Turk J Gastroenterol 2008; 19 (1): 33-39

The optimal treatment of hydatid cyst of the liver: Radical surgery with a significant reduced risk of recurrence

Karaciğer yerleşimli kist hidatikte optimal tedavi: Radikal cerrahi sonrası anlamlı düşük nüks riski

Ünal AYDIN, Pınar YAZICI, Zafer ÖNEN, Mustafa ÖZSOY, Murat ZEYTUNLU, Murat KILIÇ, Ahmet ÇOKER

Department of General Surgery, Ege University, School of Medicine, İzmir

Background/aims: *The management of hydatid cyst of the liver, which is still endemic in Turkey, varies from medical treatment or percutaneous drainage to different surgical procedures. In this study, we aimed to compare the efficacy of radical surgical procedures and conservative interventions with respect to recurrence rates.* ***Methods:*** *Patients who underwent any type of surgical treatment between March 1994 and March 2007 due to liver cyst hydatid were retrospectively evaluated. Data collection included demographic variables, diagnostic methods, surgical procedures, and morbidity and mortality rates.* ***Results:*** *242/258 (93.8%) patients with liver hydatid cyst underwent surgery, and the characteristics of 221 (91.3%) (123 female, 98 male) of these patients matched the criteria of the study. The mean age of the patients was 51 years (18-82 years). The diagnostic methods primarily included abdominal ultrasonography and computed tomography with a rate of 61.8% and magnetic resonance imaging in 12% of the patients. The patients were divided into two groups with respect to the treatment modality: Group A (n=92) - radical surgical treatment and Group B (n=129) - conservative surgery. The overall rate of recurrence was 15.3%. In Group B, this rate was 24% (n=31), whereas only 3.2% of the patients (n=3) in Group A had recurrence in the follow-up (p<0.05). The morbidity rate of the patients who underwent radical surgical modalities was also significantly lower.* ***Conclusions:*** *Although conservative surgical procedures are considered simpler and safer to perform, the rate of postoperative complications such as biliary fistula, residual cavity and recurrence, and cavity suppuration has been reported to be about 35%. On the other hand, radical surgery can be performed with low risk of recurrence (3.2%). We believe radical surgical procedures present a lower rate of recurrence and less morbidity, and thus should be the surgical treatment of choice for hepatic hydatid disease.*

Key words: Liver hydatid cyst, radical surgical treatment, low risk for recurrence.

Amaç: *Halen ülkemizde endemik olan kist hidatik tedavisine yaklaşım medikal tedavi ya da perkütan drenajdan çeşitli cerrahi prosedürlere kadar geniş bir spektrumu içermektedir. Biz bu yazıda kist hidatik yaklaşımında radikal cerrahi ile diğer konservatif girişimleri etkinlik yönünden karşılaştırdık.* ***Yöntem:*** *Mart 1994- Mart 2007 yılları arasında cerrahi girişimi uygulanan karaciğer kist hidatik hastaları retrospektif olarak analiz edildi. Demografik veriler, tanı yöntemleri, cerrahi prosedür, morbidite, mortalite ve geç dönem nüks oranları değerlendirildi. Hastalar tedavi açısından iki grupta incelendi: Grup A -radikal cerrahi, Grup B - konservatif tedavi.* ***Bulgular:*** *Hastalardan %93,8'ine (242/258) karaciğer yerleşimli kist hidatik nedeniyle cerrahi tedavi uygulandı. Bu hastalardan 221'i (%91,3) çalışmaya uygun bulundu. Hastalardan 123 tanesi kadın, 98 tanesi erkek ve tüm hastaların yaş ortalaması 51 (18-82 yıl) idi. Olguların hastaneye en sık (%45.6) başvuru şikayeti karın ağrısı olarak izlendi. Tanı metotlarında abdominal ultrasonografi ve tomografi önceliği (%61.8) gözlenirken %12 hastada manyetik rezonans görüntüleme de kullanıldı. Tedavi etkinliğinin değerlendirildiği Grup A'da 92, grup B'de 129 olgu incelendi. Genel nüks oranı % 15,3 olmakla birlikte bu oran konservatif cerrahi uygulanan olgularda (n=31) %24 (p<0.05) ve radikal cerrahi olgularında ise %3,4 olarak bulundu. Morbidite oranı da radikal cerrahi grupta anlamlı düşük bulundu.* ***Sonuç:*** *Konservatif yöntemler basit olabilmekle birlikte %35 oranlarında postoperatif komplikasyon (safra fistülü, rezidüel kavite ve nüks, kavite süpürasyonu) gözlenmektedir. Diğer yandan, radikal metotlar ise bizim çalışmamızda da görüldüğü gibi mükemmel sonuçlarla-minimal nüks riski ile (%3,2)- uygulanabilir. Çalışmamızın sonuçları doğrultusunda radikal cerrahi yöntemler özellikle anlamlı düşük nüks riski ve minimal komplikasyonlarla diğer cerrahi yöntemlere üstündür ve bu olgularda radikal cerrahi yapılabiliyorsa öncelikli olmalıdır.*

