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Clinical Analysis of 128 Children and Adolescents with Echinococcosis

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Abstract: *Objective:* To comprehend the clinical characteristics and treatment approaches for children and adolescents in Qinghai Province with two types of echinococcosis, cystic echinococcosis (CE) and alveolar echinococcosis (AE). *Methods:* A total of 128 pediatric inpatients with echinococcosis at the People's Hospital of Qinghai Province and the Clinical Research Institute of Echinococcosis of Qinghai Province between January 2016 and December 2021 were chosen as subjects. Demographic and clinical data were collected, and double data entry was executed using EpiData 3.02. Factors influencing the cure of echinococcosis were analyzed with echinococcosis cure as the dependent variable, employing statistical analysis via SPSS 19.0. *Results:* Of the cases, 35.9% had CE, and 64.1% had AE. Both types were observed in patients of all ages, with the majority aged 13–18. The number of cysts and their sizes varied between CE and AE. Complications were prevalent, including liver, gallbladder, lung, and nutritional complications. Univariate analyses revealed significant differences in outcomes based on factors such as cyst size (for CE), liver function grade (for AE), hydatid hypersensitivity test, operation, and length of hospital stay ($P < 0.05$). *Conclusion:* This comprehensive analysis of hospitalized cases sheds light on the clinical data of echinococcosis in children and adolescents in Qinghai Province. The findings contribute to a scientific foundation for formulating effective prevention and control measures tailored to this demographic, facilitating an improved understanding of echinococcosis in Qinghai province.

Keywords: Echinococcosis; Children and adolescents; Clinical features; Disease outcome.

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1. Introduction

Echinococcosis, a zoonotic parasitic disease, encompasses cystic echinococcosis (CE) and multilocular alveolar echinococcosis (AE) [1]. It is globally prevalent, particularly in Asia, Africa, Europe, Australia, and South America [2]. Echinococcosis poses a threat to approximately 60 million people, with 2–3 million identified cases, and one-third affecting children and adolescents [3]. Tragically, fatalities occur in this demographic.

In China, 21 out of 31 provinces, municipalities, and autonomous regions report varying degrees of echinococcosis, notably in the western regions [4]. A survey conducted in four counties of the Qinghai pastoral

area revealed a high infection rate of 13.74% among children and adolescents, ranking it highest among China's major pastoral areas. Moreover, the age of onset is trending younger, warranting heightened attention [5].

Given the underdeveloped immune systems of children and adolescents, echinococcosis can induce symptoms such as appetite loss, emaciation, and even anemia, impacting their overall growth and development. This study aims to retrospectively analyze clinical data from 128 children and adolescents with echinococcosis admitted to the Department of General Surgery at Qinghai Provincial People's Hospital between January 2016 and December 2021. This retrospective analysis strives to enhance the understanding of the clinical characteristics of echinococcosis in this vulnerable demographic and contribute valuable insights for improved prevention and treatment strategies.

2. Materials and methods

2.1. Data sources

Utilizing the Hospital Management Information System (HIS) of Qinghai Provincial People's Hospital and adopting the ICD-10 international disease code, basic and clinical data of juvenile patients under 18 years old with echinococcosis from January 2016 to December 2021 were gathered. This comprehensive dataset included information on patient demographics, such as age, gender, and region, as well as clinically relevant details such as preoperative Child-Pugh classification of liver function, WHO image classification, WS257-2006 clinical image classification, complications, lesion location, hepatic segment distribution, lesion number and size, length of stay, and disease outcomes. All patients adhered to the Diagnosis and Treatment Protocol of Hydatid Disease (2017 Edition) and the Expert Consensus on Diagnosis and Treatment of Hepatic Hydatid Disease (2019 edition) [6,7].

2.2. Treatment outcomes

(1) Cured: Clinical symptoms and signs disappear, and B-ultrasound examination shows characteristics such as cyst disappearance, complete calcification of the cyst wall, or cyst content consolidation for CE; and lesion disappearance or complete calcification of the lesion for AE.

(2) Uncured: Clinical symptoms and signs persist, and B-ultrasound examination reveals no changes or progressive enlargement of the lesion.

2.3. Ethical approval and patient informed consent

Ethical approval and patient-informed consent are not involved in this study.

