Joint Diseases and Related Surgery

Jt Dis Relat Surg
2023;34(3):687-693

ORIGINAL ARTICLE

Don't miss it: Extremity-located cyst hydatid may mimic soft tissue tumors

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ABSTRACT

Objectives: In this study, we present our experience in patients with hydatid cysts located intramuscularly.

Patients and methods: Between May 2018 and May 2023, a total of 11 patients (3 males, 8 females; mean age: 29.1±13.6 years; range, 8 to 56 years) with intramuscular hydatid cysts were retrospectively analyzed. Demographic data, laboratory values, serological test results, location and size of the cyst, radiological imaging findings, and complications were recorded.

Results: The mean follow-up was 44.3±17.3 (range, 5 to 60) months. The mean mass size at the time of admission was 5.4±3.3 (range, 2 to 14) cm. Serologic tests were positive in the majority of cases (72.7%). Eosinophilia was negative in 72.7% patients. The rate of isolated muscle involvement was 81.8%. The rate of lower extremity involvement was 72.7%. The most common involvement was leg (36.4%), thigh (18.2%), and shoulder (18.2%). One patient developed compartment syndrome after cyst rupture during neoadjuvant antihelmintic therapy. There was no recurrence in any of the patients.

Conclusion: Hydatid cysts should be considered in the differential diagnosis of slowly growing, deeply located, painless soft tissue masses, particularly in endemic areas. Although it is a rare complication, compartment syndrome may develop after spontaneous cyst rupture. Neoadjuvant antihelmintic chemotherapy can reduce complications. The combination of total surgical excision and chemotherapy yields successful results in the treatment of hydatid cysts located in the muscle.

Keywords: Cyst hydatid, *Echinococcus granulosus*, muscle hydatidosis.

Hydatid cyst is a parasitic zoonosis caused by different species of Echinococcus and *Echinococcus granulosus (E. granulosus)* responsible for 95% of cases.[1] It is commonly seen in Mediterranean countries, the Middle East, India, Australia, and Türkiye.[2]

Clinically, it is usually a painless, very slowly growing mass and is asymptomatic, until the size of the cyst is noticed. The symptoms usually occur when the cyst reaches large sizes; it causes local pain and rarely neurological deficit.[3-5] The most common localizations are hepatic (50 to 75%) and pulmonary (20 to 30%).[3] Musculoskeletal involvement is rare (0.5 to 4.7%).[6] The incidence of isolated intramuscular hydatid cysts is 0.2 to 2.2% and it usually occurs as the spread of the cyst to another area or as iatrogenic.[4,6]

There are case series in the literature with a few cases related to intramuscular hydatid cysts.[3,7,8] Hydatid cyst is a concern for inexperienced clinicians, as it progresses slowly, can be confused with soft tissue pathologies, can be diagnosed late, and due to complications such as anaphylaxis and recurrence. In this study, we present our experience in patients with hydatid cysts located intramuscularly.

Received: August 10, 2023
Accepted: August 24, 2023
Published online: September 20, 2023

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Doi: 10.52312/jdrs.2023.1371

Citation: Orhan Ö, Kaptan AY, Perçin A, Tekpınar İ, Sepetçi Ö, Çetin VB, et al. Don't miss it: Extremity-located cyst hydatid may mimic soft tissue tumors. Jt Dis Relat Surg 2023;34(3):687-693. doi: 10.52312/jdrs.2023.1371.

PATIENTS AND METHODS

This single-center, retrospective study was conducted at Medicine Faculty of Harran University, Department of Orthopedics and Traumatology between May 2018 and May 2023. A total of 14 patients who were diagnosed with hydatid cysts radiologically, clinically, and laboratory were screened. Patients with missing data and whose diagnosis was not confirmed histopathologically were excluded from the study. Finally, a total of 11 patients (3 males, 8 females; mean age: 29.1±13.6 years; range, 8 to 56 years) were included.

Before antihelmintic chemotherapy (albendazole, 15 mg/kg), the diagnosis was confirmed serologically and radiologically using ultrasonography (USG) or magnetic resonance imaging (MRI) in all patients. None of the patients had a neurovascular pathology before treatment. All patients were administered albendazole treatment before surgery. The cyst was excised in the third week of albendazole treatment, and the diagnosis was confirmed by histopathological examination. Irrigation with hypertonic saline solution was performed to prevent the spread of protoscolices during surgery. Then, meticulous pericystectomy (marginal resection) along the muscle fibers was applied (Figure 1). There were no anaphylactic complications during surgery. In all patients, the diagnosis was confirmed by pathological examination. After surgery, albendazole treatment (15 mg/kg) was continued for three months.

