



Prevalence, Clinical Manifestations, and Treatment Outcomes of Intra-Abdominal Hydatid Cysts: Insights from a Single Center Study in Yemen

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ABSTRACT

Background: Intra-abdominal hydatid cysts pose a significant health challenge in endemic regions, such as Yemen. This study aimed to analyze the demographic, clinical, and diagnostic characteristics and treatment outcomes of patients at a single center in Yemen.

Methods: This prospective descriptive study included 158 patients diagnosed with intra-abdominal hydatid cysts between November 2021 and November 2023. Data on demographics, clinical presentation, imaging findings, and treatment outcomes were collected and analyzed using descriptive and chi-squared statistics.

Results: Of the 158 patients, 54.0% were female, and the 21–50 age group was the most affected (62.6%). Abdominal pain was the most common symptom (65.2%), and 34.8% were asymptomatic. CT was the primary diagnostic tool used (71.5%). Surgery, mainly endocystectomy, was the main treatment (65.2%), and wound infection was the most frequent complication (41.8%). Cyst localization significantly correlated with clinical outcomes ($\chi^2=18.64$, $p=0.017$).

Conclusion: Intra-abdominal hydatid cysts in Yemen primarily affect young-to-middle-aged females. Abdominal pain is the most frequent presentation and CT is essential for diagnosis. Surgical intervention remains the primary treatment option, resulting in favorable outcomes. Standardized protocols are vital to improve patient care.

ARTICLE INFO

Keywords:

Cystic Echinococcosis, Intra-abdominal Hydatid Cyst, Surgical Treatment, Computed Tomography, Treatment Outcomes, Yemen.

Article History:

Received: 1-July-2025,

Revised: 4-August-2025,

Accepted: 3-March-2026,

Published: 28-October-2026.

1. INTRODUCTION

Hydatid disease, caused by the larval stage of *Echinococcus granulosus*, remains a major public health concern, particularly in endemic regions[1, 2]. Despite advances in diagnostic and therapeutic approaches, intra-abdominal hydatid cysts continue to pose significant clinical challenges owing to their varied presentations and potential for serious complications[3]. Although the liver is the most commonly affected organ, cysts can involve multiple organs, leading to complex clinical scenarios that necessitate comprehensive management strategies[4].

Previous studies have extensively documented the epidemiology and clinical manifestations of hydatid cysts

at various locations[2]. However, significant gaps remain in our understanding of demographic factors, particularly sex and age distribution, and the correlation between cyst localization and clinical outcomes. Additionally, although the role of advanced imaging techniques, such as computed tomography (CT), in the diagnosis is well recognized, there is a need for standardized diagnostic protocols that can be universally adopted to enhance diagnostic accuracy and patient outcomes[1].

This study addresses these gaps by providing a detailed analysis of the demographic, clinical, and diagnostic characteristics of patients with intra-abdominal hydatid cysts, based on data from a single-center study. The novelty of this research lies in its comprehensive approach to cor-



relating demographic factors with disease presentation and outcomes as well as its focus on the effectiveness of various diagnostic and therapeutic interventions.

The significance of this study is that it is multifaceted. First, this underscores the need for healthcare providers in endemic regions to consider hydatid disease in the differential diagnosis, particularly among young to middle-aged females who appear to be disproportionately affected[5, 6]. Second, this study emphasizes the critical role of CT scans in the accurate diagnosis and treatment planning of hydatid cysts and advocates the adoption of standardized diagnostic protocols[4, 7]. Third, this study highlights the importance of surgical intervention, particularly endocystectomy, in the management of hydatid cysts and the potential role of adjunctive medical therapies in reducing recurrence rates[7, 8].

By addressing these critical aspects, this research not only fills existing gaps in the literature, but also provides valuable insights that can inform clinical practice and public health initiatives aimed at reducing the incidence and burden of hydatid disease. These findings have important implications in improving patient outcomes through early and accurate diagnosis, effective treatment strategies, and comprehensive posttreatment follow-up. Moreover, this study advocates multidisciplinary collaboration and continued research to explore new diagnostic markers and treatment options, thereby contributing to the broader goal of enhancing the management and control of hydatid disease[9].

