Composite Treatment for Primary Long-bone Hydatidosis

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Abstract

Hydatid disease is a parasitic tapeworm infection caused by the Echinococcus species. Involvement of the long tubular bones is rare in hydatid bone disease. Patients are initially asymptomatic and usually present at a later stage of the disease when the bony lesions are extensive. Diagnosing bone hydatid disease is challenging, even in endemic regions, and a high index of suspicion is required because the radiologic findings often mimic other bone pathologies. Recurrence following treatment can occur after a long period of quiescence.

This article describes a case of hydatid disease in a 62-year-old woman with extensive diaphyseal tibial involvement. She was treated with initial chemotherapy followed by extended curettage, polymethylmethacrylate cementation, and intramedullary fixation. Functional outcome was excellent, with no recurrence at 60-month follow-up. She was fully weight bearing with no pain or discomfort and had full hip, knee, and ankle range of motion.

This case was important due to its rarity, the diagnostic challenge it presented, and the composite nature of the treatment used to avoid recurrence. Diaphyseal bone hydatidosis can be initially treated like a low-grade malignant tumor with curettage and high-speed burring, followed by filling the defect with polymethylmethacrylate cement. The composite treatment of chemotherapy with the surgical protocol described offers a reasonable chance of long-term disease suppression. Recurrent disease can be treated with repeat curettage and cementation. Wide excision with reconstruction of the resulting defect should only be considered for recalcitrant diaphyseal hydatid disease.

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Two Echinococcus species, E. granulosus and E. multilocularis, are the most common causes of bone hydatid disease in humans. Dogs are the definitive host for these Echinococcus species. Sheep, pigs, cattle, horses, goats, and humans are the usual intermediate hosts. Echinococcosis may result when the eggs, which are discharged with the feces of the definitive host, are accidentally swallowed by the intermediate host. The embryos are hatched in the duodenum of the intermediate host, and they traverse the intestinal mucosa to enter the portal circulation. Once they escape the filtering action of the lungs and the liver, the embryos reach the general circulation to involve the brain, kidneys, bones, and other tissues. Bone involvement in hydatidosis is rare; the reported incidence varies between 0.5% and 2.5%. Bone hydatidosis occurs most commonly in the spine (35%) and pelvis (21%), with long bone involvement of the femur (16%) and tibia (10%) seen less commonly. Involvement of the ribs, skull, scapula, humerus, and fibula is uncommon, with the incidence varying between 2% and 6%. The cysts occasionally lie dormant in the body for up to 20 years without producing clinical signs or symptoms. The lamellated structure of the osseous tissue prevents rapid growth of the cyst along medullary and trabecular channels. The disease usually presents between the fourth and sixth decades of life.

Patients are usually initially asymptomatic. They present with pain, swelling, or pathological fractures when the lesions become extensive. This article describes a rare case of a patient with hydatid disease with extensive diaphyseal involvement of the tibia who underwent composite treatment to avoid recurrence. The patient gave informed consent for her case to be published.

**CASE REPORT**

A 62-year-old woman presented with a 6-month history of left leg pain and swelling. She rated the pain as 5/10 in intensity and reported that it was aggravated on walking and relieved by taking nonsteroidal anti-inflammatory drugs. She reported no history of trauma, and her medical history was not significant.

General physical examination revealed no abnormality. A diffuse, firm to hard, nonpulsatile, ill-defined swelling over the anterior aspect of left tibia was felt. Local examination revealed bony tenderness over the middle two-thirds of the anteromedial surface of the left tibia. No evidence existed of redness, warmth, or fluctuation over the swelling. Neurovascular examination of the lower limbs was normal. Examination of the hip, knee, and spine was unremarkable.

Routine blood investigations, including C-reactive protein (4 mg/dL; normal, 0-6 mg/dL), were within normal limits. However, the erythrocyte sedimentation rate was raised to 72 mm/hr (normal, 0-15 mm/hr).

Radiographs of the left tibia revealed multiloculated osteolytic honeycomb lesions affecting the middle two-thirds of the tibial diaphysis with cortical expansion and thinning of the cortices (Figures 1, 2). Ultrasonography of the abdomen and pelvis showed no abnormalities. No significant abnormalities were found on chest radiographs. A diagnosis of a benign or low-grade malignant bone tumor was made at this stage.

