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Systematic Review

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Current Perspectives on Cystic Echinococcosis: A Systematic Review

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Introduction: Hydatidosis, a zoonotic disease caused by the larval stage of *Echinococcus granulosus*, is a significant public health concern with notable economic impact. It leads to morbidity and mortality worldwide, particularly in endemic regions. This study systematically reviews recent literature on cystic echinococcosis (CE) to provide updated insights into its prevalence, impact, and management.

Methods: A systematic review was conducted using PubMed to find original articles on hydatid cysts published between September 1, 2019, and September 1, 2024. Data extracted included the first author's name, country, publication year, study type, number of cases, clinical presentation, diagnostic methods, cyst location and quantity, cyst status, treatment type and medications, follow-up details, recurrence, and mortality rates. Data were organized and qualitatively analyzed.

Results: A total of 398 articles were identified, of which 229 articles with 1,002 patients met the inclusion criteria. Spain reported the highest number of CE cases at 362 (36.13%). Asia accounted for 487 cases (48.60%), and Europe contributed 460 cases (45.91%). The liver was the most frequently affected organ, accounting for 731 cases (72.95%), followed by the lungs with 110 cases (10.98%), and the kidney with 43 cases (4.29%). The age distribution of the cases showed that 63 (6.29%) were aged between 3 and 18 years.

Conclusion: Hydatidosis remains a significant global public health concern, impacting developing and developed countries. The liver and lungs remain the primary sites of infection. Preventive strategies, including regular animal screening and enhanced public health education, are essential for controlling the spread of the disease.

Keywords: Echinococcosis, Hydatidosis, Hydatid cyst, *Echinococcus granulosus*, Endemic regions

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1. Introduction

Cystic echinococcosis (CE), also known as hydatid disease (HD) or hydatidosis, is a well-known zoonotic disease caused by the larval stage of the tapeworm *Echinococcus granulosus*. Humans usually act as intermediate hosts, contracting the infection through direct contact with primary hosts like sheep, goats, cattle, dogs, and other canines or consuming food and water contaminated with the parasite's eggs [1, 2].

To date, HD is a serious public health problem that carries considerable economic implications. It leads to morbidity and mortality in various regions, notably in Mediterranean countries, the Middle East, New Zealand, Australia, India, and South America, mainly due to the close connections between sheep, dogs, and humans. It remains a neglected disease in many regions, necessitating

concerted efforts for prevention and control, especially in rural areas where it is more prevalent [3, 4].

Hydatidosis can affect nearly any part of the body, but the liver is the organ most frequently impacted (75%), followed by the lungs (15%) and other organs like the brain (2%) and spine (1%) [3]. Hydatidosis is marked by a prolonged asymptomatic incubation period, often lasting several years. Clinical symptoms appear when the cysts grow large enough to compress nearby tissues. Additionally, cyst rupture into the peritoneal cavity can result in secondary cyst formation and the development of daughter cysts within them [3, 4]. This study systematically reviews recent literature on CE to provide updated insights into its prevalence, impact, and management.

2. Methods

2.1. Study design

This systematic review was conducted according to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines.

2.2. Data sources and search strategy

A systematic review was performed using PubMed to identify original articles on hydatid cysts. The search strategy targeted recent, peer-reviewed clinical studies on echinococcosis in human populations, published from September 1, 2019, to September 1, 2024, and restricted to English-language research. The search was limited to the literature of the last five years to shed light on the current disease situation.

2.3. Eligibility criteria

This systematic review included only original studies and case reports. Exclusion criteria were as follows: 1) articles not in English, 2) abstract only, 3) studies on alveolar echinococcosis, 4) studies unrelated to humans, 5) inadequately peer-reviewed articles, and 6) any study types that did not meet the inclusion criteria. All references in this study were evaluated for eligibility [5].

2.4. Study selection and data extraction

The titles and abstracts of the selected studies were initially screened, followed by an in-depth full-text review to assess eligibility. Data extracted from each included study encompassed the first author's name, country of origin, publication year, study type, number of cases, clinical presentation, diagnostic approaches, hydatid cyst location, cyst quantity, cyst status (intact or ruptured), treatment type, medications used, follow-up details, recurrence rate, and mortality rate.

2.5. Statistical analyses

Data were organized in an Excel spreadsheet (Microsoft Excel, 2021) and qualitatively analyzed using the Statistical Package for the Social Sciences (SPSS, version 27.0). Key findings were summarized as median, range, frequencies, and percentages.

