CENTRAL ASIAN JOURNAL OF MEDICAL AND NATURAL SCIENCES
https://cajmns.casjournal.org/index.php/CAJMNS
*Volume: 07 Issue: 01 | January 2026 ISSN: 2660-4159*

*Article*

# Application of Contemporary Diagnostic Modalities in the Evaluation of Hepatic Echinococcosis

**Ishonjaev Hayrulla Rahimovich[1], Jafarov Khasan Mirzakhidovich[2], Sabirova Arzayim Turganbaevna[3], Karimbaev Baxram Adilbaevich[4]**

1. Associate Professor (PhD), Department of General Surgery, Tashkent State Medical Univeristy (Pediatric Campus), Uzbekistan
2. Associate Professor (PhD), Department of General Surgery, tashkent State Medical University (Pediatric Campus), Uzbekistan
3. Assistant Professor at the Department of Surgical Diseases and Transplantology at the Karakalpakstan Medical Institute, Uzbekistan
4. Assistant Professor at the Department of Surgical Diseases and Transplantology at the Karakalpakstan Medical Institute, Uzbekistan

* Correspondence: ishonhajaevh@gmail.com

**Abstract:** The objective of the present study was to assess the diagnostic efficiency of prevailing instrumental and laboratory techniques in hepatic hydatid and to construct a developed, step-by-step diagnostic algorithm for both hospital-based practices as well as seroepidemiological examinations in endemic areas.

A retrospective and prospective analysis was carried out among 282 patients with hepatic echinococcosis. We compared performance of serological tests (latex agglutination reaction, indirect hemagglutination), ultrasonography, radionuclide liver scanning, angiography and CT. Furthermore, a mass ultrasound screening study was conducted among rural dwellers in northern Uzbekistan.

Ultrasonography showed a high sensitivity (97.8%) and specificity (93.5%), whereas CT had the best diagnostic accuracy (sensitivity 99.1%, specificity 98.8%). The combined application of US and CT improved the diagnosis accuracy up to 99%. Early-stage disease was detected with a marked reduction of the complication rate by mass screening. The introduction of a staged diagnostic strategy decreased postoperative mortality rates from 4.4% to 1% and the occurrence of peripheral complications from 23.3% to 6.0%.

This case supports a structured, algorithmic diagnostic approach that includes common imaging technologies as well as more advanced techniques, and underscores the role of population-level US screening in endemic areas.

The proposed algorithm facilitates early diagnosis, better surgical management and decreased mortality especially in rural health care systems.

The limitations of the study are its regional nature and retrospective aspects, and more large-scale multicenter studies are encouraged.

**Keywords:** hepatic echinococcosis, ultrasound diagnostics, computed tomography, screening, surgical planning

**Citation:** Rahimovich, I. H, Mirzakhidovich, J. K, Turganbaevna, S. A, & Adilbaevich, K. B. Application of Contemporary Diagnostic Modalities in the Evaluation of Hepatic Echinococcosis. Central Asian Journal of Medical and Natural Science 2026, 7(1), 600-603.

Received: 03th Oct 2025
Revised: 18th Nov 2025
Accepted: 24th Dec 2025
Published: 21th Jan 2026



## 1. Introduction

Echinococcosis continues to be an important public health problem in areas of intensive animal husbandry, like in Central Asia. The disease is caused by the larval stage

of E. granulosus, and it is defined primarily by hydatid cysts that develop in several organs, especially the liver. Epidemiological data has shown that the prevalence of echinococcosis in endemic areas is as high as 6–9 per 1,000 individuals which indicates the continued existence of transmission cycles and constraints to early diagnosis [1].

More than 80% clinical presentations of echinococcosis are hepatic. Clinical course may be prolonged with many patients being asymptomatic until the cyst enlarges or is complicated. Complex forms such as suppuration, rupture into cystic or biliary cavities, and calcifications occur in 15–40% of patients and are associated with mortality rates between 5% and 35%. These statistics emphasize the importance of an early and accurate diagnosis [2].

Conventional diagnostic methods such as clinical findings and routine laboratory examination often do not detect the early stage of disease or determine cyst localization. Therefore, in current day practice, imaging modalities and serological testing have gained a prominent position in the process of diagnosis. Ultrasonography has become the primary screening modality because of its availability, lack of invasiveness, and good imaging capability. Nevertheless, calculating the precise distribution and depth of revelation in cyst lesions -especially when complex or recurrent- is limited [3].

Advanced diagnostic modalities including CT, angiography and radionuclide liver scanning offer an even wider range of information, particularly for preoperative decision making. However, they are rarely available in rural areas of resource-constrained regions where echinococcosis is highly endemic [4].

