

OUR EXPERIENCE WITH PERCUTANEOUS TREATMENT OF UNCOMPLICATED SOLITARY HEPATIC ECHINOCOCCOSIS

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Abstract: The study aims to analyze the experience of using advanced percutaneous techniques for treating uncomplicated solitary hepatic echinococcosis in 135 patients (2008–2021) at the Tashkent Medical Academy. The control group (n=72, 2008–2013) underwent standard PAIR and MoCat procedures, while the main group (n=63, 2014–2021) received staged catheter-based treatment involving non-reciprocating drainage, chitin fragmentation, and sanitation. The main group achieved 100% cavity reduction within 3 months, with complication rates decreasing from 16.7% to 4.8% (p=0.012), including anaphylaxis (5.6% to 1.6%), recurrences (2.8% to 0%), and problematic cavities (5.6% to 0%). The enhanced technique, supported by a patent, proved effective and safe, expanding indications for CE1–CE3 cysts.

Keywords: hepatic echinococcosis, percutaneous treatment, staged catheter-based treatment, PAIR, MoCat, cavity reduction, complications, albendazole, minimally invasive surgery.

Introduction

Hepatic echinococcosis remains a pressing issue in modern surgery, particularly in endemic regions such as Central Asia, including Uzbekistan, where the annual incidence is 6.5 per 100,000 population [1]. This parasitic disease, caused by *Echinococcus granulosus*, primarily affects the liver (50–70% of cases) and can lead to severe complications, including cyst suppuration, perforation, and recurrence [2]. Despite extensive research, open surgery was historically considered the most effective treatment (Karimov Sh.I., 2014; Alperovich B.I., 2015). However, the development of minimally invasive technologies, such as percutaneous puncture-drainage interventions, has opened new possibilities for reducing morbidity and improving outcomes [3].

The PAIR method (Puncture, Aspiration, Injection, Reaspiration), endorsed by the WHO in 1997–1999, became the standard for treating CE1 and CE3 cysts per the WHO-IWGE classification [4]. Recent advancements, including MoCat (Modified Catheterization Technique) [5, 6] and PEVAC (Percutaneous Evacuation) [7], have expanded indications and minimized complications. Recent studies indicate that percutaneous methods achieve high efficacy with proper patient selection, with recurrence rates below 2% and low complication rates [8].

The development of puncture and drainage methods focuses on addressing challenges in pre-, intra-, and postoperative periods, particularly anaphylactic reactions, tract seeding, and residual cavities. Preoperative management has been partially resolved through benzimidazole therapy. However, intraoperative techniques and postoperative care remain incompletely optimized.

Objective of the Study

The aim of this study is to analyze our experience with percutaneous treatment of hepatic echinococcosis through the optimization and refinement of percutaneous transhepatic puncture-drainage interventions.

Materials and Methods

From 2008 to 2021, 135 patients with solitary hepatic echinococcal cysts (SHEC) were examined and treated at the surgical departments of the Tashkent Medical Academy's

Multidisciplinary Clinic. The patient age ranged from 18 to 70 years (mean 36.7 ± 11.83), with a gender ratio of 1:1.18 (73 men, 62 women). All cysts were classified according to the WHO-IWGE ultrasound classification (2003, 2010) [9, 10].

The control group (n=72, 2008–2013) underwent evaluation of percutaneous transhepatic interventions, analyzing technical and clinical aspects, failure causes, and typical complications. These findings informed the development of an optimized approach applied in the main group (n=63, 2014–2021).

Right lobe involvement predominated in both groups (88.1%) (Table 1).

Table 1.

Distribution of Patients with Hepatic Echinococcosis by Liver Lobe Involvement

	Control Group (n=72)	Main Group (n=63)	Total (n=135)
Right Lobe	67 (49.6%)	52 (38.5%)	119 (88.1%)
Left Lobe	5 (3.7%)	11 (8.2%)	16 (11.9%)

Percutaneous interventions were performed across all right lobe segments, but for the left lobe, only segment IV was treated due to anatomical constraints, including insufficient healthy parenchyma in segments II and III, where cysts are often superficial (Table 2).

