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RESEARCH ARTICLE

# Successfully Percutaneous Treatment with Ethyl Alcohol in Multiple Hepatic and Extrahepatic Hydatid Cysts; Long Term Outcomes

## Çoklu Hepatik ve Ekstrahepatik Hidatik Kistlerde Etil Alkol ile Başarılı Perkütan Tedavi; Uzun Dönem Sonuçlar

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**ABSTRACT**

**Objective:** Hydatid cysts are primarily treated surgically, and surgical treatment is associated with high morbidity, mortality, and prolonged hospitalization. However, over the last two decades, minimally invasive percutaneous treatments that provide favorable outcomes with low morbidity and mortality have been developed. In this study, we aimed to demonstrate a percutaneous treatment for disseminated liver hydatid cysts (CE) and to evaluate the therapeutic success rates and the advantages of alcohol as a scolicidal and sclerosing agent.

**Materials and Methods:** We retrospectively investigated 132 percutaneously treated CEs in 23 patients who were admitted with disseminated hepatic and extrahepatic CE between September 2016 and December 2018, each of whom had fewer than three cysts. CE type 1 (Gharbi type 1) and CE type 3a (Gharbi type 2) hydatid cysts measuring <6 cm were treated with puncture, aspiration, injection, and reaspiration (PAIR), whereas those >6 cm were treated with catheterization (SPC). All CE cysts classified as types 2 and 3b (the latter corresponding to Gharbi type 3) were treated using the modified catheterization technique (MoCAT).

**Results:** All 132 lesions in 23 patients were successfully treated percutaneously. The following observations were recorded: pseudotumor appearance in 80 cysts (60.61%); more than 50% reduction in cystic volume in 33 cysts (25%); thickening of the cyst wall, irregular cyst contours, and membrane detachment (numbers were not reported); less than 50% reduction in cystic volume in 10 cysts (7.58%); and complete disappearance in 9 cysts (6.82%).

**Conclusion:** Percutaneous treatments are safe and effective for patients with disseminated hepatic and extrahepatic hydatid disease and should be considered first-line therapy because surgical interventions are associated with high morbidity. When appropriate safety limits and precautions are observed, alcohol appears to be a safe and effective treatment for disseminated disease, demonstrating both scolicidal and sclerosing properties.

**Keywords:** Disseminated hydatid cysts, ethyl alcohol injection, extrahepatic hydatid cysts, interventional radiology, percutaneous cyst treatment

**ÖZET**

**Amaç:** Kist hidatik, yüksek morbidite ve mortalite oranlarına sahip ve daha uzun hastanede kalış süreleri olan invaziv cerrahi yöntemlerle tedavi edilir. Ancak son yirmi yılda, düşük morbidite ve mortalite oranlarıyla mükemmel sonuçlar sağlayan minimal invaziv perkütan tedaviler geliştirilmiştir. Bu çalışmada, yaygın karaciğer hidatik kistlerinin (HK) perkütan tedavisini ve ayrıca skolisidal ve sklerozan bir ajan olarak alkolün terapötik başarı oranlarını, etkinliğini ve avantajlarını göstermeyi amaçladık.

**Gereç ve Yöntemler:** Eylül 2016 ile Aralık 2018 tarihleri arasında yaygın karaciğer ve karaciğer dışı HK nedeniyle başvuran, <3 kist içeren toplam 23 hastanın perkütan tedavi edilen 132 HK'sini retrospektif olarak inceledik. HK tip 1 (Gharbi tip 1) ve tip 3a (Gharbi tip 2) <6 cm hidatik kistleri ponksiyon, aspirasyon, enjeksiyon ve reaspirasyon (PAIR) yöntemi ile tedavi edilirken, >6 cm kistler kateterizasyon (SPC) yöntemi ile tedavi edildi. Tüm HK tip 2 ve tip 3b (Gharbi tip 3) kistleri modifiye kateterizasyon (MoCAT) tekniği ile tedavi edildi.

