BMC Cardiovascular Disorders

CASE REPORT

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Multimodal imaging for the diagnosis of cardiac alveolar echinococcosis: a case report

Mengdie Zhu[1], Xukun Gao[1], Xiaoping Wang[1] and Li Meng[1*]

Abstract

Background Primary cardiac echinococcosis is rare, and cardiac alveolar echinococcosis is even rarer and more unusual. Reported cases of this disease are extremely limited, and multimodal imaging provides an important guide to treatment and decision-making. We report a case of cardiac alveolar echinococcosis.

Case summary A 31-year-old male patient with no significant history was diagnosed to have a space-occupying lesion in the mediastinum. Transthoracic echocardiography showed a cystic mass anterior to the right lateral aspect of the right atrium, which did not show enhancement on the enhanced scan. Multidetector computed tomography (MDCT) and cardiac magnetic resonance showed a cystic space-occupying lesion in the right lateral aspect of the right atrium, with mild enhancement of the edges of the lesion and multiple small vesicles on the enhancement scan. Clinicians operated on the patient under suspicion of cardiac echinococcosis and successfully removed the lesion. Ultimately, postoperative histopathologic examination revealed cardiac alveolar echinococcosis. The patient recovered well and was discharged with regular postoperative oral albendazole tablets and regular follow-up reviews.

Conclusion We report a case of cardiac alveolar echinococcosis with multimodal imaging features and therapeutic strategies, an extremely rare cardiac occupying disease. Multimodal imaging is of great help in the diagnosis of this disease, and surgical resection and histopathological diagnosis are essential. After surgery, treatment and follow-up will be carried out based on the results of the histological examination. This rare case emphasizes the integrated diagnosis of cardiac alveolar echinococcosis with clinical, multimodal imaging and pathologic data.

Keywords Cardiac alveolar echinococcosis, Multimodal imaging, Case report

Background

Echinococcosis is a chronic disease caused by larval infection of echinococcus tapeworms of the genus echinococcus. The two main types of echinococcus tapeworms that can infect humans in the larval stage are *Echinococcus granulosus* and *Echinococcus multilocularis*, which cause cystic echinococcosis (CE) and alveolar echinococcosis (AE), respectively [1]. CE is more common, while AE is rarer, accounting for only 1–2% of cases of echinococcosis [2]. This disease is more prevalent in the liver and lungs, and cardiac echinococcosis is extremely rare, accounting for only 0.5%- 2.0% of cases [3]. Echocardiography, MDCT, and CMR can show the lesion's relationship to the heart chambers. Here, we report a case of primary cardiac alveolar echinococcosis confirmed by pathologic examination of surgical specimens.

Case description

A 31-year-old male presented to our cardiovascular surgery department on 05/2024 with the chief complaint of a one-day mediastinal space-occupying lesion detected on physical examination of a CT chest. He denied any

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family history of hypertension, diabetes mellitus, dyslipidemia, smoking, or atherosclerotic disease. His vital signs were blood pressure 120/70 mmHg, heart rate 80 beats/min, respiration 20 beats/min, and body temperature 36.7 °C. Physical examination revealed no murmurs or pericardial friction sounds in the patient's precordial area. The patient's electrocardiogram is also normal. Laboratory tests suggested that the patient's hydatid serological IgG ELISA was positive. In addition, laboratory tests indicated that the patient had Liver insufficiency and positive HBsAg, HBeAg, and HBcAb tests for hepatitis B; the rest of the laboratory tests showed no significant abnormalities.