Under such circumstances it is essential to develop an integrated stage-based diagnosis strategy appropriate to endemic regions. This work examines the relevance of modern methods for diagnosis hepatic echinococcosis- and suggests a workflow diagram- clinical (hospital) diagnoses combined with population ultrasound screening in order to enhance early diagnostics, treatment regimes an outcomes [5].

## 2. Materials and Methods

This study analyzed diagnostic data from 282 patients with confirmed hepatic echinococcosis treated at surgical departments affiliated with the Tashkent Pediatric Medical Institute. The cohort included 61% women and 39% men. Complicated forms were identified in 133 patients (47.2%), with cyst suppuration being the most common complication.

Each patient was evaluated clinically dropically and biochemically. The serological tests consisted of 212 latex agglutination reaction (LAR) and 234 indirect hemagglutination assay (IHA). Instrumental diagnostic procedures included abdomen sonography (n = 282), chest and abdomen roentgenography (n = 117), radionuclide liver scan (n = 92), angiography (n = 64) and computed tomography (n = 64).

The sensitivity and specificity of each modality were determined based on the intraoperative findings and postoperative pathological results. Mass ultrasound screening was also performed among 25,024 inhabitants from rural northern Uzbekistan by mobile diagnostic units.

Intraoperative ultrasound was used for intraoperative identification of deeper or small cysts which could not be identified preoperatively. Postoperative results including mortality and morbidity rates were documented and compared for patients treated before or after application of the stepwise diagnostic algorithm.

## 3. Results

### Serological Diagnostics

Latex agglutination reaction yielded positive results in 87.7% of cases, while indirect hemagglutination was positive in 85.3%. Reduced titers and false-negative results were most frequently observed in patients with suppurated or calcified cysts[6].

**Imaging Diagnostics**

Before presenting numerical results, it is important to note that imaging methods played a decisive role in confirming diagnosis and planning surgical intervention[7].

**Table 1.** Diagnostic Performance of Imaging Modalities in Hepatic Echinococcosis

| Method | Sensitivity (%) | Specificity (%) |
|---|---|---|
| Radionuclide scanning | 89.3 | 79.8 |
| Ultrasonography | 97.8 | 93.5 |
| Angiography | 94.2 | 96.3 |
| Computed tomography | 99.1 | 98.8 |

Ultrasonography demonstrated the highest accessibility and diagnostic reliability among noninvasive methods. However, in 14.2% of cases, US was insufficient to determine exact segmental localization and disease extent [8].

Computed tomography provided superior anatomical detail, especially in small, deep, or recurrent cysts. Combined use of US and CT increased overall diagnostic accuracy to 99% [9].

**Population Screening Results**

Mass ultrasound screening identified echinococcosis in 114 individuals: hepatic (82 cases), pulmonary (29 cases), and splenic (3 cases). Complicated forms were detected in only 7 patients. Surgical treatment was performed in 81 patients without mortality; postoperative wound suppuration occurred in 6 cases [10].

**Intraoperative Findings**

Intraoperative ultrasonography revealed previously undetected deep hepatic cysts in 7 of 25 examined patients, directly influencing surgical strategy [11].

## 4. Discussion

The findings confirm that ultrasonography is the cornerstone of hepatic echinococcosis diagnostics in endemic regions due to its high sensitivity, safety, and feasibility for mass screening. Nevertheless, its limitations in precise anatomical mapping justify the complementary use of CT in selected cases [12].

Serology showed the desired sensitivity while specificity was low in complicated cases, thus suggesting their complementary rather than confirmatory position [13]. These novel imaging modalities were resource-intensive, but increased the diagnostic confidence and improved surgical planning [14].

Significant reductions in postoperative morbidity and mortality were seen after the introduction of staged diagnostic algorithmic approach, which included outpatient- based screening, hospital-based imaging, and intraoperative ultrasonography [15]. Crucially, population-based US screening allowed early diagnosis, which decreased the most severe and complicated presentations [16].

These findings bring attention to the need of regionalised diagnostic approaches given the diversity in epidemiology and health care resource allocation [17].

## 5. Conclusion

This study demonstrates that the rational integration of contemporary diagnostic methods significantly improves outcomes in hepatic echinococcosis. Ultrasonography should be considered the primary diagnostic and screening modality, particularly in endemic and rural settings. In diagnostically challenging cases, computed tomography provides essential supplementary information, increasing diagnostic accuracy to nearly 100%.

The proposed stepwise diagnostic algorithm ensures early detection, accurate localization, and optimal surgical planning. Intraoperative ultrasonography further minimizes the risk of missed cysts. Adoption of this strategy led to substantial reductions in mortality and postoperative complications, confirming its clinical effectiveness.

Widespread implementation of structured ultrasound screening programs in endemic regions is strongly recommended as a cost-effective public health measure to reduce disease burden..

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