A 6-year-old 27.8-kg castrated male Belgian Malinois dog was admitted to the Auburn University Veterinary Teaching Hospital with a 2-month history of lethargy, tenesmus, hematochezia, and weight loss. At the initial onset of clinical signs, the patient was treated several times with antibiotics: metronidazole (50 mg/kg, PO, q 24 hr for 7 days), trimethoprim-sulfamethoxazole (15 mg/kg, PO, q 12 hr for 7 days), and fenbendazole (50 mg/kg, PO, q 24 hr for 3 days), with partial improvement. The diarrhea never fully resolved and the animal developed coprophagy accompanied by a 9-kg weight loss, lethargy, and decreased appetite. The patient had an initial diet of lamb and rice formula and then changed to puppy diet. The intermittent chronic diarrhea, despite other rounds of similar therapy, and eventual worsening of clinical signs, warranted referral for further workup.

Clinical and Gross Findings

On clinical evaluation, the patient was quiet, alert, and responsive but with a pendulous abdomen, and severely inflamed rectal mucosa. Complete blood count abnormalities included mild regenerative anemia (HCT 30.4%; reference interval [RI], 37.3% to 61.7%; reticulocytes, 145.1 X 10^9/L; RI, 10 to 110 X 10^9/L), moderate leukocytosis (24.29 X 10^9/L; RI, 5.05 to 16.76 X 10^9/L) due to neutrophilia (18.83 X 10^9/L; RI, 2.85 to 11.64 X 10^9/L), and monocytosis (2.70 X 10^9/L; RI, 0.16 to 1.12 X 10^9/L). Serum biochemistry was unremarkable. Abdominal radiographs showed severe colonic dilatation with luminal fluid and dependent material, as well as diffusely gas-distended small intestinal tract. Abdominal ultrasound revealed a severely thickened and heterogeneously hypoechoic distal descending colonic wall (2.0 cm thickness) with complete loss of normal layering, colonic lymphadenopathy (3.20 cm diameter) and mild ascites. Due to poor prognosis and financial constraints, euthanasia was elected by the owners. The patient was premedicated with butorphanol (0.3 mg/kg, IV) and dexmedetomidine (3 mcg/kg, IV), induced with propofol (4 mg/kg, IV). Euthanasia was performed using Euthasol (Virbac; 390 mg pentobarbital sodium, 50 mg phenytoin sodium/mL, 1mL/10lb IV).

Postmortem examination revealed poor nutritional condition, severe dilatation of the descending colon (approximately 3x normal; Figure 1), and multiple white to gray 0.5 cm to 4 cm diameter nodules on the colonic serosal surface, tracking along the lymphatic vessels and draining to the moderately enlarged and irregular colonic lymph nodes (Figure 1). The dilated large intestine had abundant dark green, pasty, fetid feces with some plant material covering coalescent ulcers. In the internal anal sphincter, there was a 3 cm thick, pale red, circumferential fleshy mass, protruding into and partially occluding the rectal lumen.

Formulate differential diagnoses, then continue reading.

Cytological, Histopathologic, and Laboratory Findings

Direct impression smears of the affected rectal wall performed at the time of necropsy yielded a highly cellular sample with abundant amorphous and granular necrotic debris, degenerate...
neutrophils, poorly preserved macrophages, and fewer eosinophils associated with many poorly stained pauciseptate tortuous hyphae morphologically similar to oomycetes (Figure 2).

Histopathological examination of the colon and rectum revealed a severe transmural ill-defined multinodular infiltrate of large numbers of eosinophils, macrophages, multinucleated Langhans-type giant cells with up to 14 nuclei, and admixed necrotic debris markedly disrupted the colorectal layers (Figure 2). Myriad negatively staining on H&E and poorly discernible, thick, 4 to 10-µm-diameter hyphae with nonparallel, pauciseptate wall, and occasional nondichotomous right-angle branching were scattered throughout the inflammatory infiltrate and highlighted with Gomori methenamine silver stain (Figure 2). Serosal lymphatics and draining lymph nodes were similarly affected. Intraleisonal hyphae had strong reactivity for anti-Pythium antibody (rabbit polyclonal antibody).
Pythiosis is a disease caused by *Pythium insidiosum*, a water- or soil-dwelling oomycete organism. Many *Pythium* species have a great economic impact as a plant pathogen, but only *P. insidiosum* has been recognized as causing disease in animals and human beings.\(^1\)

*Pythium insidiosum* infection can be a serious and life-threatening disease in humans and veterinary patients, largely prevalent in swampy areas of tropical, subtropical, and temperate regions.\(^2\) In the US, it is most prevalent in Gulf Coast regions, but cases in other northern and western states have been identified,\(^3\) and environmental and landscape changes such as flooding and irrigations can contribute to the expansion of its epidemiology. Horses and dogs are the predominantly reported domestic animals, but sporadic infections can afflict cattle, cats, sheep, birds, and other animals held in captivity.\(^4\)

