive liver surgery may be broadened by this approach.

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