2. METHODS

2.1. STUDY DESIGN AND SETTINGS

This prospective descriptive study aimed to elucidate the clinical patterns, radiological features, and treatment outcomes of patients with intra-abdominal hydatid cysts. The study was conducted at the Al-Gumhori Teaching Hospital Authority in Yemen from November 2021 to November 2023. This institution was selected because of its prominence as a major healthcare center in the region and it provides a large and diverse patient population suitable for the study.

2.2. PATIENTS SELECTION

The study sample consisted of 158 patients who presented with abdominal pain and were subsequently diagnosed with intra-abdominal hydatid cysts at our hospital during the study period. No restrictions were applied regarding age or sex to ensure a comprehensive evaluation of the clinical patterns associated with the disease. Patients included in the study were diagnosed with intra-abdominal hydatid cysts and confirmed through clinical examination, laboratory tests, and radiological findings. Participants of any sex and age were included, provided that they provided informed consent to participate in the

study. Patients were excluded if they declined to participate in the study or were diagnosed with hydatid cysts in other parts of the body, such as the lungs, brain, or bones.

2.3. DATA COLLECTION

Data on sociodemographic characteristics, clinical presentations, and radiological findings were gathered from patient interviews and medical record reviews. Intra-abdominal hydatid cysts (IAHC) were defined as hydatid cysts located in the abdominal viscera, peritoneal cavity, omentum, retroperitoneal space, or associated organs. This study describes the clinical presentation, radiological patterns, and complications of all patients diagnosed with IAHC. A systematic review of the existing literature and other local and global studies was conducted to compare the characteristics of IAHC disease with those in the present study. Standardized data collection forms were utilized to ensure uniformity of demographic data (age, sex, and residence), clinical presentation (symptoms, signs, duration, and organs involved), diagnostic findings (imaging and laboratory investigations), and treatment approaches (surgical techniques, medical therapy, and percutaneous interventions).

Definition of treatment outcomes: Complete resolution was defined as the disappearance of cysts on follow-up imaging (ultrasound or CT) at 6-12 months post-treatment. Partial resolution was defined as $\geq 50\%$ reduction in cyst size or change to inactive cyst stage (CE4-CE5) without complete disappearance. Recurrence was defined as the appearance of new cysts or regrowth of previously treated cysts after the initial documented improvement or resolution.

Indications for medical treatment: Medical treatment (albendazole 10-15 mg/kg/day in divided doses for 3-6 months, with treatment duration and cycles determined based on cyst response) was offered based on the following criteria.

1. Small uncomplicated cysts (< 5 cm in diameter) without biliary communication, particularly active (CE1) and transitional (CE3a) cyst types, for which medical therapy has demonstrated efficacy
2. Patients with high surgical risk due to comorbidities (American Society of Anesthesiologists [ASA] class III or IV)
3. Patient refusal of surgical intervention after thorough counseling about risks and benefits of both approaches
4. Recurrent cysts with repeat surgery deemed high-risk because of adhesions or difficult access

All patients receiving medical therapy underwent regular clinical and ultrasound follow-up at 3-month intervals to assess treatment response, with treatment failure defined as no reduction or increase in cyst size after 6

months of therapy.

2.4. STATISTICAL ANALYSIS

Descriptive statistics were used to analyze the clinical patterns of intra-abdominal hydatid cysts. Statistical analyses were performed using SPSS version 25. The data were verified for completeness, cleaned, coded, entered, and analyzed. Descriptive statistics were used to summarize the demographic and clinical characteristics. Chi-square tests (*p* values) were used to compare categorical variables, and statistical analyses were performed to explore correlations between multiple variables. For the correlation analysis between cyst localization and clinical outcomes, we performed a chi-square test for independence. Cyst localization was categorized into four groups: liver only, other single organ, multiple organs, and peritoneal/retroperitoneal. Clinical outcomes were categorized as complete resolution, partial resolution, or recurrence. Statistical significance was set at $P < 0.05$. A post-hoc analysis was performed using adjusted standardized residuals to identify the cells that contributed significantly to the overall chi-square result.

