

Effective Factors on the Disappearance of Residual Cavity Following Conservative Surgery of Liver Hydatid Cysts

Abstract

Background: Surgery is one of the treatments commonly used to treat liver hydatid cyst. Remaining of the residual cavity after conservative surgery may lead to some harmful complications. In this study, we evaluated the role of different factors affecting the disappearance of the residual cyst. **Materials and Methods:** Seventy-five patients were evaluated in 2.5 years. Patients were divided into two groups based on the remaining or disappearance of the residual cavity in follow-up visits. The baseline demographic features, preoperative cysts' size, type of technique used to eliminate the residual cavity, and cavity wall characteristics were compared in the two groups. **Results:** Residual cavity was disappeared in 46 (61%) patients after 2 years. Calcification of the wall and wall stiffness were more common in patients with the remained residual cavity (89.6% vs. 8.7% [$P < 0.001$] and 58.6% vs. 30.4% [$P < 0.01$], respectively). Demographic features, preoperative cysts' characteristics, and the procedure used during surgery were not statistically different between groups. **Conclusions:** Cyst wall calcification and wall stiffness had a role in predicting residual cavity disappearance. These factors can help surgeons to predict patients at higher risk of posthydatid cyst resection residual cavity.

Keywords: Conservative treatment, cysts, *Echinococcus granulosus*, liver, surgery

Introduction

Liver hydatid cyst (LHC) is a parasite-induced disease commonly caused by *Echinococcus granulosus* and *Echinococcus multilocularis* species. Given the nature of their life cycle and transmission, the disease is more prevalent in sheep breeding areas.^[1-3] The cysts consist of 3 layers: germinal (innermost) layer, laminated (middle) membrane, and pericyst (outermost) layer, which is made by the host cells.^[4,5]

By far, surgery is the most commonly used treatment for LHC.^[6] It aims to remove the parasites and the germinal layer from the cyst cavity.^[7,8] Surgical treatment of the LHC is classified as radical surgery and conservative surgery. The conservative method consists of sterilizing and draining cyst contents, including the cyst membrane, in addition to removing a portion of the cyst. In the radical method, the cyst is completely removed, with or without liver tissue resection.^[7]

Surgeons should make a choice between radical and conservative surgery based

on the patients' and cysts' characteristics. The conservative method is faster and easier to perform than radical surgery. Moreover, the intraoperative blood loss is much lower as the liver tissue is not manipulated.^[9] Radical procedures such as segmentectomy, lobectomy, pericystectomy, and complete cyst resection have less postoperative complications and recurrence rate; hence, new studies recommend radical procedures. This method, however, is not recommended in critically ill patients, patients with clear cysts, and when the pericyst layer adheres to main vessels.^[7,10,11]

One of the complications that may occur after the conservative LHC surgery is the persistence of residual postoperative cavity, which may lead to many complications, including bile leakage, biliary fistula, residual cavity infection, prolonged postoperative hospital admission, biliary peritonitis, and even partial intestinal incarceration in the cavity. Various surgical techniques (namely omentoplasty, capitonage, and marsupialization) are used to manage the residual cavity.^[12] Various studies have recommended a combination

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of the drainage and omentoplasty as the preferred method in reducing the length of hospital stay.^[2,13]

Considering the complications that may arise following the conservative LHC surgery due to the cyst-induced residual cavity, detecting the role of different factors affecting the cavity size reduction and disappearance is of paramount importance. In this study, we evaluated the role of different factors including patients' demographic features, techniques used during surgery, and the cysts' characteristics on the disappearance of the residual cyst cavity.

Materials and Methods

This observational study was conducted between January 2016 and December 2018 in Al-Zahra hospital, a tertiary referral center in Isfahan, Iran. Patients with cystic lesions (CL), cystic echinococcosis (CE) 1, CE2, and CE3, according to the World Health Organization (WHO) classification,^[14] who had undergone open conservative LHC surgery for the first time, were included in the study. In these patients, the diagnosis of hydatid cyst was confirmed using microscopic and macroscopic findings, during and after the surgery. The exclusion criteria were having very small cysts or multiple small cysts, cystobiliary communication, history of previous abdominal surgery, immunodeficiency, any underlying diseases such as cirrhosis, advanced cardiopulmonary disease, cancer, or severe dysfunction in other organs. After discharging, the participants were requested to visit the surgery clinic 1 week after the surgery for the first follow-up visit. Furthermore, the second, the third, and the fourth postop visits were scheduled in 4, 12, and 24 months, respectively. The mean of minimum size of residual cavities in the group of patients which their cavity size was decreasing was measured at the end of the follow-up period. This number was 4 cm² and it was chosen as the cutoff size for residual cavity disappearance for our study. The cavities smaller than 4 cm² were considered as disappeared cavities (DC). They were considered as remained cavities (RC) if the size of cavity remained constant (<5% decrease in cavity size) in two successive ultrasonographies or if the cavity size in the fourth visit was larger than 4 cm².

