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Authors: DECKER, R. A., RANDALL, T. L., and PRIDEAUX, J. W.

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ENTEROLITHIASIS IN A CONFINED HARTMAN'S MOUNTAIN ZEBRA

R. A. DECKER, T. L. RANDALL and J. W. PRIDEAUX, Central Animal Health Laboratory, Wisconsin Department of Agriculture, Madison, Wisconsin 53705, U.S.A.

Abstract: Enterolithiasis was observed on necropsy of a Hartman's mountain zebra (*Equus zebra hartmannae*). A single enterolith had caused obstruction and rupture of the small colon. The gross lesions are described and the possible etiology discussed.

INTRODUCTION

Enteroliths or intestinal concrements are now considered rare in domestic Equidae.[4,7] Udall[7] noted differences in their geographic frequency of occurrence and attributed this to the variation of salts in food and water. It is agreed that ammonium and magnesium phosphate are the mineral constituents and that these minerals are deposited upon a foreign body acting as a nucleus.[4,6,7] The source of the magnesium and phosphate is stated to be bran[4,7] or grain.[6] Ammonia is derived from protein decomposition in the colon.[6] Intestinal disease is also considered a requirement for enterolith formation.[4,6]

Enteroliths are found in the right dorsal section of the large colon (Fig. 1).[7] Signs of disease are not expected unless the enteroliths lodge at the funnel-like entrance into the small colon in the region of the left kidney.[4]

HISTORY

Hartman's mountain zebra is considered the rarest of the three recognized varieties of zebra. In 1969,[3] the world population was estimated at 7,000 and 140 were in captivity in 1973.[2] This specimen, an adult female, was captured in 1970 in South West Africa. She was estimated to be 9 years old and had been confined at Vilas Park Zoo, Madison, along with 6 adults and 2 recently born foals. No sign of disease was observed except for refusal to feed the night before death, which occurred between 2400 and 0200 hours.

The zebra herd was confined in a fenced, outdoor enclosure divided into one large pen (26.9 x 34.0 m) and 2 small pens (4.2 x 11.3 m) and covered with crushed limestone. Manure was removed daily and limestone replenished as needed to maintain sanitation and appearance.

The animals were fed good quality alfalfa hay and concentrate, the latter consisting of a commercial horse ration[1] and two different commercial vitamin-mineral supplements.[2][3]

MATERIALS AND METHODS

The enteroliths were sectioned by saw. Enteroliths and commercial ration components were analyzed for calcium and magnesium levels by atomic absorption spectrophotometry. Phosphate levels were determined by use of a commercially available, molybdate-based, colorimetric process set.[4] Published calcium and

[1] Omolene: Purina Mills, St. Louis, Missouri.
[2] Dia-Glo: Diamond Laboratories, Des Moines, Iowa.
[3] VitaTone: Ft. Dodge Laboratories, Ft. Dodge, Iowa.
[4] Catalyzed Phosphorous (6500): American Monitor Corporation, Indianapolis, Indiana.

phcsphorus levels for alfalfa were accepted.[5] The calcium:phosphorus ratio of the total ration was calculated.

Necropsy was performed 7 to 9 hours following death.

RESULTS

a) Necropsy

The body was in a good state of nutrition with much subcutaneous and omental fat. The animal was not pregnant. There was generalized peritonitis with fecal material distributed throughout the peritoneal cavity. A 10 cm tear was found in the small colon. Immediately posterior to the tear, at the approximate midpoint of the small colon, an 8 cm enterolith was so firmly lodged that it could not be moved without incising the colon. There was no ulceration of the colon at this point. Approximately 60 cm anterior to the lodged enterolith (Fig. 1),

