Viral diseases of pet animals (part 2)

4~Rabies

- Rabies virus has been linked experimentally to **apoptotic neuronal death**.

- **Rhabdovirus** ~ Rabies
  Encephalitis/myelitis/meningitis/vasculitis/ ganglioneuritis

- Rabies virus (**family Rhabdoviridae**) is one of the most **neurotropic** of all viruses infecting mammals.
- It is generally **transmitted by a bite** from an infected animal; however, **respiratory infection** has also been uncommonly reported **after exposure to virus in bat caves, accidental human laboratory exposure, and corneal transplants**

Rabies pathogenesis.

- After a bite wound, 1, the rabies virus initially replicates in muscle (can enter peripheral nerves directly), 2, enters, 3, and ascends (retrograde axonal transport) the peripheral nerve 4, to the dorsal root ganglion, 5, enters the spinal cord 6, and ascends 7, to the brain via ascending and descending nerve fiber tracts, infects brain cells, spreads to salivary glands 8, and the eye and is excreted in saliva.

- The virus moves from the periphery to the CNS by fast retrograde axoplasmic transport, apparently via sensory or motor nerves
- With sensory axons, the first cell bodies to be encountered after inoculation of a rear leg would be those of spinal ganglia, whose neuronal processes extend to the dorsal horn of the spinal cord.

- For motor axons, the cell bodies of the lower motor neurons in ventral horn gray matter or neuronal cell bodies of the autonomic ganglia are the ones initially infected.

- The virus then moves into the spinal cord and ascends to the brain using both anterograde and retrograde axoplasmic flow.

Clinical finding

	Prodromal phase	Excitatory	paralytic
Duration	lasts **2 to 3 days**	*Furious rabies* (psychotic)- **lasts for 1 to 7 days**	*dumb rabies* develops within **2 to 4 days** (range, 1 to 10 days) after the first clinical signs are noted
Clinical signs	apprehension, nervousness, anxiety, and variable fever may be noted	1-Animals become **restless and irritable** and have **increased responses to auditory and visual stimuli** 2-they frequently become **excitable, photophobic, and hyperesthetic** and bark or snap at imaginary objects 3-Dogs may **eat unusual objects (pica)**	**paralysis** usually progresses from the site of injury until the entire CNS is involved

FIG. 20-9 Dog with paralytic stage of rabies in sternal recumbency with torticollis. (Courtesy CDC, Atlanta.)

FIG. 20-10 Dog with rabies. Note open jaw and visible tongue with excessive salivary secretions resulting from the inability to swallow. (Courtesy CDC, Atlanta.)

Gross lesions & histopathology

- **Gross lesions** of the infected central nervous tissue are often **absent.**

- **Microscopic lesions** of the CNS are typically **lymphomonocytic (nonsuppurative)** and include:
  - **leptomeningitis**
  - **perivascular cuffing with lymphocytes, macrophages, and plasma cells**;
  - **microgliosis**, which sometimes is prominent;
  - **neuronal degeneration**
  - **ganglioneuritis.**

- Occasional and slight infection can also involve the leptomeninges, ependyma, oligodendroglia, and astrocytes.
- Neurons can also contain intracytoplasmic acidophilic (pale red to red) inclusions called

