Laparoscopic repair of diaphragm perforation with heart patch after microwave ablation

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ABSTRACT

الاجتثاث الميكروويف (MWA) هو تقنية جديدة تم تطويرها في السنوات الأخيرة، والتي أصبحت تستخدم على نطاق واسع في مختلف التخصصات. الميكروويف الاجتثاث هو بديل للعملية الجراحية في ازالة الأورام المختلفة، أثبتت فعاليتها في إدارة الأورام الإبتدائية والأورام النقيلي. ويستخدم الموجات الدقيقة الاجتثاث على نطاق واسع في علاج سرطان الكبد (HCC) مع تأثير واضح وآثار جانبية أقل، وكان لدى 2.7% فقط من المرضى مضاعفات خطيرة. وقد أكدت العديد من الدراسات مضاعفات الضرر الحراري، والنزف، الانصباب الجنبي، تسريب السائل المراري، الورم منبذر، خراج في الكبد، التهاب الأقنية الصفراوية، وغيرها. لكن انثقاب الحجاب الحاجز أمر نادر الحدوث، وربما يكون أول حالة تم الإبلاغ عنها. توضح هذه المقالة انثقاب الحجاب الحاجز الثانوية MVA للكبد مع الانصباب الجنبي الملاحق لفتق الحجاب الحاجز. وصفنا أيضاً إدارتها عن طريق استخدام المنظار.

Microwave ablation (MWA) is a new technology developed in recent years, which is widely used in various disciplines. Microwave ablation is an alternative to surgery in the management of various tumors, and it has been demonstrated to be effective in the management of primary tumors and metastatic tumors. Microwave ablation is widely used in the treatment of hepatocellular carcinoma with an obvious effect and less side effects, and only 2.7% had serious complications. Many studies have confirmed the complications are thermal damage, hemorrhage, pleural effusion, bile leak, tumor seeding, hepatic abscess, cholangitis, and so forth. But diaphragm perforation is rare, and it is probably the first case reported. This article describes diaphragmatic perforation secondary to MWA of the liver with subsequent pleural effusion and diaphragmatic hernia. We also describe its management via the laparoscopic approach.

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Microwave ablation (MWA) is a minimally invasive treatment for liver cancer, whose therapeutic effect is comparable to surgical resection in hepatocellular carcinoma (HCC).[1,2] It was reported that the complication rate was 14.5% in the surgical group while it was 2.7% in the ablation group.[3,4] The complications of MWA included vascular injury, bile duct injury, hemorrhage, bile leakage, tumor seeding, hepatic abscess and cholangitis, and so forth.[5] But diaphragm perforation is a rare complication that has hardly been reported. In this case report, we describe the laparoscopic repair for a case of diaphragm perforation, which was caused by MWA for liver cancer.

Case Report. A 55-year-old man presented with epistaxis and dizziness for half a year in our hospital on December 2013. There were no fever and chill or abdominal symptoms. He was found to be hepatitis B virus carriers for more than 10 years, and hepatitis B surface antigen (HBsAg) level maintained 10-100 IU/mL. The abdominal ultrasound showed that the hypoechoic area of 1.5×1.7 cm was in the right hepatic lobe and near the gallbladder. Then, MRI suggested the findings were consistent with primary hepatic carcinoma of the right lobe of the liver (segment VIII), which was 2.4×2.5 cm in size, with additional findings of cirrhosis and portal hypertension (**Figure 1**). We performed percutaneous microwave ablation by ultrasound-guidance in our hospital on January 2014. The skin entrance point was at the junction of the right anterior axillary line and the tenth intercostal space, and the microwave needle paralleled with the long axis of the gall bladder through

the liver tissue. Microwave frequency was 2450 MHz, output power was 60 W and the microwave needle was 1.8 mm in diameter and 18 mm in length. The microwave ablation was carried out for approximately 8~10 minutes. In addition, the ablation point focused on the tumor tissue and the surrounding liver tissue of 0.5~1.0 cm. No adverse reaction was found after operation. In order to consolidate the curative effect, transcatheter hepatic arterial chemoembolization was performed on this patient, a week later. He recovered well after operation, and anti-tumor, liver protection and anti-HBV drug treatment were provided for a long time. There was no postoperative complication in this period.