Table 2.

Percutaneous Interventions by Liver Segments

	Control Group (n=72)	Main Group (n=63)	Total (n=135)
Segment IV	5 (6.9%)	11 (17.5%)	16 (11.9%)
Segment V	10 (13.9%)	11 (17.5%)	21 (15.6%)
Segment VI	23 (31.9%)	6 (9.5%)	29 (21.4%)
Segment VII	21 (29.2%)	16 (25.3%)	37 (27.4%)
Segment VIII	13 (18.1%)	19 (30.2%)	32 (23.7%)

Overall, CE1 cysts predominated (62.2%), but in the main group, CE1 and CE3A cysts were nearly equally distributed (25 and 23 cases, respectively) (Table 3).

Table 3.

Distribution of Patients According to WHO Ultrasound Classification (2003, 2010)

WHO Stage	Control Group (n=72)	Main Group (n=63)	Total (n=135)
CE1	59 (82%)	25 (39.7%)	84 (62.2%)
CE3A	13 (18%)	15 (23.8%)	28 (20.8%)
CE2	0	23 (36.5%)	23 (17%)
Total	72	63	135

Primary hepatic echinococcosis was predominant in both groups. Approximately 20% of patients had a history of one or more prior surgeries for echinococcosis, classified as recurrent or residual based on cyst growth rates (1–1.5 cm/year) (Table 4).

Table 4.

Primary, Recurrent, and Residual Hepatic Echinococcosis

	Control Group (n=72)	Main Group (n=63)	Total (n=135)
Primary Echinococcosis	68 (94.4%)	45 (71.4%)	113 (83.7%)
Recurrent Echinococcosis	1 (1.4%)	6 (9.5%)	7 (5.2%)
Residual Echinococcosis	3 (4.2%)	12 (19.1%)	15 (11.1%)
Total	72	63	135

Diagnosis and treatment outcomes were assessed using clinical, laboratory, and imaging methods (ultrasound, CT, MRI). The majority of cases (84%) were asymptomatic. Clinical manifestations, when present, included right hypochondrial discomfort, skin rashes, and dyspepsia (Table 5).

Table 5.*Clinical Manifestations in Patients with Hepatic Echinococcosis*

		Control Group (n=72)	Main Group (n=63)	Total (n=135)
Asymptomatic		58 (81%)	55 (87,3%)	113 (83,7%)
With Clinical Manifestations	Right hypochondrial discomfort/pain	7 (10%)	6 (9,5%)	13 (9,6%)
	Skin rashes	5 (7%)	1 (1,6%)	6 (4,4%)
	Dyspepsia	9 (12%)	4 (6,3%)	13 (9,6%)

Laboratory findings showed eosinophilia in two control group patients and one main group patient, with no elevation in liver transaminases, indicating low diagnostic value of blood tests in asymptomatic stages. Imaging methods included ultrasound, computed tomography, and magnetic resonance imaging.

Percutaneous treatments in the control group included the standard PAIR method and MoCat for cases with biliary fistulae, while the main group received our novel staged catheter-based treatment (Table 6).

Table 6.*Distribution of Patients by Type of Percutaneous Method*

	Percutaneous Method	Number of Patients	Description
Control Group	PAIR	51	Puncture, Aspiration, Injection, Reaspiration
	MoCat	21	Modified Catheterization (parasitic cyst catheterization)
Main Group	Staged Catheter-Based Treatment	63	Stage 1: Echinococcal cyst drainage Stage 2: Chitin fragmentation and aspiration Stage 3: Drain removal after cavity reduction

The staged catheter-based treatment, implemented since 2014 in 63 patients, consisted of three stages:

1. Echinococcal cyst drainage.
2. Chitin fragmentation and aspiration.
3. Drain removal after cavity reduction.

The first stage involved non-reciprocating drainage, supported by a patent (“Method for Transhepatic Drainage of Hepatic Echinococcosis Without Reciprocating Movements,” Khakimov M.Sh., Rakhimzoda T.E., Rakhmanov S.U., Hasanov V.R., Jumanazarov A.U., 09.04.2024, No. DGU 36438).

