

## Treatment of hydatid liver cyst: Comparison of open and laparoscopic surgery

Open and laparoscopic surgery in hepatic hydatid cysts

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### Abstract

**Aim:** The aim of this study was to compare parameters that influence patient selection, cyst features, treatment outcomes, morbidity, and death rates in hepatic hydatid disease open versus laparoscopic surgery.

**Material and Methods:** A total of 660 patients were assessed between 2010 and 2020 who had surgery for a hepatic hydatid cyst diagnosis. The decision for open or laparoscopic surgery was made according to the stage, localization, number, size, and complication features of the cysts observed in the Computerized Tomography (CT) images and the characteristics of patients. The patients were divided into two groups: Open Surgery (Group A; n=607) and Laparoscopic Surgery (Group B; n=53). In terms of morbidity and mortality, characteristics of the cysts, patients, operation type, and treatment outcomes in both groups were compared.

**Results:** The demographic characteristics of the groups were similar. A total of 1020 cysts were determined in 660 patients. In Groups A and B, the mean number of cysts was 1.59 and 1.03, respectively. The mean duration of surgery in Group A and B was  $110 \pm 22$  minutes and  $70 \pm 18$  minutes, respectively ( $p > 0.05$ ). The mean hospitalization time in Group A and B was  $9.3 \pm 6.5$  days and  $6.5 \pm 1.1$  days, respectively ( $p < 0.05$ ). The rate of biliary fistula in Group A and B was 35.5%, and 13.2%, respectively ( $p < 0.05$ ). The rate of other complications was 11.5% in Group A and 3.7% in Group B ( $p < 0.05$ ).

**Discussion:** Laparoscopic surgery is an effective and safe intervention for cysts in the accessible peripheral segments of the liver.

### Keywords

Liver Hydatid Cyst, Laparoscopic Surgery, Open Surgery, Morbidity, Mortality

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## Introduction

Despite the developments in the diagnosis and treatment of hydatid cyst disease, it is still a public health problem in the Mediterranean Region, Middle East, South America, and countries like Turkey, where the disease is endemic.

Regarding the treatment of hepatic hydatid cyst disease, albendazole (medical treatment), percutaneous treatment methods, and surgical treatment methods are used. The stage of the cyst, its location in the liver, its diameter, whether it is complicated or not, factors related to the patient, and technical means play an important role in the choice of treatment [1,2].

Studies report that the success rate of albendazole monotherapy was 30% in patients with a cyst smaller than 5 cm. Albendazole monotherapy is recommended for high-morbidity patients, who have disseminated hydatidosis, who are not suitable for percutaneous treatment, and do not want surgery [1,3,4].

Percutaneous treatment is preferred over surgical treatment because it is less invasive intervention, and does not need hospitalization. It is mainly preferred in uncomplicated and unilocular Type 1 and Type 2 cysts according to the Gharbi classification. As a percutaneous treatment, the PAIR (puncture, aspiration, injection, and re-aspiration) technique is used in Type 1 and Type 2 cysts without biliary fistula. In complicated cysts with biliary fistula and multivesicular Type 3 cysts, catheter techniques are preferred within the scope of percutaneous treatment. In suitable patients, the reported success rate of the PAIR technique is between 92% and 100% [5,6].

Surgery is considered a gold standard in all cyst stages and hepatic localizations. Regarding the surgical treatment, conservative methods, in which the content of the cyst is opened and evacuated, and radical methods (pericystectomy, hepatectomy), in which the liver is resected without opening the cyst. Due to bleeding risk, it is recommended that the radical methods should be implemented in health centers, where experienced surgeons and sufficient technical capabilities are available. The most commonly used surgical method is the conservative method [7,8].

The surgical intervention can be carried out with laparoscopic and open techniques. As the hospitalization time is shorter, healing is faster, postoperative morbidities such as wound infection and incisional hernia are rare, laparoscopic surgery became popular in suitable patients [9]. The decision for open or laparoscopic surgery may be changed depending on the stage of the cyst, its location in the liver, its diameter, and whether it is complicated or not.