3. Results

A total of 398 articles were identified through the search. After an initial review, 11 articles were excluded due to duplication and non-English language. The remaining 387 articles underwent title and abstract screening, during which 64 articles were excluded for not meeting the inclusion criteria. Consequently, 323 articles proceeded to full-text screening, and 93 were excluded due to unretrievable data, editorials, letters, or incomplete information. The remaining articles were then assessed for eligibility, resulting in 229 articles [1, 3, 4, 6-231] with 1,002 patients meeting the inclusion criteria and included in the study [Fig. 1].

Among the included studies, 217 (94.76%) were case reports, seven (3.06%) were cohort studies, three (1.31%) were case series, one (0.44%) was a cross-sectional study, and one (0.44%) was a randomized controlled trial (Table 1). Among the countries, Spain recorded the highest number of cases with 362 (36.13%), followed by China with 270 cases (26.95%) and Turkey with 128 cases (12.77%), collectively accounting for approximately 75% of the total reported cases (Table 2). In terms of continental distribution, Asia recorded 487 cases (48.60%), while Europe was not far behind with 460 cases (45.91%) (Table 3).

The liver was the most frequently affected organ, accounting for 731 cases (72.95%), followed by the lungs with 110 cases (10.98%), the kidney with 43 cases (4.29%), the heart with 37 cases (3.69%), and muscle tissue with 24 cases (2.40%) (Table 4). The gender distribution among the cases was nearly equal, with 505 males (50.40%) and 496 females (49.50%). The age distribution revealed that 63 cases (6.29%) were between 3 and 18 years old, while the age of 740 patients (73.85%) was unspecified. Among the identified cases, the median age was 35 (QR:19-51) years. The most common clinical presentations included pain (18.86%), fever (6.59%), shortness of breath (4.09%), and cough (2.69%), with 51 cases (5.09%) being asymptomatic. Clinical presentation was not documented for 616 cases (61.48%). Regarding cyst characteristics, single cysts were identified in 466 cases (46.51%), and intact cysts were found in 100 patients (9.98%). Treatment predominantly involved surgical intervention, performed in 639 cases (63.77%), and Albendazole was the most commonly prescribed medication, given in 275 cases (27.44%). Follow-up data revealed that 347 patients were monitored for less than six months (34.63%). Recurrence was observed in 26 cases (2.59%), and mortality occurred in 17 patients (1.70%) (Table 5).

4. Discussion

Hydatidosis is most common in countries with extensive livestock industries but has recently become a significant global health issue due to rising immigration and travel [117, 232]. The disease is prevalent in Peru, Chile, Argentina, Uruguay, southern Brazil, the Mediterranean basin, Central Asia, western China, and East Africa. It remains absent in Antarctica and has been successfully eradicated through comprehensive control measures in Iceland, New Zealand, Tasmania, the Falkland Islands, and Cyprus [233]. In the present study, Spain unexpectedly showed the highest percentage of CE cases, with 36.13%, followed by China (26.95%) and Turkey (12.77%), collectively accounting for nearly 75% of all reported cases. Spain is known to be an endemic country for CE, but this unusually high percentage may be attributed to the fact that Spain has advanced healthcare infrastructure and diagnostic capabilities, which could lead to more accurate identification and reporting of CE cases. In contrast, in many developing countries, where resources and diagnostic tools may be limited, CE cases might be underreported or misdiagnosed [234]. This diversity underscores the importance of diagnostic and reporting capabilities when comparing CE prevalence across countries with differing healthcare systems. Regarding continental distribution, Asia represented 48.60% of cases, with Europe closely following at 45.91%. This distribution demonstrates that CE is not limited to traditionally endemic regions in developing countries but is also present in developed countries.

