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## The Pathology of Echinococcosis and the Current Echinococcosis Problem in Western Turkey (A Report of Pathologic Features in 80 Cases)

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**Abstract:** Echinococcosis is an infection caused by *Echinococcus granulosus* and *E. multilocularis*. It manifests as cyst formations in various organs, affecting both humans and animals. The cysts may be unilocular (*E. granulosus*) or multilocular (*E. multilocularis*). Multilocular cysts have particular significance, for their macroscopic appearance is reminiscent of malignant tumors and their prognosis is poor. The purpose of this study is to describe our cases and to start a discussion on the current echinococcosis problem in İzmir, western Anatolia. The pathological features of 80 cases of echinococcosis diagnosed at Dokuz Eylül University Pathology Department over the last 21 years have been reviewed. Seventy-two of the 80 cases were caused by *E. granulosus* and the rest were caused by *E. multilocularis*. Fifty-five patients (68.75%) were female and 25 (31.25%) were male. The most common localization was the liver (56.25%). Hydatid disease due to cystic echinococcosis is one of the most important public health and economic problems in Turkey. The disease occurs predominantly in eastern Anatolia but may be encountered in any part of the country.

**Key Words:** Echinococcosis, *Echinococcus granulosus*, *E. multilocularis*, western Anatolia

### Introduction

The disease caused mainly by *Echinococcus granulosus* and *E. alveolaris*, especially by the larval stages of these cestode (tapeworm) species, is called echinococcosis (hydatid cyst). It may manifest as single or multiple cystic structures in various organs, predominantly in the liver (1-3). Many mammals can serve as intermediate hosts of the disease, but sheep are the most common. The definitive host is the fox. The infection occurs in eastern Europe, Turkey, the southern Russian states, the northern states of the United States and Canada (4). In Turkey, it is most commonly found in eastern, northeastern and central Anatolia, while it may show up in the western parts randomly, due to migration, predominantly from the eastern regions of Anatolia (5-9).

*E. granulosus* (2-6 mm; with 3 ring structures) and *E. alveolaris* or *multilocularis* (2.2 mm; with 5 ring

structures) are cestode parasites (tapeworms), and their larvae cause unilocular cystic echinococcosis and multilocular (alveolar) echinococcosis, respectively. Most cases are seen as unilocular cystic echinococcosis caused by *E. granulosus* (1-3).

These parasites of the human are particularly localized in the liver (75%) and the lungs (5-15%), but they can develop in other organs as well, causing significant clinical problems (3).

Unilocular hydatid disease usually manifests as a slow-growing mass. Cysts in unconfined locations can attain a large size without interfering with vital functions, but small cysts in some locations may produce significant mechanical compression of vital structures (3). The cyst of *E. granulosus* is typically unilocular, spherical or subspherical, filled with clear fluid, and often composed of a single chamber (3). Unilocular hydatid disease is very common in Turkey (10).

Alveolar hydatid disease displays a clinical manifestation similar to that of a slow-growing malignant tumor in the liver. The parasite destroys the liver parenchyma, bile ducts and blood vessels resulting in symptoms of biliary obstruction, portal hypertension and necrosis of the central portion of the cyst with abscess formation. Growth of the germinal membrane into blood vessels produces metastasis to almost any organ, but they are more commonly found in the lungs and brain (3). Although these are less common than unilocular cysts, they have been noted in Turkey, particularly in Erzurum, Kars, Ağrı, Diyarbakır and Konya, which are mainly in eastern Anatolia (1-10), as well as in other parts of the world.

Echinococcosis is still a serious health and economic problem particularly in the rural areas of Turkey, and so our aim is to describe the cases diagnosed at our institution over the past 21 years and to start a discussion on the current echinococcosis problem in Turkey.

## Materials and Methods

### Patients

Eighty cases of echinococcosis were diagnosed at Dokuz Eylül University Pathology Department over the last 21 years, 72 of which were caused by *E. granulosus* while 8 of them were caused by *E. alveolaris* (Table 1). The age, sex, localization and pathologic features of these cases have been re-evaluated. Together with the cases of echinococcosis previously reported in the Turkish literature, the echinococcosis problem in Turkey is briefly discussed.

### Statistical analysis

Statistical analysis was performed using a chi squared test and P values less than 0.05 were considered statistically significant.

## Results

### Pathological findings

In all 80 cases, surgically resected specimens were evaluated both macroscopically and microscopically with the aid of routine hematoxylin-eosin stained sections. Seventy-two cases (90%) were unilocular cystic echinococcosis (Figure 1), while 8 of them (10%) were multilocular (alveolar) echinococcosis (Figures 2a and b).

