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Hemosiderin Deposits in the Equine Small Intestine

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Intestinal samples from 30 horses used in two unrelated experiments were found to have hitherto undescribed hemosiderin deposits in the intestinal villi. There were 15 horses and ponies obtained from conventional sources and 15 laboratory-reared, strongyle-free ponies with a minimum of other parasites which included *Setaria* sp. and *Gastrophilus* sp. All animals were reared in Louisiana and were in good condition. Complete necropsies were done on all animals and all relevant tissues were examined microscopically. Findings were consistent with the experimental designs to which these animals were submitted and did not reveal a direct association with the presence of hemosiderin deposits in the intestine.

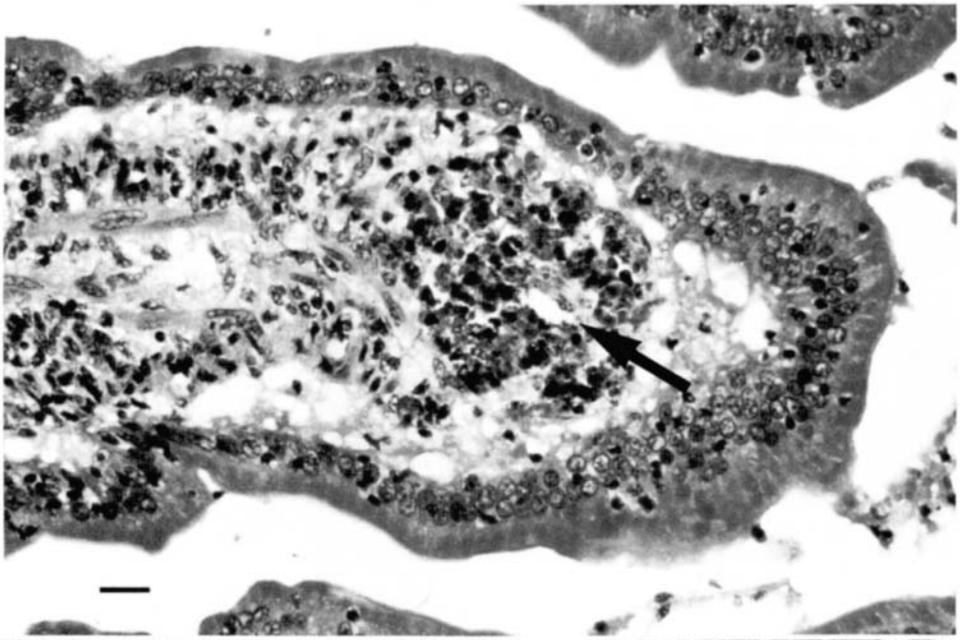
Samples were obtained from duodenum, jejunum and ileum, fixed in buffered formalin, and processed routinely. Sections were stained with hematoxylin and eosin (HE), Perls' Prussian blue for iron [3], periodic acid-Schiff (PAS) [3], and diastase-pretreated PAS [3]. Unstained sections were viewed under incident ultraviolet light for autofluorescence. Selected samples were fixed in 2% glutaraldehyde and embedded in plastic for transmission electron microscopy. Additional formalin-fixed samples were freeze-dried and gold etched for X-ray dispersion analysis of selected areas under a scanning electron microscope.

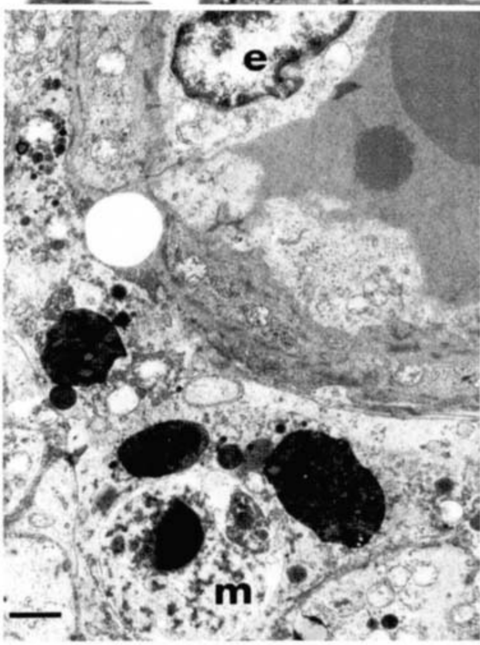
The lamina propria of the tips of the intestinal villi contained variable accumulations of iron positive deposits within macrophages (fig. 1). These deposits were birefringent and light brown in HE and unstained sections. They were positive for the PAS stain and diastase-pretreated PAS and did not have spontaneous fluorescence under ultraviolet light. Under electron microscopic examination, these macrophages were associated closely with arteries and capillaries (fig. 2) and fragments of the cells occasionally were found within their lumens. The deposits were always within membrane-bound structures interpreted as phagolysosomes. These were heterogeneous and contained markedly electron-dense granules, crystalloid structures, and lightly electron-dense particles (fig. 3). Occasional membrane-bound granules within the same macrophages contained lamellar structures similar to so-called myeloid figures. X-ray dispersion analysis revealed an iron peak in some villi.