Anahtar Kelimeler: Karaciğer kist hidatiği, radikal cerrahi tedavi, düşük nüks oranı

INTRODUCTION

Cystic echinococcosis or hydatidosis is an endemic disease caused by larval forms of the tapeworm *Echinococcus granulosus*. Hydatid cysts may develop in any organ of the human body, most frequently in

Address for correspondence: Ünal AYDIN
Ege Univesity School of Medicine
Department of General Surgery
Bornova, İzmir, 35100, Turkey
E-mail: drunalaydin@gmail.com

Manuscript received: 09.11.2007 **Accepted:** 10.01.2008

the liver (60-70%) and the lungs (20-30%) (1). Hydatid cyst remains a significant public health problem in endemic areas such as Turkey, the Middle East, South America, and Australia. As an endemic disease, it causes social and economic losses for countries (2). Thus, prevention of the disease as the first step by providing the basic hygiene and treatment as the second step are the important parts of the approach to hydatidosis.

There is still no consensus as to the optimal form of treatment. Medical treatment has been proven to be effective against larval *E. granulosus.* Mebendazole (40-50 mg/kg/day for at least 3 months) and albendazole (10-15 mg/kg/day in courses of 3 months, separated by intervals of 1 week) have been used as preoperative and postoperative chemotherapy to reduce the risk of secondary hydatidosis after operation. PAIR, a minimally invasive technique, consists of percutaneous puncture of the cyst, aspiration of the contents for injection of scolicidal agent and finally, re-aspiration of the full contents (3, 4).

Surgical treatment has traditionally been the mainstay of the therapy, with a recurrence rate of approximately 10-15% (5, 6). The surgical procedures performed for hydatid cysts have varied from simple puncture and aspiration of the cyst to radical resections and total cystectomy or even transplantation, and can briefly be divided into radical and conservative approaches. Conservative surgical treatment includes unroofing associated with various procedures for the management of residual cavity. These are technically easier and safer but are associated with high incidence of local recurrence and cavity-related complications at rates of higher than 10% and 37%, respectively (7-9). Radical procedures include pericystectomy and hepatic resection. However, the most common technique is total or partial cystectomy (10-14). It is generally believed that the more radical the intervention, the higher the intraoperative risk, but the lower the recurrence rate, whereas the more conservative the approach, the lower the peri-operative risk, but the higher the recurrence rate (15). An exogenous daughter cyst may develop from the germinal layer and protrude from the deep surface of the cyst and thus may be overlooked during the unroofing procedure; conservative approach during open surgery may leave behind disease resulting in local recurrence (11).

The purpose of this study was to compare radical and conservative surgical approaches in preventing recurrence of hydatid liver disease. Moreover, we aimed to demonstrate that radical surgery has a larger safety margin than is currently thought.

MATERIALS AND METHODS

Between March 1994 and March 2007, 242/258 (93.8%) patients with hydatid cyst of the liver were treated surgically at Ege University School of Medicine, Department of Surgery. Patients were divided into two groups according to the type of surgery. Group A consisted of patients whose treatment was radical surgery involving pericystectomy or hepatic resection while Group B included patients who had undergone conservative surgery including cystotomy and/or drainage procedures. Because both cystotomy and cystectomy operations were performed for some cysts in multiple locations, 21/242 patients were excluded from this study. The data included demographic variables, diagnostic methods, surgical procedures, morbidity, and late recurrence rates.