**Bulgular:** 23 hastadaki 132 lezyonun tamamı (%100) perkütan olarak başarıyla tedavi edildi. 80 kistte (%60,61) psödotümör görünümü, 33 kistte (%25) %50'den fazla hacim küçülmesi, kist duvarında kalınlaşma, kist konturlarında düzensizlik, membran dekolmanı ve 10 kistte (%7,58) kist hacminde %50'den az küçülme ve 9 kistte (%6,82) tamamen kaybolma tespit edildi.

**Sonuç:** Perkütan tedaviler, hepatik ve ekstrahepatik yaygın hidatik kistli hastalarda başarılı sonuçlar sağlayan güvenli ve etkili yöntemlerdir ve cerrahi tedavilerle yüksek morbidite oranları nedeniyle yaygın hastalık için ilk tedavi yöntemi olmalıdır. Güvenli sınırlar ve önlemler sağlandığı takdirde, skolisidal ve sklerozan bir ajan olarak alkol, yaygın hastalıkta güvenli ve etkili görünmektedir.

**Anahtar Kelimeler:** Dissemine hidatik kist, etil alkol enjeksiyonu, ekstrahepatik hidatik kistler, girişimsel radyoloji, perkütan kist tedavisi

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## INTRODUCTION

Hydatid cyst (CE) is a parasitic zoonosis that is endemic to Turkey, the Mediterranean region, the Middle East, South America, Central Asia, Africa, New Zealand, and Australia. The larval form of Echinococcus granulosus causes CE (1). The liver is the primary site of CE, accounting for 50–70% of cases. Other organs, such as the lungs (5–30%), kidneys, spleen, muscles, brain, bones, peritoneum, heart, ovaries, adrenal glands, and thyroid gland, are also affected (2, 3).

In patients with hydatid cysts, invasive surgical methods are generally preferred despite their association with high morbidity, mortality, and prolonged hospital stays (4, 5). Over the last two decades, minimally invasive percutaneous treatments have yielded excellent outcomes, with low morbidity and mortality (6-13). In addition, medical treatment options for disseminated CE include albendazole (administered alone or in combination with praziquantel) or mebendazole (13-18). In this single-center study, we aimed to demonstrate percutaneous treatment of multiple hydatid cysts (CE) in the liver, spleen, lungs, and kidneys, and to assess the therapeutic success rates, the advantages of this approach, and the effectiveness of alcohol as a sclerosing and scolicidal agent.

## MATERIALS and METHODS

### *Patients*

Twenty-three patients (15 females and 8 males) admitted to the Interventional Radiology Unit between September 2016 and December 2018 for multiple hepatic and extrahepatic CEs (3–19 cysts) were retrospectively analyzed. The study was conducted in accordance with ethical principles and was approved by the Medical Faculty Local Ethics Committee (registration number 2020/2305). The benefits and complications of the procedure were explained to all patients, after which informed consent was obtained.

All CEs were primarily evaluated by ultrasonography (USG). Because of disseminated disease, CT scans of the chest and abdomen were obtained. No patients were diagnosed using serological tests. The definitive diagnosis of CE lesions was established by cytological examination of aspirates. Cysts were evaluated and classified according to the definitions of Gharbi et al. (19, 20) and the World Health Organization (WHO). The two classifications of hydatid cyst lesions are presented in Table 1.

### *Preliminary procedure evaluation*

After obtaining informed consent, prophylactic oral albendazole (10 mg/kg/day) was administered starting 10 days before the procedure and continued for 3 months afterward to reduce the risk of secondary spread. Complete blood count, prothrombin time, partial thromboplastin time, international normalized ratio (INR), and platelet count were assessed before the procedures. Patients with INR <1.5 and platelet count >50.000 /µl were included in the procedure. Because of the risk of anaphylaxis, all patients were monitored post-procedure by the same anesthesiologist. Intravenous methylprednisolone (1 mg/kg) and diphenhydramine HCl (20 mg) were administered before the procedure to prevent allergic reactions and reduce the risk of anaphylaxis.

