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Review Article

# Surgical Management of Major Complications of Hydatid Cysts of the Liver- A Review of the Literature

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**Abstract**

Echinococcal disease of the liver is a rare parasitic disease in which both humans and wild or domestic animals are affected. Most frequently, liver hydatidosis present as uncomplicated cysts. However, hydatid cysts may present with complications such as cysts ruptured into the biliary tract (12%), cysts rupture involving the lung or pleural space (2.2%), cysts ruptured into the peritoneum (1.6%) and cysts ruptured into the digestive tract (0.2%). Acute cholangitis is the most common syndrome, as a result of the presence of the ruptured hydatid cystic contents into the biliary tract. The aim of this study is to review the literature concerning the presentation and management of complicated liver hydatid disease. Special emphasis is given to the specific predisposing factors, as well as clinical symptoms that should trigger the suspicion of the surgeon for each complication.

## INTRODUCTION

Echinococcal disease of the liver is a rare parasitic disease in which both humans and wild or domestic animals are affected. Although the disease is rare in western societies, there are countries where it is considered to be endemic such as Mediterranean countries, Asia, Australia and New Zealand [1]. The increased prevalence of the disease in these countries is based on the broad spectrum of intermediate and final hosts, which vary between different geographical areas. In addition, social and economic factors, bad hygiene standards and cultural factors impose an important role on the spread of the disease. Echinococcus granulosus is encountered in all continents and at least in 100 countries [1].

Most frequently, liver hydatidosis presents as uncomplicated cysts. The complications of liver hydatid cysts are mostly attributed to cyst growth and mass effect on surrounding structures, cyst rupture or secondary infection. Overall, rupture represents the most common complication of liver hydatid disease. Although rupture may be silent in clinical symptoms, the antigenic properties of the cyst fluid may cause a life-threatening anaphylactic reaction [2]. Possible sites of rupture are the biliary tract (12%), the lung or pleural space (2.2%), the peritoneum (1.6%) and the digestive tract (0.2%) [1]. Acute cholangitis is the most common syndrome, as a result of the presence of the ruptured hydatid cystic contents into the biliary tract.

Although surgical management is implicated as the treatment of choice for uncomplicated hydatidosis of the liver, evidence is not clear concerning the management of the biliary tract [3]. The aim of this study is to review the literature concerning the presentation and management of complicated liver hydatid disease, with special emphasis on the surgical management of the most common complication, i.e. the intrabiliary rupture.

## MATERIALS AND METHODS

An electronic search of the relevant literature was performed using Medline. This electronic search was limited to the period from January 1986 to December 2016.

All relevant studies reporting the assessment of one modality of treatment, or comparison between two or several therapeutic methods to treat cystic echinococcosis as mentioned above and published in a peer-reviewed journal, were considered for analysis. Structured abstracts of all potentially relevant articles were screened and accepted for analysis. Reference lists of the reviewed papers were also reviewed to include citations that

met the inclusion criteria. Articles without an accessible full text version, an abstract providing sufficient information, or sufficient data to compare with other studies were excluded.

## RESULTS

After applying the inclusion and exclusion criteria detailed above, 59 articles were selected for final analysis: one Meta-analysis, 20 review articles, 18 retrospective studies, one randomized prospective study, 19 case reports.

## DISCUSSION

It is not uncommon to encounter complications in a patient diagnosed with liver hydatid disease. The reported incidence varies from one- third to approximately 60% of the total number of patients [2]. Intrabiliary rupture and cyst super infection are considered to be the most common complications [4-6].

### Complications of liver hydatidosis

**Superinfection:** The superinfection probably occurs from sites next to the hydatid cyst (e.g. biliary or bronchial tree) or as a complication of bacteremia of any cause; secondary bacterial infection has been reported in only 5- 8% of cases [2]. The cyst itself most probably induces the infection cataract by the compression and distortion of the biliary tree. Bacteremia arising from a variety of sites is another possible origin of hydatid cyst superinfection. Classic risk factors for bacteremia, such as cirrhosis, cancer, diabetes mellitus and steroid use have been described in various case series [7]. The incidence of hepatic hydatid cyst superinfection seems to present with a higher frequency, up to 24%, in large case series of surgically managed cases [5,6]. Computed tomography is considered the modality of choice for showing infected liver hydatid cysts. Findings suggestive of infection are a poorly defined lesion, a hyper enhancing rim on a contrast- enhanced exam, patchy enhancing areas in the vicinity of the lesion, and internal gas or air- fluid levels within the cyst [2,8]. The definite diagnosis is based upon the aforementioned imaging findings in conjuction with the clinical and laboratory signs of pain, fever and leukocystosis in apetient with a known history of liver hydatid cyst.

