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A SUBCUTANEOUS ABSCESS ASSOCIATED WITH *SALMONELLA TYPHIMURIUM* IN A BLACK HOWLER MONKEY (*ALOUATTA VILLOSA*)[1,2,3,4]

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SUMMARY • *An unusual manifestation of an infection with* Salmonella typhimurium *was described in a black howler monkey* (Alouatta villosa). *This organism was isolated in pure culture from pus aspirated from a left maxillary subcutaneous abscess. Subsequent to recession of this lesion, a similar abscess developed on the right maxilla.* S. typhimurium *was isolated again. No other pathogens were cultured from samples taken during the course of infection or after death.*

High morbidity and/or mortality rates among newly-imported monkeys in primate colonies are usually attributable to such disease entities as tuberculosis, pneumonia, salmonellosis, shigellosis, and viral infections. While non-human primates are often asymptomatic carriers of enterobacteria, particularly *Shigella* and *Salmonella* species (7), these organisms appear to be one of the primary causes of diarrhea and enteritis in monkeys (2, 4). It has been shown (6) that Panamanian monkeys may be naturally infected with *Salmonella* or acquire infection during captivity.

This report describes a *Salmonella typhimurium* infection manifested by a subcutaneous abscess in a New World monkey.

HISTORY

An apparently healthy infant female black howler monkey (*Alouatta villosa*) was acquired by the Malaria Department, Gorgas Memorial Laboratory on May 26, 1969. The animal was captured in Pacora, Panamá, Republic of Panamá. At the time of arrival in the laboratory, the monkey weighed 784 g. It was kept separately in a large metal primate cage in an animal room housing other species of monkeys. The diet consisted of commercial monkey ration supplemented with cottage cheese, bread, canned fruit cocktail, and water.

CLINICAL OBSERVATIONS

Approximately 5 weeks after acquisition, the monkey developed diarrhea which persisted almost daily until death on Sept. 3, 1969 (100 days after arrival). The diarrhea was not controlled by oral administration of either kaolin-pectin mixture (2 cc) or tetracycline hydrochloride (Tetrachel-S®,[5] 50 mg of base), alone or in combination. Supportive therapy consisted of fluid and electrolyte replacement by the intraperitoneal injection of Ambex®.[6]

About the same time as the onset of diarrhea, an abscess began to develop between the skin and the left maxilla, just below the eye. The abscess became larger, and

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[5] Rachelle Laboratories, Inc., Long Beach, California.
[6] Elanco Products Co., Division of Eli Lilly & Co., Indianapolis, Indiana.

Fig 1. *Facial area of Alouatta villosa. First abscess on monkey's left side has resolved with only a scar remaining. Second abscess on the right side was aspirated 3 days prior to this photograph.*

within 1 week it was about 1.5 cm high and 1.0 cm in diameter. Daily administration of penicillin (240,000 μ, im) had no apparent effect on the growth of the abscess. On July 16, 1969, 12 days after initial appearance, the abscess was drained aseptically with a syringe and needle. Approximately 2 cc of white, thick, purulent material were removed for bacteriological culture. The abscess resolved rapidly, and within a few days only a small scar remained in the area. The monkey seemed to improve in health, although the diarrheal episodes persisted.

About 1 month after aspiration of the first abscess, a second one appeared in almost the same location on the right side of the face. One week later (on Aug. 29, 1969), this abscess was aspirated, and the material, similar in appearance to that obtained from the first abscess, was cultured. The monkey died 5 days after this second aspiration. The abscess was not completely resolved at the time of death (Fig 1). The photograph was taken 2 days prior to death.

Gross observations at autopsy showed nothing remarkable except an enlarged gall bladder; the large intestine was distended and thin-walled. Samples of heart blood, bile, and intestinal contents were taken for bacteriological culture. The brain was not examined at autopsy.

Bacteriological Results

Material obtained by aspiration of both abscesses was examined in the same way. Smears, which were stained by the Gram and acidfast methods, showed numerous pus cells and large numbers of slender, Gram-negative bacilli in all fields. Acid-fast or other forms of organisms were not observed. Cultures of the abscess material were made in the following media: blood agar, MacConkey agar, Salmonella-Shigella agar, brain-heart infusion agar, and thioglycolate and selenite F media (Baltimore Biological Laboratories, Baltimore, Maryland). After incubation at 37°C for 18 hr, *Salmonella typhimurium* grew on all media; no other organisms were recovered. Preliminary identification was made by the procedures outlined by Edwards and Ewing (3) and confirmed by the Enteric Bacteriology Unit, National Center for Disease Control, Atlanta, Georgia.

Stool cultures and material obtained from rectal swabs taken at various times during the course of diarrhea were negative for enterobacterial pathogens. Samples of heart blood, intestinal contents, and bile obtained at autopsy for culture were negative for pathogens. *Proteus* spp., *Escherichia* spp., *Pseudomonas* spp., and *Alcaligenes* spp. were recovered from the large intestine, colon, and their contents.

Discussion

On the basis of observations reported here-

in, it is difficult to delineate the course of infection that culminated in 2 abscesses, both apparently initiated by hematogenous spread of *S. typhimurium*. The first abscess may have resulted from organisms in the intestinal tract that localized in the left maxillary region. The inability to isolate *Salmonella* after the diarrhea began could have been due to the administration of tetracycline. However, despite this treatment, diarrhea was more or less continuous.

The second abscess may, in part, have been due to the trauma associated with aspiration of the primary lesion. Organisms may have been liberated into lymph channels or the vascular system to establish the second lesion. However, no *Salmonella* were cultured from the blood at the time of death.

While *Salmonella*-associated abscesses have not been reported previously in non-human primates, a few such abscesses have been observed in humans. *Salmonella* species were isolated from abscesses in the subcutis (8), in the soft tissues (1), and from an ovarian cyst removed surgically (5).

Black howler monkeys are extremely difficult to maintain in the laboratory for an extended period. Lack of defined nutritional requirements and stress probably contribute greatly to the high mortality rates. Therefore, it is not possible to assign precisely the effect the *S. typhimurium* infection had on this monkey. In the absence of postmortem examination of the brain, whether the infection was the major contributing cause of death cannot be determined. Additionally, the teeth were not examined prior to death or at autopsy. Thus, it is unknown if dental abscesses could have been responsible for the observed lesions in this monkey.

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