Case Report

Disseminated *Prototheca wickerhamii* Infection with Arthritis and Tenosynovitis

JOAN S. PASCUAL, LUCIA L. BALOS, and ALAN N. BAER

**ABSTRACT.** Achloric algae of the *Prototheca* species are a rare cause of infection in humans. These infections are usually localized to the skin, olecranon bursae, and tendon sheaths of the hands and wrists. Our patient with acquired immunodeficiency syndrome and a chronic *Prototheca wickerhamii* skin infection of the hand developed tenosynovitis and arthritis of his ankle in the setting of a documented algemia. This is the first reported case of protothecal arthritis and tenosynovitis resulting from hematogenous dissemination. The reported musculoskeletal manifestations of protothecal infections are reviewed. (J Rheumatol 2004;31:1861–5)

**Key Indexing Terms:**
- PROTO THECA
- ALGAE
- INFECTIOUS ARTHRITIS
- TENOS YNOVITIS
- ACQUIRED IMMUNODEFICIENCY SYNDROME

Prototheca are achloric algae that can be a rare cause of infection in humans. Infections are generally localized to exposed skin of the face and distal extremities, olecranon bursae, and tendon sheaths of the hands and wrists. They occur in both immunocompetent and immunocompromised hosts. Systemic protothecosis with visceral and meningeval involvement occurs rarely in immunocompromised individuals. We describe a man with acquired immunodeficiency syndrome (AIDS) and a chronic *Prototheca wickerhamii* skin infection of the hand who subsequently developed arthritis and tenosynovitis of his ankle in the setting of a documented algemia. This is the first reported case of protothecal arthritis and tenosynovitis arising as a result of hematogenous dissemination.

**CASE REPORT**

A 49-year-old man with advanced AIDS was admitted to the hospital with drug-induced pancreatitis. A nonhealing wound had developed on his left thumb 28 months prior to this hospitalization. Four months after its onset, a physician described a firm, 1 cm nodule with serous drainage and obtained a culture that grew *P. wickerhamii*. The patient had an aquarium exposed skin of the face and distal extremities, olecranon bursae, and tendon sheaths of the hands and wrists. They occur in both immunocompetent and immunocompromised hosts. Systemic protothecosis with visceral and meningeval involvement occurs rarely in immunocompromised individuals. We describe a man with acquired immunodeficiency syndrome (AIDS) and a chronic *Prototheca wickerhamii* skin infection of the hand who subsequently developed arthritis and tenosynovitis of his ankle in the setting of a documented algemia. This is the first reported case of protothecal arthritis and tenosynovitis arising as a result of hematogenous dissemination.

During the second week of his hospitalization, he developed fever and swelling of the left ankle. Physical examination at that time demonstrated multiple verrucous plaques on the left thumb, some of which were ulcerated (Figure 2). Subcutaneous nodules were present in the left forearm, right calf, right peroneus tendons, and extensor digitorum longus tendon sheath of the left ankle (Figure 3). The left ankle was diffusely swollen, warm, and tender. Fluid samples aspirated from the extensor digitorum longus tendon sheath and from the left ankle joint each grew *P. wickerhamii*. Numerous intracellular ovoid organisms that stained with Gomori methenamine silver were present in the fluid aspirated from the tendon. The scant amount of fluid obtained from the ankle joint was insufficient for cell count. On the day that the ankle was aspirated, a blood culture planted 2 weeks earlier was reported as growing *P. wickerhamii*.

He was treated with intravenous amphotericin B but failed to respond. His mental status deteriorated. The cerebrospinal fluid white blood count was 811/mm³ with 88% neutrophils, glucose was 39 mg/dl, and protein was 243 mg/dl. Culture of the cerebrospinal fluid was sterile. The patient died on the 27th hospital day.

**DISCUSSION**

The genus *Prototheca* includes 3 species of unicellular, spheric algae that lack chlorophyll and are thus unable to produce energy from photosynthesis. They exist as saprophytes in a natural habitat that includes fresh and marine water, slime flux of trees, fish tanks, vegetable surfaces, and sewage. These organisms reproduce asexually by the formation of internal autospores, each identical to the parent cell.
Figure 1. Left thumb lesion. Several sporangia in the morula form (arrow) are seen within this granulomatous infiltrate (hematoxylin and eosin stain, magnification 100×).