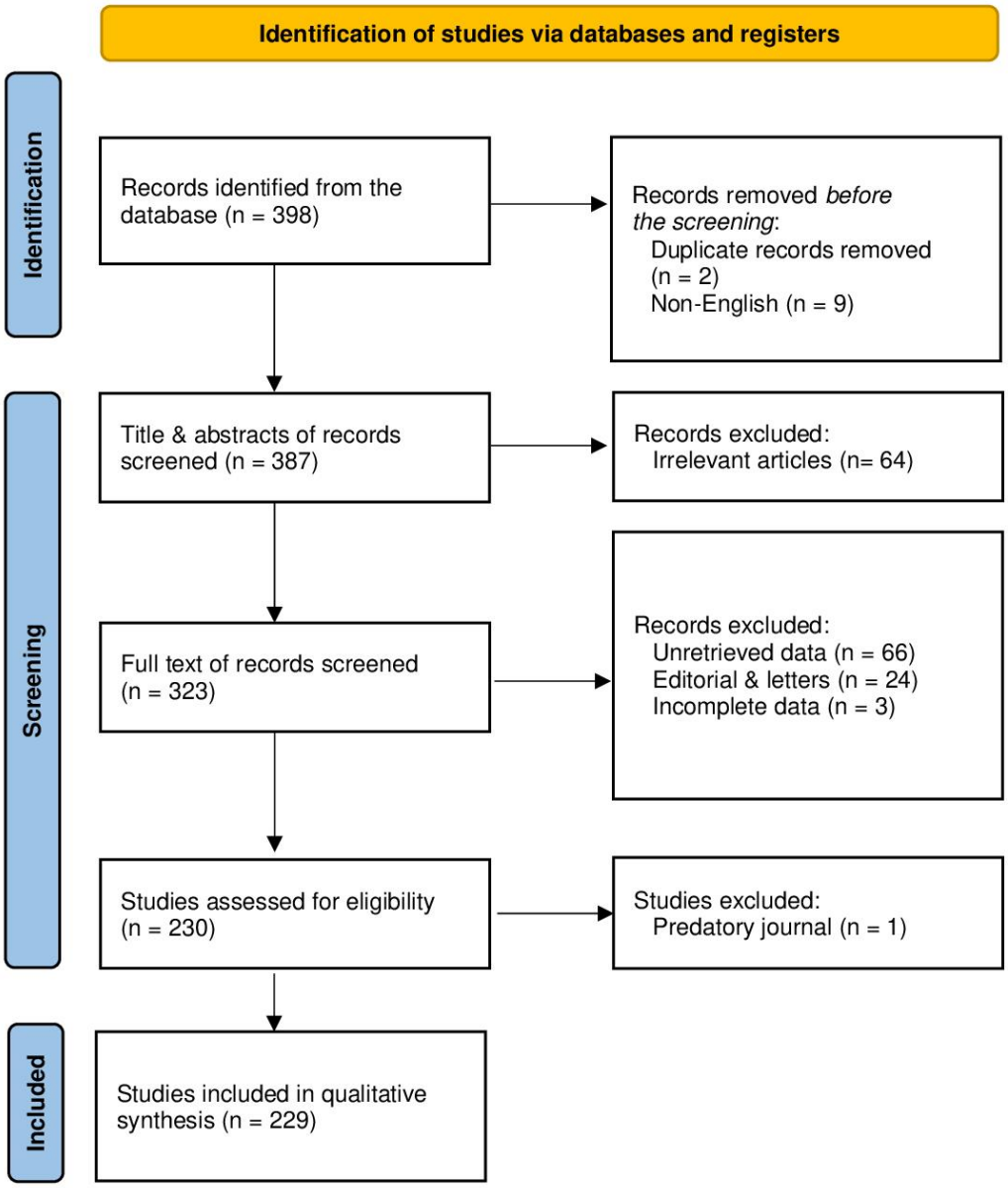

Figure 1. The PRISMA diagram illustrating the study selection process

Studies have identified the liver as the most common site for hydatid cysts, accounting for 75% of cases, followed by the lungs (15%) and the brain (2%) [3]. Furthermore, cysts can form in various other organs and structures, including the abdominal and pleural cavities, kidneys, spleen, bones, eyes, ovaries, testes, and pancreas [233]. The current study's findings confirm that the liver remains the most frequently affected organ (73%), with the lungs (11%) being the second most common site, consistent with the literature. However, the current study found that the kidneys, heart, and muscles were more frequently affected than the brain (2%–4% of cases). This contrasts with previous studies identifying the brain as the third most commonly affected organ [3, 235].

The European Centre for Disease Prevention and Control (ECDC) indicates that the occurrence of echinococcosis does not display a notable difference between genders, presenting a nearly balanced male-to-female ratio of 1.1:1 [236]. This finding aligns with the results of the present study, where the gender distribution among the cases was nearly equal, with males comprising 50.39% and females 49.50%, yielding a male-to-female ratio of approximately 1:0.98. However, Otero-Abad et al. reported that women are more susceptible to echinococcosis than men. This increased risk was linked to their more significant participation in household activities, such as food preparation and caring for pets, heightening their exposure to infected dogs, soil, and vegetables [237].