Transthoracic echocardiography shows a cystic mass of approximately 6.6 cm × 5.8 cm in size visible in the anterior right lateral aspect of the right atrium. The lesion wall is thick and double-layered, with fine light punctate echoes observed within it. The lesion compresses the inferior vena cava. Ultrasound contrast examination showed no significant enhancement of the lesion in the arterial phase, portal phase, and delayed phase, and the lesion boundary was clear (Fig. 1A-B). MDCT showed an increased volume of the right atrium and cystic hypodense occupations with varying thicknesses of the sac wall (Fig. 2A). Computed tomography angiography (CTA) of the thoracic aorta showed a cystic low-density lesion in the outer part of the right atrium, with a maximum cross-sectional area of approximately 7.4 cm × 6.7 cm × 6.4 cm. The CT value inside the lesion was approximately 15HU, and the enhanced scan showed mild enhancement at the edge of the lesion, with small cystic low-density shadows around the lesion (Fig. 2B). The lesion compresses the inferior vena cava and right atrium. CMR examination showed a cystic mass lesion on the right outer side of the right atrium, which showed a slightly low signal on T1-weighted imaging (T1WI) and a high signal on T2-weighted imaging (T2WI). Multiple small vesicles at the edge of the lesion showed a higher signal on T2WI (Fig. 3A-C). Early first-pass perfusion MRI showed no signs of perfusion inside the lesion (Fig. 3D). Enhanced scanning shows delayed enhancement of the lesion edge, compression of the right atrium and local right ventricle, compression of the hepatic segment of the inferior vena cava and unclear boundary with the lesion; mild regurgitation of the mitral and tricuspid valves (Fig. 3E). After the above examination, the

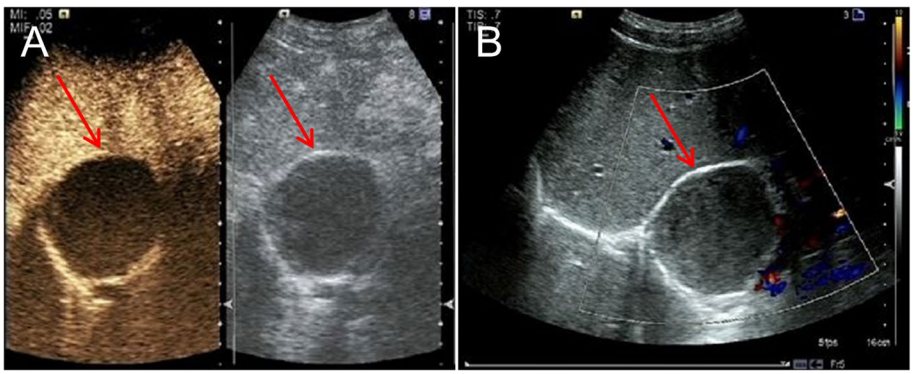

Fig. 1 Imaging findings. **A**-**B** Ultrasound contrast examination showed a cystic mass in the anterior right lateral aspect of the right atrium, with no significant enhancement and clear boundaries (red arrow)

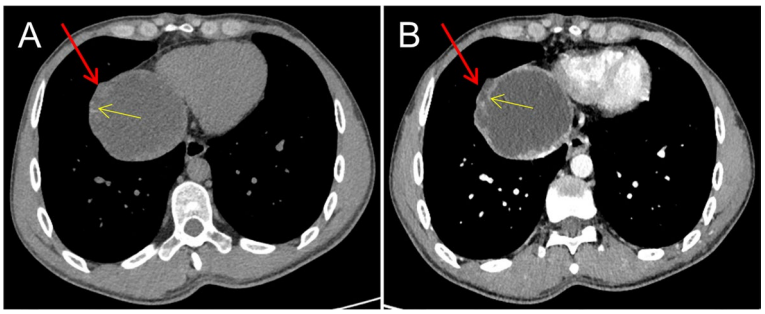

Fig. 2 Imaging findings. An MDCT shows a cystic low-density mass on the right outer side of the right atrium (red arrow). **B** CTA of the thoracic aorta showed mild enhancement of the lesion's margins, with small vesicle hypodense shadows around it (red arrow). The yellow arrow indicates small vesicles

