



# Diagnostic Exercise

From The Davis-Thompson Foundation\*

Case #: 142 Month: April Year: 2020

Answer Sheet

**Title:** Dog, intestine, parvovirus and Candida infections

**Contributors:** Taiara Müller da Silva\*, DVM, MS, PhD candidate, Marcella Barrella Ambrosio\*, DMV, MS candidate, Mariana Martins Flores\*, DVM, MS, Doctor in Veterinary Pathology, Glauca Denise Kommers\*, DVM, MS, Doctor in Veterinary Pathology. \*Laboratory of Veterinary Pathology, Universidade Federal de Santa Maria (UFSM), Santa Maria, Rio Grande do Sul, Brazil.

**Diagnosis:** Small intestines: Severe acute segmental necrotizing enteritis, with villous blunting and fusion, crypt necrosis and hyperplasia, and lymphoid necrosis of Peyer's patches.

Small intestines: Superficial colonization with yeasts, pseudohyphae and rare (suspected) true hyphae consistent with *Candida albicans*.

**Typical gross findings:** Canine parvovirus infection typically affects the small intestines. The intestinal serosa is often congested with a ground-glass appearance, the mucosal surface is irregular, and the content is frequently hemorrhagic. The injured mucosa is often covered by a thin layer of fibrin; however, some parvoviral enteritis cases (mainly those associated with canine parvovirus 2c infection) are not hemorrhagic. In these cases, the diarrhea may be white to yellowish and the exudate is fibrinous. Peyer's patches may be depressed due to lymphoid necrosis and depletion, which are consistent histological findings. The intestinal contents may be mucoid or watery and are frequently red because of hemorrhage. In cases of intestinal candidiasis, the most common lesion is a pseudomembranous fibrinous exudate adhered to the mucosal surface.

**Typical microscopic findings:** The main microscopic lesions observed with canine parvovirus infection consist of severe intestinal villous fusion and blunting with necrosis and loss of the crypt epithelium, loss of intestinal crypts, and mucosal stromal collapse. The remaining crypts exhibit epithelial hyperplasia representing regeneration. Necrosis of lymphoid tissue of the Peyer's plaques is a common finding. Lymphoid necrosis of the spleen and bone marrow aplasia are also seen in some dogs. In cases of enteric candidiasis, numerous oval to round, 3-6 µm diameter yeasts, many filamentous pseudohyphae with non-parallel walls and, sometimes, true parallel-walled hyphae can be seen along the intestinal luminal surface, occasionally invading the necrotic mucosa. Schiff's periodic acid (PAS) reaction (Figure 6) and Grocott-methenamine

silver (GMS) stain (Figure 7) better demonstrate the agent, which in this case was morphologically compatible with *Candida* sp.. The diagnosis of *Candida albicans* was confirmed with immunohistochemistry (IHC) using an anti-*C. albicans* antibody (Figure 8).

