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## CASE REPORT

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# Necrotizing lung infection caused by the protozoan *Balantidium coli*

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*Balantidium coli*, a ciliated protozoan, is well known to cause intestinal infection in humans. Extraintestinal spread to the peritoneal cavity and genitourinary tract has rarely been reported. There have also been a few cases of lung involvement from this parasite. A case of *B coli* causing a thick-walled right upper lobe cavity in an organic farmer who had contact with aerosolized pig manure is reported. Bronchoalveolar lavage fluid examined for ova and parasite revealed trophozoites of *B coli* in large numbers. Treatment with doxycycline hyclate led to marked improvement. Necrotizing lung infection caused by the protozoan *B coli* should be considered in individuals who report contact with pigs.

**Key Words:** *Balantidium coli*; *Necrotizing lung infection*

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## Une infection pulmonaire nécrosante causée par le protozoaire *Balantidium coli*

Il est bien connu que le *Balantidium coli*, un protozoaire cilié, provoque une infection intestinale chez l'humain. Une propagation extra-intestinale dans la cavité péritonéale et le système urogénital a rarement été documentée. Il existe aussi quelques cas d'atteinte pulmonaire par ce parasite. Est présenté le compte rendu d'un cas de *B coli* responsable d'un épaississement du lobe supérieur du poumon droit chez un agriculteur biologique en contact avec du fumier de cochon en aérosol. L'examen parasitologique du liquide du lavage bronchoalvéolaire a révélé la présence d'un grand nombre de trophozoïtes de *B coli*. Un traitement à la doxycycline a également favorisé une importante amélioration de l'état du patient. Une infection pulmonaire nécrosante causée par le protozoaire *B coli* devrait être envisagée chez les personnes qui font état d'un contact avec des porcs.

### CASE SUMMARY

A 42-year-old white man, a lifelong nonsmoker, presented with two episodes of hemoptysis. These occurrences were two weeks apart. On each occasion he coughed up 50 to 200 mL of bright red blood. The patient had no associated symptoms of cough, sputum production, fever, chills, night sweats, chest pain or weight loss. A right upper lobe cavitory lesion was seen on chest radiograph. The patient had a history of insulin-dependent diabetes mellitus and previous diarrheal illnesses from intestinal protozoa. Several years ago *Blastocystis hominis*, *Dientamoeba fragilis* and *Entamoeba coli* were isolated from his stool. Treatment with metronidazole resulted in the resolution of his diarrhea. He worked as an organic farmer, where he used pig manure to fertilize his vegetables. Approximately six months before the onset of his symptoms, the patient had travelled to the South American countries of Paraguay and Argentina. He did not fall ill during his travel. A Computerized Tomography (CT) scan of his thorax confirmed a 2 cm cavitory right upper lobe lesion with thick walls and fibrotic strands extending from the wall measuring 3 to 4 mm (Figure 1). Sputum Gram stain, acid-fast bacilli stain and culture were negative, except for one culture, which was positive for *Mycobacterium avium-intracellulare*. A needle biopsy of the cavitory lesion did not reveal the presence of malignant cells;

the aerobic, anaerobic and mycobacterial cultures were negative. Bronchoscopy and bronchoalveolar lavage (BAL) performed twice at two-week intervals showed no growth on bacterial, mycobacterial and fungal cultures. On repeat bronchoscopy, blood-tinged bronchoalveolar lavage fluid was obtained, no organisms were cultured, and the acid-fast bacilli culture was negative. To rule out *Paragonimus* species because of his travel history, the BAL specimen was also examined for ova and parasites. Direct examination revealed several large ciliated protozoa, which were identified as *Balantidium coli* trophozoites on wet preparation and iron-hematoxylin stain. The trophozoites measured approximately 70 by 50 µm, had a pointed anterior and a rounded posterior end and contained two nuclei. The BAL fluid cytology contained macrophages and other cells including lymphocytes and eosinophils, which were in the normal range. The HIV serology, antineutrophilic cytoplasmic antibody and antinuclear antibody tests were negative. Multiple (five) stool examinations for ova and parasites were reported to be negative during this illness. The patient was treated with a three-week course of doxycycline hyclate 100 mg/daily. His hemoptysis resolved rapidly and follow-up CT scans of the thorax performed at three-month intervals showed gradual resolution of the right upper lobe cavity one year later (Figure 2).