2.4. Statistical Methods

The collected data underwent analysis using SPSS 19.0 statistical software. The independent chi-squared test was applied for single-factor analysis of counting data. For multi-group comparisons, single-factor analysis of variance (ANOVA) was employed, and the independent sample *t*-test was used for pairwise comparison, with a significance level set at $P < 0.05$.

3. Results

3.1. Regional composition

A total of 128 clinical cases of hepatic hydatid in adolescents under 18 meeting the criteria were analyzed. The regional distribution revealed that Guoluo Prefecture was the predominant area, constituting 85.2%

(109/128), followed by Yushu Prefecture, Haibei Prefecture, Haidong City, and Hainan Prefecture (**Table 1**). The distribution among classification regions exhibited significant differences, with statistical significance (χ^2 = 22.861, $P < 0.001$).

Table 1. Geographical distribution of hepatic echinococcosis in adolescents under 18 years of age

Region (prefecture/city)	CE cases (%)	AE cases (%)	χ^2	*P*
Guoluo Prefecture	32 (69.6)	77 (93.9(	22.861	0.000
Haidong City	0 (0.0)	3 (3.7)		
Yushu Prefecture	8 (17.4)	2 (2.4)		
Haibei Prefecture	4 (8.7)	0 (0.0)		
Hainan Prefecture	2 (4.3)	0 (0.0)		
Total	46 (100.0)	82 (100.0)		

3.2. Clinical data composition

Of the 128 hospitalized cases, 35.9% were CE cases (46 cases), with 22 males and 24 females. AE cases accounted for 64.1% (82 cases), including 39 males and 43 females. Both types of echinococcosis were observed in patients of all ages, primarily within the 13–18 age group. CE proportions were 15.2%, 58.7%, and 26.1%, and AE proportions were 13.4%, 64.6%, and 21.6%, respectively. The majority of cases presented with a single cyst (CE 63.0%, AE 68.3%). Cyst size distributions were < 5 cm, 5–10 cm, and > 10 cm, with variations between CE (23.9%, 69.6%, 6.5%) and AE (40.2%, 31.7%, 28.1%). Child-Pugh grade A was observed in CE (91.3%) and AE (72.0%). Positive results for the echinococcus sensitization test were found in CE (54.4%) and AE (71.0%). Complications varied, with CE infection complications at 41.3%, liver complications at 39.1%, gallbladder complications at 26.1%, lung complications at 54.3%, and nutritional complications at 63.0%. For AE, infection complications were 35.4%, liver complications 64.6%, gallbladder complications 29.3%, lung complications 56.1%, and nutritional complications 76.8%. Cerebral complications accounted for 2.4%, with CE at 86.5% and AE at 77.3% (**Table 2**).

Table 2. Comparison of case data of different echinococcosis [*n* (%)]

Medical records	CE	AE
Gender		
Male	22 (47.8)	39 (47.6)
Female	24 (52.2)	43 (52.4)
Age		
≤ 6	3 (6.5)	3 (3.7)
7–12	17 (37.0)	23 (28.0)
13–18	26 (56.5)	56 (68.3)
Ethnicity		
Tibetan	43 (93.5)	79 (96.3)
Han	0 (0.0)	3 (3.7)
Hui	3 (6.5)	0 (0.0)

Table 2. (Continued)

Medical records	CE	AE
Cyst number		
1	29 (63.0)	56 (68.3)
≥ 2	17 (37.0)	26 (31.7)
Cyst size (cm)		
< 5	11 (23.9)	33 (40.2)
5–10	32 (69.6)	26 (31.7)
> 10	3 (6.5)	23 (28.1)
Liver function Child-Pugh		
A	42 (91.3)	59 (72.0)
B	4 (8.7)	16 (19.5)
C	0 (0.0)	7 (8.5)
Ultrasound image type		
CE1	17 (37.0)	-
CE2	8 (17.4)	-
CE3	10 (12.2)	-
CE4	7 (8.5)	-
CE5	4 (4.9)	-
AE1	-	25 (30.5)
AE2	-	36 (43.9)
AE3	-	21 (25.6)
Hydatid sensitization test		
Not done	3 (6.5)	11 (13.4)
Positive	36 (78.3)	62 (75.6)
Negative	7 (15.2)	9 (11.0)
Lesion site (liver)		
Left	7 (15.2)	11 (13.4)
Right	27 (58.7)	53 (64.6)
Left + right	12 (26.1)	18 (21.6)
Complications		
Infection	19 (41.3)	29 (35.4)
Liver	18 (39.1)	53 (64.6)
Gallbladder	12 (26.1)	24 (29.3)
Pulmonary	25 (54.3)	46 (56.1)
Nutrition and development	29 (63.0)	63 (76.8)
Kidney	2 (4.3)	7 (8.5)
Pancreatic	0 (0.0)	2 (2.4)
Splenomegaly	0 (0.0)	3 (3.7)

