

Research Article

# Relaparotomy for Peritonitis Following Liver Surgery in Alveococcosis and Echinococcosis: A Retrospective Analysis of 924 Cases

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## A B S T R A C T

**Introduction:** Hepatic cystic echinococcosis and alveolar echinococcosis are common parasitic liver diseases worldwide.

**Objective:** To assess the effectiveness of surgical treatment in patients with cystic echinococcosis and alveolar echinococcosis

**Methods:** This retrospective study examined 924 patients and 12 patients who underwent surgery for hepatic cystic echinococcosis and alveolar echinococcosis. Peritonitis cases were identified using clinical, laboratory, and imaging criteria. The surgical approach involved relaparotomy, abdominal cavity revision, infection source elimination, cavity drainage, and detoxification therapy. Descriptive statistics were used for data analysis.

**Results:** Closed echinococcectomy (EE) was the most common surgery, performed in 513 patients. Among the 625 patients with complications following hepatic surgery, 36 (5.8%) developed diffuse peritonitis. During the reoperation for peritonitis, a thorough approach included revising the abdominal cavity, eliminating the infection source, draining the cavity, and administering aggressive detoxification and anti-inflammatory therapy. Regional lymphatic stimulation was performed during multiple surgeries to enhance lymphatic drainage, reduce inflammation, and restore gastrointestinal function.

**Conclusion:** The findings contribute to the understanding of surgical management for parasitic liver cysts and emphasise the need for further research to improve treatment outcomes and reduce recurrence rates.

**Keywords:** Hepatic Hydatid Cysts, Repeated Surgery, Alveolar Hydatid Cysts, Closed Echinococcectomy, Hepatic Surgery, PAIR Technique

## Introduction

Hepatic cystic echinococcosis (CE), and alveolar echinococcosis (AE), are common parasitic liver diseases in various regions worldwide.<sup>1,2</sup> Some medical professionals advocate a systematic approach to surgery, usually beginning with the lungs or liver. Conversely, some studies have suggested that organs prone to complications should be prioritised. Currently, many patients with echinococcosis prefer minimally invasive procedures.<sup>2-5</sup> The lack of a universally accepted classification system and standardised terminology for surgical procedures further complicates the management of zoonotic liver diseases.

Diagnostic methods for liver parasites and their complications often lack accuracy, necessitating the development of diagnostic algorithms. No consensus exists on echinococectomy (EE) procedures, such as removal of the remaining liver cavity or the use of minimally invasive operations for these zoonotic diseases. Recurrent CE poses challenges in identifying the origin of recurrent cysts, hindering preventive measures. Uncertainties persist regarding extensive resections of AE, strategies to enhance liver function preoperatively, and the need for palliative liver resection after partial removal of the parasitic tumour.

Meta-analyses comparing radical excision and practical resection for liver echinococcosis have shown that radical surgery results in fewer postoperative complications, particularly biliary fistulas, and relapse, despite longer operation times.<sup>6-8</sup> Retrospective studies by Aydin et al. and Abdelraouf et al. found higher recurrence rates in patients who underwent sparing surgery.<sup>9,10</sup> However, these studies lacked randomised methods, and the mortality rates and hospital stays were similar between the groups in the meta-analyses. There is little agreement on the efficacy of postoperative rehabilitation and antiparasitic treatment for reducing recurrence rates. This study explored our experience in managing patients with parasitic liver cysts.

## Materials and Methods

This retrospective study assessed the effectiveness of surgical treatment in 924 patients with CE and 12 patients with AE, treated at the Department of Surgery from City Clinical Hospital No. 1, Bishkek, Kyrgyzstan from 2001 to 2020. Confidentiality was maintained for the collected data. Informed consent was obtained from patients. This study was approved by the Bioethics Committee of the International Higher School of Medicine in Kyrgyzstan (protocol no. 93, dated October 21, 2022) and was conducted in compliance with the criteria outlined in the Declaration of Helsinki.

This study investigated liver disease characteristics using clinical examinations, laboratory tests, and instrumental procedures, excluding post-surgical procedures for illness recurrence. Peritonitis was diagnosed and evaluated based on clinical indicators (temperature, pain, heart rate, respiration, and gastrointestinal function), laboratory markers (LIL, c-reactive protein, and procalcitonin), and objective measures (ultrasound and computed tomography scans). The examined study group consisted of 36 patients aged 18–72 years, with 12 having undergone surgeries for AE and 24 for CE.

We developed a diagnostic algorithm that incorporates symptoms, medical history, residency in endemic regions, and laboratory and instrumental methods. Laboratory studies have focused on enzyme immunoassays. Ultrasonography was the primary diagnostic tool for identifying liver parasites, and computed tomography was used for complex differential diagnoses. All patients underwent surgery using the approach determined by our classification of CE procedures.