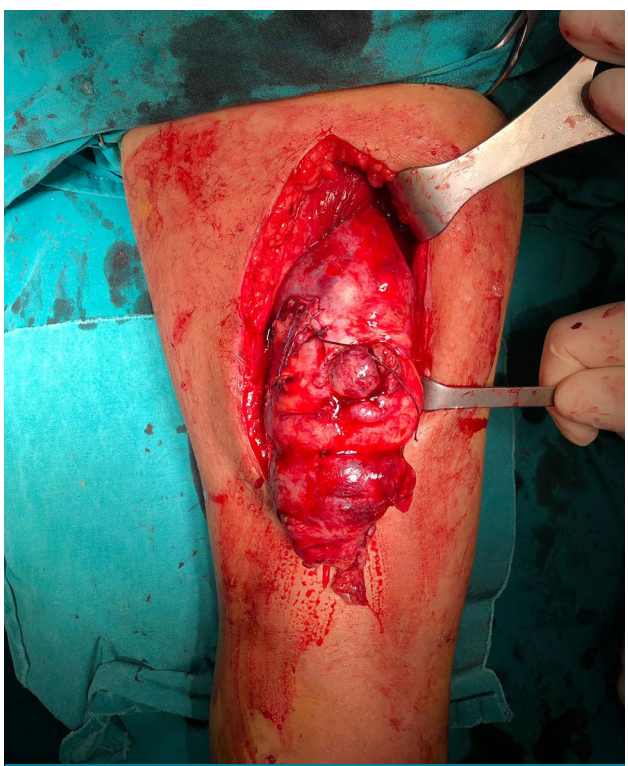

FIGURE 1. A 27-year-old female, isolated 14×7.6×7.2 cm hydatid cyst located intramuscularly in the anterior thigh.

Demographic data (age, sex), laboratory tests (white blood cell [WBC], eosinophil, C-reactive protein [CRP], erythrocyte sedimentation rate [ESR]), serological test (enzyme-linked immunosorbent assay [ELISA]), location and size of the cyst, radiological imaging (USG, MR, computed tomography [CT]), and complications were evaluated.

Statistical analysis

Statistical analysis was performed using the SPSS version 21.0 software (IBM Corp., Armonk, NY, USA). Descriptive data were expressed in mean ± standard deviation, median (min-max) or number and frequency, where applicable. Descriptive analyses were presented using percentile and quantitative values.

RESULTS

The mean follow-up was 44.3±17.3 (range, 5 to 60) months. The mean mass size at the time of admission was 5.4±3.3 (range, 2 to 14) cm. Demographic data and laboratory test results are given in Table I. Laboratory tests were normal, except for elevated ESR. Serological test results of only three patients were negative (Table II).

Lower extremities were affected in eight patients, while upper extremities were affected in three patients. Nine patients had isolated intramuscular localization and only two patients (18.2%) had liver involvement (Table II).

A spontaneous cyst rupture was observed in one patient on the forearm after minor trauma (i.e., weight lifting). She developed compartment syndrome after rupture and underwent an emergency operation. After decompression with fasciotomy, the residual cyst was excised, and the wound was closed on Day 10 after clinical healing. No complications were observed in the remaining patients. During follow-up, USG was applied to the extremity twice with an interval of three months, and no recurrence was observed.

DISCUSSION

In the present study, we evaluated patients with hydatid cysts located intramuscularly. The results of this study highlight that hydatid cyst lesions should be considered in the differential diagnosis

TABLE I
Demographic and laboratory data of the patients

	Mean±SD	Min-Max
Age (year)	29.1±13.6	8-56
Size of the cyst (cm)	5.4±3.3	2-14
White blood cell ($\times 10^9$ cells per L)	9.35±2.44	6.6-14.75
Eosinophile ($\times 10^9$ cells per L)	0.54±0.69	0.1-2.48
C-reactive protein (mg/L)	0.32±0.29	0.05-0.99
Sedimentation (mm/h)	17.63±18.40	4-66

SD: Standard deviation.

