

Doubling time in pulmonary and hepatic hydatid cysts

Pulmoner ve hepatik kist hidatiklerde doubling time

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ABSTRACT

Background: This study aims to investigate whether the concept of doubling time in hydatid cysts differs according to different parameters such as age, sex, and whether the cyst is located in the lung or liver.

Methods: Between January 2012 and August 2023, a total of 138 hydatid cysts were retrospectively analyzed. There were 55 pulmonary (32 males, 23 females; mean age: 25.6±23.8 years; range, 2 to 77 years) and 83 hepatic hydatid cyst patients (32 males, 51 females; mean age: 31.1±22.8 years; range, 3 to 75 years).

Results: The mean doubling times for pulmonary and hepatic hydatid cysts were 73.4±41.8 and 172.6±108.8 days, respectively ($p<0.001$). When children (≤ 18 years old) and adult cases were compared for pulmonary hydatid cysts, the mean doubling times were 61.1±17.6 and 87.1±55.3 days, respectively ($p=0.119$), and for hepatic hydatid cysts, 110.6±48.4 and 215.6±118.3 days, respectively ($p<0.001$). While comparing male and female cases, the mean doubling time for pulmonary hydatid cysts was 77.6±32.2 and 67.6±52.6 days, respectively ($p=0.018$), while for hepatic hydatid cysts, it was 192.0±111.7 and 160.4±106.2 days, respectively ($p=0.250$).

Conclusion: The doubling time seems to be approximately 10 weeks in the lung and approximately 25 weeks in the liver. Hydatid cysts grow faster in children than adults in both the lungs and liver.

Keywords: Doubling time, hydatid cyst, liver, lung.

ÖZ

Amaç: Bu çalışmada kist hidatiklerde doubling time kavramının yaş, cinsiyet ve kistin akciğerde veya karaciğerde yerleşimine göre farklılık gösterip göstermediği araştırıldı.

Çalışma planı: Ocak 2012 - Ağustos 2023 tarihleri arasında toplam 138 kist hidatik retrospektif olarak incelendi. Elli beş pulmoner (32 erkek, 23 kadın; ort. yaş: 25.6±23.8 yıl; dağılım, 2-77 yıl) ve 83 hepatik kist hidatik hastası (32 erkek, 51 kadın; ort. yaş: 31.1±22.8 yıl; dağılım, 3-75 yıl) mevcuttu.

Bulgular: Pulmoner ve hepatik kist hidatik için ortalama doubling time sırasıyla 73.4±41.8 gün ve 172.6±108.8 gün idi ($p<0.001$). Pulmoner kist hidatik açısından çocuklar (≤ 18 yaş) ve erişkin olgular karşılaştırıldığında, ortalama doubling time sırasıyla 61.1±17.6 gün ve 87.1±55.3 gün ($p=0.119$) iken, hepatik kist hidatik açısından sırasıyla 110.6±48.4 gün ve 215.6±118.3 gün idi ($p<0.001$). Erkek ve kadın olgular karşılaştırıldığında, pulmoner kist hidatik için ortalama doubling time sırasıyla 77.6±32.2 gün ve 67.6±52.6 gün ($p=0.018$) iken, hepatik kist hidatik için sırasıyla 192.0±111.7 gün ve 160.4±106.2 gün idi ($p=0.250$).

Sonuç: Doubling time akciğerde yaklaşık 10 hafta, karaciğerde ise yaklaşık 25 hafta olarak görülmektedir. Kist hidatikler çocuklarda hem akciğer hem de karaciğerde erişkinlere kıyasla daha hızlı büyümektedir.

Anahtar sözcükler: Doubling time, kist hidatik, karaciğer, akciğer.

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Hydatid cyst disease is a parasitic disease which is prevalent in countries where agriculture and animal husbandry are common and has a wide geographical distribution worldwide.^[1,2] This disease is caused by metacestode larvae of the flatworm *Echinococcus granulosus*. It is transmitted to humans through the animal life cycle most commonly through dog feces.^[3-7]

The growth rate of hydatid cysts has not been well understood yet. It is clinically difficult to calculate the doubling time of a hydatid cyst. In the present study, we aimed to investigate the doubling times of pulmonary and hepatic hydatid cysts and whether the doubling time of hydatid cysts differed between lung and liver cysts or between age and sex.