During different surgical procedures, the empty liver spaces were treated with ethanol and glycerine. Carbon dioxide laser and antimicrobial photodynamic treatments sterilised the cyst walls. The novel puncture, aspiration, injection, and reaspiration (PAIR) technique involves cavity cleaning with a hypertonic sodium chloride solution to treat parasites.

The diagnosis followed protocols similar to those for CE, with a greater focus on computed tomography and magnetic resonance imaging. Positional emission tomography was employed in three specific cases. Surgical technique selection was based on the evaluation of the benefits in light of the prevalence of parasitic liver disease and associated complications.

Data analysis was performed using Statistica v8.0 software (StatSoft, Inc., Tulsa, USA). Patient demographics, surgical outcomes, and complications were summarised using descriptive statistics, specifically, frequencies and percentages. Results were presented as counts (n) and percentages (%). This study did not emphasise statistical significance, as no inferential analyses, such as logistic regression or odds ratios, were conducted or reported.

## Results

Among 924 patients with CE, 502 (54.3%) were male and 422 (45.7%) were female. Their mean age was  $49.3 \pm 8.4$  years and the age range was 18–78 years. Among the 12 patients with AE, 8 (66.7%) were male and 4 (33.3%) were female, primarily young or middle-aged, with a mean age

of  $29 \pm 2.4$  years. Of these patients, 5 (41.6%) had damage to the right liver lobe, 4 (33.3%) to the left lobe, and 2 (16.7%) to both lobes.

Closed EE was the most common surgery, performed in 513 patients (Table 1). Although the immediate postoperative outcomes were similar, the long-term results varied by surgery type, prompting a preference for cystectomy in the residual liver cavity. Consequently, we re-operated on 18 patients suspected of recurrence only to find empty lesions, which were then closed by flattening. Using the PAIR technique, cyst drainage was performed in 21 patients with type I and II HCs free of complications.

Of 625 patients with complications after liver surgery for CE and AE, 36 (5.8%) developed widespread peritonitis. Table 2 outlines the surgical procedures and frequencies performed, with organ-preserving cystectomy being the most common (91.7%). Seven patients underwent re-laparotomy and active surgical interventions due to tertiary peritonitis, and nine required laparotomic access. Perforations and HCs are the main causes of peritonitis, with initial surgical interventions often failing to effectively clean the abdominal cavity. Table 3 shows the distribution of echinococcal cysts as a complication in patients with peritonitis. The data revealed that most cases were in liver segments 7–8, particularly in alveolar echinococcosis (83.3%). The abdominal cavity was subsequently sanitised with scolicidal and bactericidal agents, including ozonated sodium chloride solution.

During the reoperation for peritonitis, a thorough approach included revising the abdominal cavity, eliminating the infection source, draining the cavity, and administering aggressive detoxification and anti-inflammatory therapy. Three patients underwent repeated laparoscopic operations; two were successfully cured, while one developed a right subphrenic abscess that was resolved by ultrasound-guided puncture. For patients with tertiary peritonitis, relaparotomy was performed to address any complications arising from the additional relaparotomy.

During multiple surgeries, regional lymphatic stimulation was performed in the mesentery of the small intestine using a fixed microirrigator along with standard measures. This technique enhances lymphatic drainage, reduces inflammation, and restores gastrointestinal function. The administered lymphotropic mixture included antibiotics, heparin, lidocaine, novocaine, and proserin, providing a mechanism for their action. Among the 16 reoperated patients, six experienced complications: pleurisy in two, wound infection in two, and early intestinal obstruction

in one. Consequently, 16.7% of reoperated patients had complications, with one requiring another relaparotomy for early intestinal obstruction. Unfortunately, two patients (5.6%) died because of worsening multiple organ failure. Both patients were elderly and delayed reoperation contributed to death.

**Table 1. Types and Number of Surgical Interventions for Echinococcosis of the Liver**

Types of Surgery	n (%)
Closed echinococectomy	513 (55.5)
Cyst drainage (PAIR technique)	21 (40.9)
Re-operated	18 (35.1)

**Table 2. Types and Number of Surgical Interventions for Echinococcal Cysts in the Liver of Patients with Peritonitis as a Complication**

Types of Surgery	n (%)
Cystic echinococcosis	2 (8.3)
Radical resection	
Organ-preserving cystectomy	22 (91.7)
Alveolar echinococcosis	2 (16.7)
Hemihepatectomy	
Laparotomic access	10

**Table 3. Localisation of Echinococcal Cysts in the Liver of Patients with Peritonitis as a Complication**

Segments	Cystic Echinococcosis N = 24 n (%)	Alveolar Echinococcosis N = 12 n (%)
1–3	2 (8.3)	1 (8.3)
4	2 (8.3)	1 (8.3)
5	3 (12.5)	2 (16.7)
6	4 (16.7)	2 (16.7)
7–8	13 (54.2)	6 (83.3)
Total N (%)	36 (100.0)	

## Discussion

A 454-patient study showed a higher recurrence rate in the organ-preserving cystectomy group than in the radical surgery group.<sup>11</sup> A randomised trial of 32 patients revealed that “practical” resections led to higher early recurrence and complications than radical surgery.<sup>12</sup> However, conservative

procedures are technically simpler and less risky than major liver resections for echinococcosis treatment.<sup>13</sup> Various techniques have been used to address the postoperative issues associated with residual cavities after HC excision.