Negri bodies

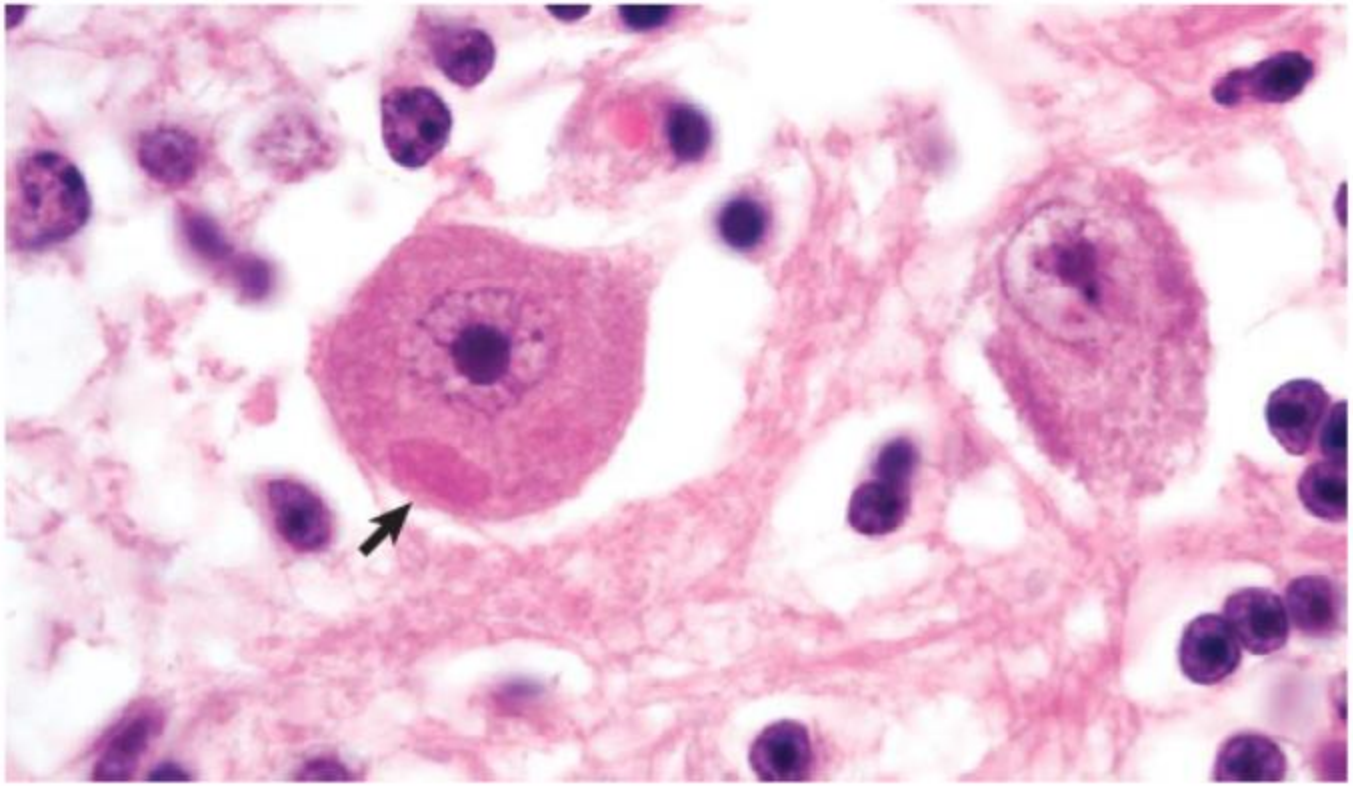
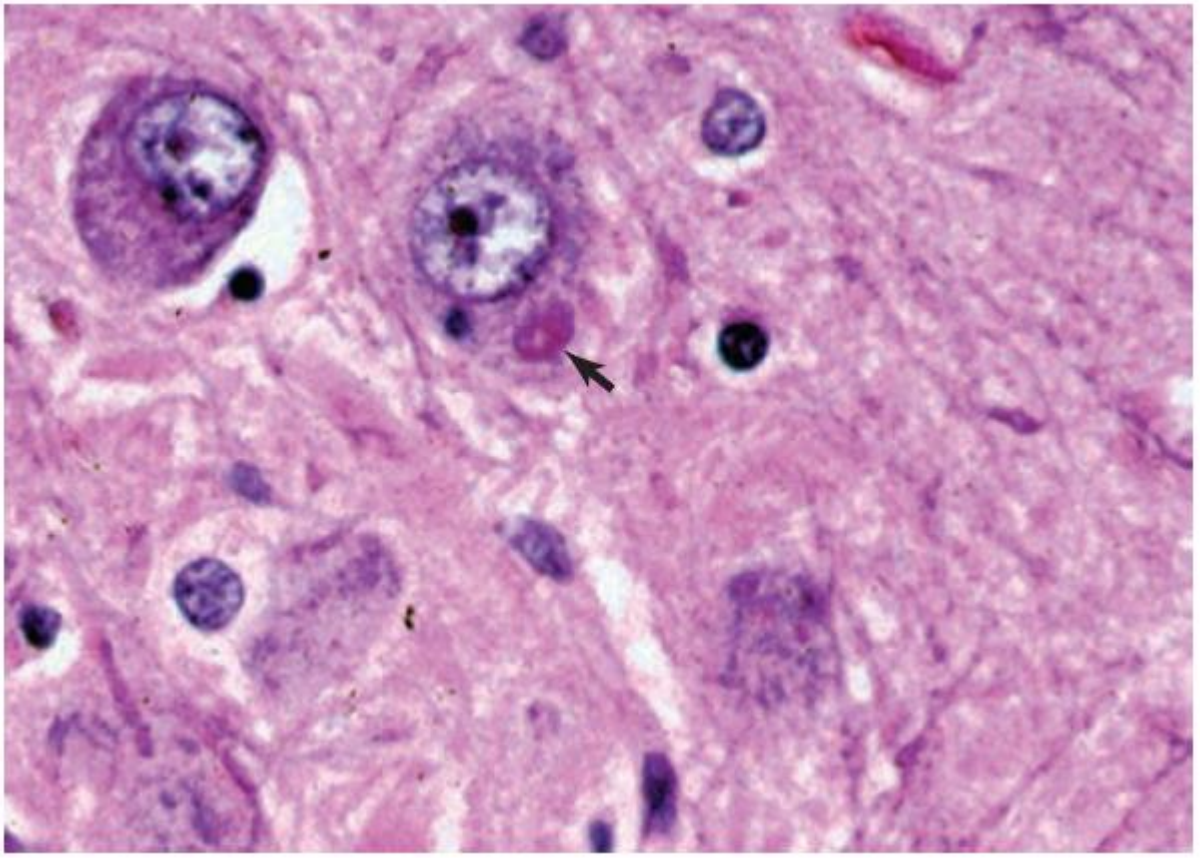