PATIENTS AND METHODS

Patients

This two-center, retrospective study was conducted at Atatürk University Faculty of Medicine and Van Yüzüncü Yıl University between January 2012 and August 2023. A total of 3,260 cases diagnosed with pulmonary or hepatic hydatid cysts were assessed for study eligibility. Among these cases, those with hydatid cysts other than type 1 cysts in the liver and complicated cysts in the lung, those who received albendazole treatment, those who underwent puncture, aspiration, injection, and re-aspiration (PAIR) or who previously underwent surgery for any of their cysts in the liver and hydatid cyst cases older than five years who had computed tomography (CT) or magnetic resonance imaging (MRI) findings without radiological imaging in the previous three years were excluded from the study. Finally, a total of 138 hydatid cysts that met the inclusion criteria were recruited. There were 55 pulmonary (32 males, 23 females; mean age: 25.6±23.8 years; range, 2 to 77 years) and 83 hepatic hydatid cyst patients (32 males, 51 females; mean age: 31.1±22.8 years; range, 3 to 75 years).

In cases where hydatid cysts were found in the lung or liver but did not receive any treatment or did not accept treatment, the doubling time was calculated according to the volume of the cyst by comparing it with the control radiological images. Apart from these cases, if a hydatid cyst was detected in children aged ≤5 years, the cases were included in the study, even if they had no previous radiological imaging, and the doubling time was calculated for the general evaluation based on the date of birth (the diameter of the cyst was accepted as 1 mm). In addition, patients older than five years who had radiological findings showing the absence of hydatid cyst in the three years prior to the

diagnosis of a hydatid cyst were also included in the study. The doubling time was calculated using the date of normal radiological appearance as the milestone (the diameter of the cyst was accepted as 1 mm), and its volume at the time of hydatid cyst diagnosis.

Imaging studies

Abdominal and thoracic images were obtained using multi-slice CT (Siemens SOMATOM Definition AS+128, Forchheim, Germany) and MRI (1.5-T MRI scanner, Magnetom Symphony, Syngo MR B17; Siemens, Germany, 2009) devices, transferred to a multimodality post-processing system with medical monitor (syngo via, Siemens Healthcare GmbH, Erlangen, Germany). The images were reviewed by two radiologists with 16 and nine years of experience, and volume measurement was performed by drawing the cyst boundaries from the axial, coronal, and sagittal images. The volume of the hydatid cyst was, then, calculated by writing the length, width, and depth of the cyst to calculate the ellipsoid volume in the open access address <https://radiogyan.com/radiology-volume-calculator/>. As the results of the volume measurement using the two methods were similar, the volume was calculated online using an open-access volume calculation application.

The cyst, whose volume was calculated by writing the calculated volume at <https://www.calculat.org/en/volume-surface-area/sphere/>, was accepted as a sphere and its diameter was found. The first and control dates and diameters obtained were written to the regions at <http://radclass.mudr.org/content/doubling-time-calculation-growth-rate-lesion-or-mass-for-doubling-time-calculation-and-doubling-time-calculation> was performed.

Age, sex, cyst location, date of first diagnosis, date of second follow-up, cyst volumes, and doubling times of the cases were reviewed. It was evaluated whether there was a difference in doubling time between liver and lung cysts, between adults and children, and between male and female sex.

A total of 55 hydatid cysts were evaluated for doubling time calculation in pulmonary hydatid cysts. In 10 of these cysts, the patient was ≤5 years old and had no previous radiological image. For general calculation in these cases, the doubling time calculation was performed by assuming the date of transmission of the cyst as the birth of the child. Then, the doubling time was calculated assuming that the transmission was one year and two years ago. For the general calculation of 15 cases with normal radiological images within three years, the doubling time calculation was performed

assuming that the date of the normal radiological image was the date of parasite transmission. The doubling time was then calculated assuming that the parasite was transmitted one and two years ago.

A total of 83 hydatid cysts were evaluated for doubling time calculation in hepatic hydatid cysts. In 13 of these cysts, the patients were ≤ 5 years old and had no previous radiological images. In these cases, the date of transmission of the cyst was assumed to be the date of birth of the child for general calculation.

