

Ultrasound-guided percutaneous sclerotherapy of a canine hepatic cyst using lower-concentration ethanol: A case report

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Abstract

A 10-year-old female Pomeranian was referred after a hepatic cyst was incidentally identified during a routine health check. Ultrasound-guided simple drainage was initially performed, and cytological examination of the aspirated fluid confirmed a simple cyst. However, the cyst re-expanded to its original size within 2 weeks. Therefore, ultrasound-guided percutaneous sclerotherapy was elected using lower-concentration ethanol (83%), a readily available medical disinfectant, rather than conventional high-concentration ethanol. Approximately 50% of the aspirated volume was replaced with 83% ethanol and retained for 20 min to achieve effective epithelial ablation. Post-procedural follow-up revealed a transient increase in cyst size and serum alanine aminotransferase levels on day 3, attributed to the inflammatory sclerosing process; however, these changes resolved spontaneously by day 20. Complete cyst regression was confirmed by day 60, with no recurrence during the 1-year follow-up. This case suggests that lower-concentration ethanol (83%) is a feasible, safe, and effective sclerosing agent for canine hepatic cysts and may represent a practical option in clinical settings where high-concentration ethanol is unavailable.

Keywords: ablation, dog, ethanol, hepatic cyst, sclerotherapy

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Introduction

Simple hepatic cysts are occasionally identified in dogs, most often as incidental findings on diagnostic imaging. Although usually benign and asymptomatic, treatment is warranted when progressive enlargement causes clinical signs such as abdominal distension, pain, or compression of adjacent organs (Fossum, 2019; Shimizu *et al.*, 2022). Traditional treatments include surgical excision or fenestration (Lafuente *et al.*, 2018; Corbarieu *et al.*, 2025), but these approaches carry risks associated with general anesthesia and invasiveness. Simple drainage provides only temporary size reduction and is prone to recurrence because the epithelial lining remains intact and continues to produce fluid (Cheng *et al.*, 2012; Skolarikos *et al.*, 2012; Pfahl and Gallaher, 2023). Therefore, definitive management requires sclerotherapy, which involves injecting a chemical agent to ablate the epithelial lining, induce irreversible fibrosis, and prevent fluid re-accumulation (Albanese and Kondo, 2010). Ethanol is the most widely used sclerosing agent because of its cost-effectiveness and efficacy (Gelczer *et al.*, 1998; Cheng *et al.*, 2012). It induces cellular dehydration, protein denaturation, and membrane lysis, resulting in coagulative necrosis of the cyst wall (Albanese and Kondo, 2010; Cheng *et al.*, 2012). Conventionally, high-concentration ethanol (95–99%) is recommended for optimal efficacy (Zatelli *et al.*, 2005; Zatelli *et al.*, 2007; Agut *et al.*, 2008; Pfahl and Gallaher, 2023); however, sterile formulations at this concentration are often unavailable in general veterinary practice. A recent study reports that 83% ethanol, a widely available medical disinfectant, is effective for renal cyst sclerotherapy in dogs (Yoon *et al.*, 2023). To our knowledge, no study on its use for hepatic cysts in dogs exists. Therefore, this report describes the successful ultrasound-guided percutaneous sclerotherapy of a simple hepatic cyst in a dog using a lower-concentration ethanol solution.

Case description

A 10-year-old intact female Pomeranian weighing 5.1 kg was referred to the Veterinary Medical Teaching Hospital at Kyungpook National University for evaluation of hepatomegaly and a hepatic cyst detected during a routine health check. The owner reported frequent scratching of the left cranial abdomen, suggesting discomfort. Physical examination revealed mild cranial abdominal distension and a palpable protrusion consistent with suspected inguinal fat herniation.

Serum biochemistry showed mildly increased alanine aminotransferase (ALT) activity (225 U/L; reference interval [RI]: 12–101 U/L) and gamma-glutamyl transferase activity (14 U/L; RI: 0–7 U/L), while the complete blood count was unremarkable. Abdominal radiographs showed a round soft-tissue opacity at the caudal liver margin, causing significant displacement of adjacent gastrointestinal segments (Fig. 1). Based on these radiographic findings, differential diagnoses included a hepatic tumor, a hepatic cyst originating from the left liver lobe or quadrate lobe, or a distended gallbladder. Abdominal ultrasound images showed a large anechoic cystic

structure at the margin of the left liver lobe. The cyst presented with a thin (< 1 mm), mildly hyperechoic wall, distal acoustic enhancement, and a small amount of internal echogenic debris, with no blood flow detected on color Doppler ultrasonography. The gallbladder was visualized within the right hepatic lobes, apart from the cystic lesion.