Fig. 14-45 Rabies, Negri body, cerebellum, Purkinje cell, cow.
A large pale red (eosinophilic) inclusion (Negri body) is present in the cytoplasm of the neuron cell body *(arrow)*. In the cow, Negri bodies are seen in Purkinje cells and in other neurons, such as those of the red nucleus and cerebral cortex. H&E stain. (Courtesy Dr. M.D. McGavin, College of Veterinary Medicine, University of Tennessee.)



- **Non-neural lesions** include variable **nonsuppurative sialitis** accompanied by **necrosis and presence of Negri bodies in canine salivary epithelial cells.**

- **Negri bodies**, formed **within neurons of the CNS** and even in the **cranial trigemina**, **spinal**, and **autonomic ganglia**, have long been the **hallmark of rabies infection**

Negri bodies~hallmark of rabies infection

- The inclusions are intracytoplasmic and initially develop as an aggregation of strands of viral nucleocapsid, which rather quickly transforms into an ill~defined granular matrix.

- **Negri bodies** also tend to occur more frequently in **large neurons** such as the **pyramidal neurons of the hippocampus**, **neurons of the medulla oblongata**, and **Purkinje cells of the cerebellum**. Also, **inclusions are frequently present in neurons not located in areas of inflammation**

5-Canine Parvovirus enteritis

- **Parvovirus enteritis of dogs and cats** is a severe, usually **fatal disease**. Because the **target cells are those that are rapidly dividing, in the intestine the crypt cells are principally affected**. This tropism is called ***radiomimetic.***

- Canine parvovirus enteritis, an important and often fatal disease of dogs, is caused by a **cytolytic virus** that infects and **kills mitotically active cells** including **crypt enterocytes** of the **small intestine**

Pathogenesis

- Virus in fecal matter is inhaled or ingested and then deposited on and trapped in the mucus layer of oral, nasal, and pharyngeal mucosae, where it infects mucosal macrophages or dendritic cells.