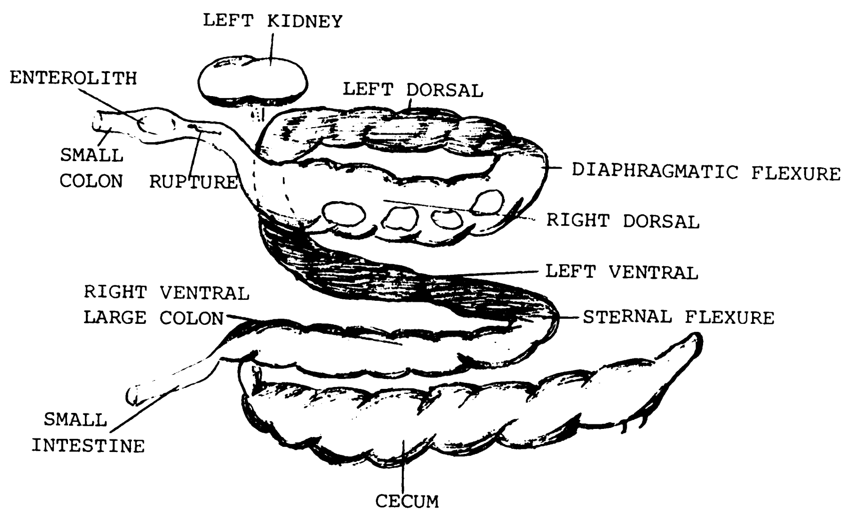

FIGURE 1. Schematic drawing, as viewed from the right side, illustrating the relative positions of the abdominal viscera.

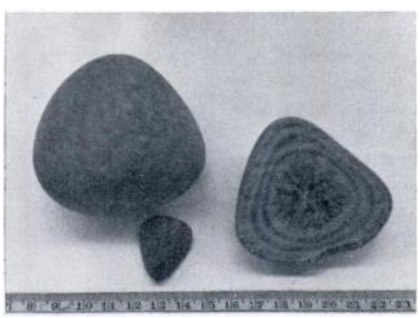

FIGURE 2. A sectioned enterolith showing the layers of mineral deposition.

in the right dorsal colon, 22 enteroliths were found distributed through the contents forward to the diaphragmatic flexure. They ranged from 3 to 8.75 cm in diameter and had a total weight of 2.26 kg. The smaller stones had worn facets showing the layered deposition of mineral. The cut surfaces of the sectioned enteroliths showed striations varying from light to dark gray (Figure 2). Stone flakes and chips were also found in the colonic contents. No evidence of chronic catarrhal gastroenteritis could be observed.

b) Chemistry

The composition of the enteroliths was magnesium ammonium phosphate (triple phosphate): 23.6% phosphorus, 18.8% magnesium, and 1.4% calcium.

The limestone used in the enclosure was the relatively soft, yellowish variety composed of the carbonates of calcium (27.6%) and magnesium (13.4%).

The stone flakes found mixed with the colonic contents were of the same composition as the enteroliths. No ingested limestone particles could be identified among them.

The calcium:phosphorus ratios of the three non-roughage ration components were: [1]0.45 kg, 1.27:0.22, [2]0.11 kg, 0.47:0.68, [3]0.23 kg, 2.7:2.2. The calcium:phosphorus ratio of the complete ration was calculated at 3:1.

DISCUSSION

In an effort to improve the nutrition of the breeding mares, the weight of concentrates fed had been increased. The fatty acid content of the ration had also been increased in an attempt to correct hoof problems. Ordinarily an increase in the mass of concentrates fed increases the proportion of phosphorus and magnesium to that of calcium. In this instance, the actual net effect was an increase in the proportion of calcium because of the high calcium content of the concentrate components chosen. The calcium and magnesium intakes could have been increased by ingestion of the limestone in the enclosure but this was not observed and could not be established by analysis of the stone chips found in the digestive tract. The predisposing nutritional factors cited in the literature do not seem to have contributed to the formation of the enteroliths found in this animal. Possibility of chronic gastrointestinal disease as the predisposition cannot be positively eliminated, but was not observed on gross examination.

Acknowledgments

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