Table 2. (Continued)

Medical records	CE	AE
Gastric	1 (2.2)	4 (4.9)
Brain	0 (0.0)	2 (2.4)
Surgery		
With	37 (80.4)	66 (80.5)
Without	9 (19.6)	16 (19.5)
Number of operations (103 cases)		
1	32 (86.5)	51 (77.3)
≥ 2	5 (13.5)	15 (22.7)
Length of stay (days)		
≤ 10	6 (13.0)	9 (11.0)
10–20	21 (45.7)	25 (30.5)
21–30	13 (28.3)	25 (30.5)
> 30	6 (13.0)	23 (28.0)

3.3. Outcome analysis of echinococcosis

Univariate analysis of CE outcomes demonstrated differences based on cyst size ($\chi^2 = 7.824$, $P = 0.020$), hydatid hypersensitivity test ($\chi^2 = 10.297$, $P = 0.006$), operation ($\chi^2 = 46.000$, $P < 0.001$), and length of hospital stay ($\chi^2 = 23.832$, $P < 0.001$). Univariate analysis of AE outcomes indicated differences among groups concerning liver function grade ($\chi^2 = 13.078$, $P = 0.001$), hydatid hypersensitivity test ($\chi^2 = 16.952$, $P = 0.002$), operation ($\chi^2 = 49.294$, $P < 0.001$), and hospital stay ($\chi^2 = 27.008$, $P < 0.001$). Refer to **Table 3** for more details.

Table 3. Univariate analysis of CE and AE disease outcomes

Medical records		CE				AE			
		Cured	Uncured	χ^2	*P*	Cured	Uncured	χ^2	*P*
Gender	Male	17	5	0.033	0.586	29	10	0.473	0.239
	Female	18	6			29	14		
Age	≤ 6	2	1	2.197	0.333	2	1	0.168	0.919
	7–12	15	2			17	6		
	13–18	18	8			39	17		
Cyst number	1	21	8	0.582	0.501	40	17	0.028	1.000
	≥ 2	14	3			18	7		
Cyst size (cm)	< 5	5	6	7.824	0.020	26	7	3.394	0.183
	5–10	27	5			20	6		
	> 10	3	0			12	9		
Lesion site (liver)	Left	7	0	3.863	0.145	8	3	0.189	0.910
	Right	18	9			38	15		
	Left + right	10	2			12	6		

Table 3. (Continued)

Medical records		CE				AE			
		Cured	Uncured	χ^2	*P*	Cured	Uncured	χ^2	*P*
Hydatid sensitization test	Not done	0	3	10.297	0.006	2	9	16.952	0.002
	Positive	29	7			49	13		
	Negative	6	1			7	2		
Liver function Child-Pugh	A	31	11	1.377	0.559	43	16	13.078	0.001
	B	4	0			14	2		
	C	0	0			1	6		
Ultrasound image type	CE1	13	4	1.256	0.869	-	-	-	-
	CE2	5	3			-	-		
	CE3	8	2			-	-		
	CE4	6	1			-	-		
	CE5	3	1			-	-		
	AE1	-	-	-	-	19	6	6.318	0.097
	AE2	-	-			28	7		
	AE3	-	-			10	10		
Surgery	With	35	0	46.000	0.000	51	3	49.294	0.000
	Without	2	9			7	21		
Length of stay (days)	≤ 10	0	6	23.832	0.000	0	9	27.008	0.000
	10–20	16	4			17	8		
	21–30	14	0			22	3		
	> 30	5	1			19	4		

