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CASE REPORT

Successful robotic extirpation of diaphragmatic seeding of hepatocellular carcinoma after previous rupture

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Abstract

A 51-year-old man who was a hepatitis B carrier presented with ruptured hepatocellular carcinoma (HCC). Hepatic arterial embolization was performed for control of bleeding which was followed by staged open left lateral sectionectomy for tumor removal. Pathology confirmed a 3.5 cm ruptured subcapsular HCC in a cirrhotic liver with clear resection margin. However, the alpha-fetoprotein (AFP) increased from 14 to 72 µg/L after 7 months. A 1.7×0.8 cm nodule at left subdiaphragmatic region abutting on the spleen but no intrahepatic lesion was seen on computed tomography (CT). Dual tracer positron emission tomography suggested the nodule was a HCC seeding with no other recurrent tumor noted. Robotic exploration was offered to patient with the possibility of splenectomy. During operation, the nodule was adherent to the diaphragm with no splenic involvement. The lesion was locally excised. The diaphragmatic defect was closed with non-absorbable suture. Recovery was uneventful and the patient was discharged on postoperative day 4. Pathology confirmed HCC cells infiltrating to skeletal muscle and fibrous tissue. The resection margin was clear. Post-operatively AFP normalised. Serial abdominal CT and ultrasound revealed no evidence of recurrent disease. Patient had a disease-free survival of 47 months after excision of tumor seeding.

Keywords Hepatocellular carcinoma · Tumor rupture · Tumor seeding · Robotic surgery

Introduction

Hepatocellular carcinoma (HCC) is the fifth commonest cancer globally [1]. It can present with tumor rupture and hemoperitoneum. The incidence is reported to range from 10 to 26% in Asia [2]. Following rupture, tumor cells disseminate into the peritoneal cavity and this can lead to intraperitoneal recurrent diseases. According to an autopsy study, the overall incidence of peritoneal seeding of HCC was 9.4%, and it is significantly associated with rupture of primary tumor [3]. Peritoneal seeding can be focal (70.6%) or into the entire peritoneal cavity (29.4%). Common sites of peritoneal seeding in descending incidence are diaphragm, omentum, intestinal serosa, mesentery, gastric serosa and Pouch of Douglas [3]. The optimal treatment of peritoneal seeding or implant after previous rupture is uncertain, but for resectable peritoneal disease surgical resection is still believed to be the best option.

Classical approach for resection of peritoneal seeding is by open laparotomy. With the development of laparoscopic and robotic surgery, the resection of isolated peritoneal seeding of HCC represents one desirable indication for minimally invasive surgery. The specimen is usually small and is readily extracted through port site. At the same time, laparoscopy allows the thorough inspection of the peritoneal cavity to exclude pre-operatively undetected peritoneal or liver metastasis. The use of robot further enhances the efficacy of dissection and suturing with the dexterity of robotic instruments under magnified 3-dimenional view. Here, we present an unusual case of diaphragmatic seeding of HCC which is successfully treated with an unusual robotic surgery.

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Case report

A 51-year-old man with no past medical history presented with a 1 day history of generalised abdominal pain. Physical examination revealed generalised peritonitis. Urgent computed tomography (CT) of abdomen was done. It revealed a ruptured HCC at left lateral section of liver with hemoperitoneum. Urgent hepatic angiogram was done. A solitary hypervascular lesion was found in left lateral section of liver but there was no active contrast extravasation. Prophylactic gelfoam embolization by selective cannulation via left hepatic artery was performed. Patient was stabilised afterwards. Blood investigation showed that the patient was positive for hepatitis B surface antigen and alpha-fetoprotein (AFP) was elevated (469 µg/L). Antiviral treatment was started for hepatitis B infection. A staged open left lateral sectionectomy was performed 11 days after admission. Around 2 L of old blood and clot within peritoneal cavity were removed and peritoneal cavity was thoroughly irrigated with warm water. Pathology confirmed a 3.5 cm ruptured subcapsular moderately differentiated HCC in a cirrhotic liver with R0 resection. In view of high risk of recurrent intrahepatic disease due to high risk tumor, adjuvant transarterial chemoembolization (TACE) was done 6 weeks after operation. The AFP fell to 14 µg/L after operation.