### *The Procedures*

A single interventional radiologist with 15 years' experience performed the procedures under USG and fluoroscopic guidance. Under sterile conditions, local anesthesia with prilocaine hydrochloride was administered, and the targeted lesions were accessed under USG guidance. Hydatid cysts larger than 6 cm were treated with catheterization (SPC), whereas CE type 1 (Gharbi type 1) and CE type 3a (Gharbi type 2) cysts smaller than 6 cm were treated with puncture, aspiration, injection, and re-aspiration (PAIR). The modified catheterization (MoCAT) technique was applied to all CE types 2 and 3b (Gharbi type 3).

To access the CE lesions during the PAIR procedure, approximately 50% of the cyst sac fluid volume (calculated from USG measurements) was aspirated with an 18-G needle. Under USG guidance, a contrast agent (sodium amidotrizoate, Urografin, Bayer) was injected either until a volume corresponding to 10–20% of the cyst volume (calculated from USG measurements) was reached or until the cyst contour was clearly delineated, to evaluate cyst integrity and relationships with adjacent structures. After the cyst was re-aspirated, the cavity was filled with contrast medium (approximately 10–20% of the aspirated volume) and absolute alcohol (98%,

**Table 1.** Classifications of hydatid cyst lesions.

| WHO-IWGE | Gharbi | Ultrasonographic features | Status |
|---|---|---|---|
| CL | - | Unilocular cyst, no cyst wall, echo-free, non-pathognomonic findings | Active |
| CE1 | Type I | Smooth, echo-free content single-cell simple cyst, wall, mobile internal echogenicity (snowflake mark) | Active |
| CE2 | Type III | Multivesicular, multi-stage cyst, daughter cysts, wheel-like / rosette-like / honeycomb pattern | Active |
| CE3A | Type II | Membrane cyst (water lily sign) | Transient |
| CE3B | Type III | Cyst with solid matrix | Transient |
| CE4 | Type IV | Heterogeneous hypoechoic or hyperechoic cyst. No daughter cyst | Passive |
| CE5 | Type V | Thick, calcified walled solid cyst | Passive |

WHO-IWGE: The World Health Organization Informal Working Group on Echinococcosis, CL: cystic lesion, CE: cystic echinococcosis

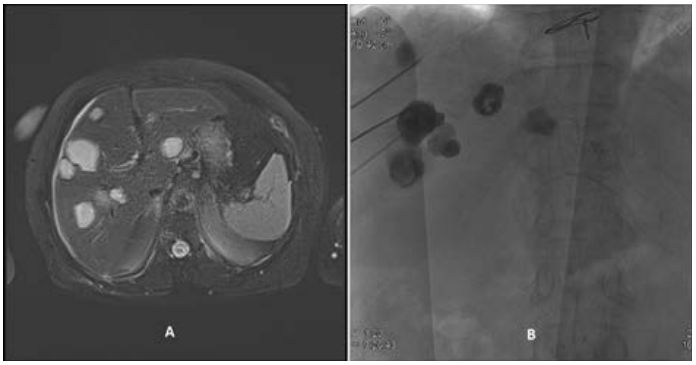


**Figure 1.** Section A represents disseminated hydatid cysts with diameters less than 6 cm are observed in the right and left lobes of the liver on T2-weighted MR sections in the axial plan. Section B represents fluoroscopic images of disseminated hydatid cysts treated percutaneously with PAIR technique.

approximately 30–50% of the aspirated volume). Before re-aspirating the injected alcohol-opaque mixture, an interval of 7–10 minutes was allowed to observe the separation of the endocyst from the pericyst (Figure 1).