Preoperative evaluation of the patients included blood tests (complete blood count, liver function tests, and anti-echinococcus antibody testing) and preoperative abdominal ultrasonography (US) and computerized tomography (CT). The cysts were classified according to the five categories described in the classification of Gharbi et al (16). Accordingly, types II and III are characteristic of hydatid cysts; type I and V are suggestive of hydatid cysts in endemic areas; and type IV simulates a pseudotumor. Since 2001, cysts have been classified according to World Health Organization–Informal Working Group on Echinococcosis (WHO-IWGE) (17). Standardization of Gharbi's classification by WHO-IWGE in 2001 is shown in Table 1. The US results were confirmed at the time of surgery, at which time the definitive diagnosis was made and location of the cyst was precisely determined. The diagnostic sensitivity of both methods was 100%. The patients were put on albendazole (Andazol™; Biofarma, Istanbul, Turkey) regimen 10 mg/kg/day for at least 4 weeks before surgery and for 12 weeks after surgery.

In the radical surgery group, "closed-cyst" method (en bloc pericystectomy or hepatectomy etc.) was used. Parenchymal transection was performed by either clamp-crush technique or an ultrasound aspiration dissector (Cavitron Ultrasonic Surgical Aspirator, CUSA) was used for parenchymal transection. Throughout the operation, afferent blood vessels and biliary ducts were ligated between the pericyst and the normal liver. In some patients

Table 1. Comparison of the Gharbi et al. (16) classification and the WHO-IWGE (17) classification

WHO-IWGE	Gharbi et al.
Type CL (Unilocular cystic lesion, cyst wall not visible)	--
Type CE1 (Unilocular cystic lesion, cyst wall visible)	**Type I** (Pure fluid collection)
Type CE2 (Multivesicular, multiseptated cysts, daughter cysts present)	**Type III** (Fluid collection with septa - honeycomb sign)
Type CE3 (Unilocular cyst containing liquid with a floating membrane inside)	**Type II** (Fluid collection with a split wall-water-lily sign)
Type CE4 (Cysts with heterogeneous degenerative contents, no daughter cysts)	**Type IV** (Heterogeneous echographic patterns)
Type CE5 (Cysts characterized by a thick calcified wall)	**Type V** (Reflecting thick walls)

who underwent hepatectomy, liver hanging maneuver was performed in order to reduce venous back flow bleeding, facilitating bloodless transection, and to maintain safe deeper dissection on the retrohepatic area (18).

In the conservative surgery group, standard drainage procedure was performed, and 20% hypertonic saline or povidone-iodine was used as scolicidal solution. The solution was left inside the cyst about 10 min to kill the scolices. To prevent accidental spillage of the cystic contents, the puncture site was covered with hypertonic saline solution-soaked gauzes. If the cyst fluid was bile-stained, a cysto-biliary communication was suspected. Such communications were identified by retrograde infusion technique modified from previous studies, in which the common bile duct was isolated, and the distal passage was impeded. In cases where leakage was seen in the cyst cavity, the orifice was sutured primarily and t-tube drainage was performed after primary closure of the orifice in the patients with larger biliary orifice. In addition to intrabiliary rupture, intraperitoneal rupture, intrathoracic rupture (bronchobiliary fistula, extension inflammation through the diaphragm), rupture into the gastrointestinal tract and infected cystic content were considered as complicated hydatid cyst. In appropriate cases, an omental flap was placed into the residual cavity. All the cavities were drained to prevent bilioma and consequent biliary peritonitis. In the follow-up period, the initial US control was routinely performed in the first 3rd month and in the first 6th month, and then annually. It is suggested that follow-up of operated patients every six months with annual US for at least three years is essential because most recurrences are observed in this time period (19).

All the data analyses were performed using SPSS version 13.0 for Windows and quantitative data were analyzed by the Mann–Whitney U test. The groups were compared using chi-square test. P values less than 0.05 were considered significant.

