Tissue from a 13-year-old Quarter Horse mare

- **Morphologic Diagnosis:** Severe granulomatous and eosinophilic enteritis (jejunitis), segmental, with intralesional nematode larvae, focal chronic non-perforating ulceration and secondary impaction and obstruction.

- **Etiologic Diagnosis:** Intestinal/enteric nematodiasis (or parasitic – nema-tode- enteritis).

- **Most likely etiology:** *Strongylus vulgaris*

**Expanded Answers and Descriptions**

1. **Gross description:**

   The proximal small intestine is moderately distended and the lumen is focally obstructed with and segmentally impacted by moderate amount of matted feed material (dry, firm, green, partially digested roughage) at the proximal portion of the jejunum. The impaction is approximately cylindrical, measuring about 30 cm in length and 9 cm in diameter. At the distal end of the impaction site the wall of the jejunum is moderately and segmentally thickened, the mucosal surface is light tan, raised, and irregular in a circumferential annular band approximately 8 cm wide and there is a focal, well-demarcated, circular, 0.8 cm diameter non-perforating chronic ulcer in the center of this lesion in the mucosa/submucosa of the mesenteric border of the intestine.

   Note: the **key words** of the description are bolded and underlined.
2- What primary basic pathological process/es might be going on in the intestinal wall?

The thickening or enlargement of an organ can be due to addition of fluid, cells or foreign bodies (or combinations of these three) to its tissues. In this case the thickening of the intestinal wall does not appear to be due to significant fluid accumulation (edema/hemorrhage) and the lesion looks grossly chronic (the mucosa is tan raised and irregular, there is no hemorrhage, edema or fibrin seen grossly on the mucosal surface or intestinal wall which are characteristic of acute/subacute lesions). When the thickening is due to cellular accumulation (such as in this case) the basic pathologic processes that might be involved are inflammation, neoplasia and/or hyperplasia/hypertrophy. Microscopic examination (histology) is necessary further classify the lesion in one of these three categories.

a. **Inflammation (enteritis):** is the basic pathological process primarily involved in this case. Possible causes for enteritis in horses include *Salmonella* spp., *Rhodococcus equi*, *Clostridium* spp. (*perfringens*, *difficile*), *Neorickettsia (Ehrlichia) risticii*, intestinal parasitism (small and large strongyles, *Parascaris equorum*, etc), and idiopathic conditions such as chronic inflammatory bowel disease, “proximal enteritis” (also known as “ulcerative duodenitis/jejunitis” or “anterior enteritis”), among others. The identification of the specific agents generally requires ancillary testing such as bacterial cultures (aerobic/anaerobic/ selective cultures), PCR (i.e. *Salmonella*), fecal exams and parasite identification, toxins detection (i.e. *C. perfringens* and *C. difficile* toxin ELISA), as well as histology and in some cases special stains and/or immunohistochemistry.

b. **Neoplasia:** malignant infiltrative neoplasias should also be considered among the gross differential diagnoses in this case, particularly since it is an adult/aged animal. Lymphosarcoma is the most common neoplasia affecting the intestine in horses while epithelial/glandular tumors (intestinal adenocarcinomas, adenomas) are rare. In this case the localized plaque-like pattern of alimentary (intestinal) intramural lymphosarcoma should be considered as a gross differential diagnosis. Other primary intestinal neoplasias or neoplasias metastatic to the intestines (secondary intestinal neoplasias), although rare should also be considered.

c. **Hyperplasia/Hypertrophy:** such as in the proliferative ileitis caused by *Lawsonia intracellularis* (*Lawsonia*-associated proliferative enteropathy). Lesions most commonly involve the ileum, (however duodenal and jejunal lesions have also been described), ulceration is not frequent and this condition is usually reported in young animals (see also LCPG Diagnostic Exercise#2 by Dr. Fabio Del Piero).
3- Microscopic findings:

Fig. 4. Jejunum, HE, 20x (subgross). Eosinophilic granulomatous enteritis with intralesional nematode larvae and focal non-perforating ulceration, severe, chronic. Intestinal lumen at the bottom and serosal surface at the upper left corner, note the severe mucosal/submucosal thickening due to inflammatory response to nematodes (cross sections) acting as foreign bodies.