2.5. ETHICS CONSIDERATIONS

This study was conducted in accordance with the ethical standards of the institutional and/or national research committee and the 1964 Helsinki Declaration and its later amendments or comparable ethical standards. Ethical approval for this study was obtained from the Al-Gumhori Teaching Hospital Authority. Informed consent was obtained from all the participants included in the study.

3. RESULTS

3.1. DEMOGRAPHIC AND CLINICAL CHARACTERISTICS

This study included 158 patients diagnosed with intra-abdominal hydatid cysts. Demographic data showed that females accounted for 54.0% of the sample, whereas males accounted for 46.0%. The most commonly affected age group was 21–50 years, representing 62.6% of the study population. Clinically, the most common presentation was abdominal pain, nausea, and vomiting (32.3%), whereas 34.8% of the patients were asymptomatic (Table 1).

The 55 asymptomatic patients (34.8%) were identified incidentally during radiological investigations for other reasons. Of these, 31 patients (56.4%) underwent abdominal ultrasound or CT as part of routine health checkups or screening purposes, including pre-employment medical examinations ($n=14$), insurance medical assessments ($n=10$), or general health screening ($n=7$). In Yemen, where hydatid disease is endemic, some employers and insurance companies include abdominal imaging in their

routine health assessments. Additionally, 14 patients (25.5%) were investigated for unrelated medical conditions, including trauma evaluation following motor vehicle accidents ($n=5$), preoperative assessment for elective surgeries ($n=4$), investigation of gynecological symptoms ($n=3$), and evaluation of suspected renal stones ($n=2$). Furthermore, 10 patients (18.2%) were identified through family screening after a first-degree relative was diagnosed with hydatid disease, which occurred in the context of family clusters where screening was offered to household members of index cases. Among the asymptomatic patients, cysts were predominantly small (<5 cm) in 37 patients (67.3%), located in the liver in 49 patients (89.1%), CE1 in 18 patients (32.7%), CE4 in 16 patients (29.1%), and single cysts in 45 patients (81.8%). This incidental discovery pattern highlights the importance of maintaining a high index of suspicion for hydatid disease in endemic regions even when imaging is performed for unrelated indications.

3.2. PREOPERATIVE EVALUATIONS

Preoperative evaluation included diagnostic imaging procedures, with computed tomography (CT) being the most frequently used (71.5%), followed by ultrasound (25.9%). The liver was the most commonly involved organ (81.6%), with multi-organ involvement observed in 14.6% of the cases (Table 2).

The most common stages identified by ultrasound were CE4 (25.53%) and CE3a (23.40%). Cyst sizes identified by ultrasound were predominantly less than 5 cm (55.3%), followed by 5–10 cm (29.8%), and > 10 cm (14.9%). The most common stages identified on CT were CE3a (34.8%) and CE2 (29.7%). Cyst sizes identified by CT were predominantly in the 5–10 cm range (57.3%), followed by less than 5 cm (28.7%), and > 10 cm (14%) (Table 3).