**Liver hydatid cysts ruptured into the biliary tract:** One of the major and potentially fatal complications of liver echinococcal cysts is their rupture into the biliary tree. This is characterized by the presence of hydatid debris into the common bile duct [3]. The mechanism which leads to this phenomenon is based upon three factors: the presence of small bile duct radicles in the pericyst, the condition of the hydatid cystic wall, as well as the pressure level of the echinococcal cyst content [9]. A major cysto- biliary communication is defined by a fistula greater than 5 mm diameter [4]. The incidence of major biliary communications ranges from 5% to 10% [3]. Predisposing factors for intrabiliary rupture are considered to be the older age, larger dimensions, multiplicity of the cysts, and bilobar cysts [11]. Rupture into the biliary tract system tends to occur into the right (55%- 69.5%), or the left hepatic duct (25%- 30%), whereas a small percentage (10%) concerns the hepatic duct junction, common bile duct, cystic duct, or the gallbladder [12].

Patients suffering from this complication usually present with right upper quadrant abdominal discomfort or pain (82%-100%), obstructive jaundice (57%-100%), fever (70%-90%), episodes of acute cholangitis (20%-37%), and rarely with acute pancreatitis, liver abscess or septicemia. Regarding biochemical workup, alkaline phosphatase (ALP), γ- glutamyltransferase (γGT), total and direct bilirubin will most probably be elevated [12].

In order to confirm the diagnosis of cysto- biliary communication, ultrasonography (US) and computed tomography have been routinely used. Dilatation of intra- or extra hepatic bile ducts, the presence of hydatid sand and debris into the common bile duct can be imaging signs of a biliary communication. Nevertheless, the only direct sign of a cysto- biliary communication is a visible cystic wall defect or the demonstration of the exact location of the communication between the cyst and the biliary tree. This highly suggestive sign of rupture is identified in approximately 75% of cases [13]. Endoscopic retrograde cholangiopancreatography (ERCP) has also proved to be a valuable diagnostic tool for the diagnosis of frank rupture into the biliary tree [14]. Its sensitivity ranges from 86% to 100% [15,16]. ERCP demonstrates the exact place of the rupture and contributes substantially to the surgical planning, and permits evaluation of acute conditions, such as acute cholangitis and obstruction. Moreover, in cases of frank intrabiliary rupture, it can offer a permanent treatment if the evacuation of the biliary tract and cystic cavity are considered feasible, and when combined with preoperative endoscopic sphincterotomy, it may decrease the incidence of the development of postoperative external fistula from 11.1% to 7.6% [14,17-19]. During the postoperative period, ERCP may provide an opportunity to manage postoperative external biliary fistulae. Magnetic resonance cholangiography (MRCP) nowadays represents a noninvasive diagnostic alternative modality without the risks associated with ERCP. It depicts the communication of an echinococcal cyst with the biliary tract system, as well as the specific details of its structure.

Preoperative and Intraoperative determination of a biliary communication is rather crucial. The gender of the patient (the incidence of cysto- biliary communications is reported to be higher in men), the abnormal preoperative values of ALP and γGT, the presence of multiple, multilocular, and degenerated cysts, the location of the cyst near the biliary bifurcation [21], and a cyst diameter greater than 10 cm represent important clinical predictors for the presence of an intrabiliary rupture [22].

**Liver hydatid cysts ruptured into the peritoneum:** The rupture of an echinococcal cyst into the peritoneal cavity represents a rather rare complication, whose consequences could be life- threatening. The reported incidence of this complication ranges from 10- 16% [11,23]. A vital hydatid cyst tends to grow in the direction of the least resistance, and usually reaches the liver surface before presenting with enormous proportions. The superficial portion of the pericyst is stretched, thinned out, and the cyst becomes visible as an irregularly shaped, fibrous structure protruding from the normal liver parenchyma. Cysts located in the inferior and anterior part of the liver continue to grow, protruding into the abdominal cavity. Due to the high intracystic pressure, both univesicular and multivesicular cysts can rupture. As a result, brood capsules, protoscoleces, and