Fig. 5. Jejunum, HE. (A) 40x. Eosinophilic granulomatous enteritis with intralesional nematode larvae and focal non-perforating ulceration, severe, chronic. Close up view of the nematodes in the Fig. 4. (B) 100x. Cross section of an intralesional nematode, which is characterized by a thick external cuticle, platymyrian musculature, a body cavity (pseudocoelom), vacuolated lateral chords and an intestine composed of few multinucleated cells. No mature gonads are noted (larval stage).
Fig. 6. Jejunum, HE, 400x. (A) Close up of Fig. 5 B. (B) The inflammatory cellular infiltrate surrounding the nematodes in the mucosa, submucosa and tunica muscularis is composed of abundant eosinophils, neutrophils and macrophages associated with cellular debris (necrosis). Multinucleate giant cells can be found occasionally (not shown).

Fig. 7. Jejunum, HE, 200x. The inflammatory infiltrate extends to the deep smooth muscular layers (A) and the intrinsic enteric nervous system (A and B). In (A) two neurons of the myenteric plexus are shrunken, have angular cell borders (degeneration) and are surrounded by macrophages (bottom). Abundant previously described inflammatory cells surround a different group of neurons of the myenteric plexus in (B).
Discussion:

The morphology of the nematode is consistent with a “large strongyle” (family Strongylidae, subfamily Strongilinae). The most important genus in this group is *Strongylus*, *S. vulgaris* considered the most pathogenic in horses and *S. edentatus* and *S. equinus*, less pathogenic. Other less important genera in this group include *Triodontophorus*, *Oesophagodontus* and *Craterostomum*. Further classification of the parasite at a level of genus is not possible in histological sections stained with HE (routine histology) and would require parasite identification (submission of nematode specimens to a parasitology laboratory) or nematode larval culture from fecal samples. Molecular techniques (PCR) for identification of nematodes in horses are also available. In this case we speculate that the inflammatory reaction to the larval nematodes in the wall of the jejunum may have interfered with the normal intestinal peristalsis (progressive motility) leading to impaction and obstruction of the involved segment, with secondary proximal intestinal and gastric overload and rupture, which was the actual cause of death in this horse. The severity and segmental distribution of the lesion and the involvement of the muscular layers and neurons of the myenteric plexus (collateral damage) support this theory. The presentation of this segmental form of large strongyle infection in horses is unusual.

Typical Gross findings: vary with the different genera and may include:

- *Strongylus vulgaris*: mesenteric endarteritis (cranial mesenteric artery, cecal/colonic arteries), intestinal infarction, aortic-iliac thrombosis, infarctions and thrombosis anywhere else in the body, cerebrospinal nematodiasis (aberrant larval migration).
- *Strongylus edentatus*: hepatic migration/eosinophilic granulomas, parenchymal scars, tags of fibrous tissue on the hepatic capsule (diaphragmatic surface), nodules or edematous/hemorrhagic plaques in the intestinal wall.
- *Strongylus equinus*: hemorrhagic subserosal nodules (ileum, cecum, colon), hepatic and pancreatic migration
- Hemomelasma ilei (intestinal subserosal hemorrhagic plaques caused by larval stages of large strongyles in general).
- All three aforementioned *Strongylus spp.*: adults (15-40 mm long and 2-4 mm thick) can be found attached to the mucosa of the large intestine causing small superficial hemorrhagic ulcers at the site of attachment.

References and Recommended literature:


4- Gardiner CH, Poynton SL. An atlas of metazoan parasites in animal tissues. 1999 Revised 2006. Registry of Veterinary Pathology, Armed Forces Institute of Pathology, Washington DC.


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A final document containing this material with answers and a brief discussion will be posted on the C. L. Davis website by the end of the current month (http://www.cldavis.org/lcpg_english.html).