Table 1. The details of the included studies

First Author, Year	Study design	Country	No. of cases	First Author, Year	Study design	Country	No. of cases	First Author, Year	Study design	Country	No. of cases
AlRashed, 2024 [1]	A	Saudi Arabia	1	Mutlu, 2022 [82]	A	Turkey	1	Gatt, 2020 [157]	A	Israel	1
Amer, 2024 [6]	A	Iran	1	Ozgokce, 2022 [83]	A	Turkey	1	Giri, 2020 [158]	A	Bhutan	1
Babiker, 2024 [7]	A	Qatar	1	Passarelli, 2022 [84]	A	US	1	Gopivallabha, 2020 [159]	A	India	1
Bazzi, 2024 [8]	A	Lebanon	1	Pulavarty, 2022 [85]	A	India	1	Delgado, 2020 [160]	A	Spain	1
Brezeanu, 2024 [9]	A	Romania	1	Rodríguez-Laiz, 2022 [86]	A	Spain	1	Handran, 2020 [161]	A	US	1
Calu, 2024 [10]	A	Romania	2	Sezer, 2022 [87]	A	Turkey	1	İriz, 2020 [162]	A	Turkey	1
Chen, 2024 [11]	A	Taiwan	1	Shahid, 2022 [88]	A	Pakistan	1	İyigün, 2020 [163]	A	Turkey	1
Darestani, 2024 [12]	A	Iran	1	Sharma, 2022 [89]	A	India	1	Jarovsky, 2020 [164]	A	Brazil	1
Ghaedamini, 2024 [13]	A	Iran	1	Sozutok, 2022 [90]	A	Turkey	1	Johny, 2020 [165]	A	India	1
Gulati, 2024 [14]	A	US	1	Sun, 2022 [91]	B	China	2	Kankilic, 2020 [166]	B	Turkey	6
Hasnaoui, 2024[15]	A	Tunisia	1	Ulusoy, 2022 [92]	A	Turkey	1	Kaskar, 2020 [167]	A	India	1
Haydar, 2024 [16]	A	Iran	1	Uzunoğlu, 2022 [93]	A	Turkey	1	Kiran, 2020 [168]	A	India	1
Jalayeri, 2024 [17]	A	Iran	1	Wang, 2022 [94]	A	China	1	Kırmacı, 2020 [169]	A	Turkey	1
Jellali, 2024 [18]	A	Tunisia	1	Agarwal, 2021 [95]	A	India	1	Kumar, 2020 [170]	A	India	1
Karahan, 2024 [19]	A	India	1	Aghajanzadeh, 2021 [4]	A	Iran	1	Lahdhil, 2020 [171]	A	Tunisia	1
Koren, 2024 [20]	A	Israel	1	Aili, 2021 [96]	A	China	1	Lapierre, 2020 [172]	A	Canada	1
Mahesan, 2024 [21]	A	India	1	Akhan, 2021 [97]	A	Turkey	1	Llanos, 2020 [173]	A	US	1
Bouhout, 2024 [22]	A	Morocco	1	Basne, 2021 [98]	A	Nepal	1	Lodhia, 2020 [174]	A	Tanzania	2
Manuel, 2024 [23]	A	Angola	1	Biswas, 2021 [99]	A	India	3	Lyske, 2020 [175]	A	Canada	1
Mierzejewski, 2024 [24]	A	Poland	1	Boumarah, 2021 [100]	A	Saudi Arabia	1	Ma, 2020 [176]	E	China	195