*Pythium insidiosum* infection in dogs consists of chronic granulomatous and eosinophilic disease affecting mostly the integument or the alimentary tract. Infection most often affects immunocompetent, young (3 years old or less), large breed dogs with a history of recurrent exposure to wetlands.\(^5\)\(^6\)\(^7\)\(^8\)\(^9\)\(^10\)\(^11\)\(^12\) Vomiting, diarrhea, weight loss, and palpable masses are the most typical, yet nonspecific, signs of the gastrointestinal form.\(^1\)\(^2\) Laboratory alterations supportive of systemic pythiosis may include eosinophilia, anemia, hyperglobulinemia, and hypoalbuminemia.\(^1\) The gastric outflow and ileocolic junction are frequent sites for the infection.\(^1\)\(^3\) Other parts of the stomach, small intestine, and, rarely, esophagus and oropharynx can be affected and are usually extensive at the time of clinical signs onset.\(^1\)\(^3\) When lesions occur near the rectum, as seen in this case, partial obstruction, constipation, hematochezia, and fistulae may be present. Lymphatic compromise or vascular invasion are common and infarction of the mucosa, although rarely reported, can be an additional complication.\(^3\)

Differential findings supported by gross findings include infection caused by other fungi including basidiobolomycosis and gastrointestinal neoplasia.\(^4\)\(^5\) Basidiobolus ranarum is a fungus of the phylum Zoopagomycota.\(^5\) Some histologic features such as larger hyphal diameter, robust radiating sleeves of eosinophilic material (Splendore-Hoepli phenomenon), and strong reactivity to Periodic acid-Schiff may help narrow down Entomophthorales fungi, instead of oomycetes.\(^1\)\(^2\) Primary intestinal neoplasms like adenocarcinoma, lymphoma, and leiomyosarcoma mimic pythiosis causing transmural obliteration of the distal colon and rectum with partial obstruction combined with the clinical signs, like in this case.\(^4\) Although not a consistent feature, annular thickening, and obstruction are characteristic of colorectal carcinomas\(^6\) and, despite the absence of a typical localized stricture in this case, it remained a reasonable clinical and macroscopic differential diagnosis.

Therapy for canine pythiosis is often arduous and can consist of surgery, immunotherapy, and antimicrobial drugs.\(^4\) The overall poor prognosis is multifactorial, but it largely relies on location and extent of the lesion, suboptimal host immune response, and ineffective treatment with most antifungal drugs given the lack of ergosterol in the oomycete cytoplasmic membrane.\(^1\)\(^2\) Complete surgical excision of the affected bowel is the favored approach,\(^6\) however, sporadic reports of successful treatment with immunotherapy and/or long-term combinations of antifungals exist.\(^2\) On such occasions, assessment of pre- and post-therapy anti-*P. insidiosum* antibodies levels, as well as regular ultrasonographic monitoring can be helpful tools to assess responsiveness or disease progression.\(^1\)

Sonographic findings in canine gastrointestinal pythiosis generally overlap with those noted in other inflammatory or neoplastic diseases, namely circumferential or focal mural thickening, obliteration of layers, and lymphadenopathy.\(^2\) In such instances, exploratory surgery with biopsy and/or organism isolation in cases where pythiosis is endemic are pivotal for a definitive diagnosis.

In a recently published case,\(^5\) a strong false-positive result for anti-*P. insidiosum* antibodies was observed, shaming a light on potential pitfalls with this diagnostic tool. Thus, eventual organism identification by culture and/or molecular assays are warranted and always encouraged.

Lagenidium sp is another oomycete organism that can share similar morphology, epidemiology, and pathogenesis in canine patients,\(^1\) chiefly inciting progressive cutaneous and visceral inflammation. However, lagenidiosis evokes more widespread disease in great vessels, lung, cranial mediastinum, abdominal lymph nodes when compared to *P. insidiosum*. Most importantly, gastrointestinal lagenidiosis has not yet been reported in veterinary medicine and, therefore, remains an unlikely differential for enteric masses in canine patients.\(^4\)

In conclusion, this patient’s presentation prompted the clinical suspicion for chronic inflammatory bowel disease and colorectal neoplasia as differential diagnoses. Postmortem impression smears were crucial for speedy cytologic identification of the etiologic agent causing the partial colorectal obstruction,
which motivated immediate submission to culture with organism identification during necropsy. Histopathology can help with the provisional diagnosis of visceral pythiosis, but it does not allow differentiation from other oomycetes and Zoopagomycota fungi. Serologic assays and immunohistochemistry might not be as specific as previously thought,\(^1,5\) so pathogen confirmation should be achieved via morphologic characterization of the cultured organism, preferably accompanied by specific PCR amplification of ribosomal RNA gene sequencing in fresh isolates or formalin-fixed paraffin-embedded tissue.

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