

## STUDY REPORTS

7. Title: Necrotic Ileitis in Hamsters.

Principal Investigators: Dennis O. Johnsen, Major, VC  
William L. Wooding, Major, VC

Associate Investigators: Ronald A. Marshall, SP5, E-5  
Curtis A. Stewart, SP6, E-6

### OBJECTIVE

The objective of this study is to determine the etiology of an epizootic of necrotic ileitis that occurred in a colony of hamsters recently imported to Thailand.

### DESCRIPTION

Approximately 100 pregnant female hamsters were received from Con Olson Co. of Madison Wisconsin on 30 November 1968 for the purpose providing a nucleus for a new hamster colony free of Salmonellosis. The hamsters arrived on 30 November 1968 and littered approximately two weeks later. The animals were placed in a well isolated airconditioned room in which all surfaces of the room and the equipment contained within it had been scrubbed with a disinfectant solution (Nolvasan, Fort Dodge Laboratories) beforehand. Cages were washed once a week and bedded with sterile sawdust which was changed three times a week.

The hamsters littered about the middle of December and their litters were weaned at 21 days of age, separated according to sex, and were placed six per cage in 160 square inch holding cages. At 45 days of age several weanlings were found dead in a cage. When the animals were necropsied the lesion responsible for the deaths was easily observed and similar in each of the animals. The terminal ileum was enlarged anteriorly for a distance of 3-5 cm. from the ileo-ceco-colic valve; it had a whitish color and the serosal surface was finely granular. The affected portion of the ileum was friable and greatly thickened with the wall sometimes reaching a thickness of 3 millimeters. Caseous white contents were observed in the lumen of the ileum which had a cross sectional diameter of 8-10 millimeters. The cecum was not involved nor did it contain any of the caseous luminal contents that were observed in the ileum. Frequently there were numerous adhesions between the affected ileum and the surrounding abdominal organs and peritoneum. In about 25% of the animals, abscesses which contained a caseous yellow exudate were found adjacent to the ileal lesions.

The microscopic appearance of the involved ileum was similar to that suggested by the gross appearance. A severe necrotic ileitis was present with a complete loss of architecture in some areas and replacement with desquamated epithelium, fibrin, blood, and masses of bacteria. With a differential stain the bacteria were seen to consist largely of masses of gram positive cocci and short bipolar gram-negative rods and long gram-negative bacilli. In some foci, only the tips of the villi were necrotic with normal epithelium in the crypts. In other foci, massive areas of necrosis were often adjacent to a normal areas of ileum epithelium. The adjacent cecum was never involved even though normal cecal epithelium was immediately adjacent to necrotic ileal epithelium.

Over a period of the next three weeks approximately 50% of the weanling hamsters succumbed to this condition. Advanced lesions were frequently found in normal appearing animals kept in cages where deaths had occurred. It was estimated from the deaths that occurred and the subsequent surveys that were made that 90% of the weanlings in this colony were affected. As a result of this experience, the animals in this group were considered to be unfit for use as foundation stock and were retained for only a short time for study purposes. In an effort to determine the etiology of this disease both microbiological and pathological techniques were employed.

## PROGRESS

Microbiological aspects. The affected ileums of several hamsters were collected and ground in phosphate buffered saline in a Tenbroeck tissue grinder. The resulting homogenate was centrifuged and the supernate was inoculated intraperitoneally in varying dilutions into randombred albino mice. From bacterial cultures of these suspensions several enteric bacteria were recovered. Proteus mirabilis was found most frequently, as well as E. coli and two types of Pseudomonas (species not identified). Although no deaths occurred among these mice they were sacrificed ten days after inoculation because of their poor appearance. Abscesses were found in 100% of the mice along the route of inoculation. The viscid yellowish exudate within the abscesses and gross appearance of the lesions resembled those observed in the hamster abscesses. Proteus mirabilis was consistently isolated from cultures taken from these abscesses. Pseudomonas aeruginosa and Enterobacter cloacae were found less frequently, and E. coli very infrequently. The same lesions were reproduced when the exudate was used to pass the infection to more mice.

In an effort to reproduce the disease in hamsters, groups of hamsters were inoculated by several routes with tissue suspensions prepared from hamster lesions and Proteus mirabilis cultures recovered from mice. Cultures and tissue suspensions were inoculated directly into the ileum of one group and orally into a second group. In addition Proteus mirabilis cultures were used to seed both drinking water and sawdust bedding used in the cages. A hamster from each group was selected and sacrificed weekly to detect developing lesions. All hamsters examined in this manner showed no signs of the typical lesion at the end of six weeks.

The microscopic appearance of the mice inoculated with infected hamster tissue was similar to the pathology observed in hamsters. Where inoculations had pierced the intestinal wall the same focal areas of necrosis adjacent to normal epithelium were also evident in the mice with masses of identical appearing bacteria and necrotic epithelium present in the lumen.

In some hamsters and mice, necrosis involved the submucosa and muscularis. In a few of the cases necrotic areas had completely eroded through the wall of the intestine. In these cases, chronic inflammation of the serosa was present and peritonitis with subsequent fibrous adhesions of portions of the intestine to each other, to the other abdominal viscera, and to the abdominal wall was observed.

Conclusions: The uniformity and high frequency of the lesions observed and the lack of success in identifying a single causative agent suggests that this disease was caused primarily by environmental or management factors and complicated by secondary infections. Sawdust bedding was incriminated as a cause of obstructive ileitis in suckling rats in this Laboratory, and although no evidence of sawdust impaction was observed, chronic irritation by ingested sawdust might easily create conditions favorable to secondary invasion by bacteria. Although the disease could not be reproduced in local hamsters under exactly the same conditions, there is little doubt that their intestinal flora is different and their exposure and subsequent resistance to the local flora and environment is greater.

Based on pathological findings and a review of some of the recent literature several possible causes (or contributing factors) for this condition may be suggested. The distinctive zone of demarcation between normal and non-viable tissue is typical of the changes seen in other animals affected with emboli of the enteric vessels. The severe necrosis may also suggest the effect of a potent bacterial toxin. That this condition is of viral etiology should also be considered since a recent article (1) describes the isolation of two viruses in cases of regional ileitis in hamsters.

A new group of hamsters from a different source is being imported soon and may provide the opportunity to determine more conclusively the etiology of this disease. A small number of these animals will be kept on sawdust as the first group was in order to compare the role that bedding may play in the development of these lesions and to pursue more fully the indicated bacterial and viral studies.

1. Two viral agents isolated from hamsters with a Form of Regional Enteritis: A preliminary Report. Am. Jr. Vet. Res. Feb, 1968, p. 445-453.