However, the AFP increased to 72 µg/L 7 months after operation. CT revealed a 1.7 × 0.8 cm nodule at left subdiaphragmatic region abutting on the spleen (Fig. 1) with no intrahepatic lesion seen. Dual tracer positron emission tomography (PET) with fluorodeoxyglucose (^{18}FDG) and ^{11}C-acetate was performed. The left subdiaphragmatic nodule was noted to predominately ^{18}FDG avid and was suggestive of HCC seeding. No intrahepatic or other extrahepatic lesion was noted. In view of small size of recurrent tumor, robotic exploration was offered to patient with the possibility of splenectomy.

The da Vinci S robotic system (Intuitive Surgical, Sunnyvale, CA, USA) was used in this operation. Patient was placed in right decubitus and 15° reverse Trendelenberg position. A 12 mm robotic camera port was placed at 2 cm above and to the left of the umbilicus. A 8 mm robotic port was placed at left anterior axillary line and another 8 mm port placed at epigastrium centered around the spleen. A 12 m assistant port was inserted at left lower quadrant and a 5 mm assistant port was inserted at right lower quadrant of abdomen. Robotic instruments included a pair of fenestrated bipolar forceps and a diathermy hook was used for dissection. The assistant ports were used for passage of laparoscopic bowel clamps, sucker, scissors and suture needle. Operation started with adhesiolysis at left upper quadrant of abdomen. Omental adhesion was taken down from stomach, spleen and left lateral abdominal wall. The diaphragmatic nodule was found after peritoneal adhesion was taken down. The nodule was adherent to the diaphragmatic surface of the left hemidiaphragm rather than invading into the spleen. The lesion was locally excised with full thickness of diaphragm with robotic diathermy hook (Fig. 2). The diaphragmatic defect of 3 cm diameter was closed with non-absorbable 3/0 suture with robotic needle drive. The specimen was extracted through the 12 mm port site within plastic bag. The whole operation lasted 230 min. Blood loss was 150 ml. There was no need for transfusion. Patient returned to surgical ward

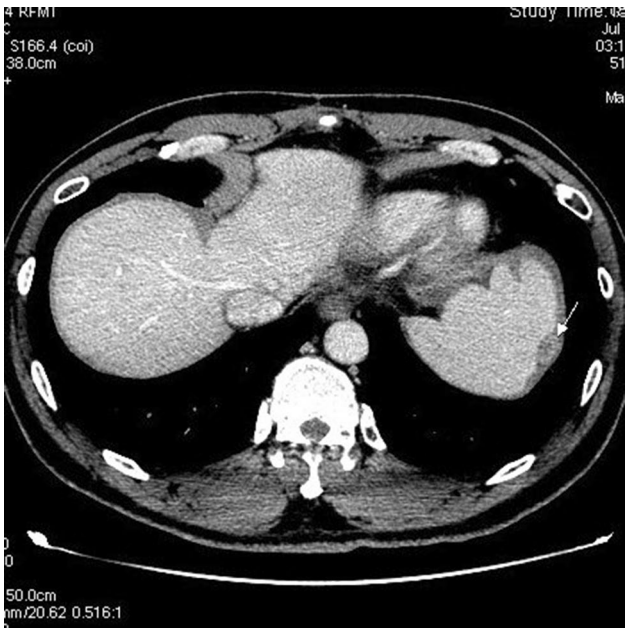

Fig. 1 Computed tomography (CT) revealed a nodule (arrow) at left subdiaphragmatic region abutting on the spleen