In this study, our aim was to discuss the factors affecting patient selection, cyst characteristics, treatment outcomes, morbidity, and mortality rates in the open and laparoscopic surgery of hepatic hydatid cysts in light of literature information.

## Material and Methods

A total of 660 patients who had undergone surgery due to the diagnosis of hepatic hydatid cyst in the General Surgery Clinic at the Atatürk University Medical Faculty Hospital between January 2010 and December 2020, were evaluated in this retrospective study.

All patients underwent abdominal CT to determine the anatomical location of the cyst and evaluate whether there are

cysts in other intrabdominal organs. All cysts were classified according to the Gharbi Classification. In undiagnosed cases, magnetic resonance imaging (MRI) and serological enzyme-linked immunosorbent (ELISA) test were performed.

Pre-operative MRI examination was used in patients with suspected cyst rupture into the biliary tract before surgical intervention. Patients underwent Endoscopic Retrograde Cholangio-Pancreatography (ERCP) according to the results of the MRI examination.

The decision for the preference of open and laparoscopic surgery was made by the team working in the unit of liver transplantation and hepatobiliary surgery according to the type, number, size, localization of the cyst, whether it is complicated or not, the presence of recurrence or not, and whether the patient had previous abdominal surgery or not. Of the 660 patients, 607 (91.9%) underwent open surgery and the remaining 53 patients (8.1%) underwent laparoscopic surgery. The patients were divided into two groups Group A (open surgery) and Group B (laparoscopic surgery). Patients' data including age, gender, laboratory results, number, type, diameter, localization of the cyst, biliary fistula, ERCP, surgical method, duration of surgery, development of postoperative biliary fistula, cavity abscess, reoperation, hospitalization time, recurrence, morbidity, mortality were obtained from the archived files and information management system of the hospital.

Albendazole treatment (10 mg/kg) was initiated one week before the surgical intervention and continued for two postoperative months.

All patients received 1g of cefazolin sodium prophylaxis 5 minutes before general anesthesia.

The incision sites and trocar entrance sites for laparoscopy were determined according to the location of the hepatic cysts. The content of the cysts was aspirated before cystotomy. Chlorhexidine gluconate (0.04%) (Chx-Glu) was injected into the cysts to inactivate the parasites. During this procedure, compresses soaked in Chx-Glu were used to protect the surrounding tissues from contamination. After 5 minutes of Chx-Glu application, the cyst was opened and its content was aspirated.

The cyst cavity was checked for biliary fistula. Propofol was administered through cystostomy or choledochus to determine the opening of the biliary fistula. Fistulas were repaired with 5-0 prolene stitches.

Unroofing was carried out with the resection of the cyst wall using energy devices. Cholecystectomy was carried out in patients, in whom the cyst wall was adherent to the gallbladder. Before discharge, all patients underwent CT or USG examination and all drains were removed. Control USG or CT examinations were performed in the postoperative 3rd, 12th, and 24th months.

## Statistical Analysis

The study data were analyzed with the Statistical Package for the Social Sciences (SPSS) version 25 software package (SPSS Inc., Chicago, IL, USA). The results were presented in frequency, percentage, median, and intervals. The Mann-Whitney U test was used for the intergroup comparison of the numeric data, and the Fisher Exact Test was used for the categorical variables.  $P < 0.05$  was considered statistically significant.

**Results**

Characteristics of the cysts in patients, who were treated with laparoscopic and open techniques, are summarized in Table 1. Of the 660 patients, 402 were females and 258 were males. The mean age was 38.2 years (18-83 years) and the follow-up period was 42 months (15-110 months). Thirty-three of the patients had recurrent cysts. The total number of cysts was 1020 (1-18) and the mean cyst diameter was 9.1 cm (2-29 cm); 407 of the cysts were inocular Type 1- Type 2; 536 were Type 3 multivesicular, 32 were Type 4, and 45 had a complication/ abscessation.