He was hospitalized again 8 months later due to the right upper quadrant pain accompanied by cough and asthma for one month, and fever for the past 3 days. On routine examination, temperature was 38.6°C, pulse rate 98/min, respiratory rate 26/min, and blood pressure 124/80 mm Hg. On routine physical examination, coarse breath sounds were audible on the right lung, moist rales were audible over the right lung, and the abdomen was distended. The results of other systemic examination were unremarkable. Abnormal laboratory investigations showed that HBsAg: >250 IU/ml (normal range: 0-0.05 IU/ml), alpha feto protein (AFP): 386.4 ng/mL (normal range: 0-8.10 ng/mL) and cancer antigen 125 (CA-125): 72.8 U/mL (normal range: 0-35 U/mL). The chest x-ray and chest CT scan showed that massive pleural effusion was on the right side, and complete atelectasis was on the lower lobe of the right lung, while partial atelectasis was on the upper lobe of the right lung. Epigastric contrast-enhanced CT scan and MRI scan showed that multiple coagulation necrosis zone was in right lobe of liver. In addition, abnormal signal was found in the left hepatic lobe and near the diaphragm muscle, which was highly suggestive of metastases. (**Figures 2 & 3**). Hence, he was diagnosed as primary liver cancer with liver metastasis, pleural effusion, viral hepatitis B, and liver cirrhosis. Thoracic close drainage system was used for the pleural effusion, which discharged 1000 ml yellowish liquid per day. One week later, the chest x-ray showed that pleural effusion was significantly reduced. Then, laparoscopic microwave ablation was employed for the liver metastasis after permission of his family members. In the operation, we found a gap of 1.0 cm in diameter at the right diaphragm, which had never been discovered in the examination before surgery (**Figure 4**), and hepatocellular carcinoma nodules were higher than the surface of the liver in the left hepatic lobe. In addition, significant hardening of the liver with blunt edge and nodular surface and a small amount of intra-abdominal ascites were also observed. Microwave ablation was employed for the new metastases under the celioscope. After that, neoplasty was performed for the

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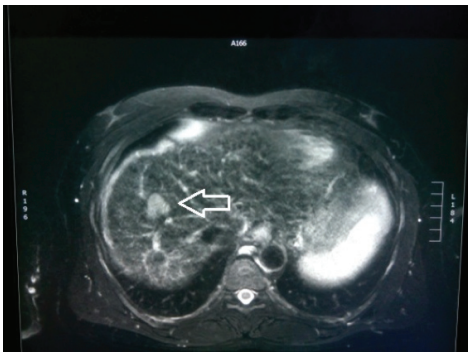

Figure 1 - Preoperative MRI examination showed intrahepatic primary tumor lesions (arrow).

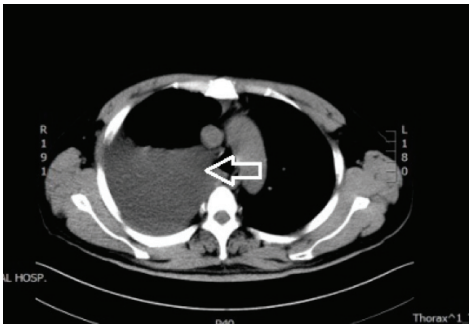

Figure 2 - The second hospitalization chest CT showed right pleural effusion (arrow).

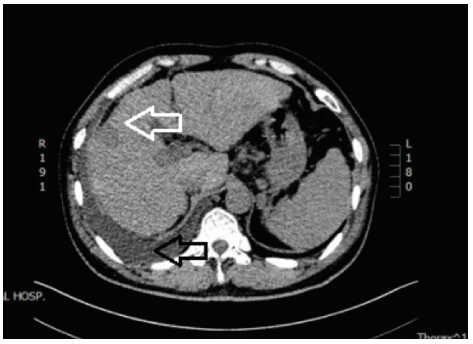

Figure 3 - The second hospitalization abdominal CT showed pleural effusion and new liver lesions (arrow).

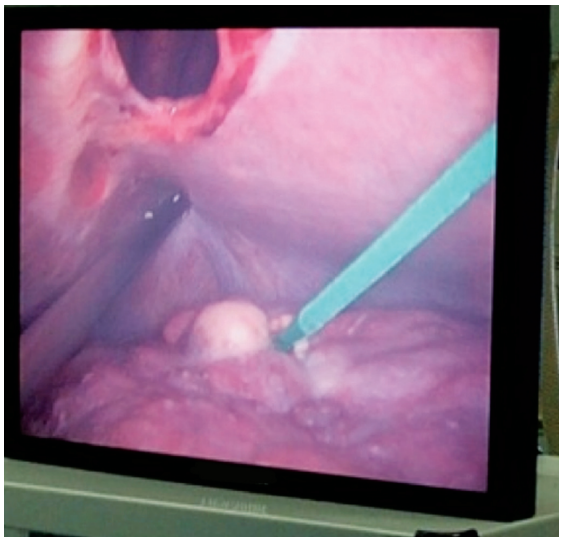

Figure 4 - Diaphragmatic perforation was found, and microwave ablation had been provided for liver metastases in the second laparoscopic operation.