daughter cysts from the ruptured hepatic echinococcal cyst are released into the peritoneal cavity. The absorption of the quite toxic antigens of the hydatid fluid from the systemic blood circulation inevitably leads to systemic anaphylactic reaction. The incidence is about 1% to 12.5% [24,25]. Abdominal pain, nausea, vomiting, and urticaria are the most common clinical symptoms. During the clinical examination, signs of acute abdomen such as guarding, rebound, and tenderness are generally present. In endemic areas, this complication should be definitely included in the differential diagnosis of an acute abdomen. In silent rupture, the patient develops disseminated abdominal hydatidosis. The release of the hydatid fluid throughout the abdominal cavity results in the development of multiple cysts in the peritoneal cavity with intestinal obstruction, gross abdominal distention, and ascites, and cachexia, even many years after the rupture has occurred. A sudden onset of bile- colored ascites in an otherwise healthy person, regardless of the fact that no hepatic cyst is visible, should raise the suspicion of intraperitoneal rupture in endemic areas. The diagnosis is established with the use of US and CT scan as imaging methods. The presence of intraabdominal fluid and the detached membrane of the hydatid cysts are clearly demonstrated. Diagnostic peritoneal lavage has been also considered to be a helpful and highly specific test for hydatid cyst perforation [26].

Significant predisposing factors for peritoneal perforation are the young age of the cyst, its superficial position, and its increasing diameter [11].

Emergent operation is mandatory in order to remove the intraperitoneal fluid and eradicate the cysts [27,28]. The most important steps during the surgical treatment are irrigation of the peritoneal cavity with a sufficient amount of scolicidal agents, removal of all cystic contents from the peritoneal cavity, combined with meticulous peritoneal washing [29]. An important parameter influencing the choice and duration of any surgical intervention is the general hemodynamic status of the patient. Furthermore, the postoperative administration of benzimidazole carmabates (mebendazole and albendazole) for a period of 3 to 6 months is arbitrarily advised.

**Liver hydatid cysts with thoracic involvement:** Thoracic complications of liver hydatid cysts are encountered in approximately 2% to 11% of cases [30]. Several factors participate in promoting intrathoracic evolution of a hepatic cyst situated in the hepatic dome: a) the intrathoracic negative pressure tends to aspirate the hepatic hydatid cyst, b) the mechanical compression maintained by the cyst on the diaphragm results in local ischemia, which can lead to muscle erosion, c) sepsis in the hepatic cyst can also contribute to muscle necrosis near the cyst, and d) in the case of biliary fistulas, the caustic property of biliary secretions can lead to chemical erosion of the diaphragm and the bronchi [30].

Pathognomonic clinical findings are bile- stained sputum, hydatid vomica and hydatidoptysis (sputum containing daughter cysts, sometimes bile- stained [31]. In selected cases, respiratory distress syndrome may also be encountered. When the rupture involves the pleural cavity, pneumothorax and systemic anaphylactic reaction are usually present.

The imaging work- up includes a chest X- ray (CXR), US, and in fewer cases CT or MRI scans. When a diaphragm with blurred or erased limits is depicted in the CXR, US are then performed, which shows the hepatic hydatid cyst and its close proximity to the thoracic lesions. The diagnosis is established with the demonstration of the diaphragmatic discontinuity. CT and MRI scans can offer additional information with regards to the precise connections between the hepatic hydatid cyst and the intrathoracic lesions. Multiplanar MR imaging including sagittal and coronal views is also very helpful in depicting transdiaphragmatic extension. Moreover, it plays a role in accurate preoperative diagnosis and planning [2,32]. Depending on the degree of cyst evolution and involvement, there are five surgical grades of diaphragmatic or transdiaphragmatic thoracic involvement in hepatic hydatid disease [33]. Grade 1 represents firm adherence between the diaphragm and the cyst surface without diaphragmatic perforation. In grade 2, the cyst perforates the diaphragm, but there is little invasion of the thoracic cavity. Cyst perforation through the diaphragm with either cyst growth inside the thoracic cavity or daughter vesicle formation is grade 3. Disease of the lung parenchyma by either cyst connection with the bronchial tree or compression and atelectasis of the lung is considered grade 4. Establishment of a bronchobiliary fistula is grade 5 [33].

Surgery remains the main therapeutic option. During surgical operations, the treatment of the liver cyst, hepatodiaphragmatic disconnection, treatment of intrathoracic lesions, restoration of the diaphragm, and a secure biliary tract represent the most important goals. Thoracotomy must be performed in cases of intrathoracic collection. Laparotomy is necessary when the biliary tree is involved and, therefore, requires adequate drainage. An isolated abdominal approach is considered sufficient when there is direct rupture into the bronchial tree.

**Liver hydatid cysts ruptured into the pericardium:** The parasites that escape through the hepatic veins may reach the right atrium, and, consequently, enter the coronary arteries' circulation. As a result, they may be situated in any part of the myocardium. A rupture into the pericardium results in disseminated pericardial echinococcis, acute cardiac tamponade, and chronic constrictive pericarditis. Nearly 10% of all cases of myocardial hydatid cystic disease rupture into the pericardium, and most of these events are fatal [34].

