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ORIGINAL STUDY

Oncological approach with antihelminthic chemotherapy and wide resection in the treatment of musculoskeletal hydatidosis. A review of 10 cases with mean follow-up of 64 months

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The objective of this retrospective study was to evaluate clinical outcomes, local recurrence and complication rates of antihelminthic chemotherapy and wide resection in patients with muscle or bone hydatidosis. The authors treated 10 patients (6 females, 4 males) between 2004 and 2012 : 8 with muscle and 2 with bone hydatidosis. The mean age at surgery was 42.5 years (range, 11-66 years). All patients were treated with wide resection and pre- and postoperative chemotherapy with albendazole. The mean follow-up was 64 months (range, 28-120 months). All patients achieved satisfactory clinical outcomes. There were no local recurrences. Surgical complications were seen in 3 patients (30%) : one superficial infection, one deep infection, and one hematoma. Two (20%) required additional surgery. An aggressive oncological approach, consisting of antihelminthic chemotherapy and wide resection, can provide favorable clinical outcomes and prevent local recurrence in patients with musculoskeletal hydatidosis. Potential complications of aggressive surgery should be preferred to potential morbidity of local and systemic dissemination.

Keywords : hydatidosis ; muscle ; bone ; antihelminthic chemotherapy ; wide resection.

INTRODUCTION

Hydatid disease is a parasitic infestation, which is caused by the larval stage of the tapeworm Echinococcus granulosus. It is a serious health problem in areas where the parasite is endemic, such as the Mediterranean region, the Middle and Far East, and South America. Poor hygiene and close contact with dogs and sheep are the main risk factors. Hydatid disease can affect any organ in the body, although the liver and lungs are the most common targets (*14,20,28*).

Muscle hydatidosis is rare, accounting for 1% to 5% of all hydatidosis cases, even in endemic areas, because the presence of lactic acid in the muscles creates an unfavorable environment for the growth of the parasite (*8,9*). A review of the literature reveals that mostly single case reports, which include a wide variety of affected muscles, have been published (*4,5,6,12, 21,25,26*).

Bone hydatidosis occurs in approximately 1% to 2.5% of human cases of hydatidosis (*24,30*). The

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spine is the most frequent location, followed by the pelvis and the hip joint (*1,7,17,30*). Several case series have been reported, demonstrating the outcomes of surgical treatment of hydatid disease of bone (*2,11,15*).

A hydatid cyst should be considered in the differential diagnosis of unusual soft-tissue masses and bone lesions in regions where the disease is endemic. It closely resembles a soft-tissue tumor on clinical and radiological examination. Similarly, bone involvement may mimic an aggressive bone tumor or a bone malignancy on imaging studies. A preoperative radiological evaluation, particularly using magnetic resonance (MR) imaging, is very important to avoid a biopsy or to prevent improper operative management of the cyst (*9,28*).

The currently recommended treatment of musculoskeletal hydatidosis combines antihelminthic chemotherapy and excision of the diseased parts with wide surgical margins (*2,8,11,24*). Antihelminthic chemotherapy is believed to minimize recurrence rates (*2,11*). Excision through the surrounding uncontaminated tissues should be preferred for both muscle and bone hydatidosis, in order to prevent rupture or spillage of the cyst material, which can be life-threatening. This aggressive oncological approach can eradicate the lesion and prevent systemic spread of the disease.

MATERIALS AND METHODS

Ten patients with musculoskeletal hydatidosis were treated between 2004 and 2012 : 8 with muscular and 2 with bony involvement. All patients were referred with the preliminary diagnosis of bone or soft-tissue sarcoma, although 2 of them had already been treated for extraskeletal hydatidosis.

Data for this retrospective study were obtained from the orthopaedic oncology files. Were noted : age and gender, location, duration and type of symptoms, radiographic and MRI findings, histological findings, previous treatment modalities, dissemination, surgical procedure and adjuvant treatment, clinical and radiological results at latest follow-up, and complications including local recurrence. The average follow-up was 64 months (range, 28-120 months).

There were 4 men and 6 women included in this study. The age of the patients at surgery was 42.5 years (range, 11-66 years). The anatomical distribution of the muscular and bony lesions is summarized in Table I. None of the patients had undergone previous surgery for musculoskeletal hydatid disease, while 2 had been treated with chemotherapy and surgical intervention for lung and liver involvement, about 2 and 4 years before.

Clinical and radiological follow-up, including MR imaging of the involved site, was performed at 6 month intervals in the first 2 years and then annually. Systemic work-up was repeated every year. Complications including local recurrence and need for additional surgery were recorded.