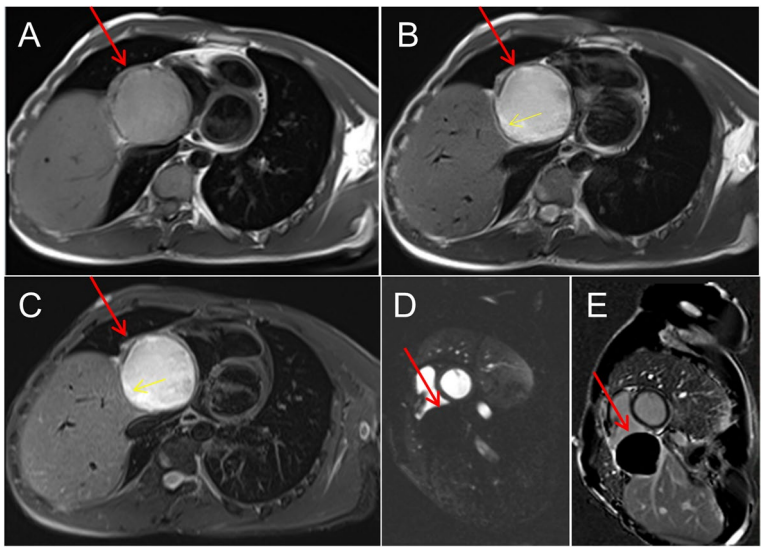

Fig. 3 CMR Imaging findings. **A**-**B** A cystic space occupying lesion on the right outer side of the right atrium, with slightly low signal on T1WI and high signal on T2WI and multiple small vesicles at the edge of the lesion (red arrow). **C** T2-weighted-turbo inversion recovery magnitude (red arrow). The yellow arrow indicates small vesicles. **D** Early first-pass perfusion showed no signs of perfusion within the lesion (red arrow). **E** Late gadolinium-enhanced showed peripheral enhancement of the lesion with no evidence of internal enhancement (red arrow)

clinical doctor considered that the patient's disease was cardiac alveolar echinococcosis but could not rule out a pericardial cyst. After obtaining informed consent for the patient's surgery, the clinical doctor performed a thoracoscopic-assisted cardiac echinococcectomy on the pati ent.

Intraoperatively, a 6 cm × 8 cm-sized mass in the right mediastinum was observed, which was tough and closely related to the pericardium and diaphragm, with noticeable compression of the right atrium and inferior vena cava. Under the guidance of extracorporeal circulation, the mass was punctured, and milky yellow pus was withdrawn; the mass was dissected longitudinally, about 50 ml of pus was left in the mass, necrotic tissues and pus moss were seen in the lumen, and the wall of the mass was irregular, the pus was aspirated, the pus moss was removed, and the wall of the mass and part of the pericardium was removed. In the pathological examination, necrosis and acute and chronic inflammatory cell infiltration were seen in the tissue sent for examination. A few powder-stained unstructured materials were also seen, which were mostly considered as echinococcosis, and ultimately, the frozen section mass was diagnosed as cardiac alveolar echinococcosis (Fig. 4A-B).

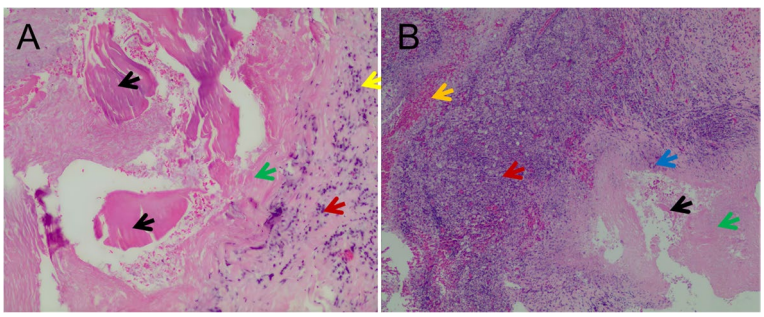

Fig. 4 Histology of cardiac alveolar echinococcosis. **A**-**B** Hematoxylin and eosin staining (original magnification × 100 and × 40). Small vesicular larval vesicles of varying sizes are scattered in the tissue (black arrows), and only the stratum corneum is visible. The epithelial tissue surrounding the vesicles is structurally necrotic (green arrowheads), with fibrous connective tissue hyperplasia (yellow arrows), accompanied by a more inflammatory cellular infiltrate (red arrows). **B** Small vesicular larval vesicles of varying sizes are scattered in the tissue (black arrows), and only the stratum corneum is visible. There is proliferation of epithelioid cells and giant cells around the vesicles (blue arrows), extensive necrosis of the tissue structure (green arrows), multifocal hemorrhages (orange arrows), and a large aggregated infiltrate of inflammatory cells (red arrows)