Core needle biopsy was subsequently performed from the osteolytic lesion of left tibia. The core biopsy was performed from the anteromedial surface to avoid contamination of the leg compartments. Histopathological examination revealed laminated hyaline membrane compatible with the diagnosis of hydatid cyst (Figure 3). An enzyme-linked immunosorbent assay test for echinococcal antibody was positive (12.58 U/mL; normal less than 8 U/mL), retrospectively, after the histopathological diagnosis was made.

Magnetic resonance imaging was not performed due to financial constraints. A musculoskeletal ultrasound performed to look for cysts in the leg compartments revealed no extraosseous spread of the hydatid disease.

Chemotherapy was started with 3 cycles of albendazole (15 mg/kg/day orally daily) for 4 weeks, with a drug holiday

![Figure 1: Anteroposterior radiograph showing the multiloculated honeycomb appearance of the tibial shaft secondary to bone hydatidosis.](image1)

![Figure 2: Lateral radiograph showing hydatid involvement of the middle two-thirds of the tibial shaft.](image2)

![Figure 3: Histopathological slide showing laminated appearance, which is consistent with the diagnosis of hydatid disease (hematoxylin-eosin stain, original magnification ×10).](image3)
of 2 weeks between the cycles. Weekly blood counts and liver function tests were performed during this period. Following completion of the chemotherapy regimen, a composite surgical procedure was undertaken with the intention to cure the disease.

The middle one-third of tibia was exposed through an anterolateral incision, which was deliberately curved distally to excise the biopsy tract. A trench (window centered over the lesion measuring 2.5 cm wide and two-thirds the length of the tibia) was made over the anteromedial surface of the tibia to expose the medullary cavity. The anterolateral cortex and the posterior cortex of the tibial shaft were left intact. Exploration of the medullary cavity revealed numerous yellowish gelatinous cysts filling the entire medullary cavity (Figure 4). Curettage was then performed to remove the yellowish-white membranous cyst wall and numerous round cysts. Care was taken to avoid spillage. The medullary cavity was continuously irrigated with 20% hypertonic saline and 10% povidone iodine during the curettage and for 20 minutes thereafter.

Once macroscopic removal of the cysts was completed, the curetted cavity was extended with a high-speed burr (Midas Rex; Medtronic, Minneapolis, Minnesota). The high-speed burr increased the curettage margins and added a thermal effect to decrease recurrence. Following high-speed burring, the cavity was rewashed with 20% hypertonic saline and 10% povidone iodine. Although the patient had no episodes of anaphylaxis intraoperatively, the anesthetists were forewarned prior to beginning the procedure. The tibial defect created was stabilized with a reamed locked intramedullary nail 10 mm in diameter, and the remaining cavity was filled with polymethylmethacrylate bone cement.

The postoperative period was uneventful. She was restarted on albendazole for 3 cycles, with a drug holiday of 2 weeks between the cycles. Each cycle consisted of daily albendazole therapy (15 mg/kg daily orally) for 4 weeks. Liver function and blood counts were monitored weekly throughout the course of postoperative chemotherapy. At 5-year follow-up, no evidence existed of recurrence (Figures 5, 6), and she was full weight bearing with no pain or discomfort and had full knee and ankle range of motion. She is currently being observed yearly for the early detection of possible recurrence.

**DISCUSSION**

Bone hydatidosis commonly involves the spine and pelvis. Hydatid involvement of long tubular bones, especially the tibial diaphysis, is rare.6-8 The disease initially involves the epimetaphyseal region, often extending to the diaphyseal region at presentation.9 Hydatid infection of osseous tissue can be suspected from radiographs, computed tomography, and magnetic resonance imaging. Serological tests for diagnosing hydatid bone disease (ie, counterimmunoelectrophoresis, Casoni, gold antibody, and indirect hemagglutination) mainly revolve around the detection of antigen-5 and antigen-B in the hydatid fluid or serum antibody.10 Enzyme-linked immunosorbent assay for hydatidosis has the highest sensitivity and specificity and can determine the response to treatment during medical therapy.