Table I. — Demographics, location, treatment, complications, follow-up

Case number	Age, gender	Location	Wide resection + albendazole	Complications	Follow-up
1	41 M	Right vastus lateralis m.	+	–	53 months
2	63 F	Left vastus lateralis m.	+	–	28 months
3	46 F	Right ilium	+	Hematoma	44 months
4	11 M	Right gastrocn. m.	+	–	120 months
5	53 F	Left hamstrings	+	–	37 months
6	66 F	Left adductor magnus m.	+	Deep infection	66 months
7	35 F	Left infraspinatus m.	+	–	72 months
8	44 M	Right hamstrings	+	Superficial infection	84 months
9	28 M	Right ilium	+	–	54 months
10	38 F	Right ilium	+	–	81 months

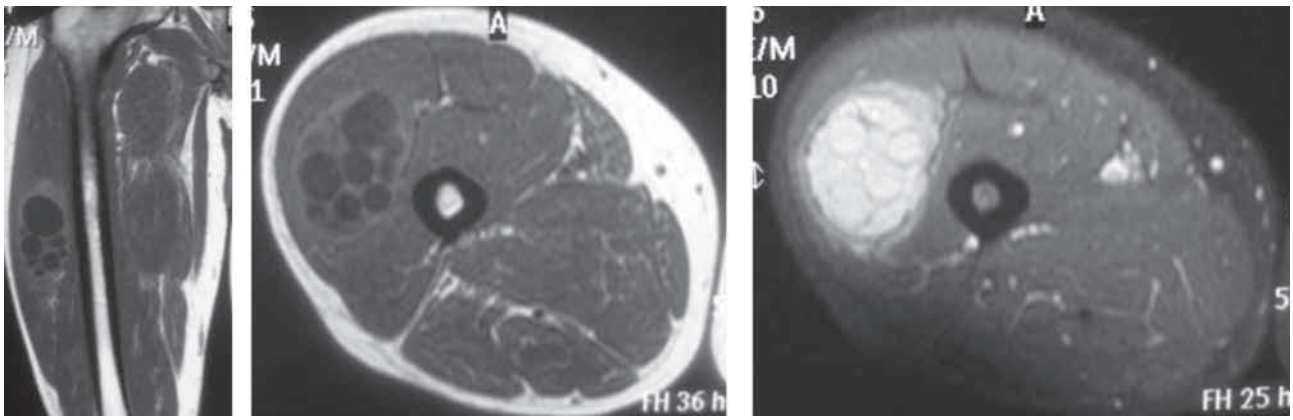

Fig. 1. — 41-year-old male with muscle hydatidosis in the right vastus lateralis muscle. From left to right : coronal and axial T1-weighted images show an intramuscular well-defined soft tissue mass with multiple round hypointense nodules ; axial T2-weighted image demonstrates daughter cysts with higher signal intensity than the mother cyst.

RESULTS

A painless slowly growing mass was the main presenting symptom in the 8 patients with muscle hydatidosis. The masses were moderate to large in size, soft, mildly tender on palpation, and deep-seated. There was no local warmth or erythema. The 2 bony lesions involving the ilium were painful, leading to a mild limp. The mean duration of symptoms for the whole study group was 6 months (range, 3-15 months).

Plain radiographs of the *8 muscular lesions* revealed the shadows of the soft tissue swellings. On MR imaging, soft-tissue masses, between 29 × 26 × 21 mm and 150 × 80 × 30 mm in size, were detected in the involved muscles. The lesions usually had sharp and well-defined borders. MR imaging findings were variable, as a function of the developmental stage of the cysts. In the stage of simple viable hydatid cyst (5 patients) the lesions were markedly hyperintense on fat-saturated T2-weighted images compared to muscle, and were cystic and homogeneous in nature. The cyst wall was hypointense. In the stage of hydatid cyst with daughter cysts (3 patients), the contents of the daughter cysts were hypointense on T1-weighted images and hypo- or hyperintense on T2-weighted images, when compared with the mother cyst (Fig. 1). A diffuse edema was seen in the surrounding muscles and adjacent subcutaneous tissues as a high-signal intensity change in both stages.

The *two bony lesions* were characterized by lytic areas associated with sclerosis and cortical irregularity on plain radiographs. Medullary extension and soft-tissue component were hypointense on T1- and hyperintense on T2-weighted MR images (Fig. 4). MR images showed cortical destruction as well (Fig. 4). Computerized tomography (CT) scans were obtained in one patient, and demonstrated intra- and extra-osseous extension of the lesion. Tc99m bone scanning revealed increased uptake for both pelvic lesions.

