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Grading of liver lesions caused by Echinococcus granulosus

I. Rozanes[1], B. Acunas[1], L. Celik[2], K. Acarli[3], I. Sayi[1], Ö. Minareci[1], A. Alper[3], A. Emre[3], O. Ariogul[3], E. Gökmen[1]

[1] Department of Radiology, Istanbul Medical Faculty, Capa 34390 Istanbul, Turkey
[2] Department of Radiology, Haydarpasa Numune Hospital, 81324 Istanbul, Turkey
[3] Hepatobiliary Surgery Unit, Department of General Surgery, Istanbul Medical Faculty, Capa 34390 Istanbul, Turkey

Abstract. The availability of different therapeutic alternatives in hydatid liver disease necessitates a comprehensive classification system in order to evaluate indications and monitor results. We have proposed a new scheme in which lesions are graded 1–5 according to the morphology of the cyst and the presence of findings in favour of cyst rupture. Ultrasound (US), CT and cholangiographic findings in 214 hydatid liver lesions in 152 patients who underwent surgery within 15 days of their radiological examinations were evaluated retrospectively. Results of the radiological classification were correlated with surgical data. We found that purely cystic unilocular lesions never ruptured, that dilatation of biliary canaliculi around a lesion with a complex morphological appearance is a non-specific finding and that there was no reliable radiological sign for a simple biliary communication. US, CT and cholangiography were reliable in diagnosing intra-biliary and direct ruptures. We conclude that the proposed grading scheme could be useful in monitoring the results of different therapeutic modalities for hydatid disease of the liver and, with the accumulation of further data, could be helpful in allocating patients to therapeutic alternatives.

Key words: Echinococcosis – Liver, cysts – Liver, echinococcosis parasites

Introduction

Hydatid disease, a zoonosis caused by the larval infestation of the taeniid *Echinococcus granulosus*, is endemic to many parts of the world. The liver is the most frequently affected organ with an infestation rate of 75% [1]. Although various surgical techniques depending on the extension of the disease remain the standard therapy in hydatid liver disease, systemic chemotherapy [2–4], percutaneous aspiration and injection of scolecidal agents [5–12] and percutaneous therapy with a cutting device [13] are being reported in the literature with favourable results. The availability of different therapeutic alternatives necessitates a comprehensive classification system in order to evaluate indications and monitor results.

Different classifications for sonographic appearances [14–17] and for cyst rupture [18] have been reported in the literature. Although these are useful per se for the sonographic differential diagnosis and for the evaluation of rupture they are not individually comprehensive enough to form a grading system. We have combined various criteria from different classifications and formulated a grading scheme which reflects the natural history of the disease and its complications and is applicable to all imaging modalities.

In this study we retrospectively analysed ultrasound (US), CT and cholangiographic findings in a patient group with hydatid disease of the liver who were operated on within 2 weeks of their radiological studies. We graded the lesions according to the proposed scheme and compared the results with surgical data, with the aim of assessing the significance of the morphology and findings in favour of rupture.

Methods

CT, US and cholangiographic findings in 214 cystic masses in 152 patients (68 men, 84 women; age range 11–72 years, mean 36 years) confirmed by surgery to be of hydatid nature were evaluated retrospectively. Six of these patients had US, CT and cholangiographic examinations; 39 patients had US and CT examinations; 88 patients had only US and 19 patients had only CT examinations.

CT examinations were performed with high-resolution scanners. All 64 patients examined by CT received orally administered contrast material, and 46 received intravenously administered contrast material in the form of a hand-injected bolus containing 30–40 g iodine. Contigu-

Correspondence to: I. Rozanes

Table 1. Grading of hydatid liver lesions

Grade 1:	Purely cystic, unilocular lesion
Grade 2A:	Lesion with a complex morphological appearance
Grade 2B:	Dilatation of biliary canaliculi around a hydatid lesion with a complex morphological appearance
Grade 3:	Lesion with intra-biliary rupture
Grade 4:	Lesion with direct rupture into surrounding spaces or organs
Grade 5:	Irregular, densely calcified lesion

Table 2. Correlation of the results of the radiological grading and surgical classification

Radiological grading	Surgical classification			
	No communication	Simple communication	Frank rupture	Direct rupture
Grade 1	39	–	–	–
Grade 2A	78	17	–	–
Grade 2B	26	10	1	–
Grade 3	3	3	18	–
Grade 4	–	–	–	19
Grade 5	–	–	–	–

ous sections 8–10 mm thick were obtained covering the whole of the abdomen. Additional thin slices were obtained in regions of interest in 17 of the patients.