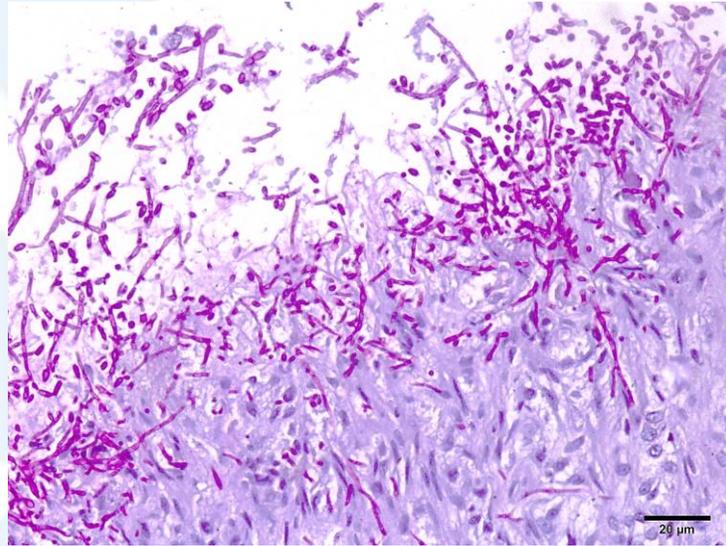


Figure 6. Schiff's periodic acid (PAS) reaction

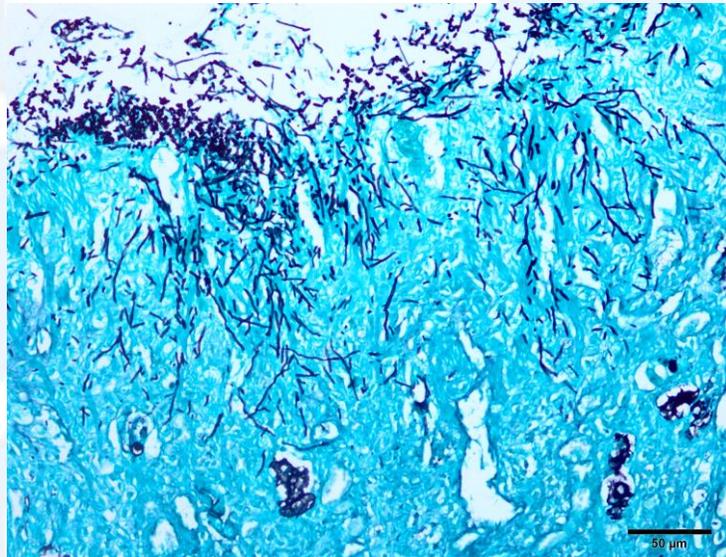


Figure 7. Grocott-methenamine silver (GMS) stain

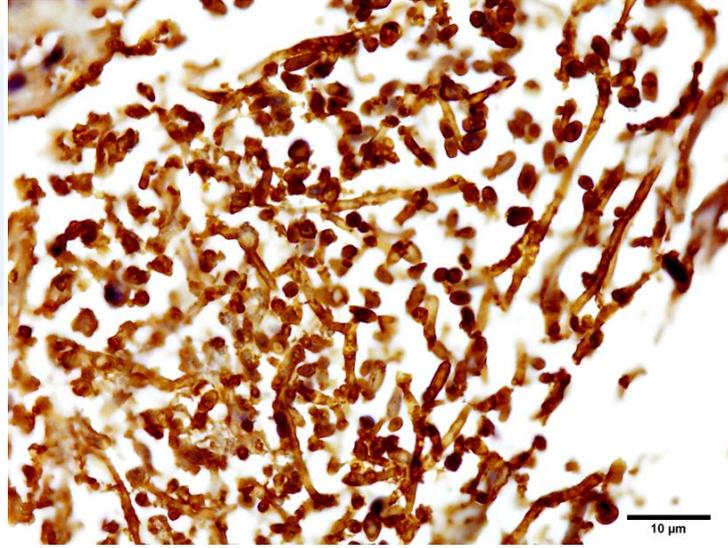


Figure 8. Immunohistochemistry using anti-*C. albicans* antibody

**Discussion:** Parvoviral enteritis is caused by canine parvovirus type 2 (CPV-2) infection. It is a highly contagious disease of young dogs that spreads through the fecal-oral or -oronasal route. The virus replicates in cells that have a high replication rate, such as lymphoid and crypt epithelial cells. Clinically, infected animals present lethargy, anorexia, diarrhea, vomiting, fever, dehydration, and abdominal pain. Dehydration due to severe diarrhea is the main cause of death. Histologically, crypt epithelial cell necrosis and regeneration, villous atrophy and mucosal collapse are highly suggestive of parvovirus infections in dogs, since other enteric pathogens such as *Salmonella* and *Clostridium* do not cause selective crypt necrosis. Nonetheless, virologic confirmation of the infection is recommended since canine distemper virus can rarely cause similar lesions. A sample of the affected intestine of this puppy was submitted to molecular investigation and parvovirus infection was confirmed by PCR. Secondary bacterial infections are much more common than fungal infections. Of fungal infections, *Candida albicans* infection is the most common in animals and humans with a weakened immune system. Thus, in this case, the primary intestinal lesion caused by CPV-2 infection is thought to have predisposed to intestinal *C. albicans* proliferation.

*Candida* spp. are commensal inhabitants of the alimentary tract of animals, mainly of keratinized epithelium. They occasionally become opportunistic pathogens due to alterations in the mucosa itself or in the local flora. In this case, the mucosal disruption (epithelial necrosis) along with a possible imbalance of the local flora (likely exacerbated by the administration of systemic antibiotics) may have contributed to the secondary candidiasis. *C. albicans* and *C. tropicalis* are the most important species in mammals. The morphologic differentiation of these two fungal species is not possible histologically. In this case, the fungal species was confirmed with the use of a specific anti-*C. albicans* antibody. *Candida* spp. can grow in the form of yeasts, pseudohyphae (that are comprised of chains of elongated yeast cells) and true hyphae, thus

being sometimes called a “trimorphic fungus”. Yeasts are 3-6 µm, oval, single-celled organisms. Hyphae and pseudohyphae are filamentous and multicellular organisms, with elongated cells that are attached to each other. One must differentiate pseudohyphae from true hyphae. The former consist of elongated yeasts that do not have completely parallel walls: they are wider at the center and narrower at the ends, with constrictions at the cell junctions similar to septa. The true hyphae, on the other hand, have parallel walls and true septa. Yeasts grow and attach to each other forming a chain, or pseudohyphae, which will eventually originate true hyphae. Differential diagnoses include other fungi that form yeasts, such as *Blastomyces dermatitidis* and *Histoplasma* spp., or hyphae, such as *Aspergillus* spp. and zygomycetes; however, the presence of pseudohyphae and yeasts in the same tissue section is strongly indicative of *Candida* sp..

#### **References and Recommended literature:**

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