

## Surgical management of complicated hydatid cysts of the liver

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Received: December 5, 2009 Revised: January 13, 2010

Accepted: January 20, 2010

Published online: March 27, 2010

Eighteen patients (26%) had complicated cysts and formed the basis for this study.

**RESULTS:** Common complications were infection (14%), intrabiliary rupture (9%) and intraperitoneal rupture (3%). All the patients with infected cysts presented with pain and fever. All the patients with intrabiliary rupture had jaundice, while only four with intrabiliary rupture had pain and only two had fever. Surgical procedures performed in complicated cysts were: infection-omentoplasty in three and external drainage in seven; intrabiliary rupture-omentoplasty in two and internal drainage in four patients. Two patients with intraperitoneal rupture underwent external drainage. There was no mortality. The postoperative morbidity was 50% in complicated cysts and 16% in uncomplicated cysts.

**CONCLUSION:** Complicated hydatid cyst of the liver can be successfully managed surgically with good long term results.

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### Abstract

**AIM:** To review the clinical presentation and surgical management of complicated hydatid cysts of the liver and to assess whether conservative surgery is adequate in the management of complicated hydatid cysts of liver.

**METHODS:** The study was carried out at Sher-i-Kashmir Institute of Medical Science, Srinagar, Kashmir, India. Sixty nine patients with hydatid disease of the liver were surgically managed from April 2004 to October 2005 with a follow up period of three years. It included 27 men and 42 women with a median age of 35 years. An abdominal ultrasound, computed tomography and serology established diagnosis. Patients with jaundice and high suspicion of intrabiliary rupture were subjected to preoperative endoscopic retrograde cholangiography. Cysts with infection, rupture into the biliary tract and peritoneal cavity were categorized as complicated cysts.

**Key words:** Liver hydatid disease; Complicated liver hydatid; Drainage; Operative techniques

**Peer reviewer:** Uwe Klinge, MD, Professor, Surgical Department of the University Hospital, RWTH Aachen Pauwelsstrabe, Aachen 30 52074, Germany

Malik AA, Bari SUL, Amin R, Jan M. Surgical management of complicated hydatid cysts of the liver. *World J Gastrointest Surg* 2010; 2(3): 78-84 Available from: URL: <http://www.wjgnet.com/1948-9366/full/v2/i3/78.htm> DOI: <http://dx.doi.org/10.4240/wjgs.v2.i3.78>

### INTRODUCTION

Hydatid disease is a parasitic disease of worldwide distribution. Seventy five percent of all hydatid cysts are found

in the liver<sup>[1]</sup>. Patients may be asymptomatic for years and usually present with non-specific complaints. However, at any time any particular hydatid cyst can undergo any of the complications which can be life threatening unless treated early<sup>[1]</sup>. Although hepatic hydatid cysts can be treated by surgery<sup>[1,2]</sup>, chemotherapy<sup>[3]</sup> and/or percutaneous aspiration<sup>[4,5]</sup>, surgery remains the traditional and established treatment. It is the only treatment which is applicable over the entire spectrum of disease<sup>[6]</sup>. This prospective study was carried out to study the clinical presentation and surgical management of complicated hydatid cyst of the liver.

## MATERIALS AND METHODS

This study was conducted prospectively over a period of one and a half years from April 2004 to October 2005 with a further follow up period of three years in the Department of General Surgery, Sher-i-Kashmir Institute of Medical Sciences, Srinagar, a tertiary level health care center. The total number of patients included in the study was 69:27 men and 42 women with a median age of 35 years (Table 1).