RESULTS

In our clinic, 242/258 (93.8%) patients with a diagnosis of hepatic hydatidosis underwent some type of surgery. Of these 242 cases, 221 (91.3%) patients (123 females, 98 males) were included in our series. The median age was 32 years and mean age was 51 years (range: 18-82 years). The two groups were statistically similar in terms of patient demographics, cyst characteristics, and the results of the hemagglutination test, which are summarized in Table 2. The most frequent symptom was abdominal pain, with a rate of 45.6%. Sixteen (17.3%) patients in Group A and 18 (13.9%) patients in Group B had a surgical history due to hydatid cyst of the liver. The combination of abdominal US and CT was the most commonly performed diagnostic test. Only 12% of the cases needed magnetic resonance imaging as a further evaluation of the hepatic masses. The 92 (41.4%) patients in Group A had undergone radical surgery as the main operation. Group B included 129 (58.1%) patients in whom conservative surgical procedures were applied. The distribution of the radical procedures performed were as follows: pericystectomy, 72 patients (78.2%), in 5 of whom t-tube was placed; hepatic segmentectomy, 14 patients (15%); and atypical hepatectomy, 6 patients (6.5%). Conservative procedures included unroofing in 44 patients (34.1%), 24 of whom also underwent omentoplasty procedure; and partial pericystectomy, 85 patients (65.8%). In Group B, primary suturing of the biliary orifice alone was sufficient in 4 patients, while the remaining 10 patients were treated by t-tube drainage after the primary suturing of the biliary orifice in patients with biliary leakage.

The morbidity rate was 3.2% in Group A and 11.6% in Group B. The postoperative complication rates of the two groups were significantly different ($p<0.05$). The complications were postoperative pneumonia (n=4), biliary fistula (n=2), cavity-related abscess formation (n=1), biliary peritonitis due to biliary leakage following removal of T-tubes (n=2), pleurisy (n=4), pneumothorax (n=1), and cardiac complication (n=1). Recurrence rate was determined as 3.2% (n=3) in Group A, whereas in Group B, this rate was significantly higher, at 24% (n=31). The mortality rate was 1.8% and the causative factors were septic complications (n=2), postoperative respiratory insufficiency and related complications (n=1), and pulmonary emboli (n=1) in one case in whom radical surgery was performed (Table 3).

DISCUSSION

Hydatid disease of the liver is not a simple benign parasitic infection caused by *E. granulosus.* It presents malignant behavior. Treatment of echinococcal infestation has a major impact on the health care economy in an endemic region (20). Liver hydatid cysts are often diagnosed incidentally, at a rate of 75%, without any symptoms (21). US is a useful tool in confirming the diagnosis of hydatid cyst of the liver and its complications with a sensitivity rate of 100% (5, 12, 22-26). Based on US classification of Gharbi et al. (16), the five categories of the cysts are: type II and III, characteristic of hydatid cysts; type I and V, suggestive of hydatid cysts in endemic areas; and type IV, which simulates a pseudotumor. In addition to being a diagnostic tool, US is also important in evaluating the efficacy of treatment, especially chemotherapy and puncture, aspiration, injection, and re-aspiration (PAIR) (27-28). CT is a helpful tool in confirming the diagnosis, especially when an ultrasound examination shows a type IV sonographic pattern. Serologic tests cannot supplant clinical or imaging investigations, but they can confirm the hydatid origin of a cyst (29).

Patients with hydatid cysts frequently present as a therapeutic challenge to the physician. There are three therapeutic modalities to treat hepatic cystic echinococcosis: chemotherapy, surgery, and percutaneous drainage. Although operation performed by the conventional or laparoscopic approach is still the treatment of choice, controversy exists about the most appropriate surgical approach (8-31). Ideal therapy of the hydatid liver disease should aim to cure the disease via eliminating the parasite with a low morbidity and zero mortality. Surgery remains the gold standard treatment for hydatid liver disease that favors rapid disappearance of the residual cavity and prevents recurrence. Treatment modality should be individualized to the patient according to the number and location of cysts, the presence of cyst infection, and complications. Radical operations remove the cyst completely with the pericyst and include pericystectomy and hepatectomy. Conservative operations evacuate the contents of the cyst without removal of the pericyst. Radical methods include operations that have excellent results, but they are feasible in few cases, whereas conservative procedures, relatively simple and still accepted, have a higher rate of morbidity. However, for complicated cysts, external drainage of the cystic cavity or unroofing procedure, partial pericystectomy and sometimes addition of omentoplasty are