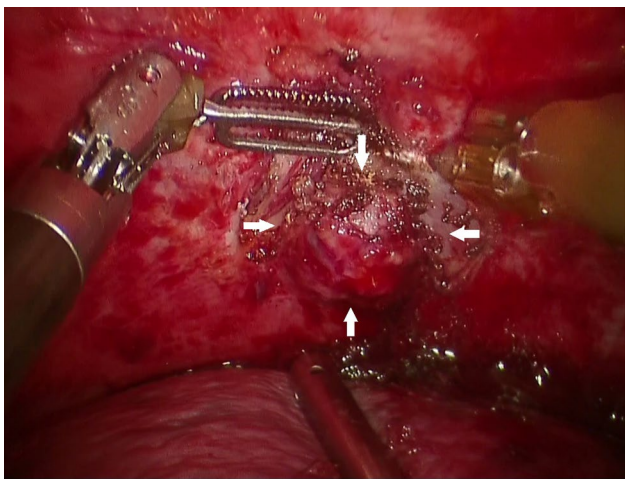

Fig. 2 Operative view showing the diaphragmatic seeding of hepatocellular carcinoma (arrows)

after surgery. Patient had an uneventful recovery and was discharged on postoperative day 4.

Pathology confirmed HCC cells infiltrating to skeletal muscle and fibrous tissue. The resection margin was clear. Post-operatively AFP reduced to 1 µg/L and remained at that level. Serial abdominal CT and ultrasound revealed no evidence of recurrent disease. Patient remained disease-free at 47 months follow-up after excision of tumor seeding.

Discussion

Spontaneous rupture of HCC is a life-threatening complication, with in-hospital mortality up to 75% [4]. Transarterial embolization is frequently utilised for initial bleeding control. Staged hepatectomy can be performed once patient's condition optimised and coagulopathy corrected [5]. To reduce the risk of implanted metastasis, peritoneal lavage with distilled water has been reported to be effective [6]. This was also done in our case. Nevertheless, a small diaphragmatic recurrence was noted 7 months after hepatectomy. A dual tracer PET with ^{18}FDG and ^{11}C-acetate was used in the present case to assess the extent of metastasis, as the two tracers were complementary and was more effective than single tracer PET in identifying candidates for curative therapy [7].

Surgical resection of implanted peritoneal metastasis have been reported previously [8–10]. In one case, four intraperitoneal tumors were found and all resected, patient remained well 13 months after operation [8]. In another case, patient received resection of multiple intraperitoneal metastases three times in a year and remained disease free for 15 months [9].

Peritoneal implant of HCC without history of rupture were also reported [11–13]. These occurred infrequently after previous hepatectomy and microwave ablation. Successful surgical resection of these peritoneal implants were possible and some patients could have long-term survival.

In the present case, the diaphragmatic seeding was the only site of recurrent disease as identified by dual trace PET CT and the size of lesion was just 1.7×0.8 cm. We decided to try minimally invasive approach for this small lesion despite previous open hepatectomy. Since the lesion was deep seated at diaphragmatic surface, the use of robot facilitated dissection around lesion and subsequent closure of diaphragmatic defect in a narrow working space. The specimen was easily extracted through the 12 mm port site within plastic bag. Patient enjoyed the benefits of minimally invasive surgery and went home on postoperative day 4. Successful use of laparoscopic approach for resection of an omental metastasis of HCC after previous rupture has been reported [10]. To our knowledge, the present case is the first one to use robot for the extirpation of peritoneal seeding of HCC after previous rupture. We believe that appropriate use of robot for small volume tumor seeding disease is desirable and it is feasible even after previous open surgery.

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Compliance with ethical standards

Conflict of interest Dr. Kit Fai Lee declares that he has no conflict of interest. Dr. Hon Ting Lok declares that he has no conflict of interest. Dr. Andrew KY Fung declares that he has no conflict of interest. Dr. Charing CN Chong declares that she has no conflict of interest. Dr. Yue Sun Cheung declares that he has no conflict of interest. Dr. John Wong declares that he has no conflict of interest. Prof. Paul BS Lai declares that he has no conflict of interest.

Ethical approval This article does not contain any studies with human participants or animals performed by any of the authors.

Informed consent Written informed consent was obtained from the patient for publication of this Case Report and any accompanying images. A copy of the written consent is available for review by the Editor-in-Chief of this journal.

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