The patients took no medicine in the course of study. The purpose of this study was described to the patients, and written informed consent was also collected. The patients were allowed to leave the study at any time and for any reason. The participants took part in no other study at the same time, and imaging measurements were not used for data collection in other studies.

This study was carried out under a protocol approved by the Ethics committee of Isfahan University of Medical Sciences, Isfahan, Iran.

The participants' demographic information such as age and gender were collected using a questionnaire at

the first postoperative visit. Intraoperative information (e.g., consistency of the cyst wall and the technique used during surgery) was also gathered using the patients' hospital records. The consistency of the cyst wall was evaluated by a pathologist measuring the amount of cyst wall tissue fibrosis, giving the results as firm or soft. The size, location, and the number of LHCs were recorded. Furthermore, they are categorized for each patient using the WHO's sonographic classification of LHCs (CL, CE1, CE2, CE3, CE4, and CE5). In cases with more than 1 cyst, the largest cyst was considered in the analysis. The type of surgery was determined by the surgeon through having a direct observation of the cyst during the surgery and taking the patient's condition into account. The size of the cyst, the consistency of the cyst wall, and the presence of internal biliary fistula were also carefully recorded. All of the surgeries and evaluations were done by one surgeon.

The postoperative data were recorded using cyst size measurements based on the ultrasonography reports during follow-up visits. All the ultrasonographies were done by one radiologist who was not aware of the objective of the study. The size of the cyst before surgery and hepatic parenchymal calcification were also evaluated using data from computed tomography (CT) scan reports.

The quantitative data were reported as mean \pm standard deviation. The qualitative data were described using frequencies and percentages.

The IBM SPSS Statistics for Windows, Version 24.0. Armonk, NY was used to analyze the data. Chi-square test and independent samples *t*-test were used for statistical analysis. $P < 0.05$ was considered statistically significant.

Results

Eighty patients were enrolled in this study. Five patients were excluded, as they were unwilling to further participate in the study: one patient at the third visit and the others on the fourth visit. The final analyses were done on 75 patients with the mean age of 46.14 ± 15.27 . There were no major complications and death in the course of the study.

After 2 years of follow-up, the residual cysts were disappeared in 46 (61%) patients: 26 patients at the second visit, 17 patients at the third visit, and 3 others at the last visit. Furthermore, two patients at the second visit, 11 patients at the third visit, and 13 patients at the fourth visit were entered into the RC group. The patients within the DC and RC groups were compared regarding their demographic information and baseline clinical features, as presented in Table 1.

Out of the patients who were included in the analyses, 14 patients had undergone omentoplasty and 15 participants had undergone capitonnage. As shown in Table 2, there was a statistically significant difference between the two groups in terms of calcification and consistency of the cyst

Table 1: Comparison of demographic features of the patients and baseline characteristics of the cysts in two groups

Demographic Features	DC group (n=46)	RC group (n=29)	P
Age	45.39±15.39	47.35±15.26	0.59
Gender (female:male)	30:16	19:10	0.97
Cyst number	1.37±1.01	1.41±0.57	0.83
Cyst location (RL:LL)	33:13	15:14	0.08
Cysts size before surgery (cm ²)	76.06±65.48 (range from 12 to 238)	68.20±80.40 (range from 10 to 320)	0.64
WHO hydatid cyst classification, n (%)			
CL	4 (8.7)	2 (6.9)	0.26
CE1	20 (43.5)	10 (34.5)	
CE2	8 (17.4)	2 (6.9)	
CE3	14 (30.4)	15 (51.7)	

P values resulted from independent sample *t*-test for continuous and Chi-square test for categorical variables. RL=Right Lobe, LL=Left Lobe, DC=Disappeared Cavity, RC=Remaining Cavity, CL=Cystic Lesions, CE=Cystic Echinococcosis, WHO=World Health Organization

Table 2: Comparison of cyst wall characteristics and techniques used during surgery in two groups

Cyst Wall Characteristics and Techniques	DC group (n=46), n (%)	RC group (n=29), n (%)	P
Calcified Wall	4 (8.7)	26 (89.6)	0.001
Hard Wall	14 (30.4)	17 (58.6)	0.01
Omentoplasty	6 (13)	8 (27.6)	0.11
Capitonnage	10 (21.7)	5 (17.2)	0.63

P values resulted from Chi-square test. DC=Disappeared Cavity, RC=Remaining Cavity

wall. The rate of omentoplasty and capitonnage was not statistically different in the two groups.