Table 2. Analysis of variables of both groups

Variable	Group A (n=92)	Group B (n=129)	Total (=221)	P value
Age (mean±SD - range)	51.3 ± 13 (18-72)	51.9 ± 15.4 (20-77)	51.6 ± 14 (18-77)	NS[1]
Gender				
Male	45 (48.9%)	53 (41%)	98 (44.3%)	NS[2]
Female	47 (51.9%)	76 (58.9)	123 (55.6%)	
Serological examination				
-	11 (11.6%)	12 (9.3%)	23 (10.4%)	NS[2]
+	81 (88.4%)	117 (90.7%)	198 (89.5%)	
Number of patients with multiple cysts	30 (32%)	46 (35.6%)	76 (34.3%)	NS[2]
Complicated/Uncomplicated cyst	42/50	52/77	94/127	NS[2]
Cyst size (cm)	10.5 (5-20)	8.9 (5-17)	9.1 (5-20)	NS[2]
Cyst classification*,				
CE3, Type II	4	6	10 (4.5%)	NS[2]
CE2, Type III	53	79	132 (59.7%)	NS[2]
CE4, Type IV	35	44	79 (35.7%)	NS[2]

NS: Not significant. [1]: Independent sample T-test. [2]: X^2 test
*Gharbi classication was used until 2001, after which cysts were classified according to WHO-IWGE (Table 1)

Table 3. Postoperative period in groups - complications and recurrences

	Group A (n=92)	Group B (n=129)	Total	P value
Hospital stay (day) (mean±SD - range)	6.7 ± 3 (2-21)	7.5 ± 4 (2-30)	7.2 ± 4 (2-30)	NS[1]
Morbidity	3 (3.2%)	15 (11.6%)	18 (8.1%)	**<0.05**[2]
Biliary peritonitis	0	2	2	
Biliary fistula	0	2	2	
Cavity abscess	0	1	1	
Wound infection	0	2	2	
Pneumonia	1	3	4	
Pneumothorax	0	1	1	
Pleurisy	1	3	4	
Cardiac complication	1	1	2	
Recurrence	3 (3.2%)	31* (24%)	34 (15.3%)	**<0.01**[2]
Mortality	1 (1%)	3 (2.3%)	4 (1.8%)	NS[2]

NS: Not significant. SD: Standard deviation. [1]: Independent sample T-test. [2]: X^2 test
*One of the patients udverwent three additional operations before

generally preferred. With advances in hepatobiliary surgery in the last decade, there has been a shift towards radical surgical interventions, as seen in our institution, because they appear to result in fewer postoperative complications, in particular recurrences, and lower mortality than do conservative techniques (32, 33).

Conservative procedures are safer and easier to perform although morbidity is more prevalent. Postoperative complication rates have been reported as 6-47% (34-39). Morbidity after conservative operations is mainly related to the extent of cavity remaining after the contents of the cyst have been evacuated. In the present series, the morbidity rate was significantly higher in Group B. Biliary fistula development was more frequent in the complicated cysts than in the uncomplicated cysts; similarly, cavity infections were also more common in the complicated cysts (40). These types of complications, mainly cavity-related, were also more frequent in the patients who had undergone conservative surgical treatment, with a rate of 17.2%. As for postoperative complications, the presence of a residual cavity or biliocystic fistula after unroofing or difficulty in controlling bleeding and bile leaks of the hepatic parenchyma after pericystectomy may lead to associated blood or bile collections, potential sources of deep suppuration; the reported rates are 12% to 26% (41). A variety of techniques, including omentoplasty, introflexion, capitonnage, external drainage, and human fibrin glue on the surface have been recommended to prevent this postoperative complication. Some authors recommend omentoplasty for its lower morbidity rate (12, 21, 42) and shorter hospital stay (21, 43). In our series, the patients diagnosed with biliary complication, fistula, leakage, or cavity abscess related to bile leak were in Group B and all the patients had complicated cysts. In addition to higher morbidity rates, relapse is also considered more prevalent in these cases. In principle, endocystectomy appears to be an adequate and relatively gentle procedure. However, a need for radical surgery seems to be warranted by the fact that echinococcal cysts are capable of forming exogenous daughter cysts in the capsular membrane and because these daughter cysts can persist in situ after endocystectomy, causing a recurrence of the disease.