Figure 2. Left thumb. Verrucous plaques with focal ulceration are evident.
Of the 3 protothecal species, *P. wickerhamii*, *P. zopfii*, and *P. stagnora*, only the first 2 are known to cause human infection. *P. wickerhamii* is the more common etiologic agent and can be readily recognized by the presence of a characteristic morula in histologic sections. The morula is a cell with symmetrically arranged endospores resembling a daisy or soccer ball that is visualized best with Gomori methenamine silver or periodic acid-Schiff stains.

Protothecal infections in humans are of 3 basic forms: cutaneous, musculoskeletal, and disseminated. The skin lesions are almost always on exposed areas, such as the distal extremities and face. Postoperative wounds in these areas are particularly susceptible to infection. In patients with a serious underlying illness or immunosuppression, the skin lesions are vesiculobullous, ulcerative, or nodular. In patients with intact immune systems, the lesions are usually plaques or papules, often eczematous. Development of these infections can usually be traced to contact with dirty water, fish tanks, or soil. Most cases have been reported from tropical areas of the world, including the southeastern United States.

Prototheca species grow rapidly on standard laboratory media; visible colonies are usually evident within 7 days. Prior or ongoing treatment with amphotericin may hinder recovery of the organism, as it most likely did with the culture of our patient’s cerebrospinal fluid. The organisms can be identified by their morphology as well as with immunofluorescent staining methods and biochemical assimilation assays.

Twenty-three patients with involvement of the musculoskeletal system from protothecosis have been reported (Table 1). Olecranon bursitis is the most common type of involvement, having been reported in 18 patients to date. In most of these cases, the bursitis is preceded by local nonpenetrating trauma or a previous corticosteroid injection. Infection of the tendon sheaths in the hands and wrists has been reported in 5 patients, all in surgical or accidental wounds; 2 patients’ infections could be traced to cleaning an aquarium. Our patient is unique in that he developed tenosynovitis and arthritis of the ankle in the setting of a documented algemia. His initial infection was a nonhealing nodule of the left thumb. A sporotrichoid type of lymphangitic spread was not noted in his left arm. Infection of the patient’s ankle joint may have been facilitated by the prior intraarticular injection of dexamethasone.

![Figure 3. Left lower leg. Multiple subcutaneous nodules are evident along the lateral aspect of the lower leg. Cytologic examination of fluid aspirated from the swollen extensor digitorum longus tendon sheath (arrow) showed numerous intracellular ovoid organisms that stained with Gomori methenamine silver.](image-url)
Cases of disseminated protothecosis have included meningitis, peritonitis, hepatic abscesses, and urinary tract infection. Most have occurred in immunocompromised patients, including those treated with immunosuppressive agents and those with longstanding indwelling intravascular catheters and endotracheal tubes. To our knowledge, there is only one prior report of systemic protothecosis in a patient with AIDS. Our patient developed meningitis during his terminal illness that was most likely a result of the disseminated protothecal infection.

Protothecal infections of the olecranon bursa and surgical wound sites are not self-healing and have generally required surgical excision for cure. Prolonged therapy with oral imidazole antifungal agents may be used for limited cuta-