**Unilocular cystic echinococcosis:** Unilocular hydatid cyst is a slow-growing mass, which grows about 1 cm a year (4). In Turkey, eastern Anatolia is the endemic region for this disease, but it can be encountered in almost any part of the country (11,12). In our series, 54 cases were from the western provinces, while 18 were from the central and eastern provinces. The geographic distribution of 72 cases are shown in Table 2. About 75% of infected individuals develop one or more cysts in the liver, and the right lobe of the liver is affected more often than the left (4). Cysts may also develop in the lungs, kidneys, spleen, brain and musculo-skeletal system. The localizations of the cases in our series are shown in Figure 3. Histologically, the wall of the cysts have 3 structural components: (i) an outer acellular laminated membrane; (ii) the germinal membrane; and (iii) the protoscolices. In our series, females were affected 2 times more often than males and most of the patients were between the ages of 20 to 60 years, with a peak incidence in the third decade (Figure 4).

There were 5 cases with the involvement of multiple sites and again the liver was the most frequent organ followed by the lungs.

**Multilocular echinococcosis:** The clinical diagnosis of alveolar hydatid disease is more difficult than that of unilocular hydatidosis and the condition is often mistaken for a carcinoma (3). It is mostly seen in the liver with the symptoms of biliary obstruction, portal hypertension and necrosis of the central portion of the cyst with abscess formation. The necrosis is thought to be due to thrombosis of the vessels in this area. Any necrotic mass located in the liver must include *E. multilocularis* in the differential diagnosis, especially for patients from eastern Turkey (7). Growth of the germinal membrane into blood vessels produces metastasis to almost any organ, but they are more commonly found in the lungs and brain. Structurally these cysts are more complex, multivesicular, with infiltrative rather than expansive growth.

Regarding both unilocular and multilocular echinococcosis cases, females were more frequently affected than males, with a ratio of approximately 2 to 1, since 68.75% (55 cases) of the cases were female and 31.25% (25 cases) were male. As for the localization, 56.25% (45 cases) of the cases were localized in the liver, 17.5% (14 cases) in the lungs and 26.25% (21 cases) in other organs.

Table 1. The clinicopathologic features of 80 cases of echinococcosis, diagnosed at Dokuz Eylül University Pathology Department, between 1980 and 2001.

ECHINOCOCCUS GRANULOSUS							
No.	Age/sex	City	Organ				
				41	32,F	İzmir	Liver
				42	29,M	Manisa	Liver
				43	32,M	Kırşehir	Muscle (iliac)
				44	21,F	Aydın	Liver
1	46,F	Konya	Muscle(neck)	45	38,F	Balıkesir	Liver
2	37,F	İzmir	Liver	46	46,M	İzmir	Liver
3	65,M	Sivas	Liver	47	28,F	Muğla	Lung
4	30,F	Uşak	Liver	48	22,F	İzmir	Lung
5	49,F	Manisa	Left Tibia	49	24,F	Uşak	Liver
6	35,M	İzmir	Kidney	50	42,F	Yozgat	Liver
7	20,F	Balıkesir	Liver	51	47,M	Kars	Liver
8	27,F	İzmir	Liver	52	35,M	Manisa	Liver
9	40,F	Muğla	Vertebra	53	35,F	Sivas	Liver
10	60,F	İzmir	Liver	54	60,F	Balıkesir	Liver
11	21,F	İzmir	Liver	55	57,M	Afyon	Lung
12	54,F	Diyarbakır	Liver	56	46,M	Manisa	Vertebra
13	45,F	İzmir	Liver	57	40,F	Denizli	Lung
14	40,M	Romania	Scrotum	58	34,F	Afyon	Liver
15	42,M	Manisa	Liver	59	22,F	Kars	Liver
16	37,F	İzmir	Liver	60	35,F	Bitlis	Lung, liver
17	41,F	İzmir	Liver	61	30,F	İzmir	Spleen
18	52,M	Balıkesir	Lung	62	44,M	Balıkesir	Kidney
19	59,F	Isparta	Spleen	63	19,F	Manisa	Liver
20	78,F	Kars	Adnex	64	72,M	Denizli	Liver
21	62,F	Manisa	Liver	65	30,F	Aydın	Liver
22	44,M	Uşak	Lung	66	34,F	Erzurum	Liver, gall bladder
23	24,M	Denizli	Liver	67	65,F	İzmir	Liver
24	14,M	Denizli	Lung	68	61,F	Bitlis	Omentum
25	59,M	Aydın	Lung	69	29,F	Balıkesir	Lung, liver
26	15,F	İzmir	Lung	70	65,F	Aydın	Liver
27	40,F	Konya	Liver	71	54,F	Manisa	Liver
28	50,F	Aydın	Lung	72	49,M	Manisa	Vertebra
29	70,M	Burdur	Brain				
30	50,M	İzmir	Spleen,appendix, meso				
31	40,M	Diyarbakır	Liver				
32	17,M	İzmir	Lung				
33	57,F	Antalya	Lung	73	59,F	İzmir	Liver
34	21,F	İzmir	Liver	74	25,M	Erzurum	Liver
35	48,F	Diyarbakır	Liver	75	26,M	Kütahya	Liver
36	31,F	Erzurum	Heart, lung, liver	76	55,F	İzmir	Lung
37	40,F	Manisa	Liver	77	55,F	Muş	Liver
38	8,F	İzmir	Subhepatic	78	25,F	Erzurum	Lung
39	38,F	Aydın	Liver	79	58,F	Afyon	Liver
40	52,F	Van	Retroperitoneal	80	21,F	Erzurum	Liver