Involvement of other organs, including cranium, lung, and liver were identified with CT scans. Concomitant cranial and hepatic lesions were seen in one patient with muscle hydatidosis. These extraskeletal lesions were managed by surgical treatment and antihelminthic chemotherapy, before resection of the muscular lesion. The remaining 9 patients had solitary musculoskeletal lesions.

Complete blood cell count, electrolytes, erythrocyte sedimentation rate (ESR), and C-reactive protein were within normal limits in 6 cases, while 2 muscle and 2 bone cases were associated with an elevated ESR level. The Casoni, or indirect hemagglutination test, was positive in 5 cases.

Biopsy was avoided in order not to produce dissemination or inoculation through the needle

Fig. 2. — Same patient as in fig. 1 : resection piece

tract. Histopathological examination of the resection specimens confirmed the diagnosis of hydatidosis in each case. Soft tissue specimens revealed cysts with an outer chitinous (fibrous laminar) and inner germinal layer. The chitinous layer was surrounded by granulation tissue. Surrounding muscular tissues showed an inflammatory infiltrate in which eosinophils were dominant. Histopathological examination of the bony lesions demonstrated osseous trabeculae compressed by the typical vesicles.

The lesions were excised en-bloc with a wide margin of surrounding tissue. (Table I) (Fig. 2, 3). Resection of the ilium (type I) was performed for both pelvic lesions (*22*) (Fig. 3). Wide surgical margins were achieved in all cases without rupture or spillage of the cyst material. Local transpositional muscle flaps were used to fill the soft-tissue defects, when needed. A nonvascularized fibular autograft was used to reconstruct the defect after an ilium resection. The other patient with ilium resection did not require any reconstruction.

The patients had a standard preoperative and postoperative adjuvant antihelminthic chemotherapy regimen with albendazole. Albendazole (15 mg/kg/day for patients < 60 kg ; 400 mg BID for patients > 60 kg) was used for a total period of 3 to 6 months.

Patients with muscle hydatidosis regained their activity more rapidly than patients with bony lesions. Seven patients with lower extremity intramuscular hydatid cysts achieved complete clinical recovery within 3 to 6 months postoperatively. They were able to use their affected extremity with full function and strenght. The only patient with upper extremity (infraspinatus muscle) involvement had restricted shoulder motion postoperatively. However, she was pain free and able to perform activities of daily living throughout follow-up. The two patients with bone hydatidosis regained full function of the lower extremities with mild limping in a year.

There was no recurrence in this series : all patients were free of disease at the time of latest follow-up, after an average of 64 months. Three (30%) patients developed surgical complications in the early postoperative period : one superficial infection, one deep infection, and one hematoma (Table I). The superficial infection was managed by oral anti-

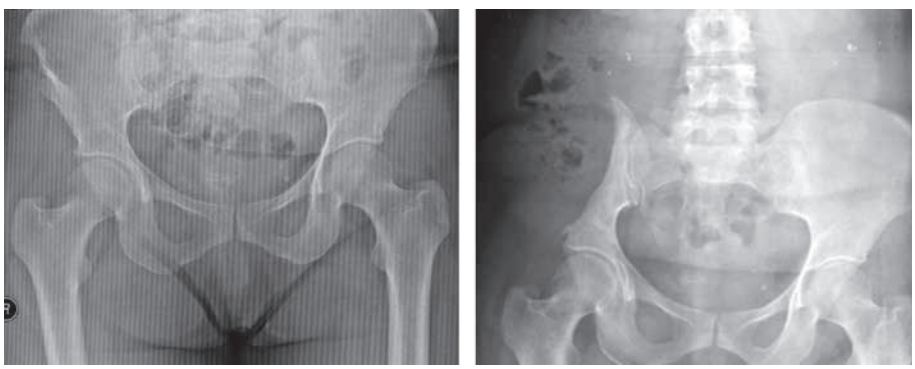

Fig. 3. — 46-year-old female with hydatid disease of the right ilium. Left : plain radiographs, preoperatively : lytic area with sclerosis. Right : after ilium type I resection, without reconstruction.

