**Balantidium coli**: an unrecognized cause of vertebral osteomyelitis and myelopathy

**Case report**

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*Balantidium coli* is a ciliated protozoan parasite that primarily infects primates and pigs. It is the largest protozoan to infect humans and is a well-known cause of diarrhea and dysentery. Extrainestinal disease is uncommon, and extraintestinal spread to the peritoneal cavity, appendix, genitourinary tract, and lung has rarely been reported. The authors describe a case of vertebral osteomyelitis with secondary cervical cord compression caused by *B. coli*. The patient was a 60-year-old immunocompetent man presenting with quadriplegia of short duration. Magnetic resonance imaging of the cervical spine showed extradural and prevertebral abscess at the C3–4 level. Drainage of the abscess, C3–4 discectomy, and iliac bone grafting were performed. Histologically *B. coli* was confirmed in an abscess sample.

To the best of the authors’ knowledge, involvement of bone by *B. coli* has never been reported, and this case is the first documented instance of cervical cord compression due to *B. coli* osteomyelitis of the spine in the literature.

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**Key words**

- *Balantidium coli* • extraintestinal disease • infection • vertebral osteomyelitis • abscess

**Balantidium** is the only ciliated protozoan known to infect humans and is the largest protozoan infecting humans and nonhuman primates.12 *Balantidium* species are primarily intestinal parasites of pigs. Porcine fecal contamination of water or food consumed by humans is a principal means of acquiring an infection.9,17 Morphologically similar organisms have been detected in a variety of mammals, including rats, chimpanzees, orangutans, and occasionally dogs or cats. In Indian subcontinents, cows and buffaloes are also frequently affected.11 *Balantidium* organisms are often nonpathogenic in humans, but patients with other infections or concomitant debilitating diseases are more likely to have a symptomatic infection.2,18 Tropical temperatures and high humidity favor survival of excreted *Balantidium* cysts in pig or human feces. *Balantidium* organisms’ habitats in humans are the cecum and colon. Humans may remain asymptomatic, as the pig does, or they may experience dysentery similar to that caused by *Entamoeba histolytica* given the potential to penetrate the mucosa, resulting in the ulceration of intestinal epithelium. *Balantidium coli* can become an opportunistic parasite in immunosuppressed hosts living in urban environments, where pigs do not interact in the life cycle of the parasite.12 Extraintestinal spread is usually very rare, and its spread to the perito-

**History and Examination.** This 60-year-old man presented with complaints of high-grade fever, bilateral weakness of the lower limbs, and incontinence of the bowel and bladder for 15 days. He was apparently asymptomatic 15 days earlier. There was no history of diarrhea, dysentery, or abdominal pain. On examination, he was conscious and well oriented, his cranial nerves were intact, and his fundus examination was within normal limits. Neurological examination revealed 4/5 power in all limbs. Deep tendon reflexes were 3+. Abdominal reflex was absent. Bilateral plantar reflexes were extensor. He had no cerebellar or meningeal signs. Examination of other systems was normal. He was found to have anemia (hemoglobin 7.5 g/dl). Total leukocyte count was slightly elevated (12,700/mm³), while the differential count showed 89% neutrophils. Radiographic studies of the cervical spine showed increased preverte-
Balantidium coli vertebral osteomyelitis

bral soft tissue at the C3–5 levels with narrowing of the laryngeal lumen. There was straightening of the cervical spine. No other significant abnormalities were seen except marginal osteophytes in vertebral bodies. Magnetic resonance imaging of the cervical spine showed extradural and prevertebral abscess at the C3–4 levels (Fig. 1). Pus culture as well as smear was negative for bacteria, including acid-fast bacilli, and fungus. Pott disease of the spine with cervical myelopathy was diagnosed clinically and radiologically, for which surgery was advised and antitubercular therapy was started empirically. There was no history of diabetes, hypertension, bronchial asthma, or tuberculosis. The whole spine was imaged and screened but did not show any other focus of marrow edema or soft-tissue destruction.

Operation. A C3–4 discectomy and iliac bone grafting were performed. Intraoperatively, a thick-walled prevertebral abscess was seen with surrounding dense adhesions. Thick creamy pus was present in the abscess cavity, which was drained out and sent for histopathological and microbiological evaluation.

Histopathological Examination. Histological examination revealed largely acellular necrotic debris. Foci of dystrophic calcification, degenerated cartilage, and bony fragments were admixed. A few scattered trophozoites of B. coli were identified. These are large, round to oval organisms measuring approximately 50–70 μm in diameter, and their surface is covered with numerous cilia. Each of these organisms contained a large bean-shaped macronucleus, and in a few of them a small spherical micronucleus was visible. Contractile vacuoles were identified (Figs. 2 and 3). No inflammatory reaction was seen. No granulomatous or neoplastic pathology was noted. Staining for acid-fast bacilli and fungus was negative. The diagnosis of balantidiasis was rendered. Stool examination did not yield any parasitic cysts or trophozoites. The patient was treated with metronidazole and antibiotic therapy including tetracyclines.

Postoperative Course. On follow-up, the patient was doing well with complete remission of neurological deficits after 6 months of treatment.