One week after the surgery, the patient underwent an MDCT examination, and no clear indication of a cardiac mass was found. The fat gap in the surgical area was blurred and slightly exudative. The patient recovered well after surgery and was discharged 2 weeks later. The clinical doctor instructed the patient to take Albendazole tablets 15 mg/(kg. d) orally, divided into two doses (after breakfast and dinner), and to have liver and kidney function, blood routine, coagulation combination examination rechecked one month later, and CT rechecked six months later.

Discussion and conclusion

AE, also known as multilocular echinococcosis, is a specific type of echinococcosis. This rare zoonotic parasitic disease has been reported throughout the world, mainly in the northern hemisphere, with epidemics throughout much of Europe, northern Asia, and North America [4–6]. A single intramyocardial hydatid cyst with a diameter of less than 1 cm rarely causes symptoms and signs so that infected patients may remain asymptomatic for many years. Secondary cardiac echinococcosis is usually transferred from echinococcosis of other organs [7]. This case is a primary cardiac alveolar echinococcosis. Symptoms of cardiac echinococcosis are related to several factors, such as the location of the lesion, the number of lesions or fistula formation. When the volume of hydatid lesions in the myocardium is large, patients may experience symptoms such as shortness of breath, palpitations, and fever [8]. Potentially life-threatening events such as pericardial tamponade, heart failure, syncope, arrhythmia, valvular stenosis or regurgitation, pulmonary hypertension, or peripheral blood vessel embolism may also occur [9]. Due to the lack of typical symptoms and signs of cardiac echinococcosis, clinical doctors cannot make a diagnosis based solely on clinical manifestations. The definitive diagnosis of cardiac echinococcosis is based primarily on imaging techniques. The most commonly used imaging techniques include echocardiography, CT, and CMR [10]. Because of the difficulty in treating cardiac alveolar echinococcosis and the high mortality rate, it poses a significant threat to the health of the people in the affected areas. Therefore, its prognosis depends on early diagnosis and timely implementation of effective treatment.

Ultrasonography is the imaging modality of choice for the general examination and clinical diagnosis and treatment of cardiac alveolar echinococcosis; however, ultrasonography is insufficient to assess the imaging features associated with cardiac alveolar echinococcosis in neighbouring lung tissue due to the influence of lung tissue. Both CT and CMR can suggest the location and imaging features of cardiac alveolar echinococcosis and reveal its relationship to neighbouring structures. Echocardiography can provide preliminary diagnostic clues and evidence for this disease, and further examination can be performed based on the condition of the lesion. CT and CMR can reveal some of the pathologic features of alveolar echinococcosis. These two imaging modalities are usually complementary [11]. MDCT examination can not only show the morphology, size, density, and calcification of the echinococcosis but also the relationship between the pericardial lesions and the surrounding structures, so MDCT has a unique value in the presentation of cardiac alveolar echinococcosis. On MDCT imaging, alveolar echinococcosis appears as inhomogeneous low-density masses, with calcification inside and at the edges of the lesion and liquefaction and necrosis in the centre of the lesion, constituting a map-like appearance; the edges of the lesion may be mildly intensified on enhancement scans, while the centre does not show significant enhancement, and small vesicles are the most characteristic manifestation of alveolar echinococcosis [12].

Cardiac alveolar echinococcosis usually presents as oval or spherical lesions with low signal on T1WI and signal intensity greater than or equal to cerebrospinal fluid on T2WI. The low-signal peripheral ring on the T2WI represents an encapsulation, which is typical Imaging manifestations of alveolar echinococcosis [12]. However, this low-signal ring is uncommon in cases of cardiac echinococcosis [13, 14]. The imaging findings range from simple cystic lesions to complete solid lesions, making it difficult to distinguish from cardiac tumours. In the enhanced scan, the lesion shows almost no enhancement, but mild enhancement can be seen at the edge of the lesion [15]. Compared with CT and ultrasound examinations, CMR examination can more clearly display the size and quantity of vesicles, and the vesicles show a slightly higher signal on T2WI, so it has important value in diagnosing this disease. However, the calcification is not as good as that shown by CT and ultrasonography.