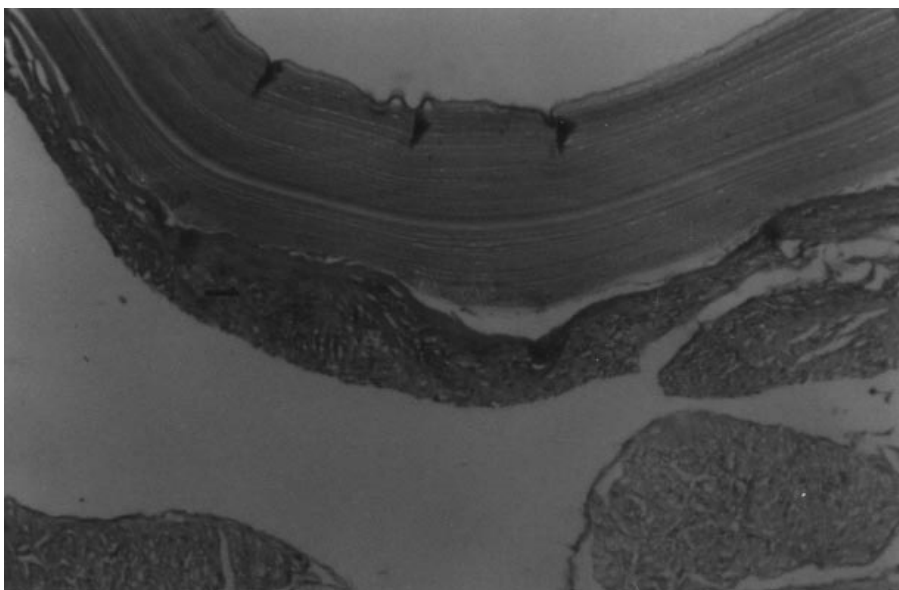


Figure 1. Left atrium unilocular cystic echinococcosis. The cuticular membrane is seen above the left atrium (arrow) (H&E X40), (1892/94).

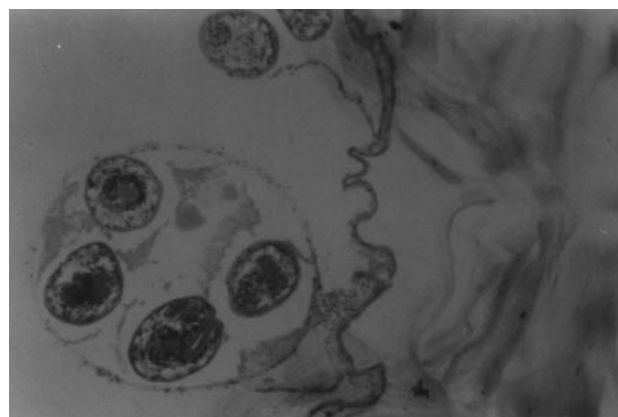
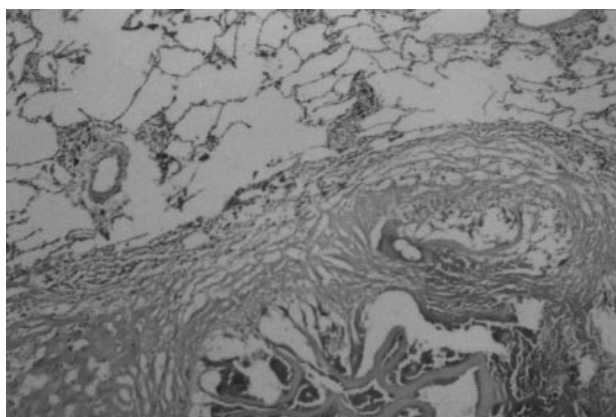


Figure 2. a: The histopathological section of *Echinococcus alveolaris* in the lung (H&E X40).  
b: Protoscolices aspirated from the cystic fluid of the lung, from the same case (H&E X100), (6986/93).