Plain radiographic findings in hydatid bone disease include intramedullary unicocular, bilocular, and often multiloculated cystic expansile lesions with surrounding sclerosis in a honeycomb pattern associated with cortical thinning.10 Soft tissue calcification surrounding these lytic lesions are occasionally present. The classic computed tomography appearance described for cystic echinococcosis is a round- to oval-shaped lesion with double-layered arcuate calcification.10 Typical magnetic resonance imaging findings include a high-signal appearance of a rose or wheel-shaped lesion in T2-weighted images due to the presence of spaces or septation in the daughter cyst.10

Diagnosing bone hydatidosis is often challenging due to the rarity of the lesions, even in endemic regions, and the
absence of a typical radiographic appearance in most cases. The differential diagnosis of hydatid lesions of bone includes aneurysmal bone cyst, fibrous dysplasia, giant cell tumor, brown tumor of hyperparathyroidism, chondromyxoid fibroma, tuberculosis, or metastasis. The diagnosis is usually confirmed by histopathological examination. These lesions can lead to abscess formation with secondary fistulization, adjacent joint involvement, pathological fracture, and secondary infection.

Combining chemotherapy with surgery is considered the most effective treatment for osseous hydatid disease. Various chemotherapeutic agents have been used for the treatment of human echinococcosis. However, benzimidazole compounds, mebendazole and albendazole, have been used more frequently than other agents for the treatment of osseous and extraosseous hydatid disease. Albendazole has better absorption and achieves higher concentration of its active metabolite in cysts and in the blood compared with mebendazole and is considered the treatment of choice in human hydatid disease.

### Table

**Long-bone Hydatidosis Treatment Methods and Outcomes**

<table>
<thead>
<tr>
<th>Patient</th>
<th>Sex/ Age, y</th>
<th>Site</th>
<th>Symptoms</th>
<th>Treatment</th>
<th>Follow-up</th>
<th>Outcome</th>
<th>Author</th>
<th>No. of Patients</th>
</tr>
</thead>
<tbody>
<tr>
<td>M/53</td>
<td>Tibia</td>
<td>Pain</td>
<td>Curettage, BG, mebendazole</td>
<td>81 mo</td>
<td>Recurrence treated by repeat curettage and BG</td>
<td>Yildiz et al 19</td>
<td>1/15</td>
<td></td>
</tr>
<tr>
<td>M/40</td>
<td>Humerus</td>
<td>Pain</td>
<td>Curettage, cementation, mebendazole</td>
<td>4 y</td>
<td>No recurrence</td>
<td>1/15</td>
<td></td>
<td></td>
</tr>
<tr>
<td>M/42</td>
<td>Femur</td>
<td>Pain</td>
<td>Curettage, cementation, internal fixation, mebendazole</td>
<td>6 y</td>
<td>No recurrence</td>
<td>3/15</td>
<td></td>
<td></td>
</tr>
<tr>
<td>F/62</td>
<td>Femur</td>
<td>Pain and pathological fracture</td>
<td>Excision, PMMA, partial prosthesis, mebendazole</td>
<td>119 mo</td>
<td>No recurrence</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>F/29</td>
<td>Femur</td>
<td></td>
<td></td>
<td>Lost to FU after 30 mo</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>F/45</td>
<td>Tibia</td>
<td>Pain</td>
<td>Curettage, iodine, albendazole</td>
<td>2 y</td>
<td>No recurrence</td>
<td>Kalinova et al 13</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>M/53</td>
<td>Tibia</td>
<td>Pain</td>
<td>Drainage, mebendazole</td>
<td>16 mo</td>
<td>No recurrence (tibia)</td>
<td>Sapkas et al 2</td>
<td>1/8</td>
<td></td>
</tr>
<tr>
<td>M/68</td>
<td>Humerus</td>
<td>Discharging sinus</td>
<td>Drainage, mebendazole</td>
<td>16 mo</td>
<td>Complete destruction, poor result</td>
<td></td>
<td>1/8</td>
<td></td>
</tr>
<tr>
<td>M/40</td>
<td>Tibia</td>
<td>Pain and swelling</td>
<td>Curettage, BG, albendazole</td>
<td>Lost to FU</td>
<td></td>
<td></td>
<td>Madiwale et al 7</td>
<td>1</td>
</tr>
<tr>
<td>F/54</td>
<td>Tibia</td>
<td>Pain and swelling</td>
<td>Curettage, fibula grating, albendazole, praziquantil</td>
<td>2 y</td>
<td>No recurrence</td>
<td>Schneppenheim &amp; Jerosch 25</td>
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<td>1</td>
</tr>
<tr>
<td>F/17</td>
<td>Femur</td>
<td>Pain</td>
<td>Curettage, cementation, albendazole</td>
<td>6 y</td>
<td>No recurrence</td>
<td>Tomak et al 5</td>
<td>1</td>
<td></td>
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<tr>
<td>F/35</td>
<td>Femur</td>
<td>Nonunion of femoral shaft and discharging sinus</td>
<td>Resection, albendazole, cementation, internal fixation (stage 1); allografting, chemotherapy (stage 2), internal fixation</td>
<td>26 mo</td>
<td>No recurrence</td>
<td>Neogi et al 28</td>
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<tr>
<td>M/18</td>
<td>Femur</td>
<td>Fracture</td>
<td>Debridement, hypertonic saline washout, albendazole</td>
<td>22 mo</td>
<td>No recurrence</td>
<td>Winter et al 24</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>M/34</td>
<td>Radius</td>
<td>Pain</td>
<td>Wide excision, albendazole</td>
<td>2 y</td>
<td>No recurrence</td>
<td>Mondal &amp; Sengupta 27</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>M/56</td>
<td>Humerus</td>
<td>Pain and pathological fracture</td>
<td>Curettage, allograft chips, albendazole, internal fixation</td>
<td>N/A</td>
<td>Recurrence treated at 1 y treated with repeat curettage, allografts, and internal fixation</td>
<td>Okzam et al 26</td>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>