Initially, patients can be asymptomatic (26.5%) [35]. They can also experience certain symptoms due to myocardial compression, or even, dyspnea, cough, fever, and hemoptysis [36].

Currently, the most valuable imaging modalities for detecting cardiac echinococcosis are echocardiography and CT scan, which give appropriate information regarding its size and relation to nearby structures [37,38].

Cystopericystectomy is the "gold- standard" surgical procedure, but it is sometimes unsuitable for particular sites, which should be treated with partial pericystectomy. The operative mortality rate ranges from 0- 5% [35,39].

**Rupture into other cavities or organs:** Although rupture to the gastrointestinal tract is rare, it has been described, specifically

to the stomach [40] and the duodenum [41-43]. Rupture to these organs presents with abdominal pain, nausea, and vomiting. Radiologic studies with CT tomography reveal the existence of air inside the echinococcal cyst, and communication of the cyst with the stomach or the duodenum. The diagnosis is confirmed with endoscopy. Treatment of these cases is surgical consisting partial or total pericystectomy and suture of the viscus.

**Rupture to major vessels (portal vein, inferior vena cava, and aorta):** The rupture of echinococcal cysts of the liver to the hepatic veins or the inferior vena cava can lead to the spread of hydatid disease to the lungs or to the pulmonary arteries. Symptoms include cough, hemoptysis and dyspnea [44-46]. In endemic areas, there must be increased clinical suspicion in patients presenting with these symptoms, especially if they have undergone liver surgery for hydatidosis. Inferior vena cava thrombosis has been reported as well [47].

Most infrequent complication of hydatid cysts of the liver is rupture to the portal vein. Four cases have been reported in the literature. In this situation, symptoms include abdominal pain, fever, signs of portal hypertension [48,49]. Anaphylactic shock is expected after rupture of a cyst in vessels [46,48].

**Cutaneous fistulization of liver hydatid disease:** Cutaneous fistulization is a rare but serious complication of hydatid disease involving many organs, including the liver. To date, 41 patients have been reported in the literature [50]. Hydatid cysts follow several stages before reaching the abdominal wall to develop into an external rupture. Stage I hydatid lesions protrude into the innermost muscular layer of the abdominal wall. Stage II lesions pass beyond the muscular layer and protrude into subcutaneous soft tissue. Stage III is characterized by the passage of lesions into subcutaneous tissue and their fistulization in the skin, which is called an external rupture, external fistulization, or cutaneous fistula [50]. A typical clinical sign of cutaneous fistulization in a patient presenting from an endemic area is discharge of hydatid fluid or daughter vesicles from the external orifice of a fistula. Combination of clinical presentation, serologic tests and radiological workup can lead to final diagnosis easily in almost all patients. Useful radiologic tools include US, CT, MRI, whereas ERCP or PTC is invasive methods used for both diagnostic and therapeutic purposes. The most useful radiological method for cutaneous manifestations of hydatid disease is contrast-enhanced fistulography. This technique is helpful in specifying the extension of the fistula, the location and size of the fistulized lesion, and its relationship with bile ducts. Success rate of fistulography in demonstrating organ involvement of a cysto-cutaneous fistula is 85.7% [50].

In terms of appropriate treatment pathway, the best approach is a combination of medical treatment and surgical intervention. A 2-4 week neoadjuvant medical treatment followed by elective surgery is considered to be the safest pathway in non- urgent cases. Surgical treatment includes en bloc resection of the primary hydatid lesion causin the complication, diseased skin region, and fistula tract [50].

**Management of echinococcal cyst communication with the biliary tract (rupture to the biliary tract):** The management of communications of the echinococcal cyst with the biliary tract represents one of the most critical steps in the conservative surgical management of hepatic hydatidosis. The rupture in the biliary tract represent an independent parameter that increases post-operative mortality and morbidity in a statistically significant degree, while insufficient management leads to life threatening complications. Sometimes, the communication with the biliary tract can be very easily identified. It is possible that a single hydatid cyst can have multiple fistulas with the biliary tree, while, similarly, a patient with multiple cysts, biliary communication can be present in more than one cysts. Reconstruction and management are both feasible and successful in most cases. However, in cases with communication of the cyst with major biliary branches, management can be quite challenging.

Pre-operative localization of most fistulas with the biliary tract is not always possible. Symptoms (cholangitis, obstructive jaundice, biliary colic), as well as pathologic laboratory exams (liver dysfunction, increased cholestatic enzymes, dilated biliary tract) are only present in a small percentage of patients (16% and 18% respectively) [51]. Predisposing factors that may warn the surgeon for existence of communication with the biliary tract are: advanced age of patient (with a long history of echinococcal disease of the liver), significant size of cysts, multiple cysts, as well as bilateral lobe cyst localization [11]. The management of fistulas depends on a lot of factors: 1) The number of cysts, 2) Cyst type, 3) Localization of the cyst, 4) Size of the fistula, 5) Biliary branch involved 6) Patient clinical status, 7) Liver function and, finally, 8) Surgeon's experience.