US examinations were performed with real-time instruments using 3.5–5 MHz transducers.

Cholangiography was performed via the endoscopic route in 4 patients (ERCP) and the percutaneous route (PTC) under US guidance in 2 patients.

All hydatid lesions were classified according to the formulated radiographical grading scheme (Table 1). Surgical findings indicative of rupture were classified according to the classical surgical classification as follows: no rupture; simple communication with the biliary tree; frank rupture into the biliary tree; and direct rupture into neighbouring organs and spaces [19].

Results

There were 39 purely cystic, unilocular (grade 1) lesions in 31 patients. Five of these lesions had dilatations of biliary canaliculi around the lesion (Fig. 1). Surgical exploration did not reveal any signs of biliary communication or rupture in any of the purely cystic lesions.

There were 175 lesions in 121 patients with complex morphological appearances (detached membranes, septations, daughter cysts, cyst matrix and partial cyst wall calcifications). Ninety-five of these lesions in 64 patients had bile ducts of normal calibre (grade 2A) (Fig. 2). Seventeen simple biliary communications were found in the surgical exploration of these lesions. There were 37 lesions with complex morphological appearances in 24 patients with dilated surrounding intra-hepatic bile ducts and normal common bile ducts (grade 2B). Ten simple biliary communications and one frank intra-biliary rupture were found in the surgical exploration of these lesions.

There were 20 patients with dilatations of the common bile ducts who harboured 24 lesions with complex morphological appearances. US and/or CT had demonstrated communication of a dilated biliary duct with the lesion (Fig. 3a) and/or hydatid vesicles or membranes in the bile ducts (Fig. 3b) in 15 of these patients. In the remaining 5 patients with dilated common bile ducts a biliary communication, intra-biliary hydatid material or additional obstructive lesions such as calculi or tumour could not be demonstrated by US or CT. These patients and an additional patient underwent cholangiography which revealed filling of the cystic cavity and intra-biliary filling defects compatible with hydatid membranes in 3 patients, distal common bile duct calculi in 2 patients and a stricture in 1 patient. In total there were 18 lesions with frank intra-biliary rupture (Grade 3). Surgery confirmed the radiological findings.

There were 13 patients with 19 hepatic lesions with direct rupture into surrounding spaces and/or organs (grade 4). Eight of these patients had trans-diaphragmatic rupture into the pleural space (Fig. 4). Three patients had multiple intraperitoneal or retroperitoneal lesions. Two patients with acute rupture had partly collapsed cysts with free peritoneal fluid. Surgical exploration confirmed the radiological findings. A patient with trans-diaphragmatic rupture was found to have a bronchial fistula. Grade 5 lesions were not treated surgically, so were not included in the study.

Results of the radiological grading and surgical correlations are summarised in Table 2.

