Laparoscopic hepatectomy for the treatment of hepatic alveolar echinococcosis

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Received 7 October 2020, Accepted 4 January 2021, Published online 13 January 2021

Abstract – Background: At present, laparoscopy is relatively mature as a minimally invasive technique, but there are few reports on this approach for the radical treatment of hepatic alveolar echinococcosis (AE). In this study, we aimed to evaluate the safety and feasibility of laparoscopic hepatectomy (LH) for AE treatment. Results: A retrospective review of medical records obtained from 13 patients diagnosed with AE between January 2018 and December 2019 and treated with laparoscopic hepatectomy was conducted at the First Affiliated Hospital of Xinjiang Medical University. All patients (n = 13) underwent hepatic resection using laparoscopy and none were transferred to open surgery. The average duration of surgery was 285 min (145–580 min). Intraoperative bleeding was 305 mL (20–2000 mL). The mean duration of postoperative catheterization was 6.9 days (3–21 days), and postoperative hospital stay was 7.2 days (4–14 days). No complication of Clavien-Dindo grade III or above occurred, except for the second patient with acute liver failure post-surgically. No recurrences or deaths were observed at 9–30 months of follow-up. Conclusions: Laparoscopic hepatectomy appears to be safe and effective in selected AE patients. The advantages of this technique for AE treatment need to be further compared with the classical open approach.

Key words: Alveolar echinococcosis, Laparoscopic hepatectomy, Minimally invasive.

Introduction

Hepatic alveolar echinococcosis (AE) is a chronic proliferative parasitic disease, with a poor natural prognosis due to its characteristic infiltrative growth [15]. It is reported that mortality in untreated or inadequately treated AE patients can be as high as 90% after 10–15 years of diagnosis [1, 8, 17]. Therefore, the expert consensus is that patients with diagnosed AE should be given timely surgery or drug treatment [4, 5]. To date, radical surgical resection has still been considered the main method of AE treatment, despite the increased interest in nonsurgical techniques [1–3, 7, 9, 11–14, 16]. In recent years, laparoscopic hepatectomy (LH) has been well accepted by patients since it is minimally invasive. Therefore, LH has
been proposed for the treatment of AE and is used in clinical practice. In this retrospective analysis, 13 AE cases admitted to our centre from January 2018 to December 2019 were included to discuss the treatment outcomes of LH and propose initial possibly selective criteria.

**Patients and methods**

**Ethics statement**

All patients in this study provided written informed consent before surgery. This study was approved by the Ethics Committee of the First Affiliated Hospital of Xinjiang Medical University (No. 20200116-04).

**Patients**

A total of 13 patients (male: 6, female: 7) receiving LH were enrolled in this retrospective analysis. Eligible patients were those confirmed with AE lesions located within the half-liver by using colour doppler ultrasound (US) and computed tomography (CT). In addition, the liver remnant was adequate (>40%). Finally, patients could tolerate a laparoscopic operation on the basis of their cardiac and pulmonary function. The exclusion criteria were as follows: patients’ lesions have invaded important vessels of the hilum and/or patients have developed extra-hepatic distant metastasis.

**Operation**

The patients were in the supine position. Routine disinfection and draping were performed after the onset of anaesthesia. Next, a small incision of about 1.2 cm was made above the umbilicus and a Veress needle was placed. Subsequently, CO₂ pneumoperitoneum was established, and intra-abdominal pressure was maintained in a range of 10–12 mmHg. Afterwards, an inspection hole was made at a position that was above the navel in order to introduce the laparoscope. On this basis, the lesion size, location and adhesion to the surrounding tissues were evaluated. Once the characteristics of lesions were clarified, the remaining four trocars were successively entered under the visualisation of a monitor. Operative procedures followed the steps described below. Step 1: the first hepatic portal was adequately separated from the peripheral tissues. Step 2: the diseased lobe was adequately separated from the peripheral tissues and organs by ultrasound scalpel. Step 3: the pre-cut liver line was marked on the liver tissue 1–2 cm away from the lesion with the coagulation hook. Step 4: after blocking the first hepatic portal vessels, the diseased lobe was resected using an ultrasound scalpel along the pre-cut liver line. In the presence of significant capillary haemorrhage, immediate haemostasis was carried out using a mono-polar electrocoagulation or ultrasound scalpel. Meanwhile, large blood vessels and bile ducts were closed using absorbable clips until total diseased liver was completely resected. Step 5: monopolar electrocoagulation was used for electrocauterisation of the hepatic wound surface. Re-examination was carried out to observe whether active bleeding and/or biliary fistula were present. Local surgical areas were covered using biological absorbable haemostatic gauzes. Step 6: the diseased liver lobe was placed into a sampling bag, and then the bag was extracted out from the abdominal wall through the extending subxiphoid incision. Step 7: a drainage tube was inserted around the surgical region.