**Abbreviations:** BG, bone grafting; FU, follow-up; N/A, not available; PMMA, polymethylmethacrylate.
Surgical treatment is usually based on the same principles as described for a locally malignant lesion. Skeletal architecture preservation with complete disease eradication should ideally be the treatment goal of long-bone hydatidosis. Due to the rarity of the lesions, standardized treatment algorithms cannot be formulated. Surgical procedures varying from simple drainage to wide excision and amputation have been suggested for the eradication of the disease.14 Although wide excision of the infected bone provides the best chance of cure, it usually leaves an extensive bone defect that can produce a challenge during reconstruction.16 Recurrence of the disease can complicate prosthetic reconstruction after cyst excision.17,18 Bone grafts used for the reconstruction of the defects can also be invaded by the disease process. Mechanical curettage with or without adjuvants has been reported to provide long-term disease suppression.19 Various scolicidal agents, including silver nitrate (0.5%), cetrimide (15%), formalin (10%), hydrogen peroxide (3%), and hypertonic saline (20%), have been used as adjuvants after curettage to decrease recurrence and affect a cure.20-22 However, the microscopic daughter cells are often resistant to their scolicidal action. Polymethylmethacrylate has been used to improve the sterilization effect after curettage.19 Monomers and free radicals released during polymer formation are toxic to living cells.23 The exothermic reaction of polymerization can also lead to cell death. Curettage followed by cementation is advantageous because recurrence can often be treated with repeat curettage. Moreover, it does not compromise a wide resection in case it becomes necessary.

Various authors have reported suppression of hydatid bone disease following curettage and antibiotic therapy (Table).2,5,7,13,19,24-26 Others have reported disease suppression after resection and chemotherapy.19,27,28 Yildiz et al19 reported that 4 of 7 patients with hydatid bone disease were disease free at long-term follow-up after curettage and cementation. Tomak et al20 also reported disease-free survival after a follow-up of 6 years following curettage and cementation in a patient with hydatid cyst of the femur. Sapkas et al17 reported no recurrence following curettage and mebendazole therapy at 3-year follow-up in a patient with a tibial hydatid cyst. The current authors used hypertonic saline and polymethylmethacrylate bone cement to decrease the chance of recurrence. High-speed burring has reduced the risk of recurrence from locally aggressive lesions, such as giant cell tumors.29 The current authors used a high-speed burr to extend the curettage margins. An intramedullary locking nail was used prophylactically to prevent a pathological fracture. At 5-year follow-up, the patient was pain free and had no evidence of recurrence.

CONCLUSION

Hydatid disease involving the long tubular bones should initially be treated as a low-grade malignant neoplasm, with curettage, high-speed burring, and cavity-filling cementation to decrease recurrence. Adjuvant chemotherapy should be used to induce disease suppression. Recurrent disease can be treated with repeat curettage and cementation. Wide excision should be reserved for adjacent joint involvement or recalcitrant disease, and amputation should only performed as a last resort for diaphyseal hydatidosis.

REFERENCES