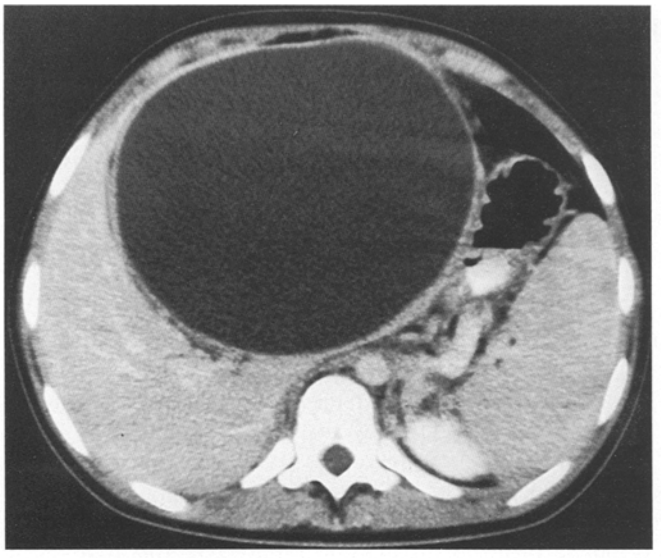
Discussion

Grade 1 lesions (purely cystic, unilocular lesions)

Hydatid cyst walls are composed of three layers. The outer layer, the pericyst, is made up of compressed host tissues and inflammatory cells. The true cyst wall derived from parasitic tissue is composed of two layers: the acellular outer layer (the ectocyst) and the germinal membrane which is one cell thick (the endocyst). These two layers are usually referred to as the endocyst. When the endocyst ruptures it detaches from the pericyst and can be observed floating in the cystic cavity. Purely cystic hydatid lesions have intact endocysts. An intact endocyst precludes cyst rupture and all the complications that occur subsequent to rupture. Surgical exploration confirmed this fact in all our patients. As there is no risk of a biliary communication and the scolecidal agent will readily reach all parts of the unilocular cavity, Grade 1 lesions are the best candidates for percutaneous aspiration and scolecidal injection therapy [8, 10].

Grade 2 lesions (lesions with complex morphological appearances with our without dilatation of biliary canaliculi around the lesion)

Complex morphological appearance of the cyst indicates that the endocyst is ruptured. Following rupture of the endocyst hydatid fluid escapes into the potential space be-



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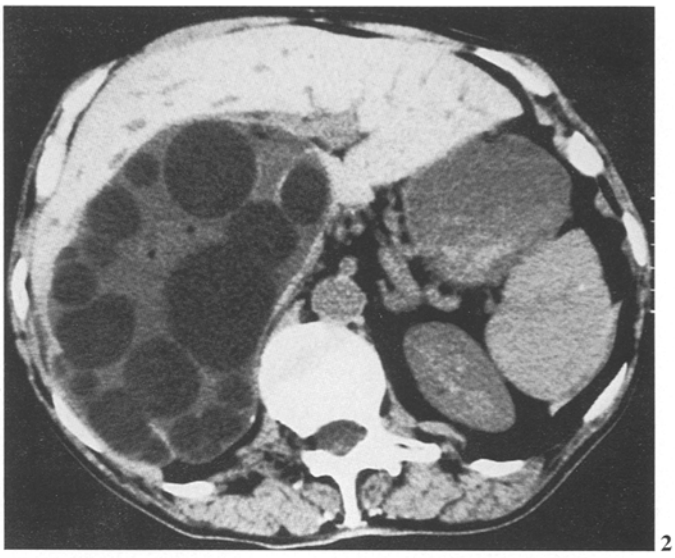

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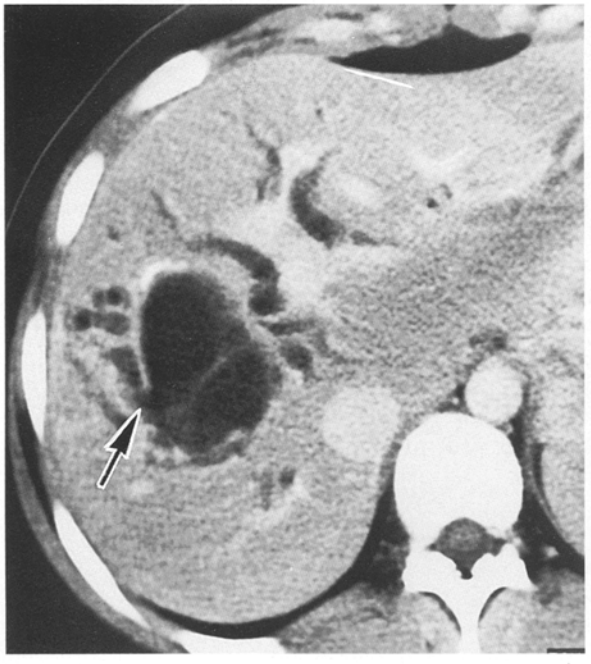