All the patients were subjected to detailed history and physical examination with all base line investigations such as haemogram, kidney function tests, liver function tests, coagulogram, electrocardiography and chest x-ray. Ultrasonography was the main tool of diagnosis. Computed tomography (CT) was performed in those cases where results of ultrasonography were equivocal. The patients with extra hepatic hydatid cysts were excluded from the study. The diagnosis was confirmed by serology, especially when imaging modalities were inconclusive. In patients with suspicion of intrabiliary rupture and/or obstruction of biliary passages based on clinical, biochemical or radiologic findings, a preoperative endoscopic retrograde cholangiography (ERCP) was performed. Patients were operated on after a preoperative course of albendazole (10 mg/kg for 4 wk) to achieve sterilization and decrease the risk of recurrence in case of intraoperative spillage, except in patients with peritonitis due to intraperitoneal rupture who were taken for immediate surgery. All patients were put on albendazole therapy (three courses of 4 wk each with a gap of 1 wk in between) in the post operative period. The choice of operative procedure was guided by the size and location of the cyst and the presence of complications. Cysts with infection, rupture into biliary tract and rupture into peritoneal cavity were categorized as complicated cysts and formed the basis of our study.

### Follow up of patients

All patients were followed up for a minimum of three years. Initially all patients were followed up twice a month for 3 mo followed by once a month for 1 year and then every 3 mo for a period of another 2 years. During this follow up patients were subjected to detailed history, clinical examination, ultrasonography and serological tests to look at the fate of residual cavity, any infection and any recurrence. Practically all residual cavities disappeared by 18 mo and there was no recurrence in complicated cysts.

**Table 1** Demographic profile and topographic distribution of the hydatid liver cyst *n* = 69 *n* (%)

	No. of Patients
Male	27 (39.1)
Female	42 (60.9)
Solitary cysts	56 (81.2)
Multiple cysts	13 (18.8)
(R) Lobe cysts	45 (65.2)
(L) Lobe cysts	17 (24.6)
Bi-lobar cysts	7 (10.1)
Rural	39 (56.5)
Urban	30 (43.5)

During follow up we observed that the patients working in offices returned to their work within 2 mo of operation with an improved quality of life, while the laboring class returned to work after a period of 6 mo.

## RESULTS

### Surgical technique

After the diagnosis was established, patients were taken for surgical intervention. Right subcostal incision was made in all the patients except for the patients with intraperitoneal rupture, where a right paramedian incision was made. After the peritoneal cavity was entered, the cyst was exposed and isolated from the remainder of operative field by using large abdominal packs which had been soaked in hypertonic saline (10%). Conservative resection was carried out in all patients which involves unroofing of the hydatid cyst, removal of its contents including laminated membrane, germinal layer, daughter cyst, hydatid fluid and scolices, leaving the pericyst behind. The radical procedure which involves total cystoprostatectomy and hepatic resection was not carried out in any patients.

After the cyst is isolated, it is penetrated by a large gauge needle and about 50 mL of fluid is evacuated to lower the cyst pressure. The color of hydatid fluid is observed. After this, three stay sutures are placed close to the needle. Upward traction is applied on the stay sutures, the needle is retracted and the cyst is incised between sutures by electrocautery. Through this incision, a large sump drain is inserted and suction continued. Once the pressure is further reduced, the incision is enlarged to 3-4 cm so that direct vision of cyst cavity and its contents is obtained. Suction is freely moved around the cavity to evacuate all the liquid. Once all the liquid has been drained, the laminated membrane collapses. The laminated membrane and the daughter cysts are removed with the help of ring forceps. When all the visible daughter cysts have been evacuated, the cavity is rinsed with warm saline, inspected for bile leakage and packed with dry, white packs soaked in saline. The packs are left in place for a few minutes and removed and examined for any bile stains. Bile stains are indicative of biliary communications and are managed by various methods. If no bile stains are visible, sterilization of cyst is carried out using 1% povidine, which is left in the cavity