4. Discussion

This study, encompassing 128 adolescent inpatients with echinococcosis, revealed both types of echinococcosis across all provinces in Qinghai Province, each demonstrating distinct prevalence patterns. CE prevailed in Yushu Prefecture, while AE was more common in Guoluo Prefecture, which was consistent with the survey results of Qinghai Province in the sampling survey and analysis of Chinese echinococcosis from 2012 to 2016 [8]. Of note, 46 cases (35.9%) indicated a mixed infection of CE and AE, consistent with global and Chinese prevalence trends [9]. The two types of echinococcosis predominantly affect those aged 13–18, which was consistent with the relevant investigation and research in China [10]. Both types primarily invaded the liver, with the right lobe being the focal point. The number of lesions is mostly one, and the Child-Pugh grade of liver function is mostly A. The hypersensitivity test of echinococcosis has important significance for the early detection of both echinococcosis types, and it is suggested that the test should be included as one of the routine detection items of echinococcosis screening, and combined with epidemiological history, clinical manifestations, and imaging results for comprehensive diagnosis, thereby further improving the detection rate of the both echinococcosis types. Notably, none of the pediatric inpatients with both echinococcosis types underwent surgical treatment, attributed to reasons such as delayed diagnosis and complications.

While infection, liver, gallbladder, lung, and nutritional complications occurred in both echinococcosis

types, complication analyses uncovered brain complications unique to AE, suggesting a longer incubation period than CE. AE's growth pattern, akin to tumor infiltration, led to metastasis, termed "insect cancer" [11]. There are no obvious clinical symptoms in the early stage, and the vast majority of patients are already in the advanced stage when diagnosed [12], showing metastasis of the lung, brain, and other organs, and hepatic encephalopathy. Concurrent clinical symptoms include obstructive jaundice, portal hypertension syndrome, abdominal and pelvic effusion, cachexia, etc. [13-16], and the opportunity for surgical treatment is lost at the time of treatment.

The outcomes of 128 children and adolescents with CE and AE revealed key factors influencing cure rates. For CE, factors included cyst size, hydatid sensitization test, operation, and length of hospital stay. Notably, a larger cyst size correlated with a higher cure rate, aligning with findings in relevant literature [17]. The increased size of the cyst facilitated the detection of lesions in patients with cystic hydatid disease. Furthermore, patients with a positive echinococcosis test exhibited a high cure rate, suggesting that the echinococcosis test could serve as a promising avenue for future research into echinococcosis treatment [18]. In the case of AE patients, the main factors influencing cure rates encompassed the echinococcosis test, Child-Pugh classification of liver function, operation, and length of stay. These findings concur with related reports [19-21], underscoring the importance of providing 100% surgical treatment to diagnosed children and adolescents with AE who meet the established surgical standards. This approach aims to enhance cure rates and improve the overall quality of life for patients. Surgical excision of cysts remains the most effective treatment for echinococcosis, supplemented by drug therapy when necessary. Successful drug treatment requires a comprehensive approach, integrating multidisciplinary knowledge and technology from fields such as pathogenic biology, molecular biology, pharmacology, and pathology. This integration is crucial for developing individualized and precise treatment programs tailored to the unique needs of adolescent patients.

This survey meticulously analyzed and compared the clinical characteristics and disease outcomes of 128 children and adolescents diagnosed with CE and AE in Qinghai Province. The depth of this investigation surpasses previous studies on echinococcosis in this demographic in Qinghai Province. Despite the detailed analysis, there are acknowledged shortcomings. Notably, this study did not conduct a systematic analysis of drug therapy for inpatients without surgery, nor did it delve into the surgical methods employed for patients treated with surgery. The lack of clarity in patients' drug histories and the potential impact of using multiple surgical methods influenced the absence of a specific analysis. Future studies will address these gaps, aiming to enhance the scientific and practical value of clinical data pertaining to echinococcosis in children and adolescents in Qinghai Province. In the broader context of "Healthy China 2030," there is a call to control key local epidemics such as echinococcosis to eliminate the threat it poses to public health. The belief is that, under governmental leadership and with the active participation of various departments and society at large, the eradication of echinococcosis is an attainable goal in the near future.

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Disclosure statement

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