TABLE II
Sex, localization and ELISA data of the patients

Case	Sex	Location	ELISA
1	Male	Biceps muscle	Negative
2	Female	Gluteus maximus muscle	Positive
3	Female	Gastrocnemius muscle/liver	Positive
4	Male	Deltoid muscle	Negative
5	Female	Gastrocnemius muscle	Positive
6	Male	Gastrocnemius muscle	Positive
7	Female	Gastrocnemius muscle	Negative
8	Female	Quadriceps muscle	Positive
9	Female	Gastrocnemius muscle	Positive
10	Female	Flexor muscles of the forearm/liver	Positive
11	Female	Quadriceps muscle	Positive

ELISA: Enzyme-linked immunosorbent assay.

of deep, painless intramuscular masses in endemic areas. Although no specific laboratory test is present, positive serology is significant for the diagnosis. Compartment syndrome may develop after spontaneous rupture of the cyst. In these patients, albendazole treatment as neoadjuvant chemotherapy before surgery would reduce complications.

Hydatid cysts should be considered in the diagnosis of patients with a large painless mass in endemic areas. A previous case series of 22 patients reported that the mean size on admission was 5.7±3.1 (range, 2 to 15) cm.[9] Similar to the previous study, the mean mass size in our study was 5.4±3.3 (range, 2 to 14) cm. We attribute these patients presenting with large masses to these masses being painless and deeply located. As a result of the localization and large size of the mass, peripheral nerves may be compressed, and neurological deficits may develop.[4,5] In our study, none of the patients had neurological deficits.

There are different theories about the localization only in the extremity of hydatid cysts. The first may be direct inoculation or bypassing the liver or lung precapillary anastomosis.[10] Another hypothesis is that the high lactic acid concentration and the constant contraction and relaxation of the muscles make the implantation of the cyst difficult.[8,11]

It has been reported in the literature that 40% of patients present with isolated extremity involvement.[3] In our series, the rate of isolated intramuscular involvement was 81.8%. Vidal-Gonzalez et al.[3] reported that the most common localization was thigh, followed by the hip, shoulder, and paravertebral muscles. In the present study, similar to the literature, lower extremity involvement was higher than upper extremity involvement.[4,9]

Acar et al.[11] also reported that lower extremities were affected more frequently due to the large masses and blood supply of the proximal muscle groups in the lower extremity. However, in our series, only three of eight patients with lower extremity involvement had proximal region involvement. Based on these findings, it can be speculated that as trauma may lead to direct inoculation, distal regions can be more open to trauma.

The liver and lung should be evaluated with thoracoabdominal scanning in patients with isolated intramuscular hydatid cysts. In our study, liver involvement was observed in two patients (18.2%). In general, USG, MRI, or CT can be preferred for screening and differential diagnosis. Radiology imaging can vary depending on the nature of the lesion (i.e., from cystic lesions to solid masses). Cysts may be single or multiple, with or without calcification.[12] The USG was the first-choice imaging modality in our study, as it is non-invasive, inexpensive, and reproducible.[13] The presence of daughter cysts, separating membrane, and double-line sign on USG is pathognomonic. The MRI is still the gold standard in musculoskeletal hydatid cysts; multiloculated polycystic lesions and the appearance of collagenized and vascularized double-layered pericyst support the diagnosis (Figure 2).[13,14] On T2-weighted MRI, the pericyst is seen as a hypointense ring and was smaller in size than a simple cyst.[12] With T2-weighted hypointense pericyst, daughter cyst or brood capsule hypointense or isointense may appear on T1- and T2-weighted sections. Contrast-enhanced MRI helps to differentiate hydatid cysts from ganglion cysts, synovial cysts, and myxoid tumors.[14] The CT is superior in examining wall calcifications, bones, and their relationship to neighboring structures. The imaging of the hydatid cyst on CT is variable and rarely shows typical characteristics.[13] Both CT and MRI were chosen in this study for the number, size, anatomic location, local complications, and systemic involvement. In addition, MRI and CT play an essential role in diagnosing complicated hydatid cysts, such as rupture and superinfection.[12]

Although there were no specific laboratory tests, CRP, ESR, WBC count, and eosinophil count should be evaluated in the differential diagnosis. Gonder et al.[6] reported WBC 8.2×10^9 cells per L (range, 4.7 to 14.4×10^9) and CRP 7.5 mg/L (range, 3.3 to 18.6) at the time of diagnosis. In the present study, the WBC count was found to be 9.4×10^9 cells per L (range, 6.6 to 14.8) and CRP to be 0.3 mg/L (range, 0.1 to 1). Although it is a parasitic disease, eosinophilia is not expected under normal conditions.[6] In our study, only three cases had eosinophilia.