Table 2 Symptomatology

Symptoms/Signs	No. of patients ( <i>n</i> = 69)	Percentage (%)
Pain	53	76.81
Lump upper abdomen	38	55.07
Fever	21	30.43
Jaundice	6	8.70
Nausea/Vomiting	47	68.11
Anorexia	41	59.42
Upper abdominal tenderness	25	36.23
Hepatomegaly	31	44.93
Abdominal distension	1	1.44

for 5-10 min. The residual cavity is managed by different methods available, depending on size, site and number of cysts and surgeon preference. These techniques are: (1) Open drainage of cyst cavity into the peritoneal cavity as in case of small, superficial and shallow uninfected cysts; (2) Obliteration of residual cavity as in case of deeply located cysts. Obliteration of residual cavity can be done by one of the following methods: (a) Capsulorrhaphy: In this, the cavity is filled with normal saline and the opening of the cavity closed without any drain; (b) Captionage: Here the dead space is obliterated by a series of purse string sutures starting from bottom of the pericyst; (c) Omentopexy: Here a flap of omentum is brought to rest within the pericyst cavity with the assumption that omentum will seal small biliary leaks and obliterate the cavity; and (d) Introflexion: It is a modification of captionage in which upper edge of the pericyst is sutured to the deepest part of cavity with absorbable sutures and then the edge of the pericyst is sutured to collapsed edge by a running suture; and (3) External tube drainage: In this an appropriate diameter tube drain is placed in the cyst cavity and brought out through a separate opening as in case of infected cysts and cysts with biliary communication. The tube drain is placed in the cavity until no fluid drains out for 48 h.

During our study, on average, the tube had to be placed for 5-6 d for simple cysts and for 10-12 d for complicated cysts.

Out of 69 patients, pain was the most common symptom, seen in 53 (77%) of patients followed by abdominal lump in 55% patients (Table 2). Thirty percent patients had fever and nausea and vomiting was seen in 68% patients. Jaundice was seen in only 9% patients. One patient presented to us with massive abdominal distension with respiratory embarrassment (Figure 1).

This patient had a history of trauma which was followed by slow distension of the abdomen by secondary echinococcosis due to rupture of cyst into the peritoneal cavity. The majority of patients had solitary cysts (*n* = 56/69, 81%). In 65% of patients, cyst was present in the right lobe (Table 1) with bilobar cysts in 10% patients. In the majority of patients (61%), cysts were 5-10 cm in size, 14% had cysts less than 5 cm and in 25% of patients, cysts were more than 10 cm in size. Associated cholelithiasis on ultrasonography was seen in 7 (10%) patients.



Figure 1 Preoperative photograph of patient with massive abdominal distension due to disseminated abdominal hydatidosis.

Out of 69 patients, 51 patients had simple cysts. Surgical procedures performed in these patients were external tube drainage in 19, omentoplasty in 18, capsulorrhaphy in 9 and captionage in 5 patients. The remaining 18 patients had complicated cysts. Among these complicated cysts, 10 had infection, 6 had intrabiliary rupture and 2 had intraperitoneal rupture. All patients with infected cysts presented with abdominal pain and fever. Among patients with intrabiliary rupture, 6 (100%) presented with jaundice, 4 (66%) presented with pain and 2 (33%) presented with fever (Table 3). Diagnostic ERCP was done in one patient with coexistent cholelithiasis to rule out common bile duct stones. One patient with intraperitoneal rupture presented with acute pain abdomen and fever, with no history of precipitating event or abdominal trauma. However, another patient with intraperitoneal rupture presented to us with massive abdominal distension with respiratory embarrassment with a history of trauma 10 years ago.

The method used for management of residual cavity in complicated cysts depends on the type of complication (Table 4). Among the patients with infected cysts, external tube drainage was put in 7 patients and omentoplasty in 3 patients. Of the patients with intrabiliary rupture, omentoplasty was done in 2 patients and internal drainage in 4 patients. In the patients with intrabiliary rupture, omentoplasty was done in those two patients where the cystobiliary communications were small and CBD was not dilated. In these patients cystobiliary communications were sutured with absorbable sutures followed by omentopexy. Internal drainage was done in the form of choledochoduodenostomy in one patient and choledochojejunostomy in three patients. In all these patients CBD was dilated to more than 2 cm. The residual cavity in these four patients was managed by captionage. Both the patients with intraperitoneal rupture were managed by peritoneal lavage, external tube drainage and evacuation of the primary cyst. None of the patients died. Postoperative morbidity was seen in 17 (25%) patients (Table 5). Morbidity was higher in patients with complicated cysts (*n* = 9/18, 50%) as compared to uncomplicated cysts (*n* = 8/51, 16%) which was statistically significant (*P* < 0.051).