Macrophages observed in the horses were similar to those reported for monkeys as containing "karyolytic bodies" [1]. Vacuoles present in the equine macrophages were much smaller and fewer than found in monkeys.

Changes were observed in 22 duodenal, three jejunal and three ileal sections. There was no significant difference among the strongyle-free and conventionally reared animals. When changes were present in ileum or jejunum, they also were present in the duodenum. Animals with ileal changes, however, did not necessarily have changes in the jejunum. This finding is an indication that these deposits do not progress distally from the duodenum.

We conclude that these deposits are hemosiderin contained within macrophages dedicated to removing a variety of particles from the areas where the deposits are found. These changes apparently have not been described in horses previously. They are similar to those reported in the literature for macaque monkeys, baboons [1], and guinea pigs [2]. They differ from those described in monkeys in that the deposits in horses do not autofluoresce under ultraviolet light, although other characteristics are very similar.





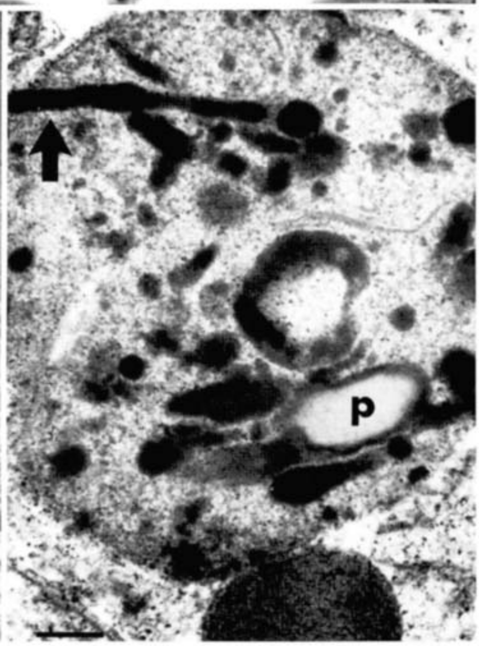


Fig. 1: Duodenal villus from horse; accumulations of hemosiderin-containing macrophages around a villar artery (arrow). HE. Bar = 20 μm.

Fig. 2: Electron photomicrograph of periarterial area of equine intestinal villus; macrophage in perivascular region (m). Several phagolysomes containing particles of differing electron density. Endothelial cell nucleus (e). Bar = 1 μm.

Fig. 3: Higher magnification of one phagolysosome from macrophage in fig. 2. Partially electron-lucent and partially crystalloid particle (P). Crystalloid particle also present (arrow). Bar = 200 nm.

The functional significance of these deposits is unknown. In horses, as in guinea pigs and simians, there are indications that hemosiderin deposits within intestinal villi do not affect gastrointestinal function adversely. There also is no apparent correlation with systemic disease. Since all animals were confined to a given geographical area, there is a possibility of environmental influence on the occurrence of these deposits. This would explain the absence of reports of this condition in the literature. It might be important to study the factors, such as iron metabolism, that may contribute to development of this condition.

Acknowledgements

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Monoclonal Gammopathy in a Horse with Defective Hemostasis

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A six-year-old quarter horse gelding was referred with anorexia, fever, anemia, weight loss, and prolonged bleeding from wounds. The duration of illness was approximately six weeks. A test for equine infectious anemia (Coggins' test) was negative two months prior to admission. Abnormalities on physical examination were slightly pale and icteric mucous membranes, slight swelling of all fetlock joints and bilateral sub-albinotic fundi with prominent choroidal vasculature. Major hematologic and biochemical abnormalities were macrocytic-normochromic anemia (packed cell volume 23%), hyperproteinemia (12 g/dl determined by refractometric measurement) and hyponatremia (120 mEq/1). Mild proteinuria was noted but was absent on subsequent occasions. The relative serum viscosity was 7.0 compared with four normal horse sera which ranged from 1.4 to 1.7. A second Coggins'