Using the SPC method, an 8-Fr catheter (Bioteq, Taipei, Taiwan) was inserted into the cyst via the trocar technique under USG guidance. After the cyst contents were aspirated, it (the cyst) was refilled with 20–30% of the aspirated volume, and the integrity of the cyst and its relationships with surrounding structures were assessed under fluoroscopic guidance. After re-aspiration, the cavity was filled with absolute alcohol (98% ethanol; approximately 30–50% of the aspirated volume) and a contrast medium (10% of the cystic volume). The cyst cavity was re-aspirated after 20 minutes. To avoid ethanol intoxication resulting from large cyst diameters, numerous cysts, or insufficient emptying of ethanol during drainage, each cavity was irrigated with 500 mL of saline (0.9% NaCl) and then allowed to drain (Figure 2).

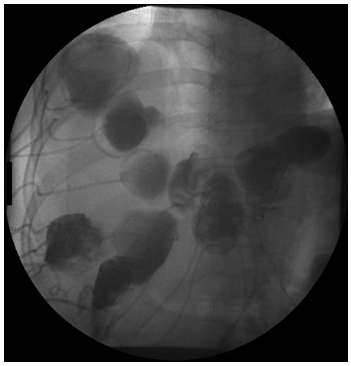


**Figure 2.** Fluoroscopic images of hepatic and left renal localized disseminated hydatid cysts treated percutaneously.

Operators accessed the cysts under USG guidance using the MoCAT technique with a 14-Fr catheter. The cyst contents were evacuated as completely as possible; the cavity was then irrigated with saline and aspirated. Daughter vesicles were fragmented by negative pressure and aspirated through the catheter. After complete aspiration of the daughter cysts, cystography was performed to confirm the absence of communication between the cyst and the bile ducts, and the cyst was subsequently reaspirated. Absolute ethanol (approximately 30–50% of the aspirated volume) and a contrast medium (approximately 10% of the cystic volume) were then injected into the cavity. After a 20-minute wait, the cyst was re-aspirated. After the catheter was secured to the skin, the cysts were drained into collection bags.

During the procedure, the total volume of absolute alcohol administered to any patient did not exceed 500 mL. All patients were monitored at the Interventional Radiology Unit after the procedures for early complications, including ethanol intoxication. Patients treated percutaneously were hospitalized for one day after the procedure and underwent USG evaluation the following day. Catheters were removed when drainage from the cavity was less than 10 mL/day.

Follow-up

Sonography was used for patient follow-up at 1, 4, 7, 10, and 13 months after the initial procedure and annually thereafter. In follow-up evaluations of treated hydatid cysts, changes in size, volume, contents, and wall properties were examined. Increased cystic wall thickness and echogenicity; decreased cyst size and volume; complete separation of the endocyst from the pericyst; decreased acid content; and resolution of the pseudotumor appearance were considered positive indicators of recovery. Hydatid cyst recurrence was defined as an insufficient reduction in the size of treated CE lesions and the emergence of new daughter cysts (7-11).

***Statistical Analysis***

Data obtained in this study were analyzed using the Statistical Analysis System (SAS University Edition), version 9.4. Categorical variables were expressed as counts and percentages. Mixed-effects models were used to compare the numerical variables. Values of $p < 0.05$ were considered statistically significant.

## RESULTS

The mean age of the 23 patients (8 males and 15 females) was 46.78 ± 20.05 years (range 18–83 years). Cysts were classified as follows: 115 (87.12%) CE type 1 (Gharbi type 1), 12 (9.09%) CE type 3a (Gharbi type 2), and 5 (3.79%) CE type 2 (Gharbi type 3). The mean cyst diameter was 52.7 ± 26.1 mm. Among all cysts, 87 (67.42%) were located in the right hepatic lobe and 40 (30.30%) in the left hepatic lobe. Additionally, two cysts (1.52%) were located extrahepatically in the left kidney, and one cyst (0.75%) was located in the rectus muscle. Five patients had pulmonary hydatid cysts.