- These cells spread parvovirus to lymphocytes of the lamina propria of the mucosa, especially that of the tonsil where it infects and replicates in lymphocytes.

- Many of these cells subsequently lyse, allowing virus to escape free into the lymph, where it and infected macrophages drain to regional lymph nodes and then, via the blood vascular system, systemically to the spleen, thymus, lymph nodes, bone marrow, and mucosa-associated lymphoid nodules (MALT) such as Peyer's patches of the small intestine.

- In **Peyer's patches**, chiefly **the mitotically active cells** of the lymphoid follicle are infected and lysed (**lymphocytolysis**).

Gross lesions

- the primary gross lesion that results is **fibrinonecrotic enteritis** with **hemorrhage** and an **accompanying serositis**.

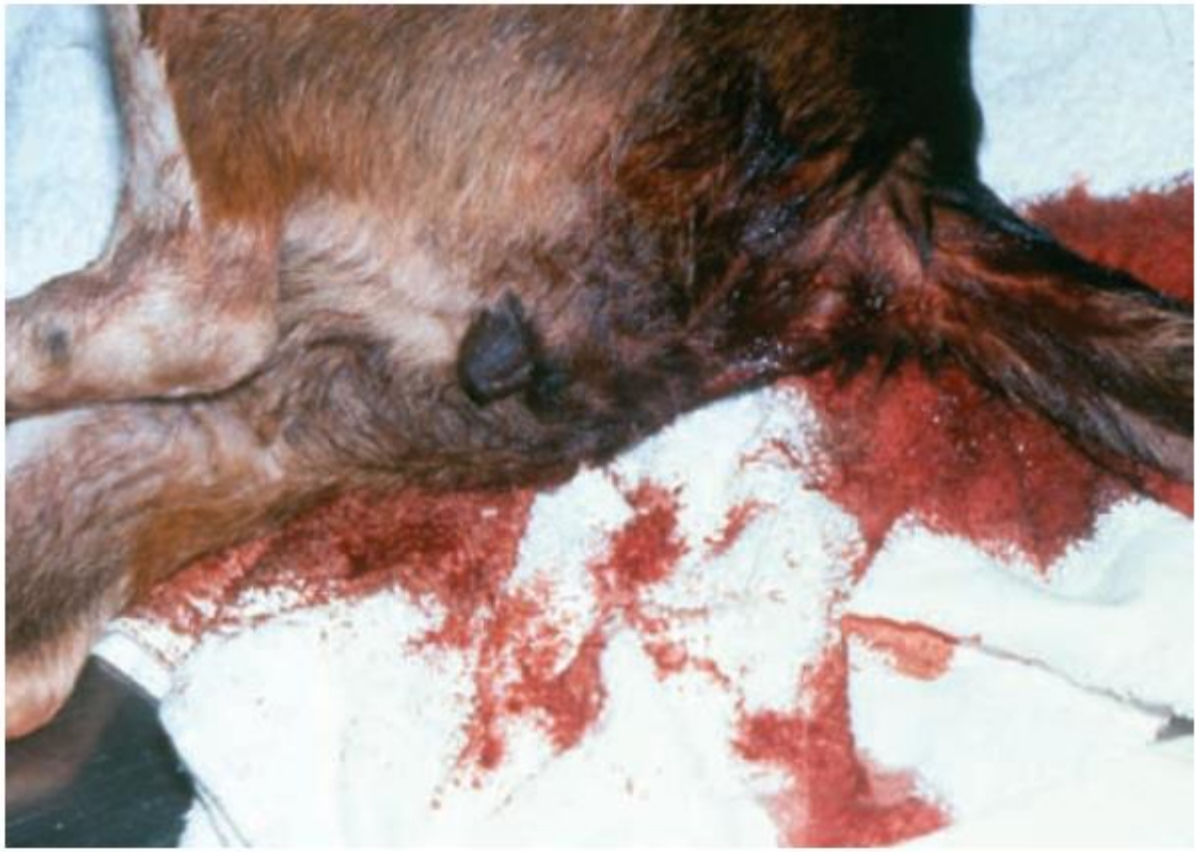


FIG. 8-3 Dog with severe bloody diarrhea characteristic of severe parvovirus enteritis. (Photograph by Craig Greene © 2004 University of Georgia Research

- **segmental areas of the mucosae** that are rough and granular (**enterocyte necrosis, villus atrophy**) with areas of hemorrhage, acute inflammation, and fibrin exudation
- (see Fig. 7-160).