The ELISA, Western blot, immunodiffusion, immunofluorescence, indirect hemagglutination (IHA), specific immunoglobulin E (IgE), specific IgE, and complement fixation are serological tests used to diagnose hydatid cysts.[15] The IgG ELISA and IHA are the two most commonly used tests in diagnosing hydatid cysts.[16] The sensitivity and specificity of serological tests may vary depending on the location of the cyst, the viability of the cyst, and the strain of the parasite.[16] Previous studies have reported that serological tests are usually negative in patients with hydatid cysts without liver or lung involvement.[4,17] In addition, serological tests and imaging are almost less likely to diagnose.[6] In the literature, serology positivity has been estimated in a wide range of 21 to 100%.[6,9] Salamone et al.[18] reported that serological examination

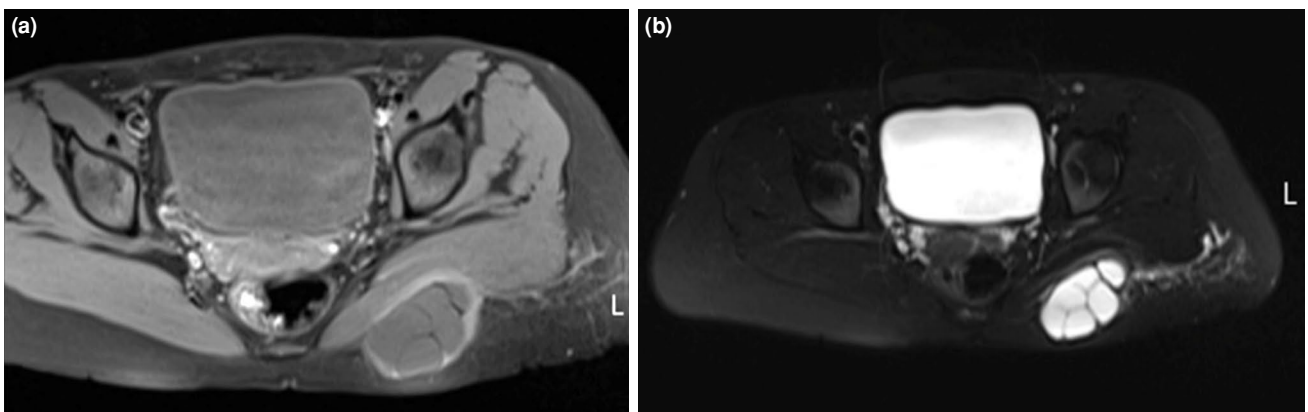

FIGURE 2. (a) Axial T1-weighted MRI before albendazole treatment showing multiple cysts in the gluteus maximus muscle and subcutaneous tissue. **(b)** Axial T2-weighted MRI before albendazole treatment showing daughter cysts with high signal intensity.
MRI: Magnetic resonance imaging.

was performed in only 65.5% of the cases, and only 19.2% had positive results. According to the literature, the ELISA test is more sensitive.[19,20] On the contrary, Yılmaz et al.[21] reported 26% seropositivity with the IHA method and 21.4% with the ELISA method. A large series of 487 cases showed a high correlation between ELISA and IHA methods.[22] The ELISA test was negative in three of our cases (27.3%). All patients with negative serology tests had isolated intramuscular hydatid cysts.

In endemic areas, the diagnosis of hydatid cysts is confirmed by clinics, serology, and radiology.[23] Intramuscular hydatid cysts may mimic soft tissue tumors. In addition, Toğral et al.[24] reported that it could mimic osteomyelitis and sarcomas in bone involvement. It can be interpreted as a benign tumor due to a painless, silently growing soft tissue mass. The differential diagnosis should consider abscess, lipoma, sebaceous cyst, helminthic cysts, neurofibromatosis, tuberculosis, fibrocystic disease, and necrotic soft tissue tumor.[3,9,25] Selahi et al.[26] reported that myositis or a calcified hematoma could be considered in the differential diagnosis. Iranpour and Masroori[15] showed that congenital cysts such as bronchial cleft cyst, or thyroglossal duct cyst, enlarged lymph nodes, and abscesses might be present in the differential diagnosis of hydatid cysts located in the neck region. Therefore, it is crucial to confirm the diagnosis before surgery. However, accidental cyst opening during needle biopsy or wide resection increases the risk of anaphylactic shock or dissemination.[27] Therefore, no biopsy was applied to our patients and, instead, total pericystectomy (marginal resection) was performed. Histopathological diagnosis could not be confirmed in three patients diagnosed with radiological and clinical hydatid cysts. After histopathological examination, two patients were diagnosed with intramuscular ganglion cysts, and one was diagnosed with sebaceous cysts.