Sokouti et al.'s prospective study found no infectious complications or relapses and shorter hospital stays in the omentoplasty group compared to cyst removal and cyst aspiration with antiseptic filling and re-aspiration.<sup>14</sup> A retrospective analysis of 304 patients indicated that external drainage led to higher complications than omentoplasty or capitonnage.<sup>15</sup> A comparative study by Mentès et al. demonstrated that omentoplasty resulted in fewer problems and shorter hospital stays than introflexion.<sup>16</sup>

Vagianos et al. conducted a study that assessed the effectiveness of orthoplasty and EE (cystectomy and drainage). However, they found no benefit when combining these procedures.<sup>17</sup> Reports suggest that omentoplasty has a lower incidence of complications than external drainage.<sup>18–20</sup> The use of fibrin glue in radical liver resection and “practical” operations may not be advantageous in terms of complication rates after the operation.<sup>21,22</sup> In this study, 46 patients (7.3%) experienced recurrent echinococcosis and required further surgical treatment.

We exclusively used open EE for the first two years of the study. Upon evaluating the early results, we determined that the procedure was too risky and had a significant potential to cause trauma and negatively impact the quality of life of the patients. Univariate analysis showed a significant association between the length of hospital stay and open surgery (odds ratio 30,  $p = 0.01$ ).

In this study, closed EE was the primary surgical approach, consistent with previous research indicating its less invasive nature and quicker recovery. However, systematic reviews by Pang et al. and Sokouti et al. have shown that more aggressive surgical techniques often yield lower recurrence rates and fewer postsurgical complications.<sup>6,14</sup> Our findings support this, as the long-term results of closed EE revealed shortcomings in preventing recurrences compared to more radical methods. We noted a 7.3% recurrence rate in our patient group, aligning with the higher recurrence rates observed in organ-sparing procedures.

Aydin et al. and Abdelraouf et al. highlighted the technical ease and reduced risk of conservative surgeries while noting their connection to higher early recurrence and complication rates.<sup>9,10</sup> Advanced techniques, such as the PAIR method, showed potential in specific cases of uncomplicated hydatid cysts, as evidenced by our results and supported by studies by Tuxun et al. and Vagianos et al.<sup>3,17</sup> Nevertheless, these approaches must be employed carefully, considering their limitations in situations involving extensive cyst presence or complications, such as peritonitis.

This study implemented regional lymphatic stimulation, improved lymphatic drainage, reduced inflammation, and restored digestive function. Combined with a lymphotropic formulation, this presents a novel mechanism for accelerating post-surgery recovery. Our results highlight the importance of managing complex tertiary peritonitis cases. The use of ozonated sodium chloride solution and antimicrobial photodynamic therapies for abdominal cavity cleansing represent innovative methods to reduce postoperative infections and complications. These findings expand upon previous approaches that relied on conventional antiseptics.

The absence of a standardised classification system and consensus on surgical techniques for hepatic CE remains a major challenge. This study highlights the importance of individualised surgical strategies based on patient clinical presentation, cyst characteristics, and complications. Although many studies advocate aggressive surgical interventions, our research suggests that less invasive procedures can be equally effective with meticulous preoperative and postoperative care.

These results emphasise the importance of minimally invasive surgical methods, such as laparoscopy and mini-laparotomy, to reduce parasite spread and complications. This study supports advanced preoperative strategies, such as portal vein occlusion, to preserve liver function and improve outcomes. Postoperative care should include cleansing, anti-inflammatory therapies, and lymphatic stimulation to reduce tertiary peritonitis and aid in recovery. The retrospective nature and single-centre design of the study may limit the generalisability of the results. The lack of randomised controlled trials comparing techniques hinders definitive conclusions.

## Conclusion

Optimal HCs treatment involves limited surgeries, such as EE, without resection of the remaining cavity or liver, as such resections can have serious, potentially fatal consequences. Low-trauma techniques, such as laparoscopy, mini-laparotomy, and the PAIR technique, should be used only when parasitic cysts are accessible and visible to minimise the risk of parasite spread within the abdomen. Advances in surgical techniques, preoperative preparations, and postoperative treatments have improved the outcomes of patients with AE. The initial occlusion of the portal vein branches before removing the affected liver lobe is crucial for preserving the functional capacity of the remaining liver and reducing postoperative inadequacy. Organ transplantation may be an effective alternative treatment for patients with AE.

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