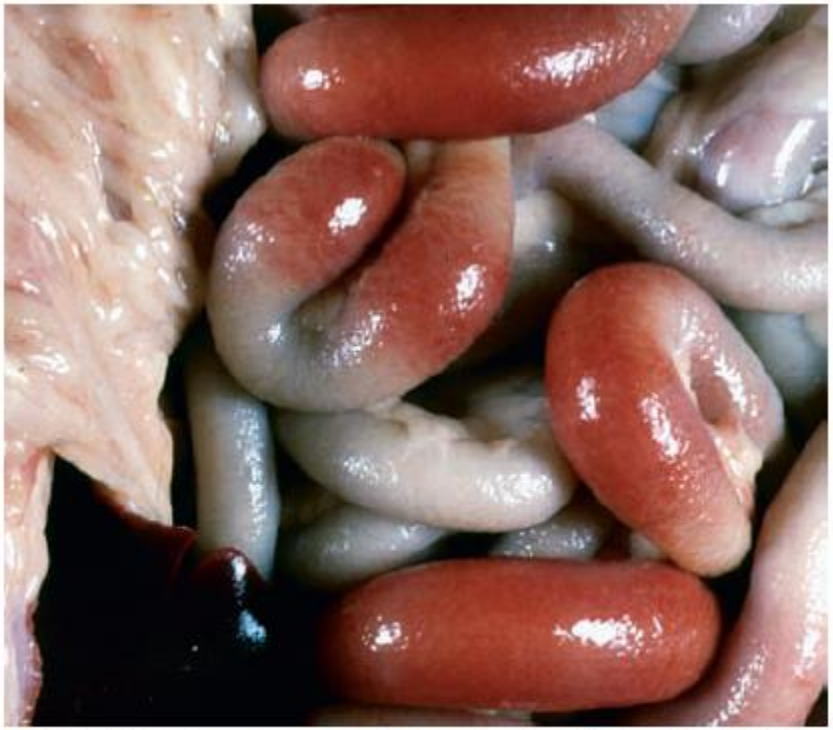
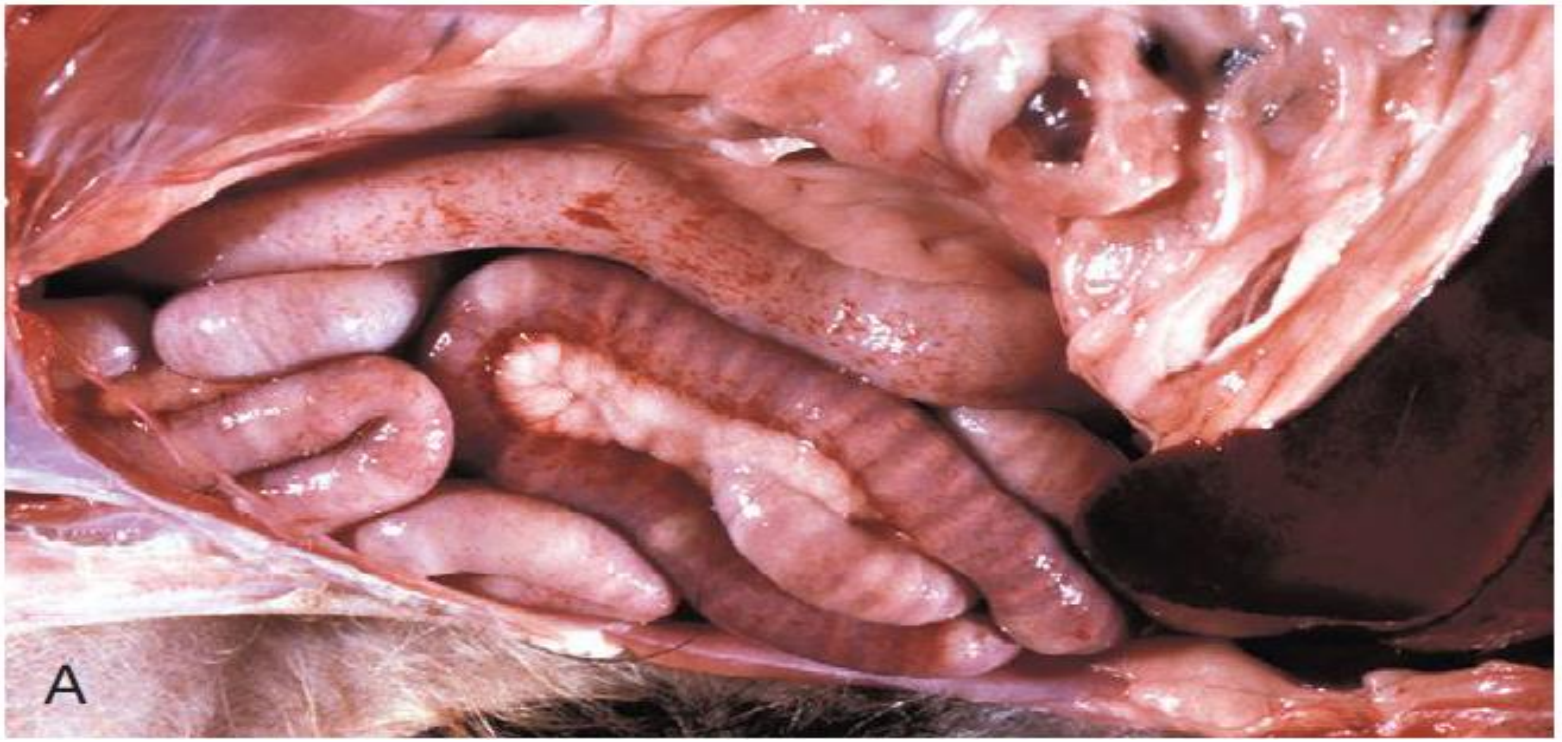