In 53 patients, who had undergone laparoscopic surgery, 55 cysts (1-2) were determined. The mean diameter of the cysts was 8.1 cm (5-14 cm); 43 cysts were unilocular Type 1 and Type 2; 9 were multilocular Type 3, and 3 had a complication/ abscessation. The cyst in one patient was recurrent. One patient had a bilobar cyst; 52 patients underwent cystotomy and drainage, and 1 patient pericystectomy. In two patients, the laparoscopic technique switched to the open technique since effective cavity aspiration and control of the spread to the surrounding tissues could not be achieved. The mean duration of surgery was 70 minutes (50-90 minutes).

**Table 1.** Demographic features of patients and characteristics of liver cysts

	Total	Group A	Group B	P value
		Open surgery	Laparoscopic Surgery	
1-Patients (n)	660	607	53	
2-Gender				
Female	402	368	34	NS
Male	258	239	19	NS
3- Age (years)	38.2	38.5	35.2	NS
4-Number of cysts	1020	965 (1-18)	55 (1-2)	NS
5- Size of cyst (cm) (range)	9.1 (2-29)	9.2(2-29)	8.1 (5-14)	NS
6-Type of cyst (number of patient)				
Type I	145	121	24	NS
Type II	104	87	17	NS
Type III	344	336	9	NS
Type IV	22	22	-	NS
Complicated/Abscess	45	42	3	NS
Total	660	607	53	
7- Recurrence (n)	33	32	1	
8-location				
Right	516	469	47	NS
Left	58	54	4	NS
Bilobar	71	70	1	NS
Caudate	15	14	1	NS
Total	660	607	53	
9-Number of the cysts				
Type I	221	195	26	NS
Type II	186	169	17	NS
Type III	536	527	9	p<0.05
Type IV	32	32	-	NS
Complicated/Abscess	45	42	3	NS

Abbreviations; NS: non specific, not statistically significant

One patient underwent reoperation on the 3rd day due to bleeding. Seven patients developed biliary fistula (13.2%). The mean hospitalization time was 6.5 days (3-12 days). Recurrence was observed in one patient (1.88%).

Data related to the surgical interventions are presented in Table2.

**Table 2.** Type of Surgical Procedures

Operation Type	n	Group A	Group B	P value
		Open surgery	Laparoscopic Surgery	
		n:607	n:53	
Conservative treatment	634	582	52	NS
Conservative+ Resection	15	15	-	NS
Resection	11	10	1 sol	NS
Elective surgery	646	493	53	
Emergency surgery	14	14	-	NS
Cyst rupture into abdomen		8	-	
Abscess/ sepsis		6	-	
Operation time		110 (65-180)	70 (50-130)	NS
Reoperation	10	9	1	NS
Abscess	8	8	-	
Bleeding	1	-	1	
Bile duct stricture	1	1	-	

Abbreviations; NS: non specific, not statistically significant

**Table 3.** Data of biliary fistulas and other complications, length of hospital stay, mortality

	Total	Group A	Group B	P value
		Open surgery	Laparoscopic surgery	
Biliary fistula/n	223	216	7	p < 0.05
	36.5 %	38.3 %	13.2 %	
ERCP				
Preoperative	57	55	2	
Postoperative	45	44	1	
Pre and postoperative	18	17	1	
Other complications				
Liver cavity abscess	14	14	-	
Deep vein thrombosis	6	6	-	
Bronchoalveolar fistula	1	1	-	
Incisional hernia	22	22	-	
Wound infection	38	38	-	
Bleeding	1	-	1	
Recurrence rate	26	25	1	
	3.93 %	4.11 %	1.88 %	
Total	72 patient	70 patient	2 patient	p < 0.05
	11 %	11.5 %	3.7 %	
Length of stay/day	9.1(4-59)	9.3 (4-59)	6.5 (3-12)	p < 0.05
Mortality/Etiology				
Sepsis	5	5	-	
Pulmonary embolism/ acute pancreatitis	1	1	-	
Liver cirrhosis + sepsis	1	1	-	

Abbreviations; ERCP: Endoscopic retrograde cholangiopancreatography, DVT: Deep vein thrombosis. \*108 complications developed in 72 patients except for biliary fistulas