Initial treatment involved ultrasound-guided percutaneous drainage performed under mild sedation with butorphanol (0.2 mg/kg, IV; Butophan, Myungmoon Pharmaceutical, Seoul, Korea). The patient was positioned in dorsal recumbency, and a 22-gauge, 32-mm needle was inserted into the cystic lesion in the left liver lobe via a left paramedian cranial abdominal approach. Approximately 210 mL of clear yellow fluid was aspirated over 5 minutes, reducing the cyst size from 82 × 55 mm to 13 × 12 mm. Fluid analysis identified a modified transudate (total nucleated cell count, 640/μL; total protein, 4.3 g/dL; specific gravity, 1.033), and cytologic examination revealed no microorganisms or neoplastic cells, consistent with a simple hepatic cyst. However, at a 2-week recheck, the cyst had re-expanded to 66 × 46 mm (Fig. 2A). Treatment options, including surgery and percutaneous sclerotherapy, were discussed with the owner, who elected ultrasound-guided percutaneous ethanol sclerotherapy because of concerns regarding anesthetic risks and surgical invasiveness.

The procedure was performed under general anesthesia, with pre-anesthetic medication consisting of butorphanol (0.3 mg/kg, IV). Anesthesia was induced with propofol (5 mg/kg, IV; Anepol, Hana Pharmaceutical, Seoul, Korea) and maintained with sevoflurane (Sevofran; Hana Pharmaceutical, Seoul, Korea) in 100% oxygen via endotracheal intubation. The patient was positioned in dorsal recumbency, and a 22-gauge, 32-mm needle was inserted into the cyst under ultrasound guidance using a linear transducer (10 MHz; UST-5415; ALOKA Prosound F75, Hitachi Aloka Medical, Tokyo, Japan) and connected to a 50 cm extension set with a 3-way valve. Approximately 80 mL of cyst fluid was aspirated as completely as possible, leaving a minimal residual volume to maintain cyst wall visualization and minimize needle displacement risk. After fluid removal, the needle remained in place, and 40 mL of 83% ethanol (Green Pharmaceutical, Eumseong, Korea), was slowly injected into the cyst cavity, corresponding to half the aspirated volume. Immediately after injection, the intracystic fluid became hyperechoic and cloudy on real-time ultrasonography. With the needle maintained in situ, the patient was tilted 15° to the left and right for 10 min each to maximize ethanol contact with the inner cyst wall. After the retention period, as much fluid as possible was re-aspirated, yielding 55 mL of a milky ethanol–fluid mixture. To minimize post-procedural pain, a mixture of 2% lidocaine (0.5 mL; Daihan Pharmaceutical, Seoul, Korea), 0.5% bupivacaine (0.5 mL; Pucain, Reyon Pharmaceutical, Seoul, Korea), and 0.9% saline (1 mL) was instilled into the cyst cavity, and tramadol (4 mg/kg; Maritrol, Jeil Pharmaceutical, Daegu, Korea) was administered intravenously. Post-ablation (Day 0) ultrasound images showed the cyst reduced to 35 × 11 mm, containing echogenic material consistent with an

intracystic blood clot and mild hyperechoic pericystic fat changes (Fig. 2B). While this hyperechogenicity extended to the adjacent gastric serosa, the gastric wall thickness and mural layering remained unremarkable. The patient showed mild pain immediately after the procedure but recovered uneventfully, with no pain noted at subsequent rechecks.

Follow-up was performed at 3, 20, and 60 days post-procedure, and at 1 year. Table 1 summarizes serial changes in cyst size and serum ALT activity. On day 3, the cyst had re-expanded, containing internal echogenic fluid and hyperechoic linear structures

consistent with an inflammatory response (Fig. 2C), and serum ALT transiently increased to 421 U/L; pericystic hyperechogenicity was also noted. Both findings resolved by day 20, when the cyst had decreased in size with irregular wall thickening and serum ALT had normalized (Fig. 2D). By day 60, the cyst had completely regressed, leaving a small (<10 mm) residual hyperechoic area (Fig. 2E). The owner reported no further discomfort and was satisfied with the outcome. At 1 year, the cyst remained regressed with no recurrence (Fig. 2F).

Table 1 Serial changes in hepatic cyst size and serum liver enzyme activities.