Bilus content of the hydatid cyst is highly indicative of fistula with the biliary tree. In most cases, the exact orifice of communication is not visible intra-operatively. In these cases, a detailed inspection of the internal surface of the cysts should be performed after wide excision of the pericyst. A suitable maneuver is the placement of a gauge in the cyst, while the surgeon applies pressure on the gallbladder. The gauge is then inspected for bilus spots [52].

Since sometimes the precise localization of the bile fistula is impossible intra-operatively, certain authors suggest the use of intra-operative cholangiography, in which daughter cysts can be revealed in the biliary tree. However, routine use of intra-operative cholangiography is avoided for the following reasons: 1) Only a small percentage of patients present concretions of hydatid contents inside the biliary, and in these cases an intra-operative ultrasound would be equally helpful, 2) In patients reporting cholangitis symptoms, endoscopic retrograde cholagiography has already been performed [53], 3) Intra-operative cholangiography can reveal contrast outside the biliary tree, confirming the existence of biliary fistula , without being able to locate the exact point of leakage [51]. An alternate method used, is the infusion of methylene blue inside the gallbladder or bile duct. This method can reveal very small communications that would have been missed by the surgeon [52]. The disadvantage of the method is diffuse spread of the dye in the entire cyst cavity [51].

The reconstruction of the biliary fistula should be as simple as possible. Reconstruction methods can be divided in the following categories: 1) Suturing of the communication (simple

suturing, suturing with simultaneous placement of T- tube common bile duct drainage, intralameral pericystectomy and capittonage), 2) Internal drainage procedures (biliodigestive bypass, transduodenal sphincterotomy, internal transfistular drainage with or without transduodenal sphincteroplasty), 3) External drainage procedures (bilateral drainage, cystobiliary disconnection), 4) Reconstruction procedures (pericystojejunostomy, intracavitary biliodigestive bypass, or bile duct repair), and 5) Hepatic resections.

In the majority of patients, the communication of the hydatid cyst involves a small peripheral branch of the biliary tract, therefore simple suturing of the communication is sufficient. In this case individual absorbable sutures should be used [51].

T-tube can be used as safety for decompression in cases of suturing of a large fistula between a stiff pericyst and big biliary branch, or in cases where the bile duct has been opened for the extraction of hydatid contents [51].

In rare cases, the orifice of the fistula is not suitable for simple suturing. In these cases, combined drainage techniques should be performed, in order for the fistula to resolve automatically. Drains should be placed inside the pericyst cavity, and the biliary tract should be decompressed with internal or exterior drainage. The bilateral drainage includes the placement of drains in the pericyst cavity, while the bile duct is drained with a T-tube (Kehr drainage). Increased post-operative bile leaks have been reported by this method leading to increased hospital stay [3,54]. The Permodo procedure consists of the interruption of the communication between the hydatid cyst and the biliary tract with anatomic separation between the residual cavity and the biliary fistula [55]. A catheter with multiple orifices at both sides is placed via the orifice of the fistula for drainage o the fistula, while one similar is placed inside the cavity of the cyst for drainage of the cyst. The bile duct is drained with a T tube.

In the internal drainage procedures, the decompression of the biliary tract is achieved with: 1) endoscopic sphincterotomy, 2) transduodenal sphincteroplasty, 3) biliojejunal anastomosis. Internal drainage via the fistula is accomplished after the meticulus evacuation of hydatid contents and suturing of the pericyst. The pericyst will be drained in the biliary tract via the existing fistula [56].

The indications for performing a cystojejunostomy are very rare and concerns large and centrally located cysts with communication with a major biliary branch with an orifice that is not suitable for suturing [51].

Biliojejunal bypass is performed in cases with massive entry of hydatid contents and daughter cysts in the biliary tract, in acute cholangitis, as well as in cases where the bile duct is dilated.

In cases of extensive communication with the biliary tract, the ideal approach includes radical surgical treatment (total or partial pericystectomy, hepatectomy). In these cases, radical surgical treatment ensures less post-operative complications and smaller hospitalization [3,11,57-59].

## CONCLUSION

Complications deriving from liver hydatid disease can easily be distinguishes from silent hepatic hydatidosis due to distinct clinical and radiological features. However, there is necessity for meticulous preoperative planning, as sometimes the surgical management includes complex maneuvers. Moreover, complicated liver hydatid cysts are characterized by increased frequency of postoperative complications which subsequently lead to prolonged postoperative period.