A total of 965 (1-18) cysts were determined in 607 patients, who underwent open surgery. The mean diameter of the cysts was 9.2 cm (2-29 cm); 364 of them were unilocular Type 1 and Type 2; 527 were multivesicular Type 3; 32 were Type 4, and 42 had complicated cysts. Seventy patients had bilobar cysts; 32 patients had a recurrence; 528 patients underwent conservative cystotomy and tube drainage, 15 patients conservative cystotomy + resection, and 10 patients only pericystectomy + resection. The mean duration of surgery was 110 minutes (65-180 minutes). Eight patients underwent reoperation due to the cavity abscess and one patient due to the stricture in the choledochus; 216 patients developed a biliary fistula (33.7%). The mean postoperative hospitalization time was 9.3 days (4-59 days). Recurrence was observed in 25 patients (3.74%). Seven patients died.

Postoperative complications observed in our patients are shown in Table 3.

### Discussion

The aim of hepatic hydatid cyst surgery is to eliminate parasites, prevent recurrence, and decrease the complications and morbidity as much as possible.

Regarding the treatment of hepatic hydatid cysts, laparoscopic surgery made a fast entry into the therapeutic field as it does not cause postoperative morbidities, which are common in open surgery. However, hepatic hydatid cyst disease has specific features. The decision for open and laparoscopic treatment is made by taking into consideration the location, type, number, complexity of the cyst, and technical means.

The decision between laparoscopic and open surgery was given during the preoperative period according to the type of the cyst and its location in the liver as observed in the CT images. Of the 660 patients, 607 (91.9%) underwent open surgery, while 53 patients (8.1%) underwent laparoscopic surgery. The characteristics of the cysts in the patients group, which had undergone percutaneous intervention and laparoscopic intervention, were similar. In the last 10 years, 560 of 1220 patients (44.4%), who had applied to our hospital with the diagnosis of hepatic hydatid cyst disease, were treated with a percutaneous approach, and the remaining 660 patients (55.6%) were treated with a surgical approach.

Open surgery was preferred mostly in patients with complicated, bilobar, three or more cysts, multivesicular Type 3 cysts, and recurrences.

In the study by Zaharie F. et al. [10], it was reported that laparoscopic surgery was a safe and effective approach in all stages of hepatic hydatid cyst. However, while laparoscopic cystotomy and aspiration of Type 1 and Type 2 cysts and removal of the germinative membrane from the abdomen can be performed easily with Endobag, the aspirator is often obstructed during the aspiration of multivesicular Type 3 cysts. This leads to the prolongation of surgery compared to open surgery and contamination of the surrounding tissues. Specially developed aspiration devices with broad lumen are needed, especially for the aspiration of the multilocular Type 3 cysts with little fluid content. Because of this problem, laparoscopy was switched to open surgery in two of our patients and the intervention was completed with open surgery.

Laparoscopic surgery is usually indicated in uncomplicated hepatic cysts and Type 1 and Type 2 cysts with peripheral locations. The cysts with intraparenchymal location, which are not apparent on the liver surface, and cysts located in segment 7, are not suitable for the laparoscopic approach. One patient with an isolated caudate lobe hydatid cyst was successfully treated with conservative laparoscopic cystotomy. However, mostly open surgery in caudate lobe cysts was preferred.

While 634 patients (94%) underwent conservative surgery, 26 patients (6%) underwent liver resection. In 25 of the 26 patients, who had undergone resection, open surgery was preferred, while laparoscopic left lateral hepatectomy was carried out in one patient. Laparoscopic liver resection is a technically difficult intervention, which requires considerable experience.

The rate of cystobiliary fistula is between 5% and 30% in the literature [4,10]. In our study, the rate of the postoperative biliary fistula was 35.6% and 13.2% respectively in open and laparoscopic surgery (the difference was statistically significant;  $p < 0.05$ ). As percutaneous treatment is a common practice in our hospital, surgery is preferred in complicated patients. Therefore, more cystobiliary fistulas are seen in patients undergoing surgery. The low rate of biliary fistula in laparoscopic surgery depends on the patient selection.