All 132 lesions in 23 patients were successfully treated percutaneously. The mean number of treated cysts per patient was 5.74 (range, 3–19). PAIR, SPC, and MoCAT were used to treat

**Table 2.** Demographics and characteristics of the patients

| Method | Frequency | Percent | Cumulative Frequency | Cumulative Percent |
|---|---|---|---|---|
| PAIR | 81 | 61,36 | 81 | 61,36 |
| SPC | 46 | 34,85 | 127 | 96,21 |
| MoCAT | 5 | 3,79 | 132 | 100 |

PAIR: Puncture of cyst, Aspiration of cyst contents, Injection to sterilize the cyst, and Re-aspiration, SPC: Single Puncture Catheterization, MoCAT: Modified Catheterization Technique

**Table 3.** Follow-up results of percutaneous treatments.

| Final image | Frequency | Percent | Cumulative Frequency | Cumulative Percent |
|---|---|---|---|---|
| Disappeared | 33 | 25 | 33 | 25 |
| Pseudotumor | 80 | 60,61 | 113 | 85,81 |
| <50% | 9 | 6,82 | 122 | 92,42 |
| >50% | 10 | 7,58 | 132 | 100 |

**Table 4.** Results of treatment with percutaneous methods.

| Treatment method | Final image | | | | |
|---|---|---|---|---|---|
| Frequency | Disappeared | Pseudotumor | <50% | >50% | Total |
| PAIR | 32 | 47 | 1 | 1 | 81 |
| | 39,51 | 58,02 | 1,23 | 1,23 | |
| SPC | 1 | 28 | 8 | 9 | 46 |
| | 2,17 | 60,87 | 17,39 | 19,57 | |
| MoCAT | 0 | 5 | 0 | 0 | 5 |
| | 0 | 100 | 0 | 0 | 132 |
| Total | 33 | 80 | 9 | 10 | |

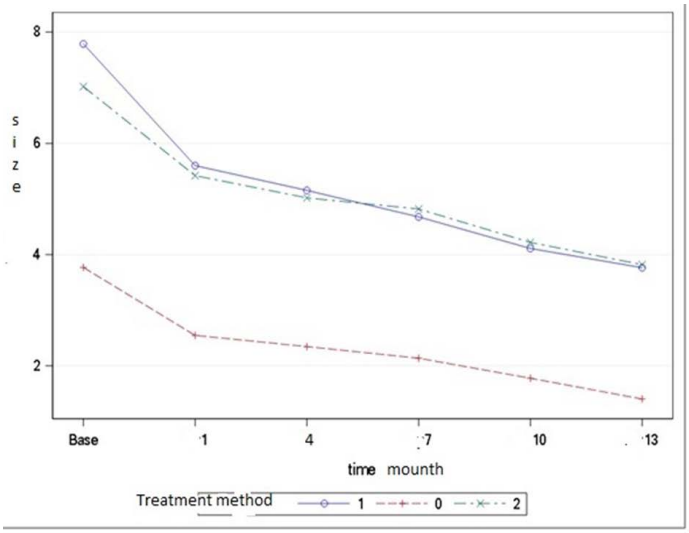
PAIR: Puncture of cyst, Aspiration of cyst contents, Injection to sterilize the cyst, and Re-aspiration, SPC: Single Puncture Catheterization, MoCAT: Modified Catheterization Technique

81 (61.36%), 46 (34.85%), and 5 (3.79%) of the CEs, respectively (Table 2). In addition to the hepatic cysts, two renal CEs and one CE in the rectus muscle were treated percutaneously. Following surgical treatment of lung-localized CEs, disseminated hepatic CEs were treated percutaneously.

The mean follow-up period was 19 months, with a range of 13–45 months. By the 13th month of follow-up, the mean diameter of effectively treated CEs was 23.3 ± 17.6 mm. At the 13-month follow-up, features of the cysts treated with different percutaneous methods are summarized in Tables 3–5. Despite a statistically significant reduction in lesion size was detected with all three percutaneous treatment methods (Student's t-test, $p < 0.001$), pseudotumor formation remained the most common outcome. The following findings were observed: pseudotumor-like appearance in 80 cysts (60.61%); more than 50% volume reduction in 33 cysts (25%); irregular cyst contours; cyst wall thickening; less than 50% volume reduction with membrane detachment in 10 cysts (7.58%); and complete disappearance in 9 cysts (6.82%). A local recurrence was observed in a degenerated hydatid cyst during the patient's second year, and the cyst was retreated using the PAIR method. Most patients who underwent catheterization were hospitalized for 1–2 days, whereas those treated with the PAIR method were discharged on the same day following 5–6 hours of observation. The mean duration of hospitalization was 1.52 ± 2.5 days (range: 0–35 days).