The radical procedures include pericystectomy and hepatic resection, which increase the operative risk for a benign disease. However, these procedures are associated with a lower risk of recurrence (44). A pericystectomy, which involves the excision of a cyst including the surrounding fibrous layer, may minimize this risk. On the other hand, this technique involves extensive dissection, resulting in a large wound area, which might increase the risk of bleeding or bile leaks. In case of extensive involvement, an anatomical liver resection may provide the best option for definitive therapy. The rate of recurrence after liver hydatid surgery has been reported to range from 1.1 to 9.6% (45, 46). According to our results, a rate of 3.2% for the risk of relapse in the patients who underwent radical surgical procedure was in line with the literature. This rate was statistically significantly lower. However, the rate for Group B was 24%. Until recently, there have been no randomized controlled trials investigating the efficacy of radical and conservative procedures. According to a randomized prospective comparative study in 2007, Yuksel et al. (47) concluded that radical surgical resection provides an effective surgical management option in preventing early local recurrence and cavity-related complications when compared

to conservative surgical approaches. Gollackner et al. (32) found that radical surgical procedures had significantly low risk of relapse in contrast to conservative techniques. Three retrospective, non-comparative studies have also concluded that radical procedures are safe and efficient (48-50). With a prospective comparative study, Tasev et al. (51), who compared 102 patients undergoing radical surgery with 250 patients undergoing conservative surgical procedures, concluded that radical surgical procedures were associated with lower postoperative morbidity and mortality rates and a shorter postoperative hospital stay. However, these procedures were performed more frequently for hydatid cysts located in the left hepatic lobe. Moumen et al. (52) retrospectively evaluated 360 patients who were treated conservatively by unroofing (resection of the prominent dome) of the hydatid cyst of the liver and reported that mortality was low (1.3%), constituting a clear advantage of this method with regard to radical surgery. On the other hand, according to some authors who compared the results of radical and conservative surgical techniques, recurrence and the type of the surgical treatment used were not correlated or presented no significant disadvantages (38, 53).

The mortality rates following hepatic surgery due to cyst hydatid range between 2.3% and 2.7% (1). With repeated surgery for hepatic hydatidosis, complication rates are higher with mortality rates of 10% (39). In our present series of patients with repeated surgery, overall mortality rate was 1.8%.

The data presented in this report emphasize that compared to conservative techniques, radical procedures provide significant advantages with respect to the rate of recurrence. Moreover, postoperative complications, particularly cavity-related complications, were more common in the patients who had undergone conservative surgery. We believe that radical surgery is an effective and safe surgical approach for treatment of hepatic hydatid disease with a lower rate of recurrence.

ACKNOWLEDGEMENT

We are extremely grateful to Hatice Uluer for assistance with statistical analyses of the data.