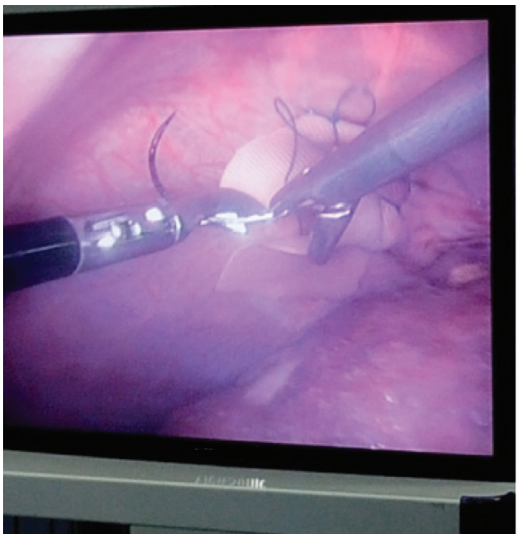

Figure 5 - The neoplasty of the diaphragmatic hiatus was performed using dacron heart patch in the second laparoscopic operation.

diaphragmatic hiatus (**Figure 5**). Dacron heart patch was selected as the repair material, which was trimmed to the appropriate size according to the size of the gap. The patch and diaphragm muscles were sutured together by 3-0 prolene. As a result, the diaphragmatic gap was completely closed. After operation, the patient recovered well, and vital signs were normal, with disappearance of breath shortness. The postoperative chest CT scan showed that pleural fluid had mostly disappeared. One week after surgery, he was discharged from the hospital.

Discussion. Microwave ablation is a new technology developed in recent years, which is widely used in various disciplines.[6] It can be used in a variety of tumors as an alternative to surgery in patients who are not typical surgical candidates. Of note, it has good effects on the liver cancer.[7] Every year, there are nearly one million new cases of liver cancer in the world.[8] The first choice is hepatectomy; however, most patients are not suitable for resection in practice.[9] With the development of interventional technology, it has played the increasingly important role in the primary or secondary liver malignancies.[10] Microwave ablation technique has gradually increased in the clinical practice, which has a good effect in the treatment of liver cancer with low incidence of complications. Due to the low incidence of complications, very few studies have described the postoperative complications.[5,7] The complications included thermal damage, hemorrhage, bile leakage, tumor seeding, hepatic abscess, cholangitis, and so forth.[5] But, the diaphragm perforation case had been hardly reported in the past medical dissertation. Currently, we have just found out one case of diaphragm perforation which was reported in Ding et al's tudy in 2013.[4] However, this case was treated with conservative method, and closed thoracic drainage was employed.

Before this case, sympathetic effusion had never been seen in our surgical patients. Additionally, imaging examination of the patient did not reveal diaphragmatic perforation. So we conjectured that this was due to the local heat injury, which leaded to pleura effusion of large amounts of liquid. After closed drainage of thoracic cavity was provided, chest radiograph review showed pleural effusion disappeared. All seemed to confirm that the hypothesis was correct. When the MWA treatment was provided for liver metastases, laparoscopic findings had overturned our previous views. We considered that the diaphragmatic hiatus was probably caused by local thermal damage in the first MWA. Microwave ablation produced lots of heat around the diaphragm, which leaded to thinning and perforation of the diaphragm. Of course, it was also possible that the microwave needle penetrated the diaphragm since MWA procedure was performed under ultrasound guidance. Finally, there was a new lesion on the diaphragm and the liver, which may erode the diaphragm and cause a fistula. Closing the large hole with primary repair using sutures would result in a higher failure rate from the tension created. Therefore, we repaired the diaphragmatic hernia by

cardiac patch. After 6-month follow-up, there were no recurrence of pleural effusion, ascites, recurrence, and metastasis of the liver cancer for this person.

For the patients with pleural effusion after MWA, imaging examination did not reveal the perforation, which could not rule out the diaphragm perforation. In addition, MWA of the lesions close to critical structures such as diaphragm should be preferably performed in an operative room under the laparoscope or live image guidance (CT rather than ultrasound guidance) to visualize these structures carefully during ablation. Of course, the utilization of a cardiac patch (biologic) as a bridging mesh helps to repair diaphragmatic injuries, which are difficult to close primarily.

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