### Table 1. Reported cases of musculoskeletal involvement in human protothecal infections.

<table>
<thead>
<tr>
<th>Reference</th>
<th>Age/Sex</th>
<th>Musculoskeletal Involvement</th>
<th>Organism</th>
<th>Comorbid Conditions</th>
<th>Antecedent Events/ Possible Sources of Infection</th>
<th>Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>7</td>
<td>63 M</td>
<td>Olecranon bursa</td>
<td>Prototheca species by morphology</td>
<td></td>
<td>Trauma to elbow</td>
<td>Excision</td>
</tr>
<tr>
<td>7</td>
<td>62 M</td>
<td>Olecranon bursa</td>
<td>Prototheca species by morphology</td>
<td></td>
<td>Nonpenetrating elbow</td>
<td>Excision</td>
</tr>
<tr>
<td>8</td>
<td>58 M</td>
<td>Olecranon bursa</td>
<td>P. wickerhamii</td>
<td></td>
<td>Bursal steroid trauma; cleaning fish tank</td>
<td>Excision</td>
</tr>
<tr>
<td>8, 9</td>
<td>36 F</td>
<td>Olecranon bursa</td>
<td>Prototheca species by morphology</td>
<td></td>
<td>Bird bath</td>
<td>Excision</td>
</tr>
<tr>
<td>8, 9</td>
<td>60 M</td>
<td>Olecranon bursa</td>
<td>Prototheca species by morphology</td>
<td></td>
<td>Penetrating trauma;cleaning fish tank</td>
<td>Excision</td>
</tr>
<tr>
<td>10</td>
<td>42 M</td>
<td>Olecranon bursa</td>
<td>P. wickerhamii</td>
<td></td>
<td>Automobile accident cleaned fish tank</td>
<td>Excision</td>
</tr>
<tr>
<td>10</td>
<td>65 M</td>
<td>Olecranon bursa</td>
<td>P. wickerhamii</td>
<td></td>
<td>Alcohol abuse; cleaning fish tank</td>
<td>Excision</td>
</tr>
<tr>
<td>11</td>
<td>39 M</td>
<td>Olecranon bursa</td>
<td>P. wickerhamii</td>
<td></td>
<td>Felty’s syndrome, cleaning fish tank</td>
<td>Excision</td>
</tr>
<tr>
<td>12</td>
<td>72 M</td>
<td>Olecranon bursa</td>
<td>Prototheca species by morphology</td>
<td></td>
<td>Gardening on hands and knees</td>
<td>Intrabursal amphotericin</td>
</tr>
<tr>
<td>16</td>
<td>68 M</td>
<td>Olecranon bursa</td>
<td>P. zopfii</td>
<td></td>
<td>Bursal steroid injection</td>
<td>Excision</td>
</tr>
<tr>
<td>17</td>
<td>45 M</td>
<td>Olecranon bursa</td>
<td>Alcohol abuse; cleaning fish tank</td>
<td></td>
<td>Doxycycline; intrabursal amphotericin</td>
<td>Excision</td>
</tr>
<tr>
<td>18</td>
<td>51 M</td>
<td>Olecranon bursa</td>
<td>P. wickerhamii</td>
<td></td>
<td>Automobile accident</td>
<td>Excision</td>
</tr>
<tr>
<td>19</td>
<td>62 F</td>
<td>Tenosynovium of hand (surgical site)</td>
<td>P. wickerhamii</td>
<td></td>
<td>Post-surgical infection</td>
<td>Synovectomies and IV amphotericin</td>
</tr>
<tr>
<td>10</td>
<td>18 F</td>
<td>Ganglion excision site</td>
<td>P. wickerhamii</td>
<td></td>
<td>Steroid injection; cleaning fish tank</td>
<td>Excision</td>
</tr>
<tr>
<td>7</td>
<td>43 M</td>
<td>Wrist ganglion excision site</td>
<td>Prototheca species by morphology</td>
<td></td>
<td>Surgical wound infection; cleaning fish tank</td>
<td>Oral ketoconazole</td>
</tr>
<tr>
<td>20</td>
<td>46 F</td>
<td>Wrist tendons</td>
<td>P. wickerhamii</td>
<td></td>
<td>Alcoholic liver disease; cleaning fish tank</td>
<td>Excision, and tetracycline</td>
</tr>
<tr>
<td>21</td>
<td>24 F</td>
<td>Extensor tendon of hand</td>
<td>Prototheca species by morphology</td>
<td></td>
<td>Hand trauma from broken glass</td>
<td>IV amphotericin</td>
</tr>
</tbody>
</table>

This report

49 M
Ankle joint and tenosynovium
P. wickerhamii
AIDS
Cleaning aquarium
IV amphotericin
neous infections. Disseminated infections require systemic antifungal therapy with intravenous amphotericin B. There is a synergistic effect between intravenous amphotericin B and oral tetracycline, and some authors have recommended the routine use of this combination in disseminated infections.

As illustrated by our patient, the clinical spectrum of protothecal infection is broader than previously reported. This algal infection must be considered as a potential cause of subcutaneous nodules, acute tenosynovitis, and acute arthritis in immunocompromised patients.

REFERENCES