The doubling time calculation was performed. As in the lung, in these cases, in addition to the general evaluation, a doubling time calculation was also performed, which occurs when the cyst is assumed to have been infected one and two years ago. In addition, there were two cases with normal radiological appearance within three years. In these cases, the doubling time was also calculated assuming transmission one and two years ago.

Statistical analysis

Statistical analysis was performed using the IBM SPSS version 20.0 software (IBM Corp., Armonk, NY, USA). Descriptive data were presented in mean \pm standard deviation (SD), median (min-max) or number and frequency, where applicable. The normal distribution of continuous variables was analyzed using the Shapiro-Wilk W-test, Kolmogorov-Smirnov test, Q-Q plot, skewness, and kurtosis. For comparisons between two independent groups, the independent samples t-test was used when the normal distribution condition was met, and the Mann-Whitney U test when it was not. For categorical variables, the Pearson chi-square test was used when the expected value was (>5), the Yates chi-squared test when the expected value was (3-5), and Fisher exact test when the expected value was (<3). A *p* value of <0.05 was considered statistically significant.

RESULTS

A total of 117 cases were included in the study and doubling times were calculated for 138 hydatid cysts (doubling times were calculated for two hydatid cysts each in six cases of pulmonary hydatid cysts and 15 cases of hepatic hydatid cysts).

When the date of normal radiological imaging was used as the milestone for hydatid cyst (diameter=1 mm) in cases with normal radiological imaging within three years and the date of birth in children aged ≤ 5 years, the mean doubling time was 73.4 ± 41.8 days for pulmonary hydatid cyst and 172.6 ± 108.8 days for liver ($p < 0.001$) (Table 1). For pulmonary

Table 1. Age, time between measurements, volumes, and doubling times of pulmonary and hepatic hydatid cysts

	Pulmonary			Hepatic			<i>p</i>
	Mean \pm SD	Median	Min-Max	Mean \pm SD	Median	Min-Max	
Age (year)	25.6 \pm 23.8	17	2-77	31.1 \pm 22.8	27	3-75	-1.902 0.057
The elapsed time (days)	536.69 \pm 545.29	249	6-1636	395.16 \pm 625.59	55	9-1995	-1.472 0.141
The first volume (mm ³)	48406.78 \pm 137256.12	1	1-906825	199022.63 \pm 332591.18	85374	1-1915033	-5.033 0.000
The second volume (mm ³)	152844.24 \pm 200489.18	80935	2824-990252	302734.47 \pm 392910.15	168698	4173-2174634	-3.401 0.001
Doubling time (days)	73.38 \pm 41.8	61	33-286	172.58 \pm 108.77	128	26-498	-7.761 0.000
Contagion 1 year ago*	54.4 \pm 49.72	35	18-286	159.75 \pm 121.18	128	18-498	-5.716 0.000
Contagion 2 years ago*	65.35 \pm 45.06	47	33-286	163.37 \pm 117.14	128	26-498	-5.716 0.000

SD: Standard deviation; * Calculation of doubling time in children aged ≤ 5 years based on the date of birth and in cases with normal radiological appearance within three years, when hydatid cyst is considered to have been transmitted one and two years ago (Table 1-4).