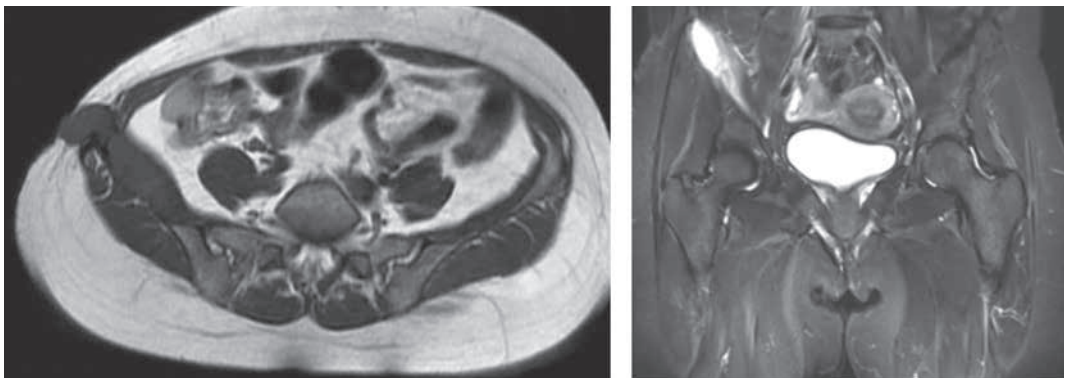

Fig. 4. **—** Same patient as in fig. 3. From left to right : T1-weighted axial and T2- weighted coronal image demonstrate intra- and extra-osseous extension of the lesion in the right ilium.

biotics. The deep infection was seen following wide resection of a muscular hydatid cyst in the adductor magnus muscle, and was managed by débridement and parenteral antibiotics. The hematoma which developed after resection of a bony lesion in the ilium was drained surgically.

DISCUSSION

Hydatid disease, or echinococcosis, is classified as a helminthic infection caused by the tapeworm Echinococcus granulosus. Its distribution is worldwide. Although hydatid disease can develop in almost any part of the body, it is most commonly found in the liver and lung (*14*). Musculoskeletal involvement is rare.

The diagnosis of musculoskeletal hydatid disease is difficult, clinically and radiographically. The cysts remain clinically silent for a long time, and the radiographic changes are usually nonspecific. The shadow of a soft-tissue swelling is the only radiographic finding in muscular lesions. Cortical erosion and ill defined areas of osteolysis producing a honeycomb appearance are suggestive of bone hydatidosis (*3*). However, the majority of the bony lesions are less typical and are difficult to differentiate from primary or secondary malignancies, benign tumors or infections including tuberculosis.

Magnetic resonance imaging is capable of adequately demonstrating most features of *hydatid disease of the muscle*. The morphological characteristics and signal intensity properties differ according to the developmental stages of the cyst (*19,20,28*). In the stage of simple viable hydatid cyst, the cyst wall is isointense relative to the fluid in the cyst on T1-weighted images, and appears as a low-signal intensity rim surrounding the high-signal intensity contents on T2-weighted images. In the stage of hydatid cyst with daughter cysts, the contents of the mother and daughter cysts are usually isointense on both T1- and T2-weighted images. In the stage of hydatid cyst with detached parasitic membranes, the membranes are seen floating within the cyst and appear dark on both T1- and T2-weighted images. At the end-stage of development, spontaneous collapse and calcification of the cyst occur, leaving an area of calcification in the host tissue.

Magnetic resonance imaging and CT can recognize intra- and extra-osseous spread of the *hydatid disease of bone* (*3*). The CT appearances of bone lesions are similar to those demonstrated on radiographs. However, CT contributes to a better evaluation of the extension within the bone, with clear demarcation of the lesion. Also MR imaging provides excellent definition of the lesion size and extension. The primary role of MR imaging is the demarcation of the extra-osseous spread of hydatid disease within the soft tissues.

A deep-seated large *intramuscular hydatid cyst* may mimic a soft-tissue sarcoma due to its heterogeneous solid or complex pattern on MR imaging. Similarly, *bone hydatidosis* may progressively

destruct the involved bone, leading to complete osteolysis and soft-tissue extension. This aggressive radiological appearance may frequently be confused with lesions such as aneurysmal bone cyst, giant cell tumor, fibrous dysplasia, myeloma, bone sarcoma, cystic metastasis, and osteomyelitis (*3*). All patients in this series were originally referred to the musculoskeletal oncology unit with the preliminary diagnosis of bone or soft-tissue sarcoma.

Specific diagnosis may be made by examination of the fluid aspirated from the cyst, but this is not routinely recommended, due to the risks of leakage, spreading of the disease and anaphylactic shock (*16*). Specific serological tests are available, especially when the lesion is situated in the liver. As seen in the current series, up to 50% of the cases may have negative serology, and although specific antibodies are available false-positive tests are common.