## REFERENCES

1. Eckert J, Deplazes P. Biological, epidemiological, and clinical aspects of echinococcosis, a zoonosis of increasing concern. Clin Microbiol Rev. 2004; 17: 107-135.
2. Alghofaily KA, Saeedan MB, Aljohani IM, Alrasheed M, McWilliams S, Aldosary A, et al. Hepatic hydatid disease complications: review of imaging findings and clinical implications. Abdom Radiol (NY). 2016.
3. Zaouche A, Haouet K, Jouini M, El Hachaichi A, Dziri C. Management of liver hydatid cysts with a large biliocystic fistula: multicenter retrospective study. Tunisian Surgical Association. World J Surg. 2001; 25: 28-39.
4. Chautems R, Bühler LH, Gold B, Giostra E, Poletti P, Chilcott M, et al. Surgical management and long-term outcome of complicated liver hydatid cysts caused by Echinococcus granulosus. Surgery. 2005; 137: 312-316.
5. Agayev RM, Agayev BA. Hepatic hydatid disease: surgical experience over 15 years. Hepatogastroenterology. 2008; 55: 1373- 1379.
6. Symeonidis N, Pavlidis T, Baltatzis M, Ballas K, Psarras K, Marakis G, et al. Complicated liver echinococcosis: 30 years of experience from an endemic area. Scand J Surg. 2013; 102: 171-177.
7. García MB, Lledías JP, Pérez IG, Tirado VV, Pardo LF, Bellvís LM, et al. Primary super-infection of hydatid cyst--clinical setting and microbiology in 37 cases. Am J Trop Med Hyg. 2010; 82: 376-378.
8. Marrone G, Crino' F, Caruso S, Mamone G, Carollo V, Milazzo M, et al. Multidisciplinary imaging of liver hydatidosis. World J Gastroenterol. 2012; 18: 1438-1447.
9. Tsitouridis J, Kouklakis G, Tsitouridis K, Dimitrios M, Nikolaos K, Maria E, et al. Intrabiliary obstruction due to ruptured hepatic hydatid cyst: evaluation with computed tomography and magnetic resonance imaging. Digestive Endoscopy. 2001; 13: 7-12.
10. Bourgeon R. L'ouverture des kystes hydatiques aux voies biliaires intra-hapatiques. Lyon chirurgical. 1985; 81: 161-164.
11. Akcan A, Sozuer E, Akyildiz H, Ozturk A, Atalay A, Yilmaz Z. Predisposing factors and surgical outcome of complicated liver hydatid cysts. World J Gastroenterol. 2010; 16: 3040-3048.
12. Bedirli A, Sakrak O, Sozuer EM, Kerek M, Ince O. Surgical management of spontaneous intrabiliary rupture of hydatid liver cysts. Surg Today. 2002; 32: 594-597.
13. Wen H, Aji T, Shao YM. Diagnosis and management against the complications of human cystic echinococcosis. Front Med China. 2010; 4: 394-398.
14. Ozaslan E, Bayraktar Y. Endoscopic therapy in the management of hepatobiliary hydatid disease. J Clin Gastroenterol. 2002; 35: 160-174.
15. Goumas K, Poulou A, Dandakis D, Tyrmpas I, Georgouli A, Sgourakis G, et al. Role of endoscopic intervention in biliary complications of hepatic hydatid cyst disease. Scand J Gastroenterol. 2007; 42: 1113-1119.
16. Cicek B, Parlak E, Disibeyaz S, Oguz D, Cengiz C, Sahin B. Endoscopic therapy of hepatic hydatid cyst disease in preoperative and postoperative settings. Dig Dis Sci. 2007; 52: 931-935.

17. Galati G, Sterpetti AV, Caputo M, Adduci M, Lucandri G, Brozzetti S, et al. Endoscopic retrograde cholangiography for intrabiliary rupture of hydatid cyst. Am J Surg. 2006; 191: 206-210.

18. Saritas U, Parlak E, Akoglu M, Sahin B. Effectiveness of endoscopic treatment modalities in complicated hepatic hydatid disease after surgical intervention. Endoscopy. 2001; 33: 858-863.

19. Simşek H, Ozaslan E, Sayek I, Savaş C, Abbasoğlu O, Soylu AR, et al. Diagnostic and therapeutic ERCP in hepatic hydatid disease. Gastrointest Endosc. 2003; 58: 384-389.