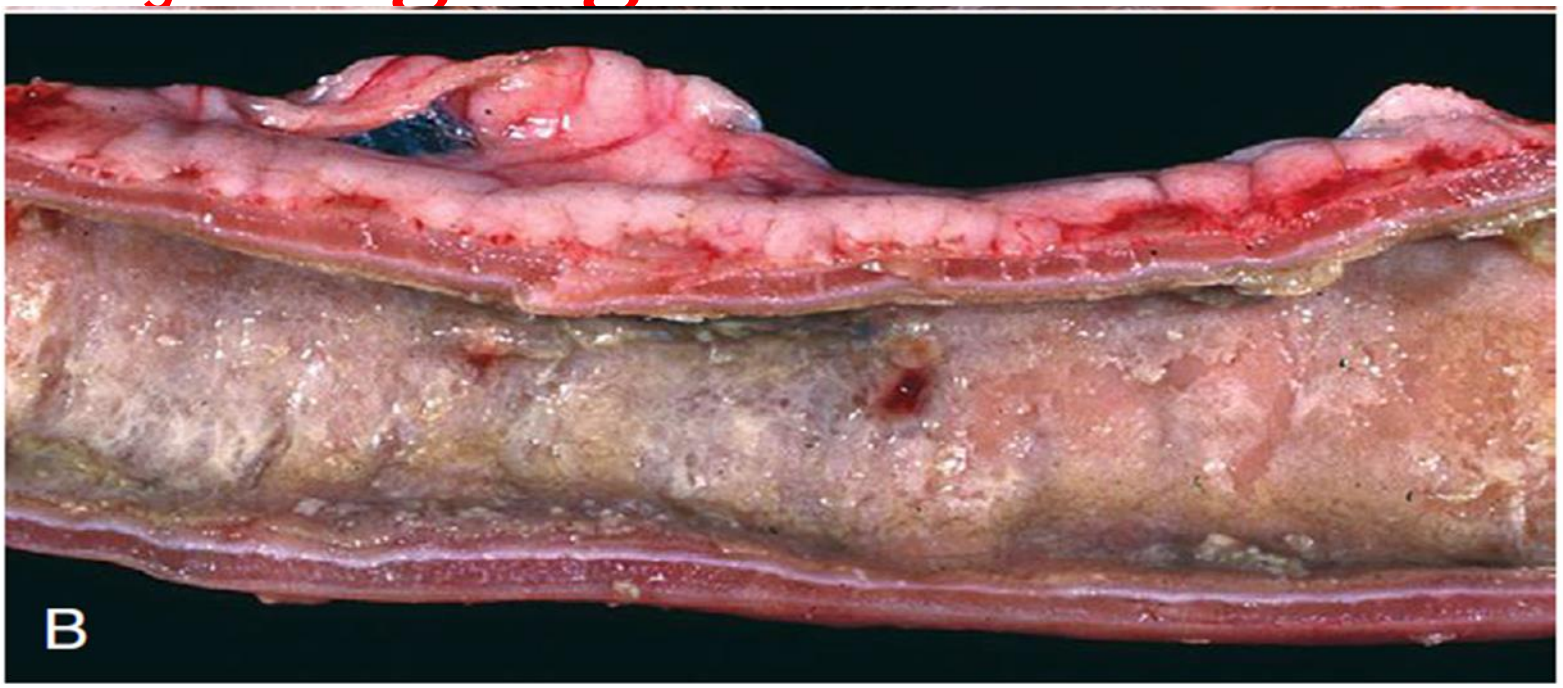