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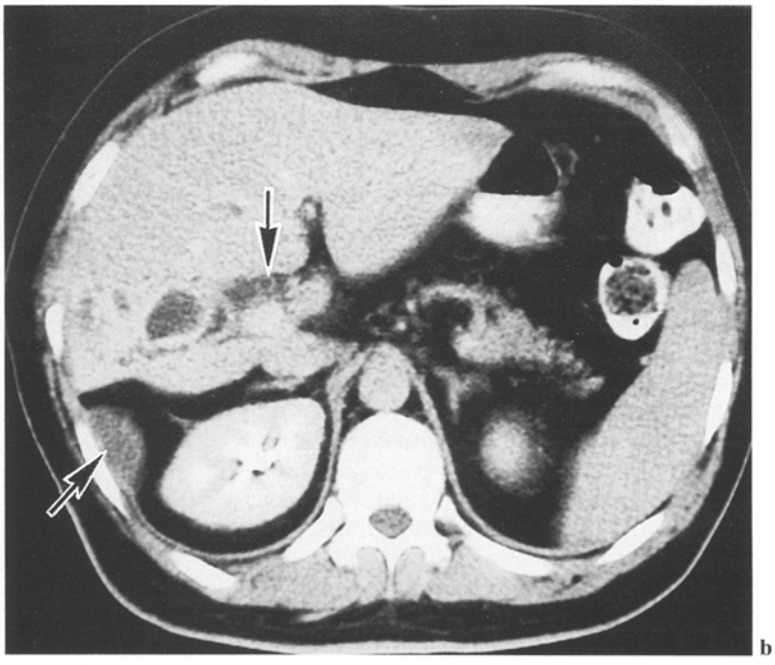

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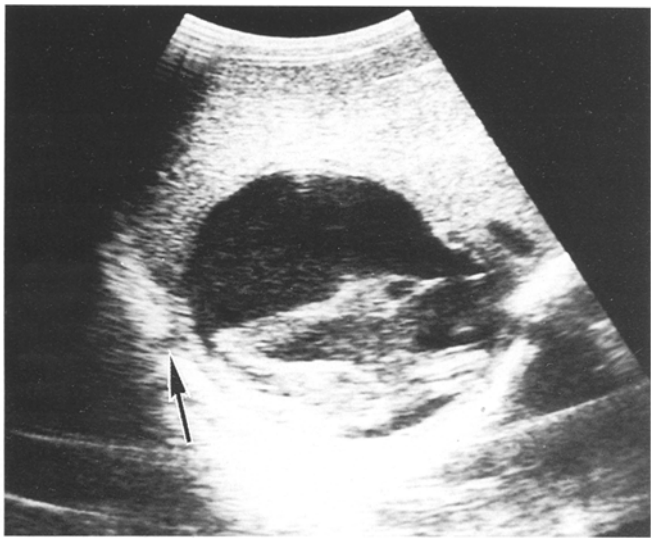

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Fig. 1. Grade 1 lesion. Purely cystic lesion in the left liver lobe. There are dilatations of biliary canaliculi around the lesion. Surgical exploration did not reveal any biliary communication

Fig. 2. Grade 2 A lesion. Lesion with a complex morphological appearance in the right lobe. The biliary tract appears normal. Surgical exploration revealed a simple biliary communication

Fig. 3. a Grade 3 lesion. Lesion with a complex morphological appearance in the right lobe. There is a large communication to a distended intra-hepatic bile duct in the lateral aspect *(arrow)*. **b** A hydatid vesicle in the distended common hepatic duct *(arrow)*. There is an additional lesion in the retroperitoneum *(arrow)*

Fig. 4. Grade 4 lesion. Lesion with a floating membrane in the right lobe. There is a rupture into the right pleural space through a diaphragmatic defect *(arrow)*

tween the endocyst and the pericyst. As the pericyst contains biliary canaliculi, a further rupture in a biliary canalicular wall caused by erosions resulting from the pressure gradient between the lumen of the cyst and the biliary tree may cause biliary communications. Therefore, a cyst with a complex morphological appearance necessitates attentive evaluation of the biliary tract.