Regarding the differential diagnosis, cardiac alveolar echinococcosis needs to be differentiated from benign cysts or tumors such as pericardial cysts, epidermoid cysts, cystic teratomas, and cardiac sarcomas15. Pericardial cysts and epidermoid cysts do not enhance on the enhancement scan, whereas alveolar echinococcosis may show mild enhancement of the lesion margins on the enhancement scan [16, 17]. In addition, pericardial cysts and epidermoid cysts are usually free of calcification and small vesicle formation. Cystic teratomas and cardiac sarcomas differed significantly from cardiac alveolar echinococcosis in signal on T1WI and T2WI and showed marked or heterogeneous enhancement after gadolinium processing [18–20]. Thus, in cases of suspected alveolar echinococcosis, the presence of

small vesicles and calcifications and mild enhancement of the margins of the lesion are crucial in differentiating it from other cardiac masses.

Due to the insidious progression and relatively severe complications of cardiac alveolar echinococcosis, early surgical resection is recommended. Surgical treatment is usually feasible in the absence of rupture or purulent infection. The goal of surgical treatment is to avoid death from anaphylactic reactions or heart failure. The effectiveness of surgical treatment depends on the lesion's number, location and size and complications. In conclusion, Cardiac alveolar echinococcosis is extremely rare in modern life. Multimodal imaging is of great value in diagnosing cardiac alveolar echinococcosis, especially in areas where the disease is endemic, and the possibility of this disease should be considered. Considering the severe complications and poor prognosis of this disease, early and accurate diagnosis is crucial, and surgical treatment should be performed for patients as early as possible before complications occur. In addition, the early application of anti hydatid disease drugs is indispensable for treating Cardiac alveolar echinococcosis.

Abbreviations

MDCT	Multidetector computed tomography
CMR	Cardiac magnetic resonance
CTA	Computed tomography angiography
CE	Cystic echinococcosis
AE	Alveolar echinococcosis
T1WI	T1-weighted imaging
T2WI	T2-weighted imaging

Supplementary Information

The online version contains supplementary material available at https://doi.org/10.1186/s12872-025-04531-z.

Supplementary Material 1.

Acknowledgements
Not applicable.

Authors' contributions
Mengdie Zhu was the primary participant in the case study. Zhu Mengdie prepared the manuscript. Xukun Gao and Li Meng revised and approved the manuscript. Xiaoping Wang provides guidance as well as administrative and technical support. All authors contributed to the article and acknowledged the submitted version.

Funding
This work was supported by the National Key Clinical Specialty Construction Project (Office of Health Commission of Qinghai Province (2024) No. 90), Qinghai Province "Kunlun Talents High-end Innovation and Entrepreneurial Talents" Top Talent Cultivation Project (No. 9,2023), and Chinese Red Cross Foundation's "Yingrui Northwest Charity Walk" (XM_HR_ICON_2020_10).

Data availability
The datasets used and/or analyzed during the current study are available from the corresponding author upon reasonable request.

Declarations

Ethics Approval and Consent to Participate
The Ethics Committee of the Affiliated Hospital of Qinghai University waived the requirement for ethical approval of this case report, and consent was also not required because of the retrospective nature of the study.

Consent for publication
Written informed consent was obtained from the patient for publication of this case report and accompanying images. A copy of the written consent is available for review by the Journal Editor.

Competing interests
The authors declare no competing interests.

