

DISSEMINATED INTRAVASCULAR COAGULATION IN A NEONATAL WHITE RHINOCEROS (*CERATOTHERIUM SIMUM SIMUM*)

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INTRODUCTION

A 10-day-old, 71-kg, female white rhinoceros (*Ceratotherium simum simum*) was found dead in its yard without exhibiting premonitory signs of disease. Gross lesions at necropsy consisted of heavy, dark lungs, petechial hemorrhages on serosal surfaces in the thoracic and abdominal cavities, and petechial hemorrhages throughout the cut surface of the kidneys. Histologic lesions included fibrinoid thrombi in the capillaries of the small intestine and kidneys. A *Salmonella* species was isolated from the heart blood and spleen. Disseminated intravascular coagulation (DIC) secondary to endotoxemia was determined to be the cause of death and is described in this case report.

CASE HISTORY

A female white rhinoceros was born 14 August 1986 at the Jacksonville Zoological Park. The baby appeared to be normal except for erythema of the conjunctival tissue surrounding the left eye and superficial skin irritation on the left side of the head. On the following day, epiphora and blepharospasm were noted on the left eye. The mother and baby were separated for manual restraint and examination of the baby. Results of the exam were considered within normal limits, except for neovascularization and a circular, cratered defect on the left cornea and superficial abrasions on the left side of the head. Fluorescein stain* of

the cornea revealed a centrally located ulceration 5 mm in diameter. The baby's body weight was 62 kg.

Treatment consisted of the application of 2% tincture of iodine to the ulcer, followed by 1% atropine sulfate^b and gentamicin sulfate^c ophthalmic ointments. A nictitating membrane flap was constructed. Long-acting penicillin^d was given i.m. (22,000 U/kg), as well as vitamin E-selenium,^e vitamin A-D,^f tetanus antitoxin,^g and flunixin meglumine^h (0.22 mg/kg). The baby was returned to the mother without incident. Six days later, the baby was reexamined and the nictitating membrane flap was taken down. The neovascularization was reduced and fluorescein stain of the cornea revealed a central defect 2 mm in diameter. The baby had gained 9 kg. The penicillin and flunixin meglumine injections were repeated, as was the topical application of atropine and gentamicin. The mother and baby were re-united again without incident. Further follow-up on the corneal lesion was considered unnecessary. Two days later the baby was found dead in the enclosure.

At necropsy, gross lesions included a healing corneal ulcer on the left eye, heavy, dark lungs, and scattered petechial hemorrhages on the endocardium and on the serosal surfaces of the trachea, pericardium, and intestinal tract. Diffuse petechial hemorrhages were noted on the cut surface of the kidneys. Abdominal lymph nodes were hemorrhagic and the spleen was enlarged and pulpy.

Tissues from major organs were handled in a routine manner for histopathology. Samples of heart blood and spleen were cultured for bacteria.

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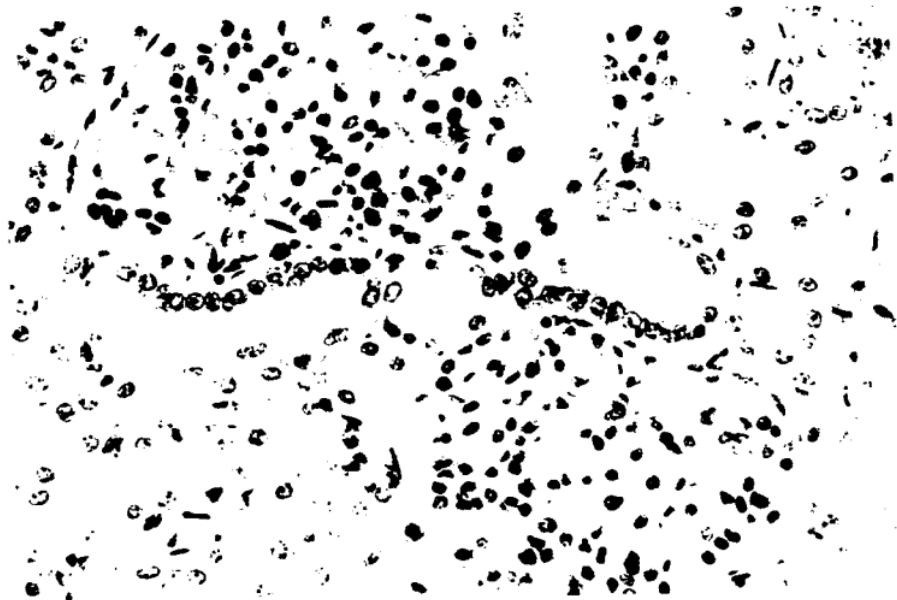


Figure 1. Glomeruli with dilated capillaries containing fibrin thrombi. H&E. $\times 400$.