hydatid cysts, the mean doubling time was 61.1 ± 17.6 days and 87.1 ± 55.3 days for children (≤ 18 years) and adults, respectively ($p=0.119$) (Figure 1). For hepatic hydatid cyst, the mean doubling time was 110.6 ± 48.4 days and 215.6 ± 118.3 days in children (≤ 18 years) and adults, respectively ($p<0.001$) (Table 2). Considering the pediatric cases, the pulmonary hydatid cyst grew faster than the liver (61.1 ± 17.6 days and 110.6 ± 48.3 days, respectively, $p<0.001$). Similarly, in adults, the pulmonary hydatid cyst grew significantly faster than the liver (87.1 ± 55.3 days and 215.6 ± 118.3 days, respectively, $p<0.001$) (Table 3). While comparing male and female cases, the mean doubling time for pulmonary hydatid cysts was 77.6 ± 32.2 days and 67.6 ± 52.6 days, respectively ($p=0.018$). While comparing male and female patients, the mean doubling time for hepatic hydatid cysts was 192.0 ± 111.7 days and 160.4 ± 106.2 days, respectively ($p=0.250$) (Table 4). In addition, in children aged ≤ 5 years with normal radiological imaging within three years and based on date of birth, the time of hydatid cyst transmission was assumed to be one year before and two years before diagnosis (diameter: 1 mm). Assuming that the pulmonary and hepatic hydatid cysts were infected one year ago, the mean doubling times were 54.4 ± 49.7 days and 159.8 ± 121.2 days, respectively ($p<0.001$). Assuming that the cyst was transmitted to the cases two years ago, the mean doubling times were 65.4 ± 45.1 days and 163.4 ± 117.1 days, respectively ($p<0.001$). When pulmonary hydatid cyst transmission was assumed to have occurred one year ago, the mean doubling time in children and adults was 31.6 ± 20.9 days and 79.9 ± 59.8 days, respectively ($p<0.001$). When

transmission was assumed to have occurred two years previously, the mean doubling time in children and adults was 47.1 ± 14.9 days and 83.6 ± 56.8 days, respectively ($p=0.001$). When transmission in the hepatic hydatid cyst was assumed to have occurred one year ago, the mean doubling time in children and adults was 80.7 ± 68.8 days and 214.6 ± 119.7 days, respectively ($p<0.001$). When transmission was assumed to have occurred two years previously, the mean doubling time in children and adults was 88.9 ± 61.7 days and 215.0 ± 119.1 days, respectively ($p<0.001$).

In 10 cases with pulmonary hydatid cysts ($n=5$ three years old, $n=4$ four years old, and $n=1$ two years old) and 13 cases with liver cysts ($n=6$ five years old, $n=5$ four years old, and $n=2$ three years old), the patient's date of birth was used as the basis. The median doubling time was calculated to be 73 days (range, 53 to 95 days) in cases with pulmonary hydatid cysts whose date of birth was considered as transmission. In these cases, the median doubling time was calculated to be 21 days and 42 days, respectively, if the date of hydatid cyst transmission was assumed to be one year and two years before diagnosis. The median doubling time was calculated as 93 days (range, 81 to 104 days) in cases with hepatic hydatid cysts where the date of birth was assumed to be the date of transmission. In these cases, the median doubling time was calculated to be 20 days and 40 days, if the date of transmission was assumed to be one year and two years before diagnosis, respectively.

In six patients with pulmonary hydatid cysts, doubling time calculations were performed separately