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**Figure 1** A Computerized Tomography (CT) scan of the thorax confirmed a 2 cm cavitary right upper lobe lesion with thick walls and fibrotic strands extending from the wall measuring 3 to 4 mm

### DISCUSSION

Protozoal infections are the most prevalent intestinal infections worldwide; they rarely involve the lungs and pleura. Pulmonary infections with free-living amoebas, *Toxoplasma* species, *Babesia* species, *Cryptosporidium* species, *Leishmania* species, and *Microsporidia* species have been well documented. Recently a case of pneumonitis where *Giardia lamblia* was isolated from BAL fluid was published (1). There have been very rare published reports of *B coli* involving lungs in humans. *B coli*, originally described by Malmsten (2) in 1857, is a large ciliated protozoan that has a trophozoite and a cyst stage. The trophozoites are ovoid in shape, are of greenish-yellow colour, and measure 50 to 70  $\mu\text{m}$  in length and 40 to 50  $\mu\text{m}$  in breadth (Figure 3). The organism is covered by longitudinal cilia that propel the body forward in a spiral motion, and contains two nuclei and several contractile vacuoles. The cysts are ovoid or spherical, measure 45 to 65  $\mu\text{m}$  in diameter and appear greenish-yellow in colour.

The natural habitat of *B coli* is the large intestine of pigs, monkeys and humans (3-5). The organism has also been reported in chimpanzees, new world monkeys, domestic and wild hawks and wild rats (3). Human infection usually occurs through contact with pig fecal matter. The cysts are infective; following ingestion excystation releases trophozoites that invade the colonic mucosa, multiply and set up colonies. Within the tissues the *B coli* propagate, produce ulcers and form abscesses that may extend to the muscular layer. Invasion of the colonic tissue induces a cellular response consisting of lymphocytes and eosinophils, and leads to ischemic necrosis of the epithelium. Three clinical presentations from *B coli* infection have been described: asymptomatic carrier; chronic symptomatic form – these patients may have diarrhea alternating with constipation and nonspecific abdominal symptoms; and acute form – these patients frequently have bloody stools, associated epigastric pain, weight loss and dehydration. The fulminant form may lead to exsanguination from intestinal hemorrhage or severe dehydration and shock.

Widespread infection from *B coli* is encountered where human exposure to hogs is common. In New Guinea, the rate of human infection in pig farmers has been reported to be 28%. By contrast, in Egypt, where exposure to pigs is rare, human balantidiasis is rare (6).



**Figure 2** A repeat Computerized Tomography (CT) scan of the thorax several months later shows significant improvement of the cavity, although the fibrotic nodule remains.

Human infection from *B coli*, despite frequent exposure to the parasite, is rather rare in the temperate climates of Canada and the United States. Cross-infection experiments suggest that humans are relatively refractory to infection by this parasite (7). In North America, epidemics of *B coli* infection have been reported from areas where poor environmental sanitation and a low level of personal hygiene exist. A high prevalence and epidemics of infection with this parasite have occurred in mental institutions in Canada and the United States (8, 9). A study of stool samples submitted for parasitic infection tests from a number of mental institutions in Ontario revealed a prevalence rate of 1.3% for *B coli* (9). Similar studies from Italian mental institutions, however, reported a much more rare prevalence of this parasite (10). No recent Canadian data on the prevalence of *B coli* in the general population or in people involved in the pig industry is available. This may well be significant in view of the growth in the pig farming and hog industry in Canada.