Received: 22 August 2024 Accepted: 28 January 2025
Published online: 17 February 2025

References

1. A JD, Chai JP, Jia SL, A XR. Historical changes in surgical strategy and complication management for hepatic cystic echinococcosis. World J Gastrointest Surg. 2023;15(8):1591–9.
2. Šimeková K, Rosoľanka R, Szilágyová M, Antolová D, Nováková E, Novák M, et al. Alveolar Echinococcosis of the Liver with a Rare Infiltration of the Adrenal Gland. Helminthologia. 2021;58(1):100–5.
3. Çelik D, Ödemiş I, Korkmaz M, Köse S. A rare case of cardiac alveolar echinococcosis without any complications for eight years. Rev Esp Quimioter. 2022;35(1):91–4.
4. Zhang X, Wei X, Ran L, Tang H. A rare case of cardiac alveolar echinococcosis. Eur Heart J. 2020;41(28):2698.
5. Bresson-Hadni S, Spahr L, Chappuis F. Hepatic Alveolar Echinococcosis. Semin Liver Dis. 2021;41(3):393–408.
6. Wen H, Vuitton L, Tuxun T, Li J, Vuitton DA, Zhang W, et al. Echinococcosis: Advances in the 21st Century. Clin Microbiol Rev. 2019;32(2).
7. Zhang R, Shen C, Rao L. Cardiac echinococcosis secondary to hepatic echinococcosis: a rare case report. Cardiovasc Diagn Ther. 2022;12(1):147–52.
8. Vazhev ZG, Stoev HA. Cardiac Echinococcosis Involving Left Ventricular Myocardium in an 18-Year-Old Patient. Folia Med (Plovdiv). 2018;60(2):308–13.
9. Firouzi A, Neshati Pir Borj M, Alizadeh Ghavidel A. Cardiac hydatid cyst: A rare presentation of echinococcal infection. J Cardiovasc Thorac Res. 2019;11(1):75–7.
10. Li T, Ito A, Pengcuo R, Sako Y, Chen X, Qiu D, et al. Post-treatment follow-up study of abdominal cystic echinococcosis in tibetan communities of northwest Sichuan Province, China. PLoS Negl Trop Dis. 2011;5(10): e1364.
11. Guo H, Liu W, Wang J, Xing Y. Extrahepatic alveolar echinococcus on multi-slice computed tomography and magnetic resonance imaging. Sci Rep. 2021;11(1):9409.
12. Gao X, Tan H, Zhu M, Wang Y, Zhang Y, Cao Y, et al. Hepatic alveolar echinococcosis accompanied by lung and kidney metastases: a case description of imaging findings. Quant Imaging Med Surg. 2024;14(1):1208–14.
13. Petik B, Hazirolan T, Uysal G, Erturk SM. Cardiac Hydatid Cysts: Computed Tomography and Magnetic Resonance Imaging Findings of the 5 Cases. J Comput Assist Tomogr. 2015;39(5):816–9.
14. Xing Y, Bawudong D, Zhang WB, Liu WY, Pan CX, Wen H, et al. Multidetector CT and MR imaging cardiac hydatidosis: case report and review of the literature. Int J Cardiovasc Imaging. 2011;27(Suppl 1):97–102.
15. Yılmaz R, Akpınar YE, Bayramoglu Z, Ozyavuz HI, Unal OF, Dursun M. Magnetic resonance imaging characteristics of cardiac hydatid cyst. Clin Imaging. 2018;51:202–8.
16. Yared K, Baggish AL, Picard MH, Hoffmann U, Hung J. Multimodality imaging of pericardial diseases. JACC Cardiovasc Imaging. 2010;3(6):650–60.
17. Meschisi M, Piccione MC, Bella GD, Zito C. Multimodalities Imaging in Diagnosis of Pericardial Cyst. J Cardiovasc Echogr. 2015;25(2):60–2.

18. Tower-Rader A, Kwon D. Pericardial Masses, Cysts and Diverticula: A Comprehensive Review Using Multimodality Imaging. Prog Cardiovasc Dis. 2017;59(4):389–97.
19. Abbas A, Garfath-Cox KA, Brown IW, Shambrook JS, Peebles CR, Harden SP. Cardiac MR assessment of cardiac myxomas. Br J Radiol. 2015;88(1045):20140599.
20. Buckley O, Madan R, Kwong R, Rybicki FJ, Hunsaker A. Cardiac masses, part 1: imaging strategies and technical considerations. AJR Am J Roentgenol. 2011;197(5):W837–41.

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