None of our patients experienced major complications, such as anaphylaxis, rupture, or intra-abdominal dissemination, and no deaths occurred. Only six patients experienced minor complications. Complications are listed in Table 6. Despite prophylaxis, minor allergic reactions (urticaria) and bile fistulae were detected in two patients each (8.7%). Fistula flow rates were measured in patients with biliary fistulas. Two patients with high-flow fistulae (>300 mL/day) whose fistula flows had not decreased for more than one week underwent endoscopic treatment. After an endoscopic intervention, a patient with a high-flow bile fistula developed an abscess containing two cysts and was recatheterized with larger-caliber catheters and treated with daily irrigation and appropriate medications (Figure 3). In one patient who presented with cholestasis, the germinative membranes of the cyst extended into both the intrahepatic and extrahepatic biliary tracts. In this patient, the cyst was punctured and a catheter was placed. Intracavitary germinative membranes were aspirated, and the bile ducts were accessed via the fistula. After the balloon dilatation of the sphincter of Oddi, the germinative membranes were displaced from the bile ducts into the duodenal lumen.

**Table 5.** Follow-up sizes of hydatid cysts treated with percutaneous methods.



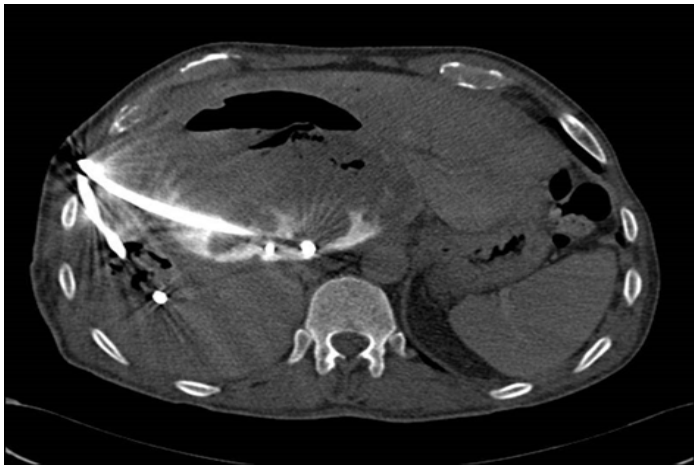



**Figure 3.** Images of percutaneous treatment of a patient who had high-flow bile fistula and developed abscess in the hydatid cysts cavities after the endoscopic intervention. CT axial plane images show the infected hydatid cyst cavities with wide-diameter drainage catheters.

**Table 6.** Minor complications of percutaneous treatments.

| Complications | Frequency | Percent | Cumulative frequency | Cumulative percent |
|---|---|---|---|---|
| None | 17 | 73,91 | 17 | 73,91 |
| Urticaria | 2 | 8,7 | 19 | 82,61 |
| Abscess | 2 | 8,7 | 21 | 91,3 |
| Fistula | 2 | 8,7 | 23 | 100 |