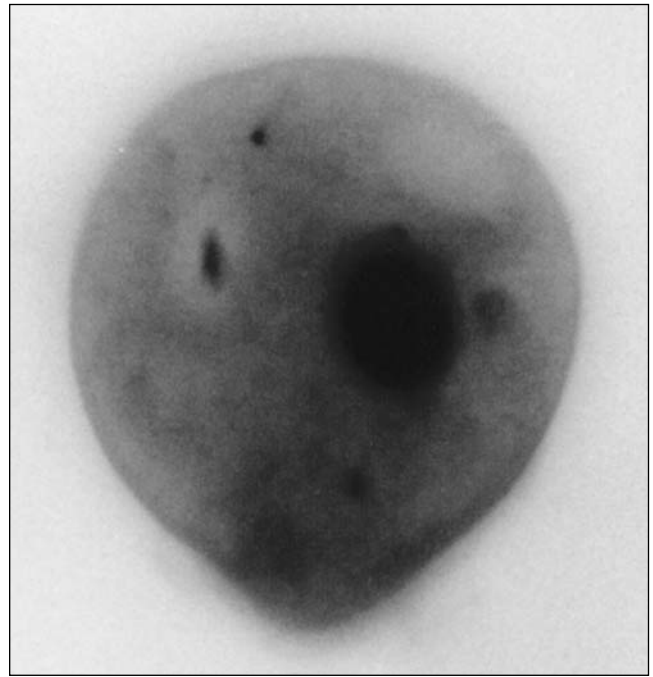
Rare cases of extraintestinal balantidial infections have been published in the literature. Two cases of peritonitis were reported from Colombia following the rupture of fulminating colon ulcers (11, 12). A case of urethritis and cystitis in a female patient and a few cases of inflammatory vaginitis have also been reported (13, 14). These extraintestinal infections most likely occurred secondary to colonic balantidiasis. While the cervicovaginitis may follow rectovaginal fistula, the common mode of spread may be genital contamination from the anus due to poor personal hygiene (15). Multiple case reports of hepatic abscess caused by *B coli* also exist in the literature. Several of these cases were associated with appendicitis or intestinal perforation and treatment with antibiotics along with surgical drainage was curative (16).

Rare cases of lung involvement from *B coli* have also been reported. A case report from Venezuela described a 16-year-old pig farmer who died from perforation of the appendix and peritonitis (17). Histological examination of the patient's lungs revealed trophozoites of *B coli* around blood vessels and inflammatory cell infiltration. Another case of pulmonary involvement was reported in a 70-year-old farmer who lived on an Aegean island (18). He had several years' history of diarrhea, and chronic colitis. A chest radiograph showed a 3 cm mass adjacent to the left hilum, which was confirmed on a chest CT scan. The aspirate on a transthoracic needle aspiration

demonstrated trophozoites of *B coli* and *Aspergillus* species. The inflammatory mass in the lung was thought to be likely from *B coli* rather than *Aspergillus* species. Treatment with doxycycline hyclate led to a marked improvement in diarrhea, however, the chest radiograph was unchanged at one-year follow-up. A Case Report in the French literature published in 1986 described a 24-year-old man who presented with respiratory distress, weight loss, fever and bloody diarrhea (19). He had a one-week history of worsening dyspnea, anorexia and weight loss. A chest radiograph showed nodular infiltrate in the right lung and cavitations in both right and left apices. A percutaneous transtracheal aspiration and fiberoptic bronchoscopy isolated *Mycobacterium tuberculosis* and *B coli*. The patient was treated with antituberculous drugs and metronidazole was prescribed for the *B coli*. With treatment, the patient became asymptomatic, although no follow-up information about the chest radiograph was provided. This is the only other case in the literature where *B coli* was associated with lung cavitations. However, the most likely cause of the bilateral upper lobe cavitations appears to be *M tuberculosis* rather than *B coli* because the protozoan may have colonized the pre-existing tuberculous cavities in this patient. Cespedes et al (20), Coleman and Root (21) and Mackie (22) have also described pleural and lung involvement in various case reports. In all of these cases, lung or pleural involvement was identified at autopsy. The *B coli* infection most likely occurred secondary to the intestinal perforation in these cases – the organism likely travelled across the diaphragm into the pleural space causing pleuritis and lung infection.