Table 1. Continued…

First Author, Year	Study design	Country	No. of cases	First Author, Year	Study design	Country	No. of cases	First Author, Year	Study design	Country	No. of cases
Mutlu, 2024 [25]	A	Turkey	1	Çankaya, 2021 [101]	A	Turkey	1	Mitrovic, 2020 [177]	A	Serbia	1
Remmerswaal, 2024 [26]	A	Netherlands	1	Cathomas, 2021 [102]	A	Switzerland	2	Mittal, 2020 [178]	A	India	1
Reyimu, 2024 [27]	A	China	1	Chatzifotiou, 2021 [103]	A	Germany	1	Moghtadaie, 2020 [179]	A	Iran	1
Sączek, 2024 [28]	A	Poland	1	Christodoulidis, 2021 [3]	C	Greece	50	Nistor, 2020 [180]	A	Romania	1
Thakar, 2023 [29]	A	India	1	Ciftci, 2021 [104]	C	Turkey	34	Ogul, 2020 [181]	A	Turkey	1
Voicu, 2024 [30]	A	Romania	1	Conlon, 2021 [105]	A	Ireland	1	Pappas, 2020 [182]	A	Greece	1
Aarif, 2023 [31]	A	India	1	Elvan-Tuz, 2021 [106]	A	Turkey	2	Ramia, 2020 [183]	C	Spain	71
Alsulami, 2023 [32]	A	Saudi Arabia	1	Gautam, 2021 [107]	A	India	1	Samadian, 2020 [184]	A	Iran	1
Ammar, 2023 [33]	A	Tunisia	1	Ghabisha, 2021 [108]	A	Yemen	1	Sangal, 2020 [185]	A	India	1
Borni, 2023 [34]	A	Tunisia	1	Gonder, 2021 [109]	C	Turkey	9	Sauteur, 2020 [186]	A	Switzerland	1
Carrel, 2023 [35]	A	Uzbekistan	1	Govindaraj, 2021 [110]	A	India	1	Savu, 2020 [187]	A	Romania	1
Casulli, 2023 [36]	A	Italy	1	Guha, 2021 [111]	A	India	1	Schleenvoigt, 2020 [188]	A	Germany	1
Caushi, 2023 [37]	A	Albania	1	Hâlmaciu, 2021 [112]	A	Romania	1	Singh, 2020 [189]	A	India	1
Das, 2023 [38]	A	India	1	Harmouchi, 2021 [113]	A	Morocco	1	Singh, 2020 [190]	A	India	1
Galvis, 2023 [39]	A	Colombia	1	Helvaci, 2021 [114]	A	Turkey	1	Singla, 2020 [191]	A	India	1
Göktürk, 2023 [40]	A	Turkey	1	Hermosa, 2021 [115]	A	Spain	1	Sonsoz, 2020 [192]	A	Turkey	1
Hakimi, 2023 [41]	A	Afghanistan	1	Iken, 2021 [116]	A	Morocco	1	Tekin, 2020 [193]	A	Turkey	1
Hasnaoui, 2023 [42]	A	Tunisia	1	Jaén-Torrejimeno, 2021 [117]	C	Spain	287	Tlili, 2020 [194]	A	Tunisia	1
Jia, 2023 [43]	A	China	1	Jindal, 2021 [118]	A	India	1	Tonkaz, 2020 [195]	A	Turkey	1

Table 1. Continued…

First Author, Year	Study design	Country	No. of cases	First Author, Year	Study design	Country	No. of cases	First Author, Year	Study design	Country	No. of cases
Kardoun, 2023 [44]	A	Tunisia	1	Kafadar, 2021 [119]	A	Turkey	1	Van De, 2020 [196]	A	Korea	2
Lao, 2023 [45]	A	China	1	Kankam, 2021 [120]	A	Iran	1	Vasilescu, 2020 [197]	A	Romania	1
Lees, 203 [46]	A	UK	1	Kechiche, 2021 [121]	B	Tunisia	10	Verma, 2020 [198]	A	India	1
Li, 2023 [47]	A	China	1	Khasawneh, 2021 [122]	A	Jordan	2	Villalobos, 2020 [199]	A	US	1
Ma, 2023 [48]	A	China	1	Kumar, 2021 [123]	A	India	1	Xu, 2020 [200]	A	China	1
Maggioni, 2023 [49]	A	Italy	1	Li, 2021 [124]	A	China	1	Yang, 2020 [201]	A	China	1
Mahmood, 2023 [50]	A	Pakistan	1	Maliqari, 2021 [125]	A	Albania	1	Yimamu, 2020 [202]	A	China	1
Mayekar, 2023 [51]	A	India	1	Moshref, 2021 [126]	A	Saudi Arabia	1	Abbas, 2019 [203]	A	Morocco	1
Moraes, 2023 [52]	A	Brazil	1	Mozafar, 2021 [127]	A	Iran	1	Aydin, 2019 [204]	A	Turkey	1
Moscatelli, 2023 [53]	A	Argentina	1	Rabhi, 2021 [128]	A	Tunisia	1	Banerjee, 2019 [205]	A	India	1
Ntombela, 2023 [54]	A	South Africa	2	Rhissassi, 2021 [129]	A	Morocco	1	Beyhan, 2019 [206]	A	Turkey	1
Peralta, 2023 [55]	A	Ecuador	1	Safari, 2021 [130]	A	Iran	1	Bracha, 2019 [207]	A	Israel	2
Peulier-Maitre, 2023 [56]	A	France	1	Shakerian, 2021 [131]	A	Iran	1	Chaouch, 2019 [208]	A	Tunisia	1
Ruíz-Pérez, 2023 [57]	A	Peru	1	Sharifi, 2021 [132]	A	Iran	1	Demir, 2019 [209]	A	Turkey	1
Safarpour, 2023 [58]	A	Iran	2	Sharma, 2021 [133]	A	India	1	Derbel, 2019 [210]	A	Tunisia	1
Shah, 2023 [59]	A	India	1	Shuaibi, 2021 [134]	A	US	1	Gök, 2019 [211]	A	Turkey	1
Türkoğlu, 2023 [60]	A	Turkey	1	Simsek, 2021 [135]	A	Turkey	3	Kandemirli, 2019 [212]	A	Turkey	1
Wang, 2023 [61]	A	China	1	Şimşek, 2021 [136]	A	Turkey	1	Kang, 2019 [213]	A	Korea	1
Ahmady-Nezhad, 2023 [62]	A	Iran	1	Singh, 2021 [137]	A	India	1	Kaya, 2019 [214]	A	Turkey	1
Assefa, 2022 [63]	A	Ethiopia	1	Ucar, 2021 [138]	A	Turkey	1	Khullar, 2019 [215]	A	India	1