The rate of cavity size reduction in the 1st 4 months in the DC group was 82.93% ± 21.22%. This rate was statistically lower in the RC group (38.11% ± 24.62%, $P < 0.001$). This difference remained constant during the third (84.45% ± 16.13% vs. 18.60% ± 31.87%, $P < 0.001$) and the fourth (80.55% ± 17.34% vs. 8.76% ± 10.01%, $P = 0.01$) postoperative visits, in comparison to the second and third follow-up visits, respectively. Furthermore, the cavity size of the patients in the DC group who underwent omentoplasty disappeared faster than other patients in this group (all of them were disappeared at the second postop visit, $P = 0.02$).

Discussion

Echinococcosis or hydatid disease is a global disease with a higher prevalence in the areas breeding sheep, including the Middle East, Turkey, China, and the Mediterranean Basin.^[1] The liver is the most affected body organ (70%), followed by the lungs. In addition to the surgical procedures, chemotherapy and skin drainage have been introduced over the last three decades to treat the LHC;^[12] however, the surgery is still the cornerstone of the LHC treatment. The main risk factors for the postoperative mortality are being older than 60 years old, cyst diameter larger than 10 cm, having more than three cysts, wall thickness, and cystobiliary communication.^[10]

This study was conducted on 75 patients, who underwent conservative surgery due to the LHC to assess the effective factors on cavity disappearance. Based on the results of this study, the demographic features such as age and gender had no role in the elimination of the cavity. Furthermore, the data showed that the procedures used during conservative surgery to manage the residual cavity (omentoplasty and capitonnage in this study) did not affect the disappearance of the cysts. However, cavity wall consistency and calcification played a role in predicting the residual cavity's final behavior as the cavities of cysts with calcified firm wall had a greater tendency to remain in the liver. In a study, reported the 25 years of experience of Tagliacozzo *et al.* on the treatment of hydatid disease on 454 patients, they discussed that thick and calcified cysts had fewer tendencies to be eliminated. Moreover, Malik *et al.* mentioned the same finding in their study.^[11,15] Their findings are consistent with the findings of our study.

The results of the present study also indicated that the mean rate of cavity size reduction in the 1st 4 months was statistically greater in the DC group (82.93% vs. 38.11%, $P < 0.001$). This finding could help the surgeons to predict the disappearance or remaining of the cavity after the 4th month visit. Besides, in patients within the DC group who underwent omentoplasty, the cavity size was obliterated faster than in the other patients; thus, the omentoplasty may accelerate the process of the cyst obliteration, although it would not change the outcome of the residual cavity.

Based on the literature review, we did not find any study, evaluating the effective factors on the disappearance of the residual cavity. Most of the previous studies compared the mortality and short-term complications such as blood loss, wound infection, bile leakage, and hospital stay. In a review by Manterola *et al.*, in some studies, patients who underwent omentoplasty had a higher postoperative mortality rate, while in some others, it was higher in patients who underwent capitonnage.^[16] In a review by Gomez *et al.* and a study by Mousavi *et al.*, the omentoplasty was recommended to prevent postoperative

complications.^[17,18] In two studies by Ozacmak *et al.* and Wani *et al.* comparing the omentoplasty with external drainage, it was concluded that omentoplasty was the better method due to fewer side effects and shorter hospital stay.^[2,19] Furthermore, in a study comparing capitonnage and external drainage by Mehrabi Bahar *et al.*, the postoperative complications were less observed in the capitonnage group.^[20] Furthermore, in a study by Panteleyev, omentoplasty and capitonnage did not have any superiority to each other.^[21] In one of the studies on the size reduction of the residual cavity, Sevinç *et al.* compared the rate of residual size reduction in patients undergoing endoscopic retrograde cholangiopancreatography (ERCP), surgery, or PAIR (percutaneous, aspiration, injection, and reaspiration). In their study, the residual size reduction in the ERCP group was less than in other groups. The cysts' size reduction was higher in the PAIR group. Sevinç *et al.* also concluded that the bile contamination of the residual cyst accelerated the obliteration of the residual cyst.^[22] In the present study, all the patients underwent conservative surgery; however, in addition to techniques used during the operation, we investigated the role of some other factors. In our study, capitonnage and omentoplasty had no preference for each other in terms of residual cavity disappearance.

This study had some limitations. We missed five patients in the follow-up visits. The sample size was another limitation of this study. Although the sample size in our study was relatively large to provide reliable results, the larger sample size may lead to more precise findings. To the best of our knowledge, it was the first study assessing the role of different factors on the closure of the hydatid cyst postsurgical cavity. To evaluate the results of this study, we recommend prospective, clinical trial studies to be performed on a larger population.

The frequency of the remained residual cavity was 38.7% after 2 years in this study. The probability of remaining residual cavity after 2 years was positively correlated with the calcification and stiffness of the cyst. The other concerning factors in this study had no effect on the likelihood of residual cavity disappearance.

Conclusions

Our data support that cyst wall calcification and wall stiffness had a role in predicting residual cavity disappearance. These factors can help surgeons to predict patients at higher risk of post-hydatid cyst resection residual cavity

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Conflicts of interest

There are no conflicts of interest.

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