**Results**

**Patient characteristics**

The characteristics of the 13 patients enrolled in our study are summarized in Table 1. According to the WHO-IWGE classification criteria, all 13 patients in our study belong to P1N0M0/P2N0M0 stages of hepatic AE. The mean age was 32.7 years (18–52 years). The mean BMI was 22.8 kg/m² (18–33 kg/m²). None of the patients had clinical discomfort when they sought medical attention, except two patients who had dull pain in the right upper abdomen preoperatively. The serology results of all patients were positive, and the residual liver volume were adequate (>40%) by preoperative imaging assessment. No patient had received albendazole treatment before surgery. Of note, the fifth patient was also found to have a CE cyst on the right liver lobe in addition to an AE lesion, and the AE lesion of the eleventh patient was located within the middle liver lobe (Fig. 1).

**Intraoperative conditions**

LH was successfully completed in all patients. The average operation duration was 285 min (145–580 min), and the average blood loss was 305 mL (20–2000 mL). Two patients were given blood transfusion due to excessive intraoperative bleeding and a long operating time. Seven patients have simultaneous laparoscopic cholecystectomy (LC) due to concurrent chronic cholecystitis. Interestingly, pathology examination results confirmed that the lesion was AE and there was no residual lesion at the resection margin (Table 2).

**Postoperative conditions**

All patients could walk and eat 1–3 days (mean: 1.2 days) after surgery. First flatus was found 1–3 days (mean: 1.7 days) after surgery. After surgery, drainage of the abdominal cavity was performed for 3–21 days (mean: 6.9 days) until no liquid was observed. The postoperative hospital stay lasted for 4–14 days (mean: 7.2 days). Clinical symptoms of acute liver failure were observed in the second patient on the first postoperative day, and she was given treatment immediately. Fortunately, with positive treatment, her liver function gradually recovered and essentially returned to normal on the 7th postoperative day. On postoperative day 14, this patient met discharge criteria and was discharged with an abdominal drain, which was removed at a local hospital one week later. The seventh patient was also discharged with a drainage tube due to hydrops in the operation area. One week later, the effusion resolved spontaneously and then the drainage tube was removed in our hospital. All patients’ incisions healed well without incision-related complications. No mortality was
reported during hospitalization. All patients were followed up. The average follow-up time was 15.7 months (9–30 months). During the follow-up period, no AE relapse was observed as revealed by US and/or CT in these patients (Table 3).

**Discussion**

Hepatic alveolar echinococcosis, also known as hepatic multilocular echinococcosis, is a rare parasitic disease caused by the larval stage of *Echinococcus multilocularis* parasitising the human liver [16, 17]. Especially in the early and middle AE stages (P1N0M0/P2N0M0), it is particularly difficult to detect due to an absence of typical clinical symptoms. In addition, our team is not currently able to perform LH in most clinical AE patients because they are already in the advanced and/or terminal stage (P3 ~ 4NxMx) of the disease, in which lesions have invaded the important vessels of the hilum and/or patients have developed extrahepatic metastasis. These reasons explain the small number of cases in the present study.

Unlike other benign and malignant liver diseases, AE lesions have unique characteristics: large size, infiltrative growth, and hard texture. These characteristics may bring some challenges in terms of intraoperative exposure and intraoperative haemostasis. The second patient in our study developed an acute decrease in liver function after surgery because of
uncontrollable massive haemorrhage caused by the peripheral small vessels that were constantly torn during separation from the firm lesion. This case shows that this minimally invasive surgical approach may involve some technical difficulties in practice.

Several published case reports on laparoscopic treatment for hepatic AE published successful results with this technique [6, 10, 18]. They did not propose the selection criteria for AE treatment by laparoscopy due to the limited number of patients.

To the best of our knowledge, this study reports the first successful attempt in the field of minimally invasive hepatectomy in more than 10 patients with hepatic AE. In our series, the results were promising, with a 100% survival rate and only one case having a complication above Clavien-Dindo grade III, which is acceptable. The advantages of this minimally invasive surgical approach were fully illustrated by the enhanced recovery after surgery of patients and short-term hospitalisation. Of note, it is important to develop specific surgical plans according to the actual situation of the patient. For example, although the fifth patient’s AE lesion was located in the right anterior lobe, we performed right half liver resection because of a CE cyst in the right posterior lobe simultaneously. In this way, the AE lesion and CE cyst could be removed simultaneously, effectively avoiding repeat surgery. In addition, the procedure for resecting a lesion in the middle liver lobe is more difficult because it is equivalent to the simultaneous completion of

Table 2. Operative parameters for 13 patients.