Table 1. Continued…

First Author, Year	Study design	Country	No. of cases	First Author, Year	Study design	Country	No. of cases	First Author, Year	Study design	Country	No. of cases
Bicer, 2022 [64]	A	Turkey	1	van Zijl, 2021 [139]	A	South Africa	1	Kuzmanovska, 2019 [216]	A	Macedonia	2
Bishnoi, 2022 [65]	A	India	1	Velho, 2021 [140]	A	Portugal	1	MadissonBernardo, 2019 [217]	A	Brazil	1
Castro, 2022 [66]	A	Brazil	1	Wang, 2021 [141]	A	China	1	Magistri, 2019 [218]	C	Italy	15
Dantis, 2022 [67]	A	India	1	Wu, 2021 [142]	A	China	1	Milosavljevic, 2019 [219]	A	Serbia	1
Dere, 2022 [68]	A	Turkey	1	Yasin, 2021 [143]	A	Malaysia	1	Ramteke, 2019 [220]	A	India	2
Fourati, 2022 [69]	A	Tunisia	1	Zedelj, 2021 [144]	A	Croatia	1	Sharma, 2019 [221]	A	India	1
González Arboleda, 2022 [70]	A	Chile	1	Zhang, 2021 [145]	A	China	1	Singh, 2019 [222]	A	India	1
Hammade, 2022 [71]	A	Syria	1	Zouaghi, 2021 [146]	A	Tunisia	1	Syllaios, 2019 [223]	A	Greece	1
Hanaliogl u, 2022 [72]	A	Turkey	1	Aboksari, 2020 [147]	A	Iran	1	Taşlıçay, 2019 [224]	A	Turkey	1
Çeviker, 2022 [73]	A	Turkey	1	Acharya, 2020 [148]	A	Nepal	1	Tonkaz, 2019 [225]	A	Turkey	1
Huertas, 2022 [74]	A	Spain	1	Akhan, 2020 [149]	D	Turkey	38	Trawinski, 2019 [226]	A	Germany	1
Ijaz, 2022 [75]	A	Pakistan	1	Akhtar, 2020 [150]	A	India	1	Wa, 2019 [227]	A	China	1
Karahan, 2022 [76]	A	Turkey	1	Arora, 2020 [151]	A	India	1	Wang, 2019 [228]	A	China	1
Karami, 2022 [77]	A	Iran	1	Assimakopoulos, 2020 [152]	A	Greece	1	Xu, 2019 [229]	A	China	1
Kartavya, 2022 [78]	A	India	1	Bakshi, 2020 [153]	A	India	1	Yacine, 2019 [230]	A	Tunisia	1
Kumar, 2022 [79]	A	India	1	Destek, 2020 [154]	A	Turkey	1	Zhuoli, 2019 [231]	A	China	1
Li, 2022 [80]	C	China	53	Dkhissi, 2020 [155]	A	Morocco	1				
Li, 2022 [81]	A	China	1	Ewnte, 2020 [156]	A	Ethiopia	1				

A: *case report,* ***B:*** *case series,* ***C:*** *cohort,* ***D:*** *randomized control trial,* ***E:*** *cross-sectional study,* ***US:*** *United States,* ***UK:*** *United Kingdom*