Table 3 Symptomatology of complicated hydatid cysts (*n* = 18) *n* (%)

Pathology	Patients	Pain	Fever	Jaundice	Abdominal distension
Infected cysts	10 (55.56)	10 (100.00)	10 (100.00)	-	-
Intrabiliary rupture	6 (33.33)	4 (66.67)	2 (33.33)	6 (100.00)	-
Intraperitoneal rupture	2 (11.11)	1 (50.00)	1 (50.00)	-	1 (50.00)

Table 4 Operative procedure for managing residual hydatid cyst cavity *n* (%)

Type of cyst	External tube drainage	Omento-plasty	Capsule-apply	Caption-age	Internal Drainage
Simple cysts ( <i>n</i> = 51)	19 (36)	18 (35)	9 (17)	5 (10)	-
Complicated Cysts ( <i>n</i> = 18)					
Infected cysts ( <i>n</i> = 10)	7 (70)	3 (70)	-	-	-
Intrabiliary rupture ( <i>n</i> = 6)	-	2 (33)	-	-	4 (67)
Intraperitoneal rupture ( <i>n</i> = 2)	2 (100)	-	-	-	-

## DISCUSSION

Although the liver and lungs are main organs affected, echinococcosis of the urinary tract has been reported in 2%-4% cases<sup>[7]</sup>. About one third of the patients with hydatid liver presented with complications. The most common complications were infection and rupture of the cyst into the biliary tree<sup>[1-3,8,9]</sup>. The other less common complications include intraperitoneal rupture, intrathoracic rupture, internal rupture, rupture into viscera, rupture into vascular system and external compression leading to portal hypertension<sup>[9-12]</sup>. In our study, complications were seen in 26% patients with infection in 14.49% patients, intrabiliary rupture in 8.69% patients and intraperitoneal rupture in 2.89% patients. In a study conducted by Waghlikar *et al.*<sup>[13]</sup> complications were seen in 26% patients. While intrabiliary rupture is the most common complication in most series<sup>[1-3]</sup> infection was the most common complication in a few large series<sup>[8,9]</sup>. The incidence of complications in these studies has been quoted as 5%-25% and 7%-11% respectively.

An infected cyst is defined as a symptomatic cyst presenting with signs of infection, pus at operation and a positive microbiology culture. The most frequently isolated microbe was *Escherichia coli*. Leakage of the cyst is an essential preliminary to infection since the laminated membrane is a potent antibacterial barrier. Entry of serum into the cyst makes it an excellent medium for rapid bacterial growth. Infected hydatid cysts in the liver are invariably bile stained since leakage into the biliary tree is a constant accompaniment of suppuration. Rupture into biliary passages is followed by secondary invasion by pyogenic organisms.

Rupture of hydatid cyst of the liver is an unusual complication. Rupture can occur because of trauma or relentless expansion of the hydatid cyst causing pressure necrosis with resultant rupture into the peritoneal cavity, the pleural cavity or the bile duct<sup>[1-3,8,9]</sup>. Intrabiliary rupture was the most common complication reported by Al-Hashimi<sup>[14]</sup>. Intraperitoneal rupture is common for a cyst reaching the anterior or inferior surface of the liver<sup>[15]</sup>. Hydatid cysts in the superior and posterior portions of the liver can grow upwards towards the chest, eroding through the