In the first years of laparoscopic hydatid cyst surgery, there was a concern that the rate of intraperitoneal contamination and recurrence might be higher compared to open surgery [11,12]. Pre- and post-operative albendazole treatment, injection of scolicedal agents, isolation of the cyst from the peritoneal cavity with sponges soaked in a scolicedal agent, and inactivation of the cyst content with scolicedal agents enabled the reduction of this rate [4,13]. We use a 0.4% Chx-Glu solution to prevent the intraperitoneal spread and inactivate the cyst content. Studies have reported that the recurrence rate in hepatic hydatid cyst disease was between 4% and 25% [1,14,15]. Twenty-five of patients with recurrence ( $n=607$ ; 4.1%) were treated with open surgery and one patient ( $n=53$ ; 1.8%) with laparoscopic surgery. The reason why the recurrence rate was lower in the laparoscopy group compared to the open surgery group is due to patient selection. At the same time, this shows that liver laparoscopic hydatid cyst surgery is safe for recurrence if surgical technique is observed.

Studies have reported that the complication rate was between 6% and 40% [16]. The rates of the complications such as postoperative surgical site infection, atelectasis, pleural effusion, deep vein thrombosis (DVT), incisional hernia, broncho-alveolar fistula, and the need for reoperation were higher in the open surgery group. Besides biliary fistulas, 108 complications were observed in 72 patients. The rate of complication development was 11%. This rate was 11.5% and 3.7% in open and laparoscopic surgery groups, respectively ( $p < 0.05$ ). When hepatic hydatid cyst is treated with a laparoscopic approach, the following benefits of minimally invasive surgery are observed compared to open surgery: less postoperative pain, shorter hospitalization time, faster return to work life, lower rates of wound infection, and incisional hernia.

The development of cavity infection and abscesses is one of the most important complications and the reason for reoperation. The rate of cavity infection is between 1% and 6.8% in the

literature [14]. In our study, cavity infection was encountered in 14 open surgery patients (2.3%). Eighth patients, in whom the cavity infection did not regress, underwent reoperation. The most important factor in the development of cavity infection is the development of postoperative biliary fistula and related long-term catheterization and the development of infection due to ERCP intervention. The higher rate of cavity infection in open surgery compared to laparoscopic surgery can be explained by the more complicated, larger cysts, higher rate of biliary fistula in the open surgery group, and the preference for open surgery in complicated cysts.

When the laparoscopic surgery patients were compared to open surgery patients; the hospital stay, post-operative complications, and biliary fistula rate were found to be lower in the laparoscopic surgery group ( $P < 0.05$ ). The reason for the shorter hospital stay and lower postoperative complications is that the advantages of minimally invasive surgery are seen in laparoscopic surgery. In addition, the reason that biliary fistula and cavity abscess were more common in the open surgery group was thought to be the fact the complicated cysts of the patients were more common in the open surgery group. The rate of type 3 multivesicular cysts was found to be statistically high in the open surgery group ( $p < 0.05$ ). This may have had an effect on the high incidence of recurrences in the open-operated patient group.

In studies, the reported mortality rate after surgical treatment of hydatid cyst disease was between 0% and 3% [14,17]. Seven of the open surgery patients ( $n=607$ ; 1.15%) died. In 5 of these patients, percutaneous treatment was attempted before surgical intervention. The development of sepsis related to cavity abscess is the most important reason for mortality in hepatic hydatid cysts.

### Conclusion

Hepatic hydatid cyst disease has specific characteristics, and each patient should be evaluated individually. Preferring laparoscopy for suitable patients decreases the duration of the hospitalization, and provides faster recovery. Laparoscopy can be performed effectively and safely with better postoperative morbidity rates compared to open surgery.

### Scientific Responsibility Statement

The authors declare that they are responsible for the article's scientific content including study design, data collection, analysis and interpretation, writing, some of the main line, or all of the preparation and scientific review of the contents and approval of the final version of the article.

### Animal and human rights statement

All procedures performed in this study were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. No animal or human studies were carried out by the authors for this article.

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### Conflict of interest

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