Time (Days)	Cyst size (mm) ^a	Serum ALT (U/L) ^b	Ultrasound findings
Initial presentation	82 × 55	225	Large anechoic cyst
Post-drainage (Immediate)	13 × 12	-	Reduction after drainage
Post-drainage (2 weeks later)	66 × 46	45	Re-expansion after simple drainage
Day 0 (Sclerotherapy)	35 × 11	-	Hyperechoic change with collapse
Day 3	52 × 39	421	Transient expansion with hyperechoic linear structures
Day 20	24 × 24	47	Size reduction, ALT normalization
Day 60	< 10	-	Complete regression
1 year	< 10	36	No recurrence

^aDimensions are measured as maximal length × depth.

^bReference interval for ALT: 12–101 U/L. ALT, alanine aminotransferase.

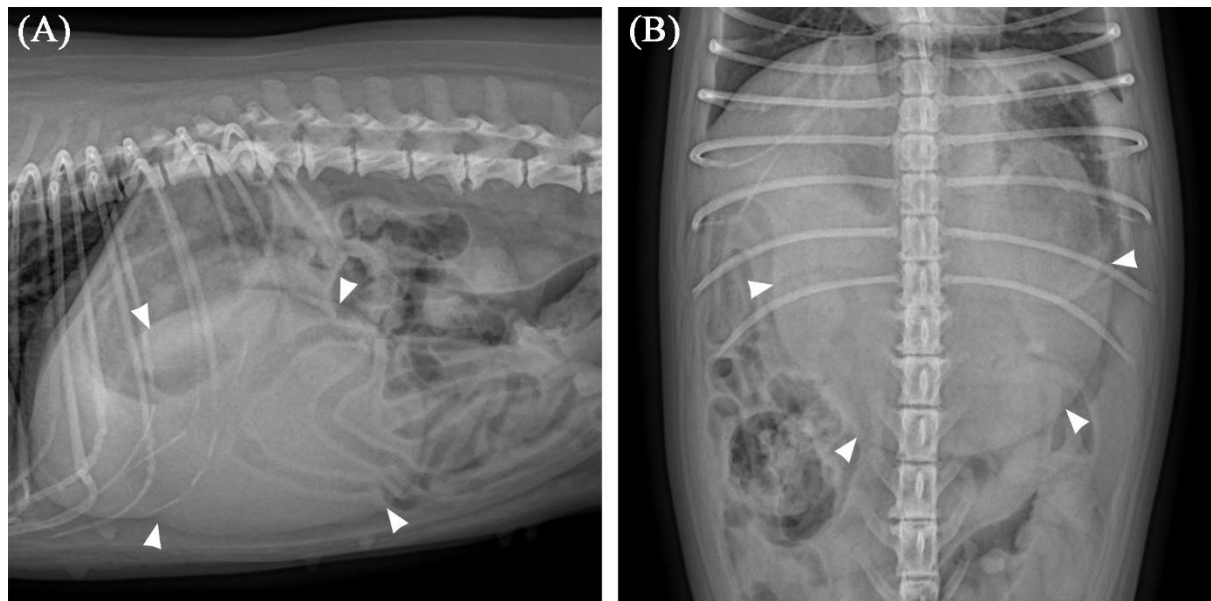


Figure 1 Diagnostic imaging of the hepatic cyst. Right lateral (A) and ventrodorsal (B) abdominal radiographs show a large, round, soft-tissue opacity mass at the caudal liver margin, occupying the midline of the cranial-to-mid abdomen. The mass displaces the gastric pylorus dorsally and shifts the small intestine and colonic segments caudally and to the right. Arrowheads indicate the margins of the mass.

