Robotic resection of diaphragmatic metastasis of recurrent ovarian cancer

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Peritoneal recurrence of advanced ovarian cancer is a substantial problem. Early detection is essential for timely treatment. Computed tomography is an excellent tool for follow-up; however, it has limitations. Positron emission tomography (PET) detects recurrent lesions by virtue of its superior image resolution. Few recorded cases reported the role of minimally invasive procedures in isolated recurrent ovarian cancer. Herein, we document a perihepatic recurrence of ovarian carcinoma successfully managed with robotic resection. This patient had stage IIIC ovarian cancer sensitive to chemotherapy (paclitaxel and carboplatin), and was followed-up with PET. The patient underwent robotic resection of limited recurrent cancer. For recurrent ovarian cancer, cytoreductive operations are recommended for platinum-sensitive tumors. Robotic-assisted surgery has been widely used since 2005 and is becoming increasingly popular. Its popularity is attributed to its being a delicate surgical technique has substantially lower blood loss and surgery time.

Key Words: Robotic surgical procedures; Cytoreduction surgical procedures; Peritoneal neoplasms; Positron-emission tomography; Carcinoma, Ovarian epithelial

INTRODUCTION

Surgical treatment for most recurrent ovarian cancer requires radical surgical resection. Early detection can provide timely treatment. Computed tomography (CT) and positron emission tomography (PET) are good imaging tools for follow-up; both have strengths and limitations.

Reproducible cytoreductive surgery plays an important role in disease control. Laparotomy is generally used for various kinds of recurrent cancers; however, in isolated lesions, minimally invasive procedures can shorten hospital-

ization and recovery periods. Laparoscopic or robotic methods are safe and effective in some selected patients.

The objective of this report was to assess an imaging tool during follow-up and describe a case of perihepatic recurrence of ovarian carcinoma that was managed with robotic resection.

CASE REPORT

A 67-year-old woman presented with a history of hypertension and hyperlipidemia. She was diagnosed with high-

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grade serous carcinoma of the ovary, stage IIIC, and underwent debulking surgery, including transabdominal total hysterectomy, bilateral salpingo-oophorectomy, omentectomy, left hemicolectomy, appendectomy, and peritoneum excision. This study was fully approved and evaluated by the institutional review board of Taipei Medical University. The requirement for informed consent was waived for the encrypted identities of the patient. After surgery, she received six courses of chemotherapy with paclitaxel (175 mg/m²) and carboplatin (area under the free carboplatin plasma concentration versus time curve [AUC], 5). Avastin (15 mg/kg) was added to the last four courses. Three months later, follow-up CT did not reveal positive findings;

however, there was a ventral hernia. Levels of tumor marker CA125 were less than 10 U/mL.

One year later, her CA125 elevated from 6.2 to 98.3 U/mL. Whole body PET scan revealed focally increased fluorodeoxyglucose (FDG) uptake in the right perihepatic area (Fig. 1A). Six courses of chemotherapy with paclitaxel (135 mg/m²) and carboplatin (AUC, 5) were initiated. Another PET scan was performed after the second round of chemotherapy. A focal FDG-avid area, likely in the S5 or its perihepatic area, had decreased in size compared to that in the previous PET/CT about 6 months ago. The impression was viable liver S5 metastasis or peritoneal seeding in the right perihepatic area (Fig. 1B). The

Fig. 1. (A) PET/CT after first round chemotherapy: focally increased FDG uptake likely in the right perihepatic area. (B) PET/CT after second round chemotherapy: a focal FDG-avid area likely in the S5 or its perihepatic area which is smaller than the lesion on the previous PET/CT. PET, positron emission tomography; CT, computed tomography; FDG, fluorodeoxyglucose.

consultation from radiologist prefer that the lesion was placed on the surface of liver instead of parenchyma. However, general surgeon of hepatobiliary was also consulted for the possibility of hepatic injury. After full discussion of the pros and cons of management, robotic resection of recurrent ovarian cancer in the perihepatic region was performed.

The patient was placed in the reverse Trendelenburg position about 10 to 15 degrees with legs in Allen stirrups because our major operation part was on the upper abdomen. Thoracic surgeon and general surgeon of hepatobiliary were stood by if the diaphragmatic perforation or lesion deep invaded in liver S5. A 1.5-cm incision was made between the xyphoid process and the umbilicus. A 12-mm trocar was inserted for inflation of pneumoperitoneum and camera. Three 8-mm trocars for robotic arms and one 10-mm assistant port were placed in the abdomen with direct visualization (Fig. 2A). In this trocars and assistant port distribution, the assistant could easy and rapidly response to the operator and avoid fighting with the robotic arms. The robotic platform was side-docked from the left abdomen site of patient. We used the instruments as right arm with a monopolar curved scissor; left arm was fenestrated bipolar forceps and assisted arm with fenestrated forceps. The power setting of monopolar and bipolar was both 20 W.