diaphragm and resulting in fever, cough and bile stained sputum. Rupture into the peritoneal cavity is accompanied by profound shock with signs of diffuse peritonitis. Treatment of these patients is by peritoneal lavage using protoscolicidal agents, hypertonic saline and management of shock. Sometimes the rupture may be totally silent and the patient presents years later with disseminated abdominal hydatidosis and abdominal distension<sup>[16,17]</sup>. Even in those patients who survive, the ultimate prognosis is poor as recurrence is unavoidable in such cases. Drug therapy using mebendazole, albendazole, praziquantel *etc.*, has shown to decrease the incidence of recurrence of hydatid disease in these patients.

Intrabiliary rupture was the second most common complication in our study and was seen in 8.69% patients. Waghlikar *et al.*<sup>[13]</sup> reported intrabiliary rupture in 9% of cases in their study. The diagnosis of intrabiliary rupture is suspected clinically in all cases, based on a history of jaundice and cholangitis. Although ultrasound and CT scan define the extent of disease in uncomplicated cases, they are not always sensitive and specific in suspected biliary tract involvement. ERCP is the investigation of choice in hydatid cyst with suspected biliary tract involvement. The operative approach is to clean the mother cyst of hydatid membranes and to explore and clear the CBD if preoperative clearance was not done. Biliary communications with the cyst are identified and meticulously sutured<sup>[14]</sup>. A supraduodenal choledochostomy is made and bile duct cleared by all membranes and debris with the help of choledochoscope. The choledochostomy is closed over a T-tube. If CBD is grossly dilated or clearance is not complete or there is a major cyst biliary communication, a drainage procedure such as choledochoduodenostomy is performed<sup>[14]</sup>. Omentoplasty is an alternative procedure done in patients with small biliary communication<sup>[14]</sup>. Here a flap of omentum is brought to rest within the pericyst cavity with the assumption that omentum will seal small biliary leaks and obliterate the cavity. Omentoplasty also protects against infection by promoting reabsorption of serosal fluid and by inducing macrophage migration in septic foci. Manouras *et al.*<sup>[18]</sup> reported a case of an elderly woman with frank rupture into the biliary tract. The patient was managed by



Table 5 Postoperative morbidity (*n* = 69) (*n*, %)

Morbidity	Simple cysts ( <i>n</i> = 51)	Complicated cysts ( <i>n</i> = 18)
Nausea vomiting	6 (11.76)	3 (16.67)
Fever	2 (3.92)	2 (11.11)
Respiratory infection	4 (7.84)	2 (11.11)
Wound infection	2 (3.92)	3 (16.67)
Paralytic ileus	-	1 (5.56)
Biliary fistula	-	1 (5.56)
Total morbidity	14/51 (27.45)	12/18 (66.67)
Patients with morbidity	8 (15.69)	9 (50.00)
Recurrence	1 (1.96)	Nil

*P* < 0.05 (significant).

endoscopic retrograde cholangiography with endoscopic sphincterotomy. The patient remained asymptomatic during a follow up period of 3 years.