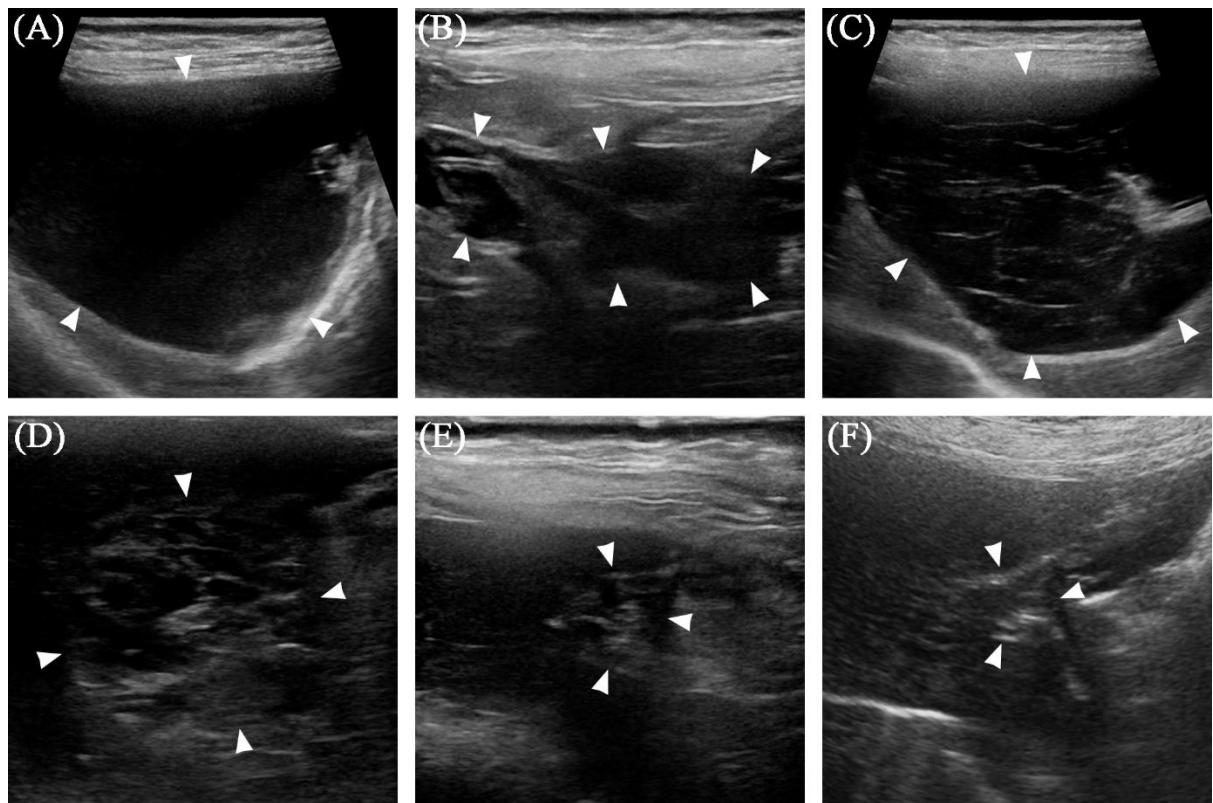


Figure 2 Serial ultrasonographic changes of the hepatic cyst following ethanol sclerotherapy. (A) Two weeks after initial drainage, the cyst re-expanded to 66×46 mm. (B) Immediately after the procedure (Day 0), the cyst lumen collapsed to 35×11 mm and contained internal hyperechoic material with mild pericystic hyperechoic changes. (C) On day 3, the cyst transiently enlarged to 52×39 mm with numerous internal linear echogenic structures. (D) On day 20, the cyst decreased to 24×24 mm, while the internal linear echogenic structures persisted. (E) On day 60, the cyst regressed to <10 mm, appearing as a residual hyperechoic scar. (F) The cyst remained regressed at 1-year follow-up. Arrowheads indicate cyst margins.

Discussion

This case demonstrates successful treatment of a simple hepatic cyst using ultrasound-guided percutaneous sclerotherapy with 83% ethanol. Although simple cysts are usually asymptomatic incidental findings on diagnostic imaging (Fossum, 2019), treatment was indicated in this case due to mild discomfort and abdominal distension. Simple drainage resulted in recurrence, prompting the owner to request definitive treatment. Therefore, ultrasound-guided percutaneous ethanol sclerotherapy was performed instead of surgical cystectomy. While 95–99% ethanol is traditionally used for sclerotherapy (Zatelli *et al.*, 2007; Agut *et al.*, 2008; Pfahl and Gallaher, 2023), most general veterinary clinics stock only lower-concentration ethanol for disinfection, and sterile high-concentration ethanol is often unavailable. A human study indicates that sclerosing effects remain effective if intracystic ethanol exceeds 40% (Okano *et al.*, 2000). To maintain this concentration, cystic fluid was aspirated as completely as possible before instilling 83% ethanol. A previous study reports successful outcomes using 83% ethanol for canine renal cysts, although a 1-to 2-month follow-up was insufficient to assess long-term prognosis (Yoon *et al.*, 2023). This case extends those findings to hepatic cysts, confirming the long-term efficacy of 83% ethanol with no recurrence over 1 year.