At first, scanning of the abdominal cavity did not disclose other metastasis or minimal seeding except the lesion disclosed in our preoperative evaluation. A flexible liver retractor was placed to create surgical space applied from the assistant port. Surgical findings included a tumor, about 4 cm in diameter, at the right perihepatic peritoneal area on

that diaphragm that was adherent to the hepatic surface (Fig. 2B). The tumor was dissected carefully to avoid injury of hepatic stroma. Then, the lesion was placed in an endo-bag for intact removing and avoiding possibility of further trocar site metastases. The docking and console times were 10 minutes and 45 minutes, respectively. Blood loss during the entire surgery was minimal.

DISCUSSION

In advanced ovarian cancer, perihepatic metastasis could lead to peritoneal seeding. The parenchymal area is less involved than the peritoneum. As a tool for determining whether the liver parenchyma has been invaded, the sensitivity and specificity of CT scans have been discussed [1]. PET is another technique that could be considered.

The sensitivity of perihepatic metastasis of ovarian cancer ranged from 35% to 80% among radiologists with an experience gap of 2 years [1]. The experience of the reporter was the factor that most confounded the interpretation of the CT scans. Interpretation of imaging findings requires detailed knowledge of the peritoneal anatomy, flow direction of peritoneal fluid, and specific disease sites. The more precise the report is, the more difficulties that would occur during the surgical procedure and [2]. This information helps surgeons plan operations and decreases the possibility of morbidities.

In a recent meta-analysis, PET/CT had the highest sensitivity among PET, CT, or even magnetic resonance imaging alone [3]. PET imaging reveals accurate localization of well-circumscribed nodules and diffuse surface FDG uptake.

Fig. 2. (A) Docking method. (B) Recurrent lesion (red arrow) on diaphragm with hepatic adhesion (blue arrow). C, camera; A.P., assisted port; A.A., assisted arm; L, left arm; R, right arm.

Nodular soft-tissue masses with variable degrees of metabolic activity show a common appearance. Some tumors, including small, necrotic, mucinous, cystic or low-grade tumors, may yield false-negative findings on PET/CT [4].

Using the details obtained in the imaging study, the surgical plan should include adequate border cytoreduction with minimal invasion of the important organs. Robotic assisted surgery, as the minimally invasive technique, is safe and effective. The benefits include less blood loss and surgical care with delicate resection along the tumor margin.

In a retrospective analysis, Magrina et al. [5] reported surgical time and blood loss. Their mean surgery time was 238.2 minutes (range, 75–505) with a standard deviation of 102.6 minutes, and the mean blood loss was 236.4 mL (range, 25–1,600) with a standard deviation of 393.4 mL. However, in that study, diaphragm resection was not measured separately.

Port placement is important in this procedure. Adequate placement helps not only the console time but also may minimize injury to other organs and great vessels. Holloway et al. [6] described the technique of liver and diaphragm recurrent ovarian carcinoma management using robotic resection. Both Holloway et al. [6] and our group use the Da Vinci® Surgical System (Intuitive Surgical Inc, Sunnyvale, CA, USA). The Da Vinci® Xi would be also suitable for this procedure. Their console time was 82 minutes with an estimated blood loss of 100 mL. The major difference in port placement was in the camera site. They placed the camera in the midclavicular line for the assisted arm located in the right flank position anticipating its use in retracting the right hepatic lobe away from the diaphragm. Although we placed the assistant port in the midclavicular line, adequate space was created using the flexible liver retractor.

There was no problem in checking for bleeding and hemostasis in our case. Owing to the degree of surface invasion of the lesion on the diaphragm and liver only, the suture technique was not used. The most worrisome complication, pneumothorax, did not occur in our case. The patient recovered well after the surgery and was discharged without discomfort on postoperative day 2.

We recommend that future research should be conducted on tumor cell seeding via the trocar site or intra-abdominal metastases via the gas used to create the surgical space. In this case, we used the surgical bag to remove the speci-

men to avoid trocar site metastasis. However, theoretically, the risk of wound site metastasis or intra-abdominal spreading during operation would be similar during a minimally invasive procedure and trans-abdominal procedure. Further long-term follow-up studies are needed to confirm this. This possibility of procedure-related metastases is the key aspect we considered in the selection of the surgical approach.

In summary, imaging techniques have evolved over time such that they can provide an adequate assessment for presurgical planning. PET/CT is an excellent tool for follow-up of recurrent ovarian cancer because the possible recurrent sites may be identified. After adequate image survey and planning, minimally invasive surgery using the robotic system is safe and effective, not only with respect to reduced less blood loss and surgical time but also for creating minimal wounds and allowing faster recovery time than that achieved with laparotomy.

Conflict of interest

No potential conflict of interest relevant to this article was reported.

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