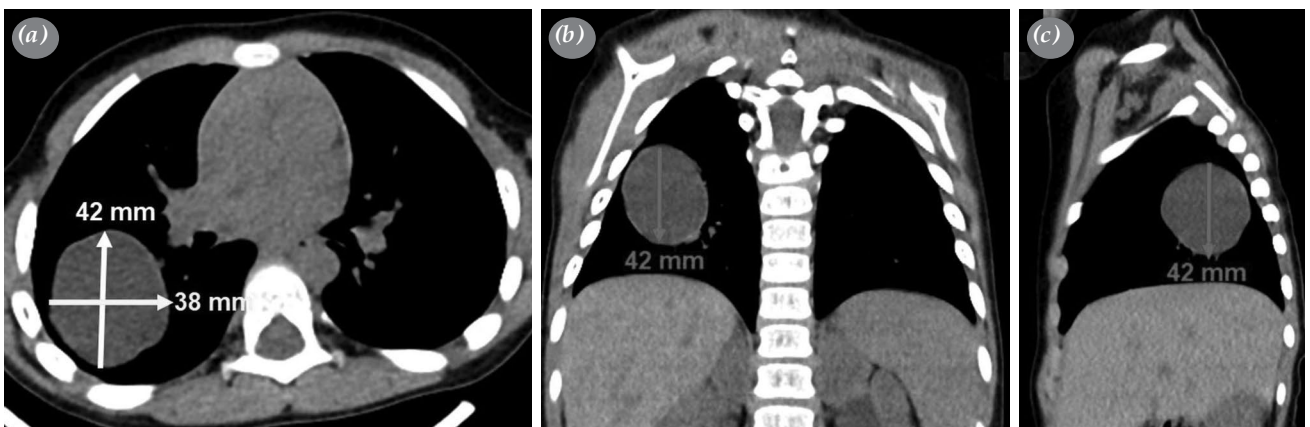


Figure 1. Considering the date of birth of a three-year-old male patient as the onset of the hydatid cyst, (a) axial, (b) coronal, and (c) sagittal computed tomography sections obtained 1,202 days later are shown. The volume of the cyst was measured to be 35057 mm^3 . In this case, the doubling time for the pulmonary hydatid cyst was calculated as 75 days, based on the contamination at birth (1 mm diameter). The doubling time was calculated to be 23 days if the time of infection of the cyst was assumed to be one year ago, and 46 days if it was assumed to be two years ago.

Table 2. Comparison of children and adults for pulmonary hydatid cysts and children and adults for hepatic hydatid cysts

	Children (≤18 age)				Adults				t, Z	p
	Mean±SD	Median	Min-Max	Mean±SD	Median	Min-Max				
Pulmonary										
Age (year)	7±5	4	2-18	47±18	44	21-77			-6.369	0.000
The elapsed time (days)	800±536	980	17-1636	243±387	67	6-1429			-3.507	0.000
The first volume (mm ³)	11273±26649	1	1-101885	89825±191086	19112	1-906825			-3.827	0.000
The second volume (mm ³)	159343±184507	82353	21746-898095	145595±220435	57636	2824-990252			-1.163	0.245
Doubling time (days)	61±18	58	33-95	87±55	78	35-286			-1.560	0.119
Contagion 1 year ago*	32±21	22	18-89	80±60	60	20-286			-4.372	0.000
Contagion 2 years ago*	47±15	42	33-89	84±57	60	35-286			-3.270	0.001
Hepatic										
Age (year)	9±5	8	3-18	46±17	43	20-75			-7.719	0.000
The elapsed time (days)	755±820	151	15-1995	146±225	43	9-1198			-2.464	0.014
The first volume (mm ³)	90362±157189	15156	1-657826	274420±397262	141285	1-1915033			-4.112	0.000
The second volume (mm ³)	209078±196764	143931	5062-730514	367721±476013	201221	4173-2174634			-1.421	0.155
Doubling time (days)	111±48	97	26-297	216±118	182	66-498			-4.964	0.000
Contagion 1 year ago*	81±69	82	18-297	215±120	182	20-498			-5.520	0.000
Contagion 2 years ago*	89±62	82	26-297	215±119	182	40-498			-5.529	0.000

SD: Standard deviation.

Table 3. Comparison of pulmonary and hepatic hydatid cysts in children and adults

	Pulmonary				Hepatic				t, Z	p
	Mean±SD	Median	Min-Max	Mean±SD	Median	Min-Max	t, Z	p		
Age ≤18 years	6.69±5.06	4	2-18	9.18±5.37	8	3-18	-2.341	0.019		
The elapsed time (days)	800.45±536.07	980	17-1636	754.94±820.18	151	15-1995	-.186	0.852		
The first volume (mm ³)	11273.03±26648.86	1	1-101885	90362.21±157189.4	15156	1-657826	-3.020	0.003		
The second volume (mm ³)	159343.48±184507.28	82353	21746-898095	209077.76±196763.81	143931	5062-730514	-1.241	0.215		
Doubling time (days)	61.1±17.6	58	33-95	110.62±48.38	97	26-297	-5.802	0.000		
Contagion 1 year ago*	31.59±20.92	22	18-89	80.65±68.8	82	18-297	-2.531	0.011		
Contagion 2 years ago*	47.12±14.92	42	33-89	88.91±61.7	82	26-297	-2.479	0.013		
Age >18 years	46.58±17.95	44	21-77	46.33±17.1	43	20-75	.000	1.000		
The elapsed time (days)	242.5±386.92	67	6-1429	145.51±225.34	43	9-1198	-.011	0.991		
The first volume (mm ³)	89825.19±191085.68	19112	1-906825	274419.65±397261.79	141285	1-1915033	-3.981	0.000		
The second volume (mm ³)	145595.08±220434.64	57636	2824-990252	367720.76±476012.7	201221	4173-2174634	-3.340	0.001		
Doubling time (days)	87.08±55.28	78	35-286	215.57±118.31	182	66-498	-5.494	0.000		
Contagion 1 year ago*	79.85±59.78	60	20-286	214.63±119.69	182	20-498	-5.405	0.000		
Contagion 2 years ago*	83.58±56.82	60	35-286	215.04±119.05	182	40-498	-5.422	0.000		

SD: Standard deviation.