FIG. 8-4 Small intestine at necropsy from a dog that died suddenly of parvovirus enteritis. Note the discoloration of the intestinal wall and fibrin on the serosal surfaces. (Photograph by Department of Veterinary Pathology © 2004 University of Georgia Research Foundation Inc.)

- A, Segments of the small intestine are diffusely reddened (active hyperemia of the mucosa), and the serosal surface is roughened, faintly granular, and



.. B, The mucosa of the small intestine is necrotic. Note the roughened, granular, focally petechiated, and focally sloughing mucosa.



- The contents of the small intestine are brown to red-brown and fluid with a fibrinous exudate, with or without hemorrhage.
- Mesenteric lymphadenomegaly with variable hemorrhage is present.
- The bone marrow is depleted
- Decreased platelet numbers (thrombocytopenia)

- In **Peyer's patches**, chiefly **the mitotically active cells** of the lymphoid follicle are infected and lysed (**lymphocytolysis**).

Complication of canine parvo virus

- **Endotoxic shock** and (Disseminated intravascular coagulation) **DIC can result** and kill the affected animal.

- **Panleukopenia** also occurs because of virus-induced cytolysis of rapidly dividing stem cells in the bone marrow.

6~ FELINE PANLEUKOPENIA (PARVOVIRUS)

- **Causative agent: PARVOVIRUS**
- **Parvovirus** causes **lymphocytolysis of proliferating cells**, including those in the **bone marrow.**