3.3. TREATMENT AND SURGICAL MANAGEMENT

Most patients (65.2%) were treated surgically, whereas 34.8% received medical treatment. Endocystectomy was the most common surgical procedure performed (85.5%). Among the 55 patients (34.8%) who received medical treatment only, the indications were as follows: Small uncomplicated cysts (<5 cm) were observed in 31 patients (56.4%), among whom the cyst stage distribution was CE1 in 14 patients (45.2%), CE3a in 12 patients (38.7%), and CE4 in 5 patients (16.1%); complete resolution was achieved in 27 of these 31 patients (87.1%). Patient refusal of surgery accounted for 12 patients (21.8%), who had cysts ranging from 4–12 cm in size. Despite counseling about the higher efficacy of surgery for larger cysts, these patients declined surgical intervention due to fear of surgery ($n=7$), financial constraints ($n=3$), or personal



Table 1. Demographic and Clinical Characteristics

Characteristic	Frequency	Percentage
Gender		
Male	72	46.0%
Female	86	54.0%
Age Group		
6-20	20	12.7%
21-50	99	62.6%
51-65	23	14.6%
66-89	14	8.9%
81-95	1	0.6%
>95	1	0.6%
Clinical Presentations		
Abdominal pain	31	19.6%
Abdominal pain/Nausea/Vomiting	51	32.3%
Nausea/Vomiting	15	9.5%
Abdominal distension	6	3.8%
Asymptomatic	55	34.8%
Associated Symptoms		
Nausea/Vomiting	66	41.8%
Appetite/Weight Loss, Anorexia, Night Sweating, Fever	59	37.3%
No Associated Symptoms	33	20.9%

beliefs (n=2), and complete resolution was achieved in 7 patients (58.3%), partial resolution in 4 patients (33.3%), and treatment failure requiring subsequent surgery in 1 patient (8.3%). High surgical risk due to comorbidities was observed in 8 patients (14.5%), including uncontrolled diabetes mellitus (n=3), severe hypertension (n=2), advanced chronic liver disease (n=1), chronic kidney disease (n=1), and severe anemia with malnutrition (n=1). These patients were ASA class III, and complete resolution was achieved in 6 patients (75.0%), with partial resolution in 2 patients (25.0%). Recurrent cysts following previous surgery were the indication in 4 patients (7.3%), who had undergone surgery 2-5 years previously and presented with recurrent cysts. Complete resolution was achieved in 3 patients (75.0%), with one patient (25.0%) showing partial resolution requiring continued medical therapy. Overall, among those treated medically, complete resolution was achieved in 45 patients (81.8%), partial resolution in eight patients (14.5%), and treatment failure requiring subsequent surgery in two patients (3.6%). No significant adverse effects requiring treatment discontinuation were observed, although 12 (21.8%) patients reported mild transient nausea or abdominal discomfort (Table 4).

3.4. POSTOPERATIVE COMPLICATIONS AND OUTCOMES

Postoperative complications included wound infections (41.8%), bile leaks (4.9%) and fistulas (0.9%). Regarding perioperative care, all surgical patients (n=103) received prophylactic antibiotics (cefazolin 2 g intravenously) at the induction of anesthesia. Intraoperative cyst spillage was documented in 23 patients (22.3%), and scolicidal agents (20% hypertonic saline) were used in all cases where spillage occurred. The mean operative time was 124 ± 38 min (range: 65-210 minutes). Postoperative wound infections were diagnosed based on clinical criteria (purulent discharge, erythema, warmth, and fever) and occurred at a median of 7 days post-surgery (range: 4-14 days). Culture results were available for 28 of 43 patients with wound infections, and the most common organisms were **Staphylococcus aureus** (n=12, 42.9%), **Escherichia coli** (n=8, 28.6%), and mixed flora (n=5, 17.9%). Most patients experienced complete resolution of symptoms (86.7%), with partial resolution observed in 8.2% and recurrence of hydatid cyst disease in 5.1% of patients (Table 5).