Accurate differentiation of simple hepatic cysts from other cystic lesions—such as biliary

cystadenomas, hepatic abscesses, or a distended gallbladder—is critical for determining the appropriate therapeutic strategy. Simple hepatic cysts are typically characterized by anechoic contents, a thin smooth wall, and distinct distal acoustic enhancement. In contrast, biliary cystadenomas or carcinomas typically appear as multilocular masses of mixed echogenicity that contain cysts, while hepatic abscesses usually exhibit anechoic-hypoechoic regions with irregular, poorly defined hyperechoic margins (Larson *et al.*, 2020). In the present case, the lesion exhibited typical features of a simple cyst: a thin wall (<1 mm), anechoic fluid, and lack of internal vascularity or solid components. Furthermore, the cyst was located in the left liver lobe, anatomically distinct from the gallbladder situated between the quadrate and right medial lobes, thereby ruling out gallbladder disease. Although the ultrasonographic features in this case were highly characteristic of a simple hepatic cyst, definitive differentiation from other cystic neoplasms or infectious lesions should be achieved through ultrasound-guided aspiration and fluid analysis. In the present case, a definitive diagnosis was confirmed by analyzing the aspirated fluid, which was clear and acellular, thereby excluding the possibilities of biliary cystadenoma or hepatic abscess.

During ethanol injection, the cyst contents became markedly hyperechoic and cloudy on ultrasound, likely due to protein denaturation between ethanol and cyst fluid (Gelczer *et al.*, 1998; Albanese and Kondo, 2010; Cheng *et al.*, 2012). This echogenic cloudiness can

obscure the needle tip, increasing the risk of inadvertent far-wall perforation. A pigtail catheter may be a safer alternative, as suggested in human and feline studies, due to its better retention and lower perforation risk (Lin *et al.*, 2005; Larssen *et al.*, 2016; Pfahl and Gallaher, 2023).

Although longer ethanol-cyst wall contact time correlates with improved outcomes in one study (Lin *et al.*, 2005), recent reports show no significant difference based on retention duration (Larssen *et al.*, 2016; Kim *et al.*, 2022). Given the anesthesia risks in veterinary patients, a 20-min retention time was chosen to balance safety and efficacy (Agut *et al.*, 2008; Yoon *et al.*, 2023). The patient was also repositioned to ensure even ethanol contact with the entire epithelial lining.

Consistent with previous studies (Agut *et al.*, 2008; Larssen *et al.*, 2016; Yoon *et al.*, 2023), cyst size transiently increased on day 3, then decreased by day 20, accompanied by transient serum ALT elevation that normalized by the 20-day follow-up. These changes likely result from localized chemical injury to adjacent hepatocytes caused by ethanol permeation through the cyst wall or minor leakage. The reactive changes were self-limiting and resolved without treatment. By day 60, the cyst was replaced by hyperechoic scar-like tissue, reflecting expected fibrosis and tissue contraction (Agut *et al.*, 2008).

The most common complication of ethanol sclerotherapy is local pain (Wijnands *et al.*, 2017). To mitigate this, a local anesthetic was instilled into the cyst cavity, analgesics were administered (Yoon *et al.*, 2023), and the patient exhibited only mild, transient pain on the day of the procedure, with none observed during follow-up. Other potential risks include extracystic ethanol leakage, systemic intoxication from residual alcohol, cyst rupture, and hemorrhage (Gelczer *et al.*, 1998; Zatelli *et al.*, 2007; Wijnands *et al.*, 2017). These risks were minimized through several safety measures: the needle was left in situ to prevent leakage, ethanol volume was limited to 50% of the aspirated fluid and injected slowly to reduce rupture risk, and the residual mixture was aspirated after the retention period. Despite precautions against ethanol leakage, theoretical risks include chemical injury to adjacent organs like the pancreas and stomach (Burton *et al.*, 2009; Seki *et al.*, 2002). In the present case, while mild pericystic inflammation was observed extending to the gastric serosa due to its proximity to the left liver lobe, this reaction remained localized, and the gastric wall thickness and layering were preserved. Nevertheless, it is important to consider that ethanol leakage can pose a risk depending on the location of the lesion. Therefore, ultrasonographic monitoring of adjacent organs is recommended during and after the procedure to ensure the early detection of any inadvertent chemical injury.

In conclusion, ultrasound-guided percutaneous sclerotherapy using 83% ethanol achieved complete resolution of the hepatic cyst without recurrence. When high-concentration ethanol is unavailable, lower-concentration ethanol can be considered as a safe and effective alternative for general veterinary practice.

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