Gross lesion

- Thymic atrophy and collapse of the cortex
- Cerebellar hypoplasia

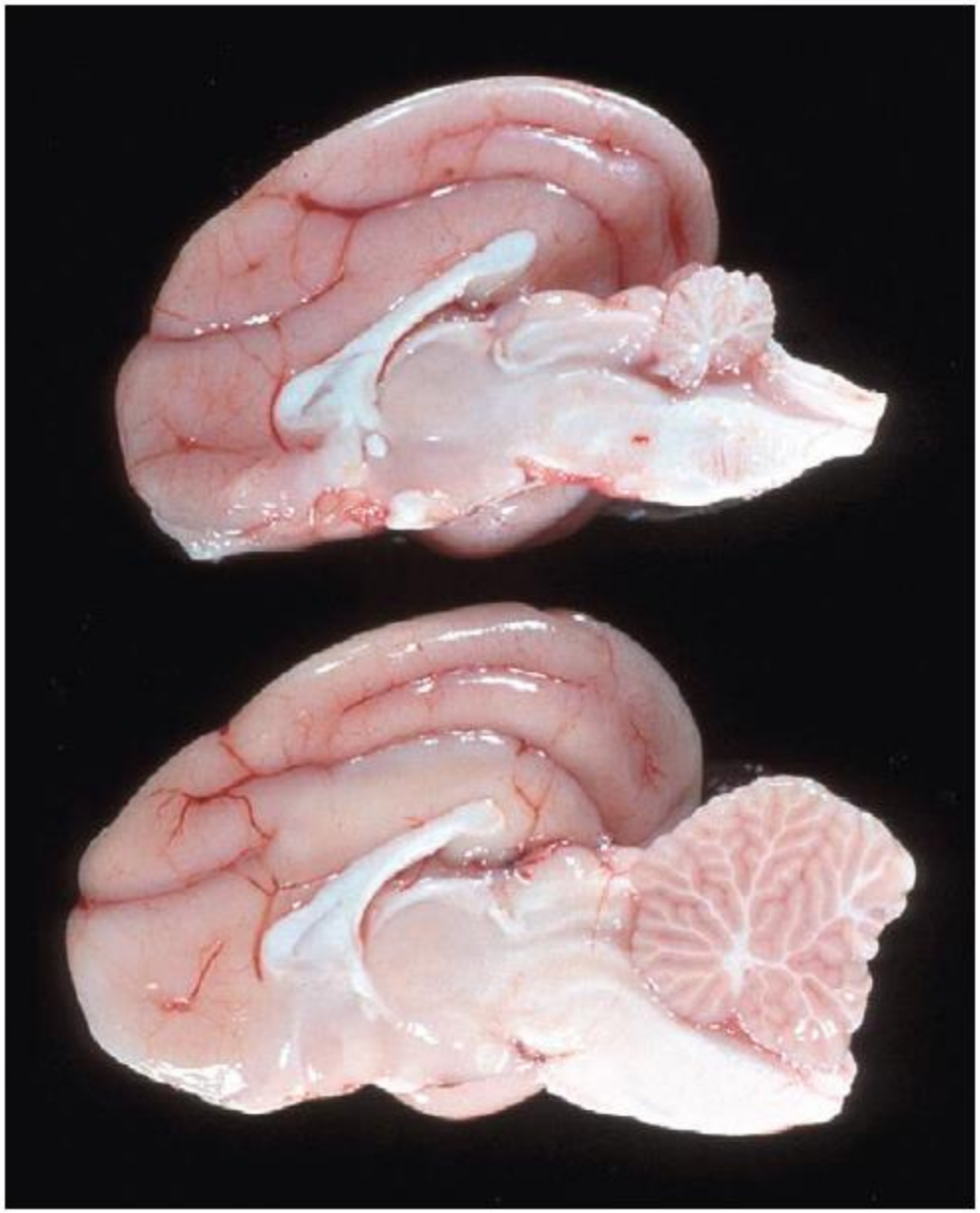
FIG. 94-8 Queen and her litter of kittens, which were dying of panleukopenia. Kittens had thymic atrophy and neutropenia associated with neonatal infection with a parvovirus. (Photograph by Craig Greene © 2004 University of Georgia Research

FIG. 9-2 Kitten with congenital feline panleukopenia and cerebellar hypoplasia showing marked ataxia. (Photograph by Craig Greene © 2004 University of Georgia Research Foundation Inc.)

Thymic atrophy

As the thymus solely depends on bone marrow for the supply of lymphocytes, the result is thymic atrophy and collapse of the cortex.

Cerebellar hypoplasia



cerebellar hypoplasia most commonly is the result of in utero infection with feline panleukopenia virus (parvovirus).

The virus infects and causes lysis of dividing cells in the external granular layer (on the outside of the cerebellum in the fetus). Because these cells are no longer available to migrate to form the (internal) granular layer, the cerebellum remains small.