Table 2. Preoperative Evaluations

Evaluation	Frequency	Percentage
Diagnostic Imaging Procedures		
CT Scan	113	71.5%
Ultrasound	41	25.9%
Ultrasound and CT Scan	4	2.5%
Number of Involved Organs		
One Organ	129	81.6%
- Liver	116	73.4%
- Other (Omentum, Mesentery, etc.)	13	8.2%
Two Organs	17	10.8%
Three Organs	6	3.8%
Four or More Organs	6	3.8%

3.5. CORRELATION BETWEEN CYST LOCALIZATION AND CLINICAL OUTCOMES

Analysis of the correlation between cyst localization and clinical outcomes revealed a statistically significant association ($\chi^2 = 18.64$, $p = 0.017$). As shown in Table (6), patients with liver cysts had the highest rate of complete resolution (89.7%), whereas those with multi-organ involvement showed higher rates of partial resolution (17.4%) and recurrence (13.0%). Cysts localized to other single organs (omentum, mesentery, etc.) demonstrated intermediate outcomes, with complete resolution in 76.9% of the cases. Further analysis of the multi-organ involvement subgroup ($n=23$) revealed that patients with liver plus one additional organ ($n=17$) had better outcomes (complete resolution in 82.4%) than those with three or more organs involved ($n=6$), with a complete resolution of only 66.7% and recurrence of 16.7%. The most common combinations associated with poorer outcomes were liver-spleen and liver-pancreas involvement.

4. DISCUSSION

This study offers a comprehensive analysis of intra-abdominal hydatid cysts, providing valuable insights into the demographic characteristics, clinical presentations, diagnostic imaging, treatment approaches, and outcomes of patients at the Al-Gumhori Teaching Hospital Authority in Yemen. These findings contribute to the existing literature and underscore the need for improved diagnostic and treatment strategies to improve patient outcomes.

The sex distribution, with a slight female predominance (54% female to 46% male), is consistent with findings from previous studies that suggest a higher susceptibility to hydatid disease in females, possibly due to occupational and environmental factors. The age distribution, with a mean age of 40.39 years and median age of 35.5

years, reflects the typical presentation of hydatid disease in middle-aged individuals, as supported by other epidemiological studies[1]. The predominance of the 21-to 50-year age group (62.6%) indicated a significant impact of the disease on the economically productive segment of the population.

Our study revealed a higher prevalence of intra-abdominal hydatid cysts in women (54.0%) than in men (46.0%). The condition predominantly affects young to middle-aged adults, with the most common age group being 21-50 years. This distribution aligns with the findings of Abebe et al. (2017) in Ethiopia, who reported a female preponderance (64.3%) and a mean age of 37 years, with the most affected group being in the fourth decade of life[10]. However, Harbawi et al. (2022) found a higher prevalence of men in Iraq, indicating potential regional differences in sex distribution[5].

Abdominal pain was the most common symptom experienced by 65.2% of the patients, which is consistent with the literature highlighting abdominal pain as a primary manifestation of intra-abdominal hydatid cysts[11]. The incidental discovery of asymptomatic cases in 34.8% of the patients underscores the importance of routine imaging in endemic regions. These asymptomatic patients were identified through various routes, including routine health check-ups, investigations for unrelated medical conditions, and family screening after diagnosis of an index case, highlighting that a significant burden of hydatid disease may remain undetected without active surveillance. Other symptoms, such as nausea, vomiting (41.8%), abdominal distension (3.8%), and appetite loss (37.3%), reflected the varied clinical spectrum of the disease, as documented in previous research[12].

The reliance on CT (71.5%) and ultrasound (25.9%) for diagnosis agrees with current diagnostic practices, which prioritize the accuracy and accessibility of these imaging modalities[3]. The liver is the most commonly affected or-



Table 3. Ultrasound and CT Scan Findings

Finding Type	Stage	Frequency	Percentage
Ultrasound Stage	CE1	4	8.51%
	CE2	8	17.02%
	CE3a	11	23.40%
	CE3b	7	14.9%
	CE4	12	25.53%
	CE5	5	10.63%
Ultrasound Size	<5 cm	26	55.3%
	5-10 cm	14	29.8%
	>10 cm	7	14.9%
CT Scan Stage	CE1	22	13.9%
	CE2	47	29.7%
	CE3a	55	34.8%
	CE3b	23	14.6%
	CE4	9	5.7%
	CE5	2	1.3%
CT scan size	<5 cm	41	28.7%
	5-10 cm	82	57.3%
	>10 cm	20	14.0%

gan (81.6%), and this finding corroborates existing data that identifies it as the primary site for hydatid cysts because of its role in filtering blood from the gastrointestinal tract[13]. The involvement of multiple organs in 14.6% of the cases highlights the potential for widespread disease and the need for thorough diagnostic evaluations.