Results

Anaphylactic reactions were observed in both groups, indicating a risk of acute allergic reactions inherent to both puncture and drainage techniques. Anaphylaxis occurred in 4 cases (5.6%) in the control group and 1 case (1.6%) in the main group, yielding a 4.0% difference. This reduction is likely due to the enhanced technique in the main group, which minimized allergic risks by avoiding the Seldinger technique during catheter placement.

Tract seeding (recurrence) was recorded in 2 cases (2.8%) in the control group but was absent in the main group. The complete absence of recurrences underscores the efficacy of the modified technique, likely due to preoperative albendazole chemotherapy and meticulous individualized cyst mapping, consistent with reports of zero recurrence rates. Recurrences were successfully managed with renewed albendazole courses (15 mg/kg/day), followed by three additional courses. Monitoring continued for one year post-chemotherapy, revealing small calcified areas in the liver.

Residual cavities >3 cm were typically associated with right hypochondrial discomfort, particularly during physical activity, and were classified as problematic, while smaller cavities were asymptomatic. In some cases, cavities stabilized, while others increased in size without parasitic components (Fig. 1).



Figure 1. Ultrasound image of the right liver lobe after PAIR for a 6x5 cm echinococcal cyst. Six months post-procedure, a 4x3 cm residual cavity formed.

Problematic cavities were observed in 4 cases (5.6%) in the control group but none in the main group, where staged treatment achieved 100% cavity reduction within 3 months, confirming the method's superiority. In the control group, symptomatic residual cavities were treated with repeat PAIR using absolute ethanol, achieving full reduction in three cases and partial reduction (6.1 cm to 2 cm) in one. The progressive increase in residual cavity size is concerning, as it may indicate inflammation or biliary fistula leading to biloma formation. In our study, bilomas were not observed, and cavity contents were serous. Repeat PAIR with ethanol halted cavity growth, reducing them to asymptomatic sizes, though full reduction was not achieved. In cases of

biloma, a drainage approach is required, with patients retaining percutaneous drains due to non-obiterated biliary fistulae (Table 7).

Table 7.

Postoperative Complications in Control and Main Groups

	Control Group (PAIR + MoCat, n=72)	Main Group (Staged Catheter-Based Treatment, n=63)
Anaphylactic Reaction	5.6% (4 cases)	1.6% (1 case)
Tract Seeding (Recurrence)	2.8% (2 cases)	None
Problematic Cavity	5.6% (4 cases)	None
Residual Cavity Suppuration	2.8% (2 cases)	None
Intracystic Bleeding	None	1.6% (1 case)

Residual cavity suppuration occurred in 2 cases (2.8%) in the control group but was absent in the main group, likely due to improved sanitation and chitin removal. Suppurated cavities were managed as liver abscesses.

Intracystic bleeding was not observed in the control group but occurred in 1 case (1.6%) in the main group, the only complication where the main group performed worse, possibly due to the technical aspects of catheterization, which involves a more aggressive approach compared to PAIR and MoCat.

Discussion

Our experience confirms the efficacy of percutaneous methods as an alternative to open surgery, particularly for CE1–CE3 cysts. The enhanced staged catheterization technique expanded indications to include CE2 cysts, previously considered a relative contraindication [8]. Complication reduction aligns with recent studies, where MoCat achieved recurrence rates below 2% for CE2/3b cysts [5]. Preoperative albendazole minimized dissemination risks, as noted in a 2024 Cochrane review [11]. Chitin removal, not performed in standard PAIR or MoCat, facilitated faster and complete cavity reduction.

Conclusion

Percutaneous interventions represent an effective approach for treating hepatic echinococcal cysts, particularly small to medium-sized ones. Advanced technologies and refined techniques enhance the efficacy of these procedures, making them increasingly preferred by both patients and clinicians. These methods are gaining popularity due to their minimal invasiveness, high efficacy, and rapid recovery. Currently, various percutaneous interventions can be tailored to different stages of parasitic cyst development.

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