Infection from *B coli* can be treated successfully with tetracycline hydrochloride, metronidazole, or iodoquinol. Two previous case reports have described the use of doxycycline hyclate (18, 23). One case had recurrence of infection one-year later, which was treated with a repeat course of doxycycline hyclate and led to the cure (18). In another case reported from French Guyana, *B coli* dysentery occurred in a patient infected with HIV, the treatment with doxycycline hyclate for 20 days resulted in a clinical and parasitological cure (23).

This is a rare report of necrotizing lung infection caused by the ciliated protozoan, *B coli*. Our patient had a long history of close contact with pigs and pig manure. While fertilizing vegetables the patient likely aerosolized pig excrement containing *B coli* cysts. The tissue invasion and destruction led to a thick-walled cavitory lesion in the right upper lobe. The organism is known to prefer an alkaline or neutral habitat and avoids acidic environments. Therefore, the respiratory tract would have offered a favourable environment for the organism's survival. The patient's diabetes may have played a role in the acquisition of the infection because it has been suggested that debility, intercurrent disease or malnutrition is necessary for tissue invasion by this organism (7). It is also plausible that the parasite travelled in retrograde fashion in to the stomach from the lower intestines, and was refluxed and aspirated in to the lungs. This hypothesis is less likely because the patient is not known to suffer from achlorhydria. Interestingly, neither *B coli* nor any other parasite was found in the patient's stools despite repeated examinations, thus further excluding this hypothesis. Although one sputum culture revealed *M avium-intracellulare*, this was most likely colonization or contamination rather than infection because the organism was not isolated from subsequent cultures, and the cavitory lesion improved without specific antimycobacterial therapy. Many species of free living



**Figure 3)** A photograph of *Balantidium coli*. (Original magnification x 400)

protozoans were isolated from pharyngeal swabs of healthy patients in Mexico (24). Among the various protozoans found, *B coli* was also cultured; these individuals were asymptomatic carriers of these protozoans in their upper airways. Therefore, it is possible that this patient had colonized his upper airway with the parasite, which then was aspirated into the lung and resulted in invasive disease. Our patient was treated with an extended course of doxycycline hyclate, which resulted in the resolution of hemoptysis and radiological findings. On repeat CT scan, marked improvement in the right upper lobe cavity was evident, although some scarring persists (Figure 2).

Recently, concerns have been raised that increasing the pig population in Canada may pose a public health risk, particularly from the spread of manure on the fields. In Canada, human infection from pig parasites is rare, even among pig producers and their families. However, watershed contamination and subsequent drinking of untreated surface water, unsafe handling of pig manure, poor personal hygiene and impaired immune system may lead to the acquisition of infection from various parasites common in healthy pigs. These include pig round worm (*Ascaris suum*), *Giardia* species, *Cryptosporidium* species and *B coli*. *B coli* has not been reported to be a public health concern in industrialized countries. When applied to the fields the pig manure is exposed to temperature, sunlight and dryness; this is sufficient to kill most parasites and bacteria. Unless contamination of surface or ground water occurs, a public health risk does not exist. Furthermore, the housing of pigs indoors and the use of manure containment systems have further reduced the risks of watershed contamination.

*B coli*, a ciliated protozoan is a well known cause of intestinal infection and dysentery in humans. Extraintestinal infections have rarely been reported. We report a case of necrotizing lung infection in a farmer who had contact with pig manure. Parasitic infections may be worth considering in patients with cavitory lung involvement who have contact with the pig industry.

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