A longitudinal study was conducted by Secchi *et al*<sup>[19]</sup> in ten referral centers in Argentina from 1975 to 2007. The result analysis was divided into two study groups (1975-1990 and 1991-2007). A total of 1412 patients underwent radical, conservative and combined surgical procedures. Radical procedures (396 patients) included total pericystectomy (removal of cyst and 1-2 cm of normal parenchyma), total cystectomy (complete removal of cyst) or liver resection. Conservative surgical procedures (748) included the Mabit procedure (deroofting of the cyst and extraction of the parasite with omentoplasty and external drainage of the cyst cavity), the Posadas procedure (deroofting of the cyst with captionage of the cavity without drainage), partial pericystectomy (leaving a deeply situated part of cyst wall within the liver), marsupialization and inter cysto-jejunal drainage. Combined procedures (268) included associated radical and conservative procedures, conservative procedures associated with liver resections and concomitant surgical or endoscopic biliary procedures. Laparoscopic surgery was done in patients with Gharbi's type 1 to type 3 in a laparoscopically accessible location, namely left lateral and right anterior segments. PAIR technique was used in large Gharbi's type 1 and type 2 hydatid liver cysts and in patients refusing surgery. The overall mortality and complication rate was 1.8 and 39% respectively. The complication rate was significantly lower in group 1 (26%) compared to group 2 (45%). There was a significant decrease in mortality (2.3% *vs* 1%), complications (42% *vs* 34%) and early reoperation rates (12% *vs* 6%) between the first part (918 patients) and second part (494 patients). During median follow up of 7 years there was a significant decrease in the first part of the study in the reoperation rate (8.4% to 3%) and in disease recurrence. In our study, among the patients with infected hydatid cyst of the liver, external tube drainage was done in seven patients and omentoplasty in three patients. In a study conducted by Waghlikar *et al*<sup>[13]</sup>, out of five patients with infected hydatid cysts, external tube drainage was done in two patients and omentoplasty in three patients. In their study, they reported a biliary fistula in one of the patients managed by external

tube drainage. In a large series of 304 patients, external drainage was associated with high incidence of infective complications (29.5%) and long lasting biliary fistulae (8.2%)<sup>[8]</sup>. In our study, biliary fistula was seen in only 1 (5.56%) patient managed by external tube drainage. Out of six patients with intrabiliary rupture, omentoplasty was done in two patients and internal drainage in four patients. On the other hand, intrabiliary rupture was treated with omentoplasty in two cases and internal drainage in other two cases in a study conducted by Waghlikar *et al*<sup>[13]</sup>. In a series of 155 cases of liver hydatid, omentoplasty was associated with a significantly lower incidence of external fistula and infection compared to external drainage<sup>[3]</sup>. Dawson *et al*<sup>[20]</sup> conducted a study involving 48 patients and concluded that omentoplasty is the best technique as it is associated with shorter hospital stay and lower incidence of biliary fistula. In our study, four cysts were drained internally in the form of choledochoduodenostomy in one patient and choledochojejunostomy in three patients. In all four patients, CBD was grossly dilated. Internal drainage is safe and useful procedure and is advised in presence of a major biliary communication which is difficult to close or where closure of the communication may compromise biliary drainage or where CBD is grossly dilated. Cystojejunostomy has a dual advantage of internally draining the biliary fistula and managing the residual cavity. The stoma should always be located in the dependent site to ensure adequate drainage. Waghlikar *et al*<sup>[13]</sup>, reported safe and successful internal drainage in two cases. In another study conducted by Lygidakis, internal drainage was done in 18% of cases with intrabiliary rupture<sup>[21]</sup>. Alwan performed internal drainage in 10 out of 14 patients with biliary communication with good results in comparison to the remaining four patients who had external biliary fistulae for 3 mo to 4 mo following external drainage<sup>[22]</sup>. In another study conducted with Waghlikar *et al*<sup>[23]</sup> in 2003, internal drainage in the form of choledochojejunostomy was done in 4 patients and Roux-en-y cystojejunostomy in four patients. They reported high incidence of infective complications (38%) with this procedure with suppuration of residual cavity in two patients treated with internal drainage, which necessitated percutaneous external drainage. The hydatid cyst in the liver does not collapse after evacuation as it is lined by ectocyst, thereby leaving a residual cavity. This situation is more likely to be encountered when the cyst is large or in a calcified cyst. If the internal drainage is not dependent or the cyst is located in the superior segment, stagnation of the contents will occur. The two patients who presented to us with intraperitoneal rupture were dealt with the management of primary cyst, thorough peritoneal lavage with scolical agents and external drainage and postoperative chemotherapy. In a study of Waghlikar *et al*<sup>[13]</sup>, one patient had free intraperitoneal rupture and underwent surgical exploration with management of primary cyst, peritoneal lavage and external drainage. Waghlikar *et al*<sup>[23]</sup> reported intrathoracic rupture in one patient. However, we did not encounter such a patient during our study. Salemis<sup>[24]</sup> described a case of 55 years old female patient who was

diagnosed with a giant hydatid cyst occupying the entire left lobe of the liver. Partial cystectomy was done and the residual cavity was managed by combination of suture obliteration and omentopexy. We did not perform partial cystectomy in any of our patients.