Table 4. Comparison of males and females for pulmonary hydatid cysts and males and females for hepatic hydatid cysts

	Male			Female			t, Z	p
	Mean±SD	Median	Min-Max	Mean±SD	Median	Min-Max		
Pulmonary								
Age (year)	32±25	27	3-77	16±19	6	2-66	-2.676	0.007
The elapsed time (days)	520±545	275	6-1461	560±558	173	17-1636	-0.683	0.495
The first volume (mm ³)	72642±175343	14502	1-906825	14689±29602	1	1-125546	-1.309	0.190
The second volume (mm ³)	188253±244457	103227	2824-990252	103580±100477	58846	3840-349285	-1.177	0.239
Doubling time (days)	78±32	75	35-197	68±53	53	33-286	-2.373	0.018
Contagion 1 year ago*	59±43	50	18-197	48±58	33	19-286	-1.247	0.212
Contagion 2 years ago*	71±37	59	35-197	58±54	42	33-286	-2.591	0.010
Hepatic								
Age (year)	30±24	24	3-75	32±22	28	3-75	-0.501	0.616
The elapsed time (days)	507±679	140	15-1866	325±586	41	9-1995	-2.279	0.023
The first volume (mm ³)	215326±281503	127129	1-1158549	188793±363323	84067	1-1915033	-0.352	0.725
The second volume (mm ³)	364604±346488	245248	5062-1344240	263914±418043	154201	4173-2174634	-1.871	0.061
Doubling time (days)	192±112	158	81-464	160±106	128	26-498	-1.151	0.250
Contagion 1 year ago*	176±129	158	18-464	149±116	128	18-498	-0.791	0.429
Contagion 2 years ago*	181±124	158	37-464	153±113	128	26-498	-0.870	0.384

SD: Standard deviation.

for two hydatid cysts that met the study criteria. In these cases, an average difference of nine days (range, 1 to 21 days) was found between two cysts in the same individual.

In 15 cases of hepatic hydatid cysts, the doubling time was calculated separately for two hydatid cysts that met the study criteria. In these cases, an average difference of 23 days (range, 1 to 90 days) was found between two cysts in the same individual.

DISCUSSION

Our study results show that the overall doubling time is approximately 10 weeks for the lung and 25 weeks for the liver. Due to the date of birth in cases up to five years of age and the date of normal imaging in cases with normal radiographs up to three years ago, this period can be accelerated to eight weeks in the lung and up to 21 weeks in the liver. For pulmonary hydatid cysts, the doubling time can be shortened to five to nine weeks in children and 12 to 16 weeks in the liver, while in adults it can be extended to 11 to 13 weeks for the lung and up to 30 weeks for the liver. For both lung and liver, the doubling time was found to be shorter in females than in males, and this was significant for the lung.

The rate of growth of a hydatid cyst depends on the softness of the organ and the elasticity of the surrounding tissues.^[8] The relatively compact structure of the liver prevents excessive growth of the cyst and, therefore, cysts in this organ may remain undiagnosed for a long time due to the low number of symptoms they cause. On the other hand, the growth rate of hepatic hydatid cysts is not clear. Most reports indicate a growth rate of 1 to 2.5 mm per month, while some authors have reported a growth rate of 4 to 5 cm per year. In addition, cystic growth has been reported to be one centimeter in diameter for the first six months, after which it is closely related to host immunity and surrounding tissue resistance, and liver cysts have been reported to grow more slowly than lung cysts.^[9,10] In 1986, Romig et al.^[11] followed 44 hydatid cysts in 36 patients for up to 18 months using ultrasound for liver hydatid cysts. During the observation period, 66% of the cysts grew, while 34% remained stable, collapsed, or disappeared. The maximum cyst growth was over 130 mm with an average growth of 29 mm. Cyst enlargement was most common in patients aged 5 to 15 years (34%). This was followed by the 16 to 53 age group (20.3%) and growth was slowest in the oldest patients (14.4%). In our study, the median overall doubling time for the liver was 173 days. While comparing

hepatic hydatid cysts between children and adults, the median doubling time was significantly faster in children (111 days and 216 days, respectively). Only type 1 cysts for the liver were analyzed in our study, due to the cessation or slowing down of growth in complicated cysts.