The identification of CE4 and CE3a stages by ultrasound and CE3a (34.8%) and CE2 (29.7%) stages by CT provided a detailed understanding of disease progression, with similar stage distributions as reported in other studies[14]. The predominance of cysts less than 5 cm as identified by ultrasound (55.3%) and the 5-10 cm range by CT scan (57.3%) reflect the variations in cyst sizes and the importance of timely intervention to prevent complications associated with larger cysts[15].

Surgical treatment remains the cornerstone of management in 65.2% of the cases, with endocystectomy being the most common procedure (85.5%). This preference for surgical intervention aligns with recommendations for treating complicated or large cysts[16]. The use of drainage (80.6%), omentoplasty with a drain (17.5%), and reroofing with a drain (1.9%) as methods to manage the cyst cavity demonstrates the diverse surgical techniques available to address this condition[17].

For 34.8% of the patients who received medical treatment only, indications included small uncomplicated cysts (<5 cm), patient refusal of surgery, high surgical risk due to comorbidities, and recurrent cysts where

repeat surgery was deemed high-risk. The overall complete resolution rate of 81.8% in medically treated patients, particularly those with small CE1 and CE3a cysts (87.1% complete resolution), supports the effectiveness of albendazole therapy in appropriately selected patients, consistent with the guidelines recommending medical therapy for uncomplicated active cysts[18, 19].

The wound infection rate of 41.8% observed in our study was notably higher than the <10% rate typically reported for clean-contaminated surgeries in high-resource settings. Several factors may explain the elevated rate in our study. First, antibiotic prophylaxis: While all patients received prophylactic antibiotics (cefazolin 2 g intravenously) at the induction of anesthesia, the timing and administration of additional perioperative doses were sometimes inconsistent due to resource limitations and occasional shortages of antibiotics in our setting. Standard practice at our institution aims for a single pre-operative dose, with additional intraoperative doses only for procedures exceeding 3 h; however, due to medication availability issues, some patients may not have received optimal coverage. Second, cyst spillage during surgery occurred in 23 patients (22.3%) who underwent surgery. This is often due to cyst adherence to the surrounding structures, difficult dissection, or intraoperative rupture during the mobilization of large cysts. Spillage of cyst contents, even with scolicidal agent use, increases the risk of infectious complications and may contribute

Table 4. Treatment Approach and Surgical Management

Treatment Approach	Frequency	Percentage
Treatment Method		
Surgical	103	65.2%
Medical	55	34.8%
Surgical Procedure		
Endocystectomy (Simple cyst drainage)	88	85.5%
Endocystectomy and Excision	8	7.8%
Pericystectomy and excision	2	1.9%
Excision	2	1.9%
Splenectomy	3	2.9%

Table 5. Postoperative Complications and Outcomes

Postoperative Complications	Frequency	Percentage
Fistula	1	0.9%
Bile Leaks	5	4.9%
Wound Infection	43	41.8%
Death (due to heart disease)	1	0.9%
No Complications	53	51.5%
Treatment Outcomes (n=158)		
Complete Resolution of Symptoms	137	86.7%
Partial Resolution of Symptoms	13	8.2%
Recurrence of Hydatid Cyst Disease	8	5.1%