Complications such as anaphylactic shock, risk of dissemination, and recurrence have been reported in the literature in case of perforation or accidental opening of the cyst during resection.[7,8] To the best of our knowledge, there is only a single case in the literature in which abdominal compartment syndrome and anaphylactic shock developed after the cyst rupture in the liver.[28] However, compartment syndrome after the rupture of the intramuscular cyst has not been reported yet. A spontaneous cyst rupture developed in one of our cases after minor trauma as weight lifting. The patient was admitted to the emergency department after the cyst rupture, and treatment was planned with the diagnosis of compartment syndrome. We suppose that compartment syndrome develops after an anaphylactic reaction, as the cyst content is an allergen, and its systemic load is high. Our case was receiving albendazole for two weeks (15 mg/kg), and we attribute the lack of systemic anaphylaxis symptoms to this. We propose using neoadjuvant albendazole in muscle hydatid cysts, as it reduces preoperative intracystic pressure and parasite load and prevents anaphylaxis and dissemination in the intra- and postoperative period.

In their study, Thurski and Torresi[29] reported that the treatment of musculoskeletal hydatid cysts was pericystectomy. Al-Hakkak[30] also reported that marginal excision or incisional biopsy was contraindicated due to the dissemination of the cyst content and the risk of anaphylactic shock. The World Health Organization (WHO) recommends radical surgery and antihelmintic chemotherapy to prevent recurrence in localized lesions.[31] Radical wide resection can reduce recurrence in hydatid cyst lesions with bone involvement.[32] In inoperable cases, percutaneous aspiration, infusion of scolicidal agents, and re-aspiration (PAIR) can be applied under the guidance of USG or CT as an alternative to surgical treatment.[33] We meticulously performed pericystectomy in all patients, while they were under albendazole treatment; however, the intraoperative cyst wall ruptured in one case. To prevent the involvement of the scolex, we sutured the ruptured cyst wall and totally excised the cyst. We excised the residual cyst structures in the patient who developed compartment syndrome after cyst rupture.

Nonetheless, there are some limitations to this study. First, it is a retrospective study, including a relatively short period, and historical data could not be reached. Another limitation is that infection origin, such as direct contact, contact with animals, trauma, or insect bite, was not noted. Moreover, the patients were referred to our center from external centers, and serological tests were not repeated in our clinic. Finally, larger patient series are needed to generalize these results to the entire population. However, the main strength of our study is that, to the best of our knowledge, it is one of the few studies with the largest patient series in the literature.

In conclusion, hydatid cysts should be considered in the differential diagnosis of slowly growing, deeply located, and painless masses in a region where *E. granulosus* is endemic. Although isolated involvement is common in these patients, thoracoabdominal imaging should be performed.

Although it is a rare complication, compartment syndrome may develop after spontaneous cyst rupture. Neoadjuvant chemotherapy can minimize possible complications. The combination of surgical total excision and chemotherapy can be expected to yield successful results in the treatment of hydatid cysts located in the extremity.

Ethics Committee Approval: The study protocol was approved by the Harran University Faculty of Medicine Clinical Research Ethics Committee (date: 10.07.2023, no: 2023/12/15). The study was conducted in accordance with the principles of the Declaration of Helsinki.

Patient Consent for Publication: A written informed consent was obtained from the patients and/or parents of the patients.

Data Sharing Statement: The data that support the findings of this study are available from the corresponding author upon reasonable request.

Author Contributions: Idea/concept and design: Ö.O., A.Y.K.; Data collection and/or processing: Ö.O., İ.T., Ö.S.; Analysis and/or interpretation: Ö.O, A.P.; control/supervision: M.A.A., A.Y.K.; Literature review and writing the article: Ö.O., İ.T., Ö.S., A.P.; Critical review: V.B.Ç., M.A.A.; References and fundings: Ö.O., M.A.A.; Materials: Ö.O., M.A.A., V.B.Ç.

Conflict of Interest: The authors declared no conflicts of interest with respect to the authorship and/or publication of this article.

Funding: The authors received no financial support for the research and/or authorship of this article.

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