| Case | Date of operation (yyyy/mm/dd) | Duration (min) | Bleeding (mL) | Blood transfusion (units) | Residual lesions | Details |
|------|--------------------------------|----------------|---------------|---------------------------|-----------------|---------|
| 1    | 2018.02.11                      | 375            | 200           | 0                         | NO              | LWR + LC |
| 2    | 2018.05.10                      | 400            | 2000          | 3                         | NO              | LRH + LC |
| 3    | 2018.11.14                      | 285            | 100           | 0                         | NO              | LLLH    |
| 4    | 2018.12.04                      | 365            | 200           | 0                         | NO              | LRH + LC |
| 5    | 2018.12.14                      | 240            | 20            | 0                         | NO              | LRH + LC |
| 6    | 2019.05.28                      | 205            | 100           | 0                         | NO              | LRH + LC |
| 7    | 2019.07.23                      | 285            | 250           | 0                         | NO              | LWR + LC |
| 8    | 2019.10.11                      | 145            | 50            | 0                         | NO              | LLLH    |
| 9    | 2019.10.17                      | 235            | 50            | 0                         | NO              | LLLH + LC |
| 10   | 2019.10.22                      | 160            | 20            | 0                         | NO              | LWR     |
| 11   | 2019.10.23                      | 580            | 800           | 2                         | NO              | LLLH    |
| 12   | 2019.11.28                      | 190            | 30            | 0                         | NO              | LWR     |
| 13   | 2019.11.28                      | 235            | 150           | 0                         | NO              | LWR     |

LWR: laparoscopic wedge resection; LRH: laparoscopic right hepatectomy; LLLH: laparoscopic left lateral hepatectomy; LLH: laparoscopic left hepatectomy; LMH: laparoscopic midlobe hepatectomy; LC: laparoscopic cholecystectomy.
two hepatectomies. Therefore, we do not recommend attempting this approach for inexperienced surgical teams. Interestingly, all patients in this study did not take albendazole tablets regularly after surgery, but no relapse case was observed at 9–30 months follow-up.

With regard to the surgical indications of LH for AE treatment, we propose preliminary selective criteria (Fig. 2): (1) The patient’s cardiopulmonary function and general condition can tolerate laparoscopic surgery. (2) Preoperative liver function is Child-Pugh grade A or B. (3) According to the WHO-IWGE classification criteria, the AE stage should be P1N0M0/P2N0M0. (4) The single AE lesion diameter should be ≤10 cm. (5) Multiple AE lesions should all be located in the same half-liver. (6) The lesion does not adhere to the surrounding tissue. In addition to the above conditions, when the single lesion diameter exceeds 10 cm and/or the lesion is adherent to the surrounding tissue but no dense as armor, the surgical team should make the choice whether to perform LH according to the actual situation.

Although the results of our trial were encouraging, with only one patient experiencing a complication above Clavien-Dindo grade III and zero hospital mortality, we still consider that this study has some shortcomings. Firstly, the number of cases included was relatively small. Secondly, it is difficult to make an objective scientific evaluation of the superiority and inferiority of LH for AE treatment due to lacking direct comparison with classic open surgery. Therefore, further comparative studies with classical open hepatectomy are needed.

In conclusion, the results of our preliminary study showed that LH is safe and feasible for radical treatment of hepatic AE. It can eliminate the whole AE lesion with a minimal wound. Strict patient selection and experienced surgical teams are key to successful surgery. The advantages of this technique for AE treatment need to be compared further with the classical open approach.

**Conflict of interest**

There are no competing interests.

**Acknowledgements.** This work was supported by the Natural Science Foundation of Xinjiang Uyghur Autonomous Region (No. 2017D01C322).

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**Table 3. Postoperative and follow-up information.**

| Case | Eating (d) | Emission (d) | Tube (d) | PHS (d) | Postoperative complications | Follow-up (months) | Recurrence |
|------|------------|--------------|----------|--------|-----------------------------|-------------------|------------|
| 1    | 1          | 1            | 6        | 7      | None                        | 30                | NO         |
| 2    | 1          | 3            | 21       | 14     | Acute liver failure         | 27                | NO         |
| 3    | 1          | 1            | 5        | 6      | None                        | 21                | NO         |
| 4    | 3          | 3            | 9        | 9      | None                        | 20                | NO         |
| 5    | 2          | 3            | 3        | 6      | None                        | 15                | NO         |
| 6    | 1          | 1            | 4        | 5      | Hydrops                     | 13                | NO         |
| 7    | 1          | 2            | 14       | 7      | None                        | 10                | NO         |
| 8    | 1          | 1            | 3        | 7      | None                        | 10                | NO         |
| 9    | 1          | 1            | 4        | 6      | None                        | 10                | NO         |
| 10   | 1          | 1            | 6        | 8      | None                        | 10                | NO         |
| 11   | 1          | 3            | 8        | 10     | None                        | 10                | NO         |
| 12   | 1          | 1            | 3        | 4      | None                        | 9                 | NO         |
| 13   | 1          | 1            | 4        | 5      | None                        | 9                 | NO         |

PHS: postoperative hospital stay.
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Cite this article as: Wan L, Ran B, Aji T, Shalayiadang P, Jiang T, Shao Y & Wen H. 2021. Laparoscopic hepatectomy for the treatment of hepatic alveolar echinococcosis. Parasite 28, 5.