Simple drainage or débridement have been used as a treatment option for bone hydatidosis. However, incomplete removal of the lesion has been reported with early recurrence and dissemination. Loudiye *et al* (*15*) reported development of a persistent sinus tract in 6 patients with bone hydatidosis treated by curettage. On the other hand, they obtained favorable results in 3 patients who underwent radical resection. Arazi *et al* (*2*) observed a 50% recurrence rate in hydatid disease of bone following curettage or partial resection. Liang *et al* (*13*) reported 9 patients with hydatid disease of pelvic bones, all treated with curettage. However, 5 of them required several débridement procedures in combination with chemotherapy or radiotherapy. Herrera *et al* (*11*) obtained satisfactory results in extremity lesions managed by complete or wide excision. However, the results were disappointing when inadequate excision was performed in the pelvis and hip region.

Some authors advocate chemical sterilization by absolute alcohol, formalin (10%), silver nitrate (0.5%), povidone iodine (10%), or hypertonic saline (20%) in order to kill live cysts (*1,7,10,18,24*). However, microscopic lesions cannot be completely destroyed by swabbing.

Yildiz *et al* (*29*) reported improved results in patients who were treated with curettage and débridement, followed by cementation of the defect. The authors believed that polymethylmethacrylate (PMMA) had a necrotizing effect on daughter cysts due to its thermal effect.

Several reports have been published demonstrating the efficacy of ultrasonography-assisted percutaneous drainage in the treatment of uncomplicated cysts of the liver (*27*). However, this technique has not been described for hydatid cysts located in muscle or bone.

The currently recommended treatment of muscle and bone hydatidosis combines chemotherapy with antihelminthic agents and resection of the lesion with adequate surgical margins (*11,14*). High healing and low recurrence rates have been reported, even with marginal resection of muscular hydatid cysts (*2,4,12,25*). Intralesional procedures including incisional biopsy, curettage or débridement are not recommended. Rupture or spillage of the cyst material may release a large number of viable scoleces, which implant elsewhere and produce secondary cysts.

En-bloc excision of the cyst, preferably with wide surgical margins, prevents local and systemic dissemination, which is associated with high morbidity. *Intramuscular hydatid cysts,* when they are located in the extremities, can be excised through the surrounding uncontaminated muscle tissue without a significant morbidity. However, achieving a wide margin may be difficult for *bone hydatidosis*, particularly in certain locations such as the pelvis and hip. Removal of healthy bone may compromise critical structures in these complex locations (*2,11*).

The authors achieved wide surgical margins in all cases. Seven of the *8 muscular hydatid cysts* were located in the lower extremities, and complete clinical healing was achieved in all without a significant morbidity. Restricted function was observed in only one patient with infraspinatus involvement. There were only *2 bone hydatidoses*, located in the pelvis. Both were managed by ilium (type I) resection which is technically easier and associated with fewer complications when compared to periacetabular (type II), obturator (type III) or sacral (type IV) resection (*22*). Although a mild limping was observed, satisfactory clinical outcomes were obtained in both patients.

The use of antihelminthic agents as an adjuvant to surgical treatment is recommended by many authors (*2,6,11,23,24,29*). Albendazol causes inhibition of microtubule polymerization. Thus, it inhibits cell proliferation and causes death of the parasite at the end (*23*). Although some authors believe that chemotherapy is not required when wide or radical margins are achieved (*8*), antihelminthic medication generally is recommended to improve the clinical status of the patients and to avoid recurrence. In this series, all patients received preoperative and postoperative albendazole for 3 to 6 months, as part of a standard treatment protocol.

This study has limitations. First, it is a retrospective study with a relatively small number of patients. Second, the study group includes patients with muscle and bone hydatidosis. Mixed study groups are not ideal, but musculoskeletal hydatidosis is rare, limiting the overall number of patients seen at any single location, even in endemic regions. On the other hand, all patients were treated with a standard approach, including wide resection and antihelminthic chemotherapy, in the same institution. In addition, the patients were followed extensively with detailed clinical and radiological records.

CONCLUSION

Musculoskeletal hydatidosis should be considered in the differential diagnosis of bone and soft-tissue tumors in regions where the disease is endemic. Preoperative MR imaging is very important to avoid a biopsy or to prevent improper intraoperative management of the cyst. The same surgical principles as for bone and soft-tissue sarcomas must be employed in the initial management of musculoskeletal hydatid disease, and an attempt must be made to achieve wide surgical margins even in complex locations such as the pelvis.

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