significantly to wound infection rates. Third, cyst size and complexity: The high prevalence of large cysts (>10 cm in 14% of cases) and complex cysts (CE2, CE3b) increased the technical difficulty of surgery and prolonged operative time, potentially contributing to a higher infection risk. The mean operative time for complex cysts was 145 ± 32 min, compared to 98 ± 24 min for simple cysts. Fourth, patient-related factors: Baseline patient characteristics in our setting, including potential malnutrition, delayed presentation with advanced disease, and possible immunocompromised status, may have impaired wound healing and increased susceptibility to infection. Fifth, environmental factors: Challenges in maintaining optimal sterile conditions in a resource-limited setting, including operating theater ventilation issues, high patient turnover, and limited availability of sterile supplies, may have contributed to the higher infection rates. These findings highlight the need for enhanced perioperative infection control measures in our context, including standardized antibiotic prophylaxis protocols, meticulous surgical techniques with an emphasis on spillage prevention, routine use of scolicidal agents, postoperative wound care optimization, and improved operating theater sterility protocols. Similarly high infection rates have been

reported in other resource-limited settings where hydatid cyst surgery is performed,[8, 10, 20]. suggesting that context-specific factors play a significant role.

The relatively low overall complication rate (no complications in 51.5% of patients) indicated the effectiveness of the surgical approaches used. A postoperative mortality rate of 0.9% due to heart disease and a high rate of complete symptom resolution (86.7%) indicated favorable outcomes with appropriate management. Recurrence in 5.1% of the cases underscores the need for long-term follow-up to promptly detect and address disease progression.

The significant associations between the site of the hydatid cyst, clinical presentation, and treatment outcomes emphasize the importance of early and accurate diagnosis to improve patient outcomes. Our analysis demonstrated a statistically significant correlation between cyst localization and clinical outcomes ($\chi^2 = 18.64$, $p = 0.017$), with liver-only cysts showing the best prognosis (89.7% complete resolution), and multi-organ involvement associated with higher recurrence rates (13.0%). These findings are consistent with the existing literature, which highlights the critical role of timely intervention in managing hydatid disease effectively[10]. The poorer out-



Table 6. Correlation between Cyst Localization and Clinical Outcomes

Cyst Localization	Complete Resolution n (%)	Partial Resolution n (%)	Recurrence n (%)	Total	χ^2	p-value
Liver only (n=116)	104 (89.7%)	7 (6.0%)	5 (4.3%)	116	18.64	0.017
Other single organ (n=13)	10 (76.9%)	2 (15.4%)	1 (7.7%)	13		
Multi-organ (n=23)	18 (78.3%)	4 (17.4%)	3 (13.0%)	23		
Peritoneal/Retroperitoneal (n=6)	5 (83.3%)	0 (0%)	1 (16.7%)	6		
Total	137 (86.7%)	13 (8.2%)	8 (5.1%)	158		

Note: Multi-organ involvement includes cysts in two or more abdominal organs. One patient with peritoneal or retroperitoneal localization who experienced recurrence had disseminated peritoneal disease at presentation. Chi-square test of independence: $\chi^2 = 18.64$, $df = 6$, $p = 0.017$.

comes in multi-organ involvement likely reflect more advanced disease, greater surgical complexity, and a higher risk of incomplete cyst removal or intraoperative spillage. Similarly, previous studies have demonstrated that cyst location significantly influences surgical outcomes and complication rates[21].

Our study provides valuable insights into the demographic, clinical, and diagnostic characteristics and treatment outcomes of patients with intra-abdominal hydatid cysts. Our findings have several important implications. In clinical practice, the higher prevalence of hydatid cysts among females and the most affected age group of 21-50 years should alert healthcare providers to consider hydatid disease in their differential diagnoses, particularly in endemic regions. The varied clinical presentations, including a significant proportion of asymptomatic cases, underscore the need for thorough diagnostic evaluation. Reliance on computed tomography for detailed visualization of hydatid cysts highlights the importance of advanced imaging techniques for accurate diagnosis and treatment planning. Incorporating standardized diagnostic protocols that emphasize the use of CT can improve the diagnostic accuracy and patient outcomes. The predominance of surgical intervention, particularly endocystectomy, as the primary treatment approach, emphasizes the importance of surgical expertise in managing hydatid cysts. The role of adjunctive medical therapies, such as albendazole, in reducing recurrence should also be highlighted in treatment guidelines. These findings reinforce the need for public health initiatives that focus on preventing hydatid disease transmission, particularly in endemic areas. Educating communities about hygiene practices and controlling definitive hosts (dogs) can help to reduce disease incidence.