RESULTS

Histologic lesions included diffuse congestion in the spleen, lymph nodes, small intestine, liver, and lung. Hemorrhage was seen in the kidney, pericardium, and lymph nodes. Scattered macrophages were present within alveoli in the lung, and multiple foci of necrosis and minimal inflammatory infiltrate were noted in the liver. Small fibrinoid thrombi were present in capillaries in the lamina propria of the small intestine and within almost all glomerular capillaries of the kidney (Fig. 1).

A heavy growth of a *Salmonella* species was cultured from the heart blood and spleen.

DISCUSSION

Acute renal failure occurs in about 50% of human patients with DIC when fibrin thrombi form within renal glomeruli. This has also been reported in horses. The

thrombi result in ischemia that leads to cortical medullary necrosis. Infections with gram-negative, endotoxin-containing bacteria are common causes of DIC in people and animals. Endotoxin can trigger DIC by indirect factor XII activation through endothelial damage, direct activation of factor XII, or by stimulating granulocytes to produce tissue factor.¹

The absence of premonitory signs of illness, the hepatic necrosis with minimal inflammatory infiltrate, and the isolation of *Salmonella* sp. from the heart blood and spleen indicate a peracute septicemia and endotoxemia causing release of thrombo-elastic substances and DIC in the rhinoceros. The stress of handling and the age of the animal predisposed it to infection. The source of the *Salmonella* was thought to be stagnant wallows in the enclosure; however, this was not confirmed. A fecal culture from the mother was negative for pathogenic bacteria.

PRODUCTS MENTIONED IN TEXT

- a. Fluorecaine, Maury Biological Co., California.
- b. 1% Atropine sulfate ophthalmic ointment, Pharamaderm, New York.
- c. Gentocin ophthalmic ointment, Schering Corp., New Jersey.
- d. Depo-penicillin, The Upjohn Co., Michigan.
- e. Vitamin A-D Injection, Veterinary Products, Inc., Colorado.
- f. E-Se, Schering Corp., New Jersey.

- g. Tetanus antitoxin, Professional Biological Co., Colorado.
- h. Banamine, Schering Corp., New Jersey.

REFERENCE

1. Morris, D. D. and Beech, J.: Disseminated intravascular coagulation in six horses. *Journal of the American Veterinary Medical Association* 183(10): 1067-1072, 1983.

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BOOK REVIEW

Vertebrate Fetal Membranes: Comparative Ontogeny and Morphology; Evolution; Phylogenetic Significance; Basic Functions; Research Opportunities, Harold W. Mossman. Rutgers University Press, 109 Church Street, New Brunswick, New Jersey 08901. 1986. 383 pp., illustrated. Price: \$95.00.

Success of the current effort to save and propagate endangered animal species crucially depends on our comparative knowledge of reproductive structures and functions in a wide variety of species. This book makes a substantial contribution in this direction. It is a result of the author's lifelong research in comparative placentology and greatly expands his extensive classical review of the topic published 50 years ago. The book compares the formation of fetal membranes in vertebrate species from primitive fish to mammals (including man). The text is supplemented by numerous drawings and tables enhancing the comparative aspects.

The review of fetal membranes in lower vertebrates is intended to elucidate the developmental homologies in the phylogeny of vertebrate species and their membranes. The questions elaborated include the phylogenetic role of individual fetal membranes and their significance in vertebrate evolution and taxonomy.

The largest section of the book deals with the available descriptive information on the comparative morphology of the fetal membranes and uteri of individual taxonomic orders of Eutheria. This part includes ontogeny of the fetal membranes and related information on the anatomy of the female reproductive organs, ovulation, fertilization, blastocyst attachment to the uterine wall, and early conceptus development. The fetal membrane development is given first in general terms with the description of placental types.

Throughout the book the author uses terminology that avoids ambiguity within the broad scope of vertebrates included. This meticulously consistent terminology may cause some uneasiness with those used to casually simplified terminology in dealing with only one or a few related species of interest. To alleviate terminologic differences, the author included an extensive glossary of over 700 terms.

The bibliography contains nearly 2,500 references from the beginning of placentology to the present. It is an invaluable information source for reproduction specialists, comparative zoologists, and students.—Reviewed by Petr Hradecík