Table 2. The distribution of reported cases across countries

Country	Number of Cases	Percentage (%)
Spain	362	36.13%
China	270	26.95%
Turkey	128	12.77%
Greece	53	5.29%
India	44	4.39%
Tunisia	24	2.40%
Iran	18	1.80%
Italy	17	1.70%
Romania	8	0.80%
Morocco	6	0.60%
United States	6	0.60%
Brazil	4	0.40%
Israel	4	0.40%
Saudi Arabia	4	0.40%
Germany	3	0.30%
Pakistan	3	0.30%
South Africa	3	0.30%
South Korea	3	0.30%
Switzerland	3	0.30%
Albania	2	0.20%
Canada	2	0.20%
Ethiopia	2	0.20%
Jordan	2	0.20%
Macedonia	2	0.20%
Nepal	2	0.20%
Poland	2	0.20%
Serbia	2	0.20%
Tanzania	2	0.20%
Afghanistan	1	0.10%
Angola	1	0.10%
Argentina	1	0.10%
Bhutan	1	0.10%
Chile	1	0.10%
Colombia	1	0.10%
Croatia	1	0.10%
Ecuador	1	0.10%
France	1	0.10%
Ireland	1	0.10%
Lebanon	1	0.10%
Malaysia	1	0.10%
Netherlands	1	0.10%
Peru	1	0.10%
Portugal	1	0.10%
Qatar	1	0.10%
Syria	1	0.10%
Taiwan	1	0.10%
United Kingdom	1	0.10%
Uzbekistan	1	0.10%
Yemen	1	0.10%

Moro et al. stated that only 10-20% of CE cases are identified in patients under 16 years old [238]. This is likely because CE is slow-growing and often asymptomatic, with most liver and lung cysts becoming symptomatic and diagnosed in adults. In contrast, in the current study, the highest prevalence of CE was observed in the pediatric age group of 3-18 years, with a rate of 24.05% among the 262 patients with available age data. This difference may be attributed to advancements in early CE diagnosis and the fact that most cases in this study were based on case reports. However, it is important to note that age data were unavailable for 73.85% of patients, which could potentially influence the observed distribution, as the missing data might disproportionately affect certain age groups and alter the findings. The next highest prevalence was in the 19-30 years (19.85%) and 31-40 years (17.94%) age groups, indicating that CE is also common among young and middle-aged adults. In contrast, a study in Western Romania found the highest prevalence in individuals aged 50-59 years (21.7%) [239], while the current study showed a much lower prevalence in the 51-60 years age group (1.80%). These differences may be attributed to regional variations in risk factors, such as livestock exposure, environmental conditions, and access to healthcare, all of which can influence the age distribution of CE.

Table 3. Distribution of cases across continents

Continent	Number of cases	Percentage (%)
Asia	487	48.60%
Europe	460	45.91%
Africa	38	3.79%
South America	9	0.90%
North America	8	0.80%

The clinical presentation of CE is highly variable, primarily influenced by factors such as the cyst's location, size, and condition. As CE cysts tend to grow slowly over time, they often result in a prolonged asymptomatic phase. Symptoms usually appear when the cysts reach a size that causes pressure effects or functional impairment in the affected organ [238]. Several studies highlight the differences in asymptomatic rates across various organ involvements. Ciftci et al. reported that 52.9% of patients with renal hydatid cysts were asymptomatic, indicating that cysts in the kidneys may remain unnoticed for extended periods until they cause local complications or are incidentally discovered [104]. In contrast, Akhan et al. found a higher rate of asymptomatic cases, 73.68%, among patients with liver hydatid cysts, suggesting that hepatic involvement might often go undetected, potentially due to the liver's capacity to accommodate growth without immediate symptoms [149]. In the present study, clinical presentation for 386 patients was available, and a much lower asymptomatic rate of 13.21% was observed. This discrepancy could be due to differences in cyst locations. It is possible that a higher proportion of patients in this study presented with symptoms due to the cysts being located in more clinically sensitive areas. Additionally, the lower asymptomatic rate might reflect a population with more advanced or larger cysts at the time of diagnosis, thereby increasing the likelihood of symptomatic presentation.

Early detection of CE can greatly improve the success of its management and treatment [240]. The definitive diagnosis of CE typically relies on imaging techniques such as radiology, ultrasound, computed tomography (CT), and magnetic resonance imaging (MRI) [241]. Serological tests like enzyme-linked immunosorbent assay (ELISA) offer high specificity for detecting HD, but a positive result does not accurately reveal the cyst's location. Conversely, imaging methods provide detailed visualization, identifying cysts at specific sites.

This limitation emphasizes combining serological testing with imaging to diagnose and precisely locate the hydatid cyst [242]. In the present study, among the 170 patients with CE who had serological test results available, 18.23% tested negative.

