BACTERIAL INFECTIONS

Clostridial Enteropathies, Hamster*
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Synonyms. Acute cecitis (typhlitis), acute necrotizing cecitis (typhlitis), hemorrhagic cecitis (typhlitis), enterocolitis, antibiotic-associated cecitis (typhlitis, ileocecalitis, enterocolitis, colitis)

Gross Appearance

The cecum is usually distended with gas and a fetid watery or semiliquid content (Figs. 357, 358). Occasionally, the cecum is not distended and contains only a small amount of fluid. The cecal content may be cream, tan, or red (bloody) in appearance. Infrequently, pseudomembranous plaques are adhered to focal areas of the cecal mucosa. The small intestine and colon may be distended with fluid chyme. Often, the distal ileum and proximal colon are also hyperemic or hemorrhagic. If the animal had clinically apparent diarrhea, the distal (terminal) colon and rectum are usually distended with watery stool, but sometimes they are empty.

Microscopic Features

A spectrum of microscopic lesions occurs, ranging from a mild acute typhlitis to a pseudomembranous typhlitis; however, the latter condition is rare in the hamster (Browne et al. 1977; Rehg and Lu 1982). Mild typhlitis is characterized by hyperemia and a few polymorphonuclear cells in the lamina propria, and the surface epithelial cells may be distorted or shortened and may have projecting blebs (Figs. 359, 360). In other instances, the inflammatory reaction also involves the submucosa, and both the lamina propria and submucosa may be edematous (Fig. 361). Occasionally, pseudomembranous plaques of cellular debris and exudate are adhered to an ulcerated, hemorrhagic mucosal surface (Fig. 362). In addition, the crypts sometimes may be elongated (Fig. 362; Borriello et al. 1987). Recently, hyperplasia of the cecal mucosa has been reported in association with spontaneous C. difficile typhlitis in hamsters (Chang and Rohwer 1991; Ryden et al. 1991). The distal ileum and proximal colon may have microscopic features similar to those in the cecum.

Ultrastructure

As reported by Humphrey et al. (1979), the ultrastructural features of C. difficile typhlitis in hamsters are nonspecific. The microvilli of affected surface epithelial cells are distorted, irregular in length, tufted, or absent. Some surface epithelial cells also contain large intracellular vacuoles, indicative of cellular edema. In edematous cells, the endoplasmic reticulum is swollen and the mitochondria are crenated.

Differential Diagnosis

Salmonella (Innes et al. 1956), enteropathogenic Escherichia coli (Frisk et al. 1981), and Bacillus piliformis (Zook et al. 1977), which is now designated Clostridium piliforme (Duncan et al. 1993), each produce a typhlitis in hamsters that is often similar to the disease caused by C. difficile. In Salmonella and C. piliforme infections, other organs are often affected, but intestinal lesions are the only changes reported to be associated with C. difficile infections. However, interstitial pneumonia and hepatocellular vacuolization have been described in rats administered C. difficile toxin experimentally (Czuprynski et al. 1983). When

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*This review covers Clostridium infections other than Clostridium piliforme, the etiologic agent of Tyzzer's disease.
culture and toxin assays are inconclusive, special stains and electron microscopy aid in differentiating C. difficile typhlitis from that of the other three organisms. C. difficile does not invade intestinal epithelial cells, whereas Salmonella, E. coli, and C. piliforme can be easily observed within the cytoplasm of enterocytes with special stains or electron microscopy.

Cecal mucosal hyperplasia may occur with C. difficile infection (Chang and Rohwer 1991; Ryden et al. 1991) and in the hyperplastic enteropathy “transmissible ileal hyperplasia” that has been attributed to a campylobacter-like organism recently designated Desulfovibrio sp. (Fox et al. 1994). Generally, C. difficile disease can be readily differentiated from Desulfovibrio hyperplastic enteropathy. In contrast to C. difficile disease, Desulfovibrio infection is associated with ileal hyperplasia in addition to cecal hyperplasia and, unlike C. difficile, Desulfovibrio is an intracytoplasmic pathogen generally identifiable in infected epithelial cells with silver stains and electron microscopy.

Although not yet reported, concurrent infection by C. difficile and one of the other four bacterial pathogens listed above is possible. In these cases, a differential diagnosis would be problematic.

The gross and microscopic lesions of intestinal C. difficile infection are similar to those of other Clostridium infections (Borriello et al. 1984; Borriello and Carman 1983; Knoop 1979). Although Clostridium species other than C. difficile and C. piliforme have not been established as causes of typhlitis in hamsters, these infections may occur. Not long ago, C. difficile itself was considered nonpathogenic. C. sordelli, which has been implicated in enteric clostridiosis in calves and foals (Al-Mashat and Taylor 1983; Hibbs et al. 1977), has also been isolated from hamsters with antibiotic-associated colitis. Whether C. sordelli is a hamster pathogen remains to be proved. C. perfringens type D has also been associated with an enterocolitis in hamsters (Goldman et al. 1972), but there has not been any confirmation that this organism is a cause of disease. Although C. spiroforme, a cause of intestinal clostridiosis in the rabbit (Rehg and Pakes 1982), has not been implicated in spontaneous intestinal disease in the hamster, it causes a fatal typhlitis when inoculated experimentally to hamsters administered clindamycin (Borriello and Barclay 1985).