REFERENCES

1. da Silva AM. Hydatid cyst of the liver/criteria for the selection of appropriate treatment. Acta Tropica 2003; 85: 237-42.
2. Dawson JL, Stamatakis JD, Stringer MD, et al. Surgical treatment of hepatic hydatid disease. Br J Surg 1988; 75: 946-50.
3. Bastid C, Azar C, Doyer M, et al. Percutaneous treatment of hydatid cysts under sonographic guidance. Dig Dis Sci 1994; 39: 1576-80.
4. Beggs I. The radiological appearances of hydatid disease of the liver. Clin Radiol 1983; 34: 555-63.
5. Little JM, Hollands MJ, Ekberg H. Recurrence of hydatid disease. World J Surg 1988; 12: 700-4.
6. Mottaghian H, Saidi F. Postoperative recurrence of hydatid disease. Br J Surg 1978; 65: 237-42.
7. Sıelaff TD, Taylor B, Langer B. Recurrence of hydatid disease. World J Surg 2001; 25: 83-6.
8. Demirci S, Eraslan S, Anadol E, et al. Comparison of the results of different surgical techniques in the management of hydatid cyst of the liver. World J Surg 1989; 13: 88-90.
9. Kayaalp C, Bostancı B, Yol S, et al. Distribution of hydatid cysts into liver with reference to cystobiliary communications and cavity-related complications. Am J Surg 2003; 185: 175-9.
10. Belghiti, J, Benhamou, J, Houry, S, et al. Caustic sclerosing cholangitis. Arch Surg 1986; 121: 1162-5.
11. Magistrelli P, Masetti R, Coppola R, et al. Surgical treatment of hydatid disease of the liver. Arch Surg 1991; 126: 518-22.
12. Safioleas M, Misiakos E, Manti C, et al. Diagnostic evaluation and surgical management of hydatid disease of the liver. World J Surg 1994; 18: 859-65.
13. Morris DL, Dykes PW, Dickson B, et al. Albendazole in hydatid disease. Br Med J 1983; 286: 103-4.
14. Queiroz-Medeiros M, Menezes-Silva A, Raposo-D'Almeida, et al. Surgical treatment of hepatic hydatid disease. European IHPBA Congress, Hamburg 97, Monduzzi editore, International Proceedings Division, Bologna 1997; 229-33.
15. Filice C, Pirola F, Brunetti E, et al. A new therapeutic approach for hydatid cysts. Aspiration and alcohol injection under sonographic guidance. Gastroenterology 1990; 98: 1366-8.
16. Gharbi HA, Hassine W, Brauner MW, et al. Ultrasound examination of the hydatic liver. Radiology 1981; 139: 459-63.
17. WHO/OIE, Manual on echinococcosis in humans and animals: a public health problem of global concern. World Organisation for Animal Health and World Health Organisation, 2001, Paris, France.
18. Unal A, Pinar Y, Murat Z, et al. A new approach to the surgical treatment of parasitic cysts of the liver: hepatectomy using the liver hanging maneuver. World J Gastroenterol 2007; 13: 3864-7.
19. Kapan M, Kapan S, Göksoy E, et al. Postoperative recurrence in hepatic hydatid disease. J Gastrointest Surg 2006; 10: 734-9.
20. Dogan R, Yuksel M, Cetin G, et al. Surgical treatment of hydatid cysts of the lung: report on 1055 patients. Thorax 1989; 44: 192-9.
21. Muftuoglu AT, Koksal N, Topaloglu U. The role of omentoplasty in the surgical management of remnant cavity in hepatic hydatid cyst. HPB 2005; 7: 231-4.
22. Zaouche A, Haouet K, Jouini M, et al. Tunisian Surgical Association: management of liver hydatid cysts with large biliocystic fistula: multicenter retrospective study. World J Surg 2001; 25: 28-39.