Discussion

Balantidium coli infection is uncommon in humans despite its potential for worldwide distribution. The organism, although pathogenic, has low virulence. Its worldwide prevalence is estimated at 0.02%–1%4,12 but varies widely by geographic location. Areas of high prevalence include regions of Latin America, the Philippines, Papua New Guinea, and areas of the Middle East.14

The asexual life cycle consists of cysts or trophozoites. Transmission is direct with no intermediate host involvement. Usually, humans ingest infective cysts in contaminated food or water that develop into trophozoites and migrate to the large intestine, which is the most affected organ. The organism produces no known toxins but can penetrate the mucosa and cause ulcers, probably due to the production of hyaluronidase. It has been noted

![Fig. 1. Sagittal T2-weighted MR images demonstrating abnormal prevertebral soft tissue at the C3–5 levels with airway narrowing. Note the prevertebral abscess, epidural abscess, and cord compression, respectively.](image)
that the invasion of colonic epithelium by Balantidium organisms might be secondary to damage caused by intestinal bacteria.\textsuperscript{10}

Human infection is usually associated with intestinal symptoms, such as diarrhea and dysentery, but ranges from an asymptomatic carrier state through a chronic symptomatic infection presenting with nonbloody diarrhea to a dysentery-like picture. Balantidium coli can thrive in the colon in balance with its host without causing dysenteric symptoms, but malnutrition, alcoholism, or a compromised immune system can tip the balance in favor of the ciliate, leading to disease.\textsuperscript{2,18} Our patient belonged to a family of farmers and was a known alcoholic with compromised nutritional status. He lived close to the cows and buffaloes he owned. A provisional diagnosis of Pott disease of the spine was made for a few reasons. Firstly, the radiological picture of marrow edema accompanied by a necrotic soft-tissue component on MRI was indistinguishable from tubercular osteomyelitis. Secondly, it has been observed that Ziehl-Neelsen staining is positive for acid-fast bacillus in only about 40% of cases. Lastly, tubercular osteomyelitis is rampant in India and is known to occur in an immunocompetent as well as immunocompromised population.

Tuberculomas on imaging produce varied enhancement patterns with shortening on T2-weighted MRI and a hyperintense rim. Pyogenic abscesses show a hypointense central core on T1-weighted MRI and a hyperintense core on T2-weighted MRI.

Imaging features of fungal infections are nonspecific, and thus several infections were biopsied for a definitive diagnosis.

Although the intestine is the most common site of balantidiasis, there are extraintestinal sites of infection such as the appendix, lung, genitourinary tract, and rarely the liver.\textsuperscript{1,3,6,13,15} Genitourinary sites of infection, including urethral infection, vaginitis, and cystitis, are thought to occur via direct spread from the anal area or secondary to rectovaginal fistulas created from infection with B. coli.\textsuperscript{13} Lung infections with Balantidium organisms are infrequent but noteworthy.\textsuperscript{1,13,15} Most of these infections have occurred in the elderly or otherwise immunocompromised persons. Nutritional status, intestinal bacterial flora, parasite load, achlorhydria, alcoholism, or any chronic disease can affect the severity of the balantidiasis.\textsuperscript{4} Among the possible pathways by which Balantidium organisms of the colon could colonize the extraintestinal sites are the circulatory or lymphatic systems, perforation of the colon and spread through the peritoneal cavity, or invasion and colonization of the nasopharynx with spread to the lungs, resulting from aspiration of fluid from the oral cavity.\textsuperscript{1,3,6,13,15} There was no indication of Balantidium ciliates or cysts in the stool samples of most reported cases of extraintestinal involvement\textsuperscript{1,3,6,13,15} similar to the present case. In our case, we postulated that the parasite gained access to the portal venous system and, subsequently, the epidural venous plexus. From the venous blood, the parasite migrated into the epidural space, causing destruction of the spine.

The marrow edema involving the contiguous vertebrae was diffuse in nature, suggesting that the infection started in vertebral bodies before spreading into the adjoining soft tissues, including the prevertebral space.

Histomorphology of the trophozoites confirmed B. coli in our case and ruled out other parasites, which vary in size and morphology. Definitive diagnosis in balantidiasis is made on demonstration of the trophozoites, organ changes suggestive of infection, imaging evidence, and response to treatment. Tetracyclines and metronidazole are treatments of choice for human balantidiasis. Our patient responded well after a course of these antibiotics. Parasitic myelopathy is rare. Other parasitic infestations reported in the spine include cysticercosis,\textsuperscript{7} hydatid disease,\textsuperscript{8} fascioliasis,\textsuperscript{16} and schistosomiasis.\textsuperscript{5}

Cysticercosis involved the intramedullary region of the spinal cord, whereas hydatidosis was extradural in location. Fascioliasis affected the T4–7 vertebrae with epidural cord compression, and schistosomiasis was present in the lower spinal cord with enlargement of the medullary cone and roots of the cauda equina.
Balantidium coli vertebral osteomyelitis

Radiologically, hydatid cysts are usually large, well-defined, isointense to CSF, hypointense on T1-weighted MRI, and hyperintense on T2-weighted MRI and do not demonstrate contrast enhancement. In general, contrast enhancement may be seen due to cyst leakage, edema, and inflammation and is seen in cysticercosis, reflecting the inflammation. Fascioliasis displays isointensity on T1-weighted images and becomes hyperintense on T2-weighted images. In toxoplasmosis, imaging usually shows multiple ring-enhancing lesions with edema and mass effect. An eccentric target sign on postcontrast T1-weighted imaging is considered pathognomonic but is seen in a limited number of cases.

Conclusions

This is a rare report of necrotizing prevertebral infection caused by the ciliated protozoan Balantidium coli, involving bone in an alcoholic patient. Although it is not commonly encountered in clinical practice, parasitic infection involving the spine remains a significant global health concern.

Disclosure

The authors report no conflict of interest concerning the materials or methods used in this study or the findings specified in this paper.

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