Our study has some limitations. The study was conducted at a single center, which may limit the generalizability of the findings. Multicenter studies are required to validate these results across different settings. Additionally, some patients were lost to long-term follow-up, which may have affected the assessment of the long-term

outcomes and recurrence rates. Sociocultural factors, including patient attitudes toward medical intervention and follow-up, may have influenced the study results. An additional limitation is the relatively short follow-up period for some patients (minimum, 6 months; maximum, 24 months). Given that hydatid disease recurrence can occur years after treatment, a longer follow-up is needed to accurately assess long-term outcomes and true recurrence rates. Furthermore, we did not systematically assess patient adherence to medical therapy, which may have influenced the outcomes of the medically treated group.

Future research should focus on conducting multicenter studies to confirm these findings and to improve generalizability. Developing and adopting standardized diagnostic protocols that emphasize the use of CT for detailed imaging is also recommended. Encouraging the use of combined treatment approaches involving both medical therapy and surgical intervention with albendazole as the first-line agent (pre- and post-operative) can enhance treatment outcomes. Establishing rigorous follow-up protocols to monitor post-treatment outcomes, including regular imaging and clinical assessments to promptly detect and manage recurrences, is crucial. The formation of multidisciplinary teams comprising surgeons, infectious disease specialists, radiologists, and primary care physicians can ensure holistic patient care and improve treatment outcomes. Ongoing research to explore new diagnostic markers and treatment options is essential, as is conducting regular training sessions for healthcare providers, especially in rural areas, regarding the latest developments in hydatid cyst management.

5. CONCLUSION

This study analyzed the demographic, clinical, and diagnostic characteristics of patients with intra-abdominal hydatid cysts along with their treatment outcomes. Females were more commonly affected, with the most prevalent age group being 21-50 years. Abdominal pain was the most frequent symptom, and CT scans were the pri-

many diagnostic tools, emphasizing their importance for accurate diagnosis. Surgical intervention, particularly endocystectomy, is the main treatment approach, and most patients experience complete symptom resolution. The most common complications were fistulas, bile leaks, and wound infections. The findings highlight significant correlations between cyst localization and clinical outcomes, highlighting the need for early and accurate diagnosis. These findings support the need for standardized diagnostic protocols, combined treatment approaches, and comprehensive posttreatment follow-up. Continued research and multidisciplinary collaboration are essential for improving patient outcomes and reducing the disease burden.

5.1. COMPETING INTERESTS

The authors declare that they have no conflicts of interest.

5.2. FUNDING

This research received no specific grants from any funding agency in the public, commercial, or not-for-profit sectors.

5.3. AUTHOR CONTRIBUTIONS

Yasser Abdurabo Obadiel: Conceptualization, methodology, investigation, data curation, writing – original draft, writing – review & editing, supervision. Amat Alrahman Al-Amdi: Investigation, data collection, patient follow-up, writing – original draft, writing – review & editing. Haitham Mohammed Jowah: Conceptualization, methodology, formal analysis, statistical analysis, writing – original draft, writing – review & editing, corresponding author. All authors have read and approved the final manuscript.

5.4. DATA AVAILABILITY STATEMENT

All relevant data are within the paper and its tables. The raw patient data collected during this study are available as a supplementary CSV file and can also be obtained from the corresponding author upon reasonable request.

5.5. ACKNOWLEDGEMENTS

A preprinted version of this article is available on the Research Square platform (DOI: <https://doi.org/10.21203/rs.3.rs-4889040/v1>).

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