Table 4. Distribution of organs and body parts affected by hydatid cysts

Organ	Number of cases*	Percentage (%)
Liver	731	72.95%
Lung	110	10.98%
Kidney	43	4.29%
Heart	37	3.69%
Muscle	24	2.40%
Brain	21	2.10%
Abdominal cavity	16	1.60%
Bone	14	1.40%
Vertebral and spinal region	14	1.40%
Pelvic region	12	1.20%
Pancreas	9	0.90%
Spleen	8	0.80%
Mediastinum	5	0.50%
Breast	4	0.40%
Uterus	4	0.40%
Intra-orbital	3	0.30%
Thyroid gland	2	0.20%
Gallbladder	1	0.10%
Others	14	1.40%

***** *Some patients had hydatid cysts in more than one organ.*

Preventing CE relies on disrupting *E. granulosus*'s life cycle. For instance, regular screening and treatment of infected dogs have effectively eradicated the disease in endemic regions. Additional control measures include restricting the feeding of home-slaughtered livestock to dogs and vaccinating intermediate hosts, such as sheep [243]. Community education plays a crucial role in preventing disease spread by raising awareness of the risks associated with infected animals and contaminated environments. Ongoing monitoring and collaboration among healthcare providers, veterinarians, and the community are essential for early detection and prompt intervention [244].

One limitation of this study is the predominance of case reports among the included studies. While these reports offer valuable insights into rare occurrences, they are inherently limited by small sample sizes, and potential selection bias. As a result, the findings may not be easily generalized to broader populations, and the ability to draw strong conclusions. Further research is needed to address the diagnostic challenges of CE in non-endemic regions, with a focus on improving early detection and treatment. Future studies should prioritize increasing healthcare professionals' knowledge, refining diagnostic processes, and evaluating the effectiveness of serological and imaging tools in regions with low disease prevalence.

Table 5. Clinical and demographic characteristics of patients

Variables	Frequency (percentage)
Gender	
Male	505 (50.40%)
Female	496 (49.50%)
Non-Identified	1 (0.10%)
Age (year)	
3 – 18	63 (6.29%)
19 – 30	52 (5.19%)
31 – 40	47 (4.69%)
41 – 50	34 (3.39)
51 – 60	18 (1.80%)
61 – 70	28 (2.79%)
> 70	20 (2.00%)
N/A	740 (73.85%)
Median (QR)	35 (19–51)
Clinical presentations*	
Pain	189 (18.86%)
Fever	66 (6.59%)
Shortness of breath	41 (4.09%)
Cough	27 (2.69%)
Asymptomatic	51 (5.09%)
Others	42 (4.19%)
N/A	616 (61.48%)
Diagnostic findings	
Hydatid serology	
Positive	139 (13.87%)
Negative	31 (3.09%)
N/A	832 (83.03%)
CT scan	806 (80.44%)
Ultrasound	475 (47.40%)
MRI	168 (16.77%)
X. ray	69 (6.88%)
Echocardiogram	23 (2.29%)
N/A	105 (10.48%)
Quantity of the cyst	
Single cyst	466 (46.51%)
Multiple cysts	203 (20.26%)
N/A	333 (33.23%)

Table 5. Continued…

Variables	Frequency (percentage)
Cyst status	
Patients with intact cysts	100 (9.98%)
Patients with ruptured cysts	97 (9.68%)
Patients with intact and ruptured cysts	6 (0.60%)
N/A	799 (79.74%)
Type of treatment	
Surgical intervention	639 (63.77%)
Percutaneous treatment	75 (7.49%)
Medical treatment	31 (3.09%)
None	2 (0.20%)
N/A	255 (25.45%)
Medication	
Albendazole	275 (27.44%)
Albendazole & Praziquantel	9 (0.90%)
Mebendazole	1 (0.10%)
None	26 (2.59%)
N/A	691 (68.96%)
Follow up	
< 1 month – 6 months	347 (34.63%)
> 6 months – 1 year	25 (2.50%)
> 1 year – 2 years	27 (2.69%)
> 2years – 4 years	13 (1.30%)
> 4 years – 7 years	5 (0.50%)
> 7 years	2 (0.20%)
N/A	583 (58.18%)
Recurrence	
Yes	26 (2.59%)
No	566 (56.49%)
N/A	410 (40.92%)
Death	
Yes	17 (1.70%)
No	666 (66.47%)
N/A	319 (31.83%)

***** *Some patients had multiple clinical presentations,* ***CT scan****: computed tomography scan,* ***MRI****: magnetic resonance imaging,* ***N/A****: not available*

5. Conclusion

Hydatidosis persists as a significant global public health concern, impacting both developing and developed countries. The liver and lungs remain the primary sites of infection. Preventive strategies, including regular animal screening and enhanced public health education, are essential for controlling the spread of the disease.

Declarations

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