20. Gomez I Gavara C, López-Andújar R, Belda Ibáñez T, Ramia Ángel JM, Moya Herraiz Á, Orbis Castellanos F, et al. Review of the treatment of liver hydatid cysts. World J Gastroenterol. 2015; 21: 124-131.

21. Kayaalp C, Bzeizi K, Demirbag AE, Akoglu M. Biliary complications after hydatid liver surgery: incidence and risk factors. J Gastrointest Surg. 2002; 6: 706-712.

22. Atli M, Kama NA, Yuksek YN, Doganay M, Gozalan U, Kologlu M, et al. Intrabiliary rupture of a hepatic hydatid cyst: associated clinical factors and proper management. Arch Surg. 2001; 136: 1249-1255.

23. Karavias DD, Vagianos CE, Kakkos SK, Panagopoulos CM, Androulakis JA. Peritoneal echinococcosis. World J Surg. 1996; 20: 337-340.

24. Gunay K, Taviloglu K, Berber E, Ertekin C. Traumatic rupture of hydatid cysts: a 12-year experience from an endemic region. J Trauma. 1999; 46: 164-167.

25. Saenz de San Pedro B, Cazaña JL, Cobo J, Serrano CL, Quiralte J, Contreras J, et al. Anaphylactic shock by rupture of hydatid hepatic cyst. Follow-up by specific IgE serum antibodies. Allergy. 1992; 47: 568-570.

26. Kurt N, Oncel M, Gulmez S, Ozkan Z, Uzun H. Spontaneous and traumatic intra-peritoneal perforations of hepatic hydatid cysts: a case series. J Gastrointest Surg. 2003; 7: 635-641.

27. Toumi O, Noomen F, Salem R, Rabeh H, Jabra SB, Korbi I, et al. Intraperitoneal rupture of hydatid cysts. Eur J Trauma Emerg Surg. 2016.

28. Di Cataldo A, Lanteri R, Caniglia S, Santangelo M, Occhipinti R, Li Destri G. A rare complication of the hepatic hydatid cyst: intraperitoneal perforation without anaphylaxis. Int Surg. 2005; 90: 42-44.

29. Dziri C, Haouet K, Fingerhut A, Zaouche A. Management of cystic echinococcosis complications and dissemination: where is the evidence? World J Surg. 2009; 33: 1266-1273.

30. Gastaca M, Kataryniuk Y, Uribe-Etxebarria N, Rojo R, Ortiz de Urbina J. Thoracic involvement of hepatic hydatidosis. Surgery. 2015; 157: 169-170.

31. Gerazounis M, Athanassiadi K, Metaxas E, Athanassiou M, Kalantzi N. Bronchobiliary fistulae due to echinococcosis. Eur J Cardiothorac Surg. 2002; 22: 306-308.

32. Pedrosa I, Saíz A, Arrazola J, Ferreirós J, Pedrosa CS. Hydatid disease: radiologic and pathologic features and complications. Radiographics. 2000; 20: 795-817.

33. Gómez R, Moreno E, Loinaz C, De la Calle A, Castellon C, Manzanera M, et al. Diaphragmatic or transdiaphragmatic thoracic involvement in hepatic hydatid disease: surgical trenads and classification. World J Surg. 1995; 19: 714- 719.

34. Demircan A, Keles A, Kahveci FO, Tulmac M, Ozsarac M. Cardiac tamponade via a fistula to the pericardium from a hydatid cyst: case report and review of the literature. J Emerg Med. 2010; 38: 582-586.

35. Thameur H, Abdelmoula S, Chenik S, Bey M, Ziadi M, Mestiri T, et al. Cardiopericardial hydatid cysts. World J Surg. 2001; 25: 58-67.

36. Bogdanovic A, Radojkovic M, Tomasevic RJ, Pesic I, Petkovic TR, Kovacevic P, et al. Presentation of pericardial hydatid cyst as acute cardiac tamponade. Asian J Surg. 2014.

37. Desnos M, Brochet E, Cristofini P, Cosnard G, Keddari M, Mostefai M, et al. Polyvisceral echinococcosis with cardiac involvement imaged by two-dimensional echocardiography, computed tomography and nuclear magnetic resonance imaging. Am J Cardiol. 1987; 59: 383-384.

38. Demirtaş M, Usal A, San M, Birand A. Hydatid disease presenting as cardiac tamponade. A case history. Angiology. 1996; 47: 601-607.

39. Gürbüz A, Tetik O, Yilik L, Emrecan B, Ozsöyler I, Ozbek C. Cardiac involvement of hydatid disease. Jpn J Thorac Cardiovasc Surg. 2003; 51: 594-598.