## DISCUSSION

The results of this study indicate that percutaneous treatment should be the initial procedure for hepatic and extrahepatic CEs and that the application of absolute alcohol as a sclerosing and scolicidal agent is safe and effective. Ultrasonography is a widely used imaging modality for the screening and diagnosis of CE lesions (3, 21). Conversely, USG is used during treatment and follow-up (3). Cyst types are defined by USG findings according to the Gharbi and WHO classifications (19, 20). Computed tomography (CT) images of the CE are not pathognomonic and may be mistaken for benign lesions (e.g., congenital cysts, pseudocysts, and hematomas) or malignant lesions (e.g., solitary or multiple metastases) (22, 23). However, CT is superior to magnetic resonance imaging (MRI) in detecting lesional and wall calcifications. MRI, an effective imaging modality for detecting soft-tissue hydatid cysts, clearly demonstrates the separation between the pericyst and the endocyst. The cystic wall demonstrates low signal intensity on both T1- and T2-weighted images (24). In this study, USG was used for the primary diagnosis and follow-up of CE lesions. However, CT or MRI scans were performed to exclude extrahepatic disease in patients with disseminated hepatic disease. In addition to hepatic CEs, hydatid cysts were identified in the kidneys of two patients and the lungs of five patients.

Albendazole and mebendazole (benzimidazoles) are used in the medical treatment of CE lesions. It has been reported in the past few years that the combination of praziquantel and albendazole has yielded better results (14-18) However, the use of these agents alone in medical treatment may be insufficient, particularly for large-diameter hydatid cysts. These agents are administered before and after percutaneous treatment to prevent abdominal dissemination and recurrence (7, 11). In this study, oral albendazole was administered to all patients for 10 days before and 3 months after the procedure. Although surgical treatments are associated with high morbidity and mortality rates, poor cost-effectiveness, and other disadvantages, such as invasiveness, they remain the standard treatment for hydatid cysts. Surgical procedures are associated with an even higher risk of morbidity and mortality in the presence of disseminated disease (4, 5, 25-27). We believe that medical treatment and percutaneous interventions should be

preferred in cases of disseminated disease.

Percutaneous treatments are less invasive and reliable alternatives to surgery. These modalities should be preferred for treating hepatic and extrahepatic CE lesions because they are associated with lower rates of complications and recurrence, and shorter hospital stays (6-13). Percutaneous treatment of hepatic CEs can be performed using PAIR, SPC, or MoCAT. In the method described by Akhan et al (8), cysts greater than 6 cm are treated by catheterization. Alcohol, used as a sclerosing agent, was usually injected the day after the procedure. Nayman et al. (11]) reported a therapeutic success rate of 97.7% and minor and major complication rates of 11.7% and 0.55%, respectively, in patients treated solely with the modified PAIR technique. In the present study, we employed different percutaneous treatment modalities, selected according to the location, size, and type of each lesion, to maximize therapeutic success and minimize complications and recurrences. Hydatid cysts larger than 6 cm were treated with catheterization (SPC), whereas CE type 1 (Gharbi type 1) and CE type 3a (Gharbi type 2) hydatid cysts smaller than 6 cm were treated with puncture, aspiration, injection, and re-aspiration (PAIR). A modified catheterization technique (MoCAT) was performed in all cases of CE types 2 and 3b (Gharbi type 3).

The success of percutaneous treatments may vary depending on lesion type and size. Kabaalioğlu et al. (13) reported an 80% success rate among 77 hydatid cyst lesions treated with the PAIR method. In that study, success rates were higher for CE type 1 (Gharbi type 1) and CE type 3a (Gharbi type 2) lesions than for CE type 2 and CE type 3b (Gharbi type 3) lesions. Our success rate was 99.25%. All three percutaneous treatment methods produced a statistically significant decrease in lesion size. In patients treated with the PAIR method, the complete disappearance rate was 6.82%, higher than those for the other two techniques. This result confirms that the rate of complete disappearance increases as cystic volume decreases. Consistent with the literature, pseudotumor formation was the most common finding across all three methods used in our study. In a study by Yağcı G et al (27), the reported recurrence rates were 16.2%, 3.3%, and 3.5% for laparotomic surgery, laparoscopic surgery, and PAIR, respectively. In the present study, only one CE lesion (0.75%) recurred and was successfully treated with an additional percutaneous intervention. None of the patients required surgical intervention.