Pericystectomy consists of removing the cyst en block along with 1-2 cm of surrounding liver parenchyma. Pericystectomy is an ideal procedure for multivesicular cysts and calcified cysts especially if there is bile duct communication. It should be avoided for cysts impinging on major hepatic veins or inferior vena cava and close to the hilum. Long term results of the surgery have been found to be excellent, although recurrence has been seen even 40 years later. However the major problem is that large numbers of patients are lost for follow up so accurate data is not available.

There was no mortality in our study. Postoperative morbidity was seen in 9 (50%) of patients with complicated cysts as compared to 8 (16%) patients with uncomplicated cyst. Among patients with complicated cysts, wound infection was seen in 3 (16.67%) patients, respiratory tract infection in 2 (11.11%), nausea and vomiting in 3 (16.67%), fever in 2 (11.11%) and biliary fistula in 1 (5.56%) patient. Complications such as nausea and vomiting can occur in any of the patients irrespective of the nature of the cyst and type of procedure done. Fever and respiratory tract infection in the form of basal atelectasis was seen in patients who were put on external tube drainage. Probably putting an external tube hampered respiratory tract excursion because of pain thereby increasing the incidence of so called respiratory tract infections. Postoperative biliary fistula was seen in one patient with complicated cyst. The bilious drainage slowly decreased over a period of time and completed stopped in 8 wk. Wagholikar *et al*<sup>[13]</sup> also reported no mortality in their study. They reported postoperative morbidity in 14 (32%) patients with wound infection in 6, chest infection in 3, external biliary fistula in 2 and infection of the residual cavity with suppurative in 3 patients.

In conclusion, complicated liver hydatids represent a special subset of patients who require a timely and appropriate treatment of complications which can be life threatening. While postoperative morbidity is significantly more than uncomplicated cysts, long term results are equally good. An individualized management and a flexible approach are the key to successful management. Internal drainage is a safe and useful procedure and is recommended especially in the presence of a major biliary communication which is difficult to close as it has a dual advantage of internally draining the biliary fistula and managing the residual cavity. The site of stoma is critical and should be located in the dependent site to ensure adequate drainage with collapse of residual cavity. A nondependent drainage leads to a "teapot" effect, predisposing the residual cavity to infection.

## COMMENTS

### Background

Hydatidosis is a zoonotic disease that most commonly affects liver. The disease occurs in sheep grazing areas but the distribution is world wide.

## Research frontiers

The complications are seen in one-third of patients with hydatid liver cyst. The most common is rupture which could be internal or external. External rupture could be intrabiliary, intrathoracic or intraperitoneal. Other complications are secondary infection and anaphylactic shock. The aim of this study was to review the clinical presentation and surgical management of complicated hydatid cysts of the liver and to assess the role of conservative surgery in the management of complicated hydatid cysts of the liver.

## Innovations and breakthroughs

Recent multicenter studies have shown a significant improvement in surgical management of hydatid liver disease, with a decrease in mortality, morbidity, early and late reoperation and recurrence rates. A recent trend was observed in favor of an earlier diagnosis, less complicated clinical presentation and recent use of minimally invasive approaches.

## Applications

This study may represent a future strategy for therapeutic intervention in the treatment of patients with complicated hydatid cyst liver disease.

## Peer review

The authors undertook extensive study to assess the clinical presentation of uncomplicated and complicated hydatid cyst of the liver and its management by various surgical options available at present. The results are interesting and may form the basis for more extensive study.

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