40. Diez Valladares L, Sanchez-Pernaute A, Gonzalez O, Perez-Aguirre E, Talavera P, Gutierrez del Olmo A, et al. Hydatid liver cyst perforation into the digestive tract. Hepatogastroenterology. 1998; 45: 2110-2114.

41. Nouira K, Hila H, Bedioui H, Baccar S, Ben Messaoud M, Ksantini R, et al. [Rupture of hydatid cyst of the liver into the duodenum. A case report]. Tunis Med. 2007; 85: 979-981.

42. Daldoul S, Moussi A, Zaouche A. Spontaneous fistulization of hepatic hydatid cyst into the duodenum: an exceptional complication. J Coll Physicians Surg Pak. 2013; 23: 424-426.

43. Noguera M, Alvarez-Castells A, Castella E, Gifre L, Andreu J, Quiroga S. Spontaneous duodenal fistula due to hepatic hydatid cyst. Abdom Imaging. 1993; 18: 234-236.

44. Aribas OK, Kanat F, Turk-Aribas E, Erayman I, Yuksek T. Embolisation of hydatid cysts in the pulmonary artery presenting with haemoptysis. Neth J Med. 2007; 65: 109-111.

45. Akgun V, Battal B, Karaman B, Ors F, Deniz O, Daku A. Pulmonary artery embolism due to a ruptured hepatic hydatid cyst: clinical and radiologic imaging findings. Emerg Radiol. 2011; 18: 437-439.

46. Marriott PJ, Karani J, Lucas SB1, Chiodini PL, Heaton ND. Anaphylaxis from intravascular rupture of Hydatid disease following liver trauma. J Surg Case Rep. 2010; 2010: 1.

47. Berthet B, N'Guema R, Assadourian R. An unusual complication of hydatid disease of the liver: spontaneous operative rupture of the inferior vena cava into the cyst wall. Case report. Eur J Surg. 1994; 160: 447-448.

48. Zubiaurre Lizarralde L, Oyarzabal Pérez I, Ruiz Montesinos I, Guisasola Gorrotxategi E. [Invasion of the portal vein by a hydatid cyst. Review of the literature]. Gastroenterol Hepatol. 2006; 29: 405-408.

49. Herek D, Sungurtekin U. Magnetic Resonance Imaging of a Liver Hydatid Cyst Invading the Portal Vein and Causing Portal Cavernomatosis. Ochsner J. 2015; 15: 479-480.

50. Bahce ZS, Akbulut S, Aday U, Demircan F, Senol A. Cutaneous fistulization of the hydatid disease: A PRISMA-compliant systematic review. Medicine (Baltimore). 2016; 95: e4889.

51. Milicevic M. Echinococcal cysts: cause, diagnosis, complications and medical and surgical treatment. In: Bland K, editor. Mastery of Surgery 5th edn: Lippincott Williams & Wilkins; 2006; 1044-1071.

52. Kayaalp C. Hydatid disease of liver. In: Blumgart LH, editor. Surgery of Liver, Biliary tract, and Pancreas 4th Ed. Philadelphia. 2007. 952- 70.

53. Zaouche A, Haouet K, Jouini M, El Hachaichi A, Dziri C. Management of liver hydatid cysts with a large biliocystic fistula: multicenter retrospective study. World J Surg. 2001; 25: 28-39.

54. Bouzidi A, Chehab F. [Surgical treatment of biliary cystic fistula caused by hydatic cysts. Apropos of 83 cases]. J Chir (Paris). 1997; 134: 114-118.

55. Perdomo R, Morelli R, Carriquiry L, Chifflet J, Bergalli L. [Transhepaticocystic coledochostomy in the case of an open hydatic cyst in the biliary ducts]. Nouv Presse Med. 1977; 6: 747-749.

56. Goinard P, Pegullo J, Pelissier G. [Stenosis of Oddi's sphincter after rupture of hydatid cysts of liver into the bile ducts: surgical findings]. Mem Acad Chir (Paris). 1958; 84: 619-631.

57. Rohner A. [Treatment of hydatid cyst of the liver]. Ann Chir. 1988; 42: 635-638.

58. Yagci G, Ustunsoz B, Kaymakcioglu N, Bozlar U, Gorgulu S, Simsek A, et al. Results of surgical, laparoscopic, and percutaneous treatment for hydatid disease of the liver: 10 years experience with 355 patients. World J Surg. 2005; 29: 1670-1679.

59. Jabbari Nooghabi A, Mehrabi Bahar M, Asadi M, Jabbari Nooghabi M, Jangjoo A. Evaluation and Comparison of the Early Outcomes of Open and Laparoscopic Surgery of Liver Hydatid Cyst. Surg Laparosc Endosc Percutan Tech. 2015; 25: 403-407.

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