Percutaneous treatments can also be performed using various agents. The most commonly used endocavitary scolicidal agent is hypertonic saline (8, 28). However, ethanol is used for its sclerosing effect in larger catheterized lesions. Alcohol has well-known scolicidal and sclerosing effects that are greater than those of 20% hypertonic saline (29). Since alcohol injection provides both scolicidal and sclerosing effects during a single session, the procedure is completed with a single agent (30). In large-volume cysts, the germinative membrane prevents drainage of residual alcohol, which we believe increases the risk of intoxication. In a study by See Young Jang et al. (31), up to 500 mL of alcohol was instilled in a single session to achieve effective ablation of hepatic cysts. Danny Cheng et al (32) recommend limiting the volume of ethanol to 100 mL in adults undergoing treatment for simple hepatic cysts to prevent systemic alcohol intoxication and monitoring patients for signs of alcohol intoxication. In the present study, we injected up to 500 mL of absolute alcohol into the cyst cavities of patients with large-volume, disseminated hydatid cysts and maintained exposure for 20 minutes while patients were repositioned into different orientations. Each cavity was subsequently irrigated with 500 mL of saline and left to drain freely. At follow-up, we observed that irrigation with saline did not reduce the sclerosing effect and that the cysts' response to percutaneous treatment was consistent with the literature. We propose that saline irrigation removes residual alcohol from the cystic cavity, thereby reducing the risk of alcohol intoxication in patients with large-diameter or multiple cysts.

Another reason alcohol is not preferred as a primary therapeutic agent is the risk of sclerosing cholangitis secondary to bile leakage. In patients with cysts that communicate with the bile ducts, the use of 20% hypertonic saline solution is recommended because of the risk of sclerosing cholangitis (8). In our study, two patients developed biliary fistulas after percutaneous treatments. Despite intracavitary injection of alcohol, used as a scolicidal agent, none of the patients developed symptoms consistent with sclerosing cholangitis. A bile fistula becomes noticeable after the first puncture, when the cyst contents are aspirated and the pressure is lowered (33). Therefore, we believe that in patients with no bile leak detected on the initial cystogram, alcohol, when injected at volumes not exceeding 30% of the cyst volume, neither enters the biliary tract nor causes sclerosing cholangitis. Allergic reactions — even anaphylactic reactions, which are typically characterized by urticaria, mucosal erythema, and swelling — are adverse events that may result from cyst rupture, leakage, and spillage (1, 34). In the literature, various methods to mitigate leakage risk have been described. Kabaalioğlu et al. (13) minimized the risk of leakage from all right-lobe cysts by employing an intercostal approach through the liver parenchyma. Corona et al. (35) used a coaxial system, consisting of a 20-cm-long needle enclosed within a 10-Fr outer sheath, to reduce the risk of leakage. In the present study, some patients did not develop anaphylaxis despite undergoing 18–19 punctures for disseminated disease. In our opinion, rapid reduction of intracystic pressure in large-diameter cysts by single-stage trocar catheterization without dilatation decreases the risk of leakage of fluid into adjacent tissues or the peritoneal cavity. In this study, only two patients developed minor allergic reactions consistent with urticaria; both responded to treatment with antihistamines and steroids.

Although the patient cohort was smaller than planned, the available sample size still allowed us to generate meaningful findings that enhance therapeutic approaches and prognostic assessments for patients with hydatid disease. In conclusion, percutaneous treatments are safe and effective, providing successful outcomes for patients with disseminated hepatic and extrahepatic hydatid cysts. They should be initial treatments for disseminated disease, because surgical treatment is associated

with high morbidity. If appropriate limits and precautions are observed, alcohol appears to be a safe and effective scolicidal and sclerosing agent in disseminated disease.

***DECLARATIONS***
***Conflict of Interest:*** *The authors declare no conflict of interest.*

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***Author Contributions:*** *Concept: SB, MK, Design: SB, MK, BT, Data Collection or Processing: SB, BT, Analysis or Interpretation: MK Literature Search: SB, MK, BT, Writing: SB, MK*

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