Simple communications are small communications that do not allow daughter cysts and/or hydatid membranes large enough to cause an obstruction in the biliary tract to escape from the cyst. Simple communications are sometimes sealed by the high intraluminal pressure of the cyst and become patent only after the cyst has been drained.

In our series simple communications were found with lesions with complex morphological appearances with or without dilatation of biliary canaliculi around the lesion. This shows that dilatation of biliary canaliculi around the lesion is a non-specific finding and can result either from impeded flow in the bile ducts caused by the pressure of the cyst or from a relatively small biliary communication which did not allow hydatid material large enough to cause an obstruction in the larger biliary canals to escape from the cyst. Magistrelli et al. [20] reported that ERCP did not adequately visualise small cysto-biliary communications in their series. Cholangiography is therefore not indicated in the evaluation of simple biliary communications.

Treatment of hydatid lesions with complex morphological appearances by percutaneous aspiration and injection of a scolecidal agent is a complicated issue. Septations in the cyst may prevent contact of the scolecidal agent with all parts of the cavity and an undetected biliary communication may cause spillage of the agent into the biliary tract causing chemical cholangitis. If continuous catheter drainage is used membrane fragments may frequently block the catheter lumen [9]. Filice et al. [11] advocated the use of a rapid biochemical test of the aspirated hydatid fluid for the presence of bilirubin and/or contrast radiography of the cyst cavity to rule out a biliary communication. They report that alcohol (a very potent scolecidal agent with high diffusion capacity) was effective even in lesions with prominent solid components [7, 11]. Khuroo et al. [9] used hypertonic saline, which is probably safer than alcohol in terms of biliary spillage, and performed aspiration and injection of every individual loculation in hydatid lesions with prominent fluid components. The use of hypertonic saline, which acts as a contrast agent under CT guidance, may also help to identify septations and biliary communications [8, 10]. Saremi reported that lesions with prominent solid components may benefit from the use of a cutting device for percutaneous therapy [13].

Grade 3 lesions (lesions with intra-biliary rupture)

CT and sonography are highly sensitive in demonstrating dilatation of the common bile duct. Sonography and/or CT may also identify a relatively large cysto-biliary communication and hydatid membranes or vesicles in biliary ducts of a large calibre [21].

As common bile duct calculi and strictures may coexist with hydatid disease [22], cholangiography is indicated in patients with dilated common bile ducts whose obstructive lesion cannot be confidently diagnosed by cross-sectional imaging modalities. A patient with hydatid disease and cholestasis urgently requires a biliary decompressive procedure, either endoscopic [20] or surgical [23].

Grade 4 lesions

Rupture of the endocyst and the pericyst causes spillage of cyst contents into neighbouring organs and spaces. A growing or secondarily infected cyst may cause atrophy in the diaphragm resulting in rupture into the pleural space and pulmonary parenchyma. Hydatid cysts may rarely rupture into hollow neighbouring organs such as the stomach or colon [24]. Direct rupture causes discharge of scoleces resulting in seeding metastasis and precluding curative surgery or percutaneous treatment. Systemic chemotherapy is definitely worth trying in these patients.

Grade 5 lesions

Irregular, densely calcified walls or a totally calcified lesion indicate that the disease is inactive. Treatment of such a lesion is not indicated unless the patient is symptomatic [14].

Additional clinical studies are necessary to determine the value of different therapeutic modalities in hydatid disease of the liver. We believe that this new grading scheme will be useful in monitoring results. With the accumulation of further data, grading of the lesions should be helpful in allocating patients to therapeutic alternatives.

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