Due to the spongy structure of lung tissue, cysts in the lung can grow larger than those in other organs and cause symptoms and signs earlier.^[12,13] It has been reported that lung cysts grow faster than liver cysts because the consistency of the lung is softer than that of the liver. Negative pleural pressure can also accelerate cyst growth.^[14,15] Due to more elastic lung tissue and lower lung compliance, cysts grow faster and larger in children than in adults.^[16-18] Borrie^[19] reported that the diameter of the hydatid cyst usually reached 1 to 2 cm at the end of six months and 6 cm in a year. Sarsam^[20] reported that the growth of pulmonary hydatid cysts was very variable and the cyst could reach large sizes without causing symptoms due to the elasticity of the lung tissue and the average diameter of the cyst is 1 to 2 cm per year. A decrease in the rate of cyst growth with increasing host age has also been reported in pulmonary cysts.^[11] There are no randomized-controlled trials in the literature to support these statements. As it is both very difficult and an important ethical issue to perform such a clinical trial prospectively, most statements about the doubling time of hydatid cysts in the literature are based on clinical observations and estimates. A recent publication presented a case showing that the doubling time of a pulmonary hydatid cyst in a child could be as short as seven to eight weeks.^[21] In our study, the overall doubling time for pulmonary hydatid cysts was 73 days. While comparing children and adults, the median doubling time was 61 and 87 days, respectively.

There was little difference in hydatid cyst growth between the sexes or between primary and recurrent infections.^[11] Recurrent infections were not evaluated in this study. While comparing male and female cases, the median doubling time for pulmonary hydatid cysts was 78 days and 68 days, respectively, and the difference was statistically significant. The median doubling time for hepatic hydatid cysts was 192 days and 160 days for male and female cases respectively; however, it did not reach statistical significance.

It should be noted that different cysts in the same patient may grow at different rates.^[11] In our study, two hydatid cysts were evaluated in 21 cases (six lung, 15 liver). In cases with pulmonary hydatid cysts, the

median difference in doubling time between two cysts in the same individual was nine days. For hepatic hydatid cysts, the difference was 23 days.

Nonetheless, this study has several limitations. First, the study was retrospective. Second, in children aged ≤ 5 years, calculating the doubling time by taking birth as the milestone and assuming that they were infected one or two years ago limits the exact evaluation of the doubling time, as the actual date of infection is not known. The same applies to cases with normal radiological imaging within three years. Third, since the study was retrospective, the calculation was based on the situation between the dates of first diagnosis and control imaging, and monthly growth could not be evaluated, as measurements could not be taken in between. Fourth, as the time interval between cases varied, there may be shortcomings in the assessment, since the growth of the cyst may change in a short time and in a long time. Finally, as CT and MRI were used in the measurements, the fact that they were not performed with the same imaging method may be a limiting factor of the study.

In conclusion, the growth of hydatid cysts in the lung and liver differs significantly. In general, the doubling time is about 10 weeks in the lung and 25 weeks in the liver. In children, the growth of the cyst in both the lungs and liver is faster than in adults. Although the growth of hydatid cysts in both the lung and liver is shorter in women than in men, it is significant for pulmonary hydatid cysts.

Ethics Committee Approval: The study protocol was approved by the Atatürk University Faculty of Medicine Clinical Research Ethics Committee (date: 02.06.2022, no: B.30.2.ATA.0.01.00/469). The study was conducted in accordance with the principles of the Declaration of Helsinki.

Patient Consent for Publication: A written informed consent was obtained from the patients and parents and/or legal guardians of the patients.

Data Sharing Statement: The data that support the findings of this study are available from the corresponding author upon reasonable request.

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