Statistically, there was a significant difference between geographic region and the localization of the disease ( $P = 0.022$ ), with the liver and lungs being the most commonly affected sites in western provinces.

Nearly all of the cases with rare localizations, like the kidneys (2 cases - 2.5%), spleen (2 cases - 2.5%), muscle (2 cases - 2.5%), vertebra (3 cases - 3.75%), omentum (1 case - 1.25%), brain (parietal lobe) (1 case - 1.25%), scrotum (1 case - 1.25%), retroperitoneal (1 case -

1.25%), subhepatic (1 case - 1.25%) and adnexial regions (1 case - 1.25%), and bone (left tibia) (1 case - 1.25%) were seen in association with unilocular echinococcosis.

### Discussion

Echinococcosis (unilocular and alveolar cysts) is one of the most important health problems in Turkey. Although

Table 2. Geographic distribution of the 72 unilocular cystic echinococcosis cases.

The western provinces of Anatolia (54 cases)	
İzmir	18
Manisa	10
Aydın	6
Balıkesir	6
Denizli	4
Uşak	3
Muğla	2
Afyon	2
Burdur	1
Isparta	1
Antalya	1
The central and eastern provinces of Anatolia (18 cases)	
Kars	3
Diyarbakır	3
Sivas	2
Bitlis	2
Erzurum	2
Konya	2
Kırşehir	1
Yozgat	1
Van	1
Romanian patient	1
TOTAL	72

it is mainly encountered in eastern Anatolia, because of the social and economic problems and migrations from east to west, the incidence of the disease has been increasing. Our results support this idea of the increasing incidence of the disease in western Anatolia, since 54 of the 72 unilocular echinococcosis cases were from western provinces. Again the fact that 4 of the 8 multilocular cystic echinococcosis cases (İzmir, Afyon and Kütahya) were from western Anatolia shows that cases are imported to İzmir from the endemic regions, and that immediate precautions have to be considered for eradication.

The most common sites of echinococcus cysts are the liver (60% to 70% of patients), brain and lungs, but they may occur in other locations including the spleen, soft tissue, bone, breast, heart and spinal extradural space (13,14). Some 56.25% of our cases were localized in the liver, 17.5% in the lungs and 26.25% in uncommon sites.

Grossly, hydatid cysts are solitary in about two thirds of cases. The cysts are usually 1 to 7 cm in size. The majority occur in the right lobe of the liver, but they may be multiple, involving all lobes (13). A histological examination of the cyst wall shows an outer chitinous (or fibrous laminar layer) and an inner germinal layer: this may be surrounded by either granulation tissue or a fibrous capsule (13).

The disease seems to be localized significantly more in the liver in western provinces ( $P = 0.022$ ) when compared to eastern parts; however, these patients applied directly to Dokuz Eylül University in İzmir, and primary cases in the central and eastern provinces should also be evaluated before making definitive conclusions.

Many scientists have studied the echinococcosis problem in Turkey in great detail. Prof. Dr. Muhittin Ülker, Prof. Dr. Ekrem Kadri Ünat, Prof. Dr. Mihri Mimioğlu and Prof. Dr. Ahmet Merdivenci are just a few of them (7,9,10).

In conclusion, echinococcosis is still an important health problem in Turkey that needs further study. There is a need for a suitable eradication program, so that untethered dogs as well as foxes, which play an important role in the contagiousness of the disease in rural areas, can be eradicated as an infectious agent in the new millennium.

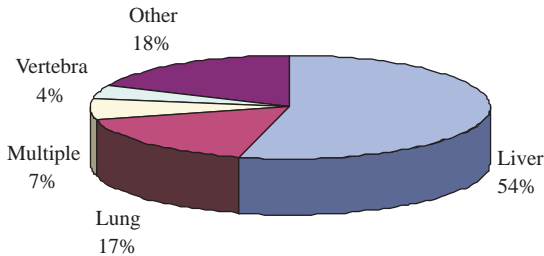


Figure 3. The localizations of the 72 unilocular cystic echinococcosis cases.

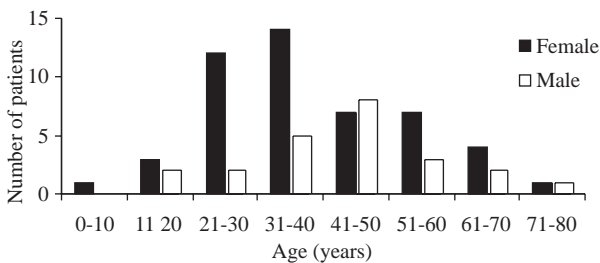


Figure 4. Age and sex distribution of the 72 unilocular cystic echinococcosis cases.

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