23. Kilani T, El Hammami S, Horchani H, et al. Hydatid disease of the liver with thoracic involvement. World J Surg 2001; 25: 40-5.
24. Sayek I, Onat D. Diagnosis and treatment of uncomplicated hydatid cyst of the liver. World J Surg 2001; 25: 21-7.
25. Agaoglu N, Turkyilmaz S, Arslan MK. Surgical treatment of hydatid cysts of the liver. Br J Surg 2003; 90: 1536-41.
26. Vagianos CE, Karavias DD, Kakkos SK, et al. Conservative surgery in the treatment of hepatic hydatidosis. Eur J Surg 1995; 161: 415-20.
27. Caremani M, Benci A, Maestrini R, et al. Abdominal cystic hydatid disease (CHD): classification of sonographic appearance and response to treatment. J Clin Ultrasound 1996; 24: 491-500.
28. Franchi C, Di Vico B, Teggi A. Long-term evaluation of patients with hydatidosis treated with benzimidazole carbamates. Clin Infect Dis 1999; 29: 304-9.
29. Biava MF, Dao A, Fortier B. Laboratory diagnosis of cystic hydatic disease. World J Surg 2001; 25: 10-4.
30. Kouraklis G, Dosios T, Glinavou A, et al. An alternative approach for the surgical management of hydatid disease of the liver. Langenbecks Arch Surg 2001; 386: 62-4.
31. Morel P, Robert J, Rohner A. Surgical treatment of hydatid disease of the liver: a survey of 69 patients. Surgery 1998; 104: 859-62.
32. Gollackner B, Langle F, Auer H, et al. Radical surgical therapy of abdominal cystic hydatid disease: factors of recurrence. World J Surg 2000; 24: 717-21.
33. Cirenei A, Bertoldi I. Evolutions of surgery for liver hydatidosis from 1950 to today: analysis of a personal experience. World J Surg 2001; 25: 87-92.
34. Alfieri S, Doglietto GB, Pacelli F, et al. Radical surgery for liver hydatid disease: a study of 89 consecutive patients. Hepatogastroenterology 1997; 44: 496-500.
35. Sayek I, Yalin R, Sanac Y. Surgical treatment of hydatid disease of the liver. Arch Surg 1980; 115: 847-50.
36. Ozmen V, Igci A, Kebudi A, et al. Surgical treatment of hepatic hydatid disease. Can J Surg 1992; 35: 423-7.
37. Langer JC, Rose DB, Keystone JS, et al. Diagnosis and management of hydatid disease of the liver. A 15-year North American experience. Ann Surg 1984; 199: 412-7.
38. Bulbuller N, Ilhan YS, Kirkil C, et al. The results of surgical treatment for hepatic hydatid cysts in an endemic area. Turk J Gastroenterol 2006; 17: 273-8.
39. Silva MA, Mirza DF, Bramhall SR, et al. Treatment of hydatid disease of the liver. Evaluation of a UK experience. Dig Surg 2004; 21: 227-33.
40. Kayaalp C, Sengul N, Akoglu M. Importance of cyst content in hydatid liver surgery. Arch Surg 2002; 137: 159-63.
41. Barros JL. Hydatid disease of the liver. Am J Surg 1978; 135: 597-600.
42. Mentes A, Yuzer Y, Ozbal O, et al. Omentoplasty versus introflexion for hydatid liver cysts. J R Coll Surg Edinb 1993; 38: 82–5.
43. Uravic M, Stimac D, Lenac T, et al. Diagnosis and treatment of liver hydatid disease. Hepatogastroenterology 1998; 45: 2265-9.
44. Omerci N, Soykan I, Bektas A, et al. A new percutaneous approach for the treatment of hydatid cysts of the liver. Am J Gastrenterol 2001; 96: 2225-30.
45. Akhan O, Ozmen MN. Percutaneous treatment of liver hydatid cysts. Eur J Radiol 1999; 32: 76-85.
46. Ustunsoz B, Akhan O, Kamiloglu MA, et al. Percutaneous treatment of hydatid cysts of the liver: long-term results. Am J Roentgenol 1999; 172: 91-6.
47. Yuksel O, Akyurek N, Sahin T, et al. Efficacy of radical surgery in preventing early local recurrence and cavity-related complications in hydatic liver disease. J Gastrointest Surg 2007 Oct 5; [Epub ahead of print].
48. Khuroo MS, Wani NA, Javid G, et al. Percutaneous drainage compared with surgery for hepatic hydatid cysts. N Engl J Med 1997; 337: 881-7.
49. Akhan O, Dincer A, Gokoz A, et al. Percutaneous treatment of abdominal hydatid cysts with hypertonic saline and alcohol. An experimental study in sheep. Invest Radiol 1993; 28: 121-7.
50. Akhan O, Ozmen MN, Dincer A, et al. Liver hydatid disease: long-term results of percutaneous treatment. Radiology 1996; 198: 259-64.
51. Tasev V, Dimitrova V, Draganov K, et al. Hepatic echinococcosis: radical or conservative surgical treatment. Khirurgiia (Sofiia) 2002; 58: 10-3.
52. Moumen M, El Alaoui ME, Mehhane M, et al. Resection of the prominent dome of a hydatid cyst of the liver: about 360 cases. J Chir (Paris) 1990; 127: 83-6.
53. Hofstetter C, Segovia E, Vara-Thorbeck R. Treatment of uncomplicated hydatid cyst of the liver by closed marsupialization and fibrin glue obliteration. World J Surg 2004; 28: 173-8.