

## CASE REPORT

# Cryptosporidiosis in Two Foals

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### Abstract

*Cryptosporidium* oocysts were identified by phase contrast microscopy on smears from flotations of greenish-yellow pasty feces obtained from two foals. One foal, a one week old Percheron was recumbent, anorectic and lethargic, believed to be the result of a septicemia of undetermined etiology. Despite therapy and nursing care the animal died. Using light and electron microscopy, numerous stages of *Cryptosporidium* sp. were seen protruding from the surface of epithelial cells of intestinal villi. The other foal, a six week old Arabian had a mild diarrhea. The diarrhea and passage of oocysts eventually ceased. Immunological tests on sera of both these foals provided no evidence of abnormal immune function. This report is the first to describe cryptosporidiosis in apparently immunocompetent horses.

**Key words:** Cryptosporidiosis, neonatal diarrhea, coccidia, protozoa, horse.

### Résumé

#### Cryptosporidiose chez deux poulains

La microscopie en contraste de phase a permis d'identifier des oocystes de *Cryptosporidium* sp. dans des fèces pâteuses et jaune-verdâtre, obtenues de deux poulains et soumises à l'épreuve de flottation. Un de ces poulains, un Percheron âgé d'une semaine, manifestait du décubitus, de l'anorexie et de la léthargie qu'on pensait imputables à une septicémie d'étiologie indéterminée; il mourut, en dépit d'un traitement et de soins appropriés. La microscopie photonique et électronique révéla la présence de plusieurs stades de *Cryptosporidium* sp. qui faisaient protrusion à la surface des

entérocytes. L'autre sujet, une pouliche Arabe âgée de six semaines, présentait une légère diarrhée qui cessa éventuellement, tout comme l'élimination d'oocystes. Des épreuves immunologiques, effectuées avec le sérum de ces deux poulains, ne révélèrent aucune évidence d'une fonction immunitaire anormale. Il s'agit du premier rapport qui décrit la cryptosporidiose, chez des chevaux apparemment immunocompétents.

**Mots clés:** cryptosporidiose, diarrhée néonatale, coccidies, protozoaires, cheval.

### Introduction

Cryptosporidiosis is an important cause of enterocolitis and diarrhea in several species of mammals, birds, fish and reptiles (1,2). In mammals, the disease is considered to be caused by a single species, *Cryptosporidium muris* (3), which is included within the coccidian group of protozoan parasites. The organism completes its life cycle intracellularly but extracytoplasmically at the apical border of epithelial cells of the intestine (4) or respiratory tract (5). Once infections with *Cryptosporidium* were regarded as rare and largely asymptomatic, but cryptosporidiosis is now believed to be more prevalent and the recognized host range has been greatly expanded to include many species (2). Affected livestock include calves, lambs, kids, piglets, chickens, turkeys and geese (2). There are frequent reports of the infection in immunodeficient hosts, especially man (6).

Cryptosporidiosis in horses is regarded as a rare occurrence (7) and *Cryptosporidium* has been reported

only in immunodeficient Arabian foals (7,8). One report describes the infection in five of six combined immunodeficient foals that died of adenoviral enteritis (7). Although the foals had diarrhea, it was not possible to separate the effects of cryptosporidiosis from those of the concomitant adenoviral infection. In another case (8), an Arabian foal, also with combined immunodeficiency, was diagnosed with cryptosporidiosis. Snyder *et al* (7) suggested that *Cryptosporidium* sp. is not normally infectious for horses and that the state of combined immunodeficiency results in increased susceptibility; however, one survey demonstrated antibodies to *Cryptosporidium* species in 19 of 22 Scottish horses (9).

Examination of feces from 14 neonatal foals affected with "foal heat" diarrhea, failed to demonstrate the presence of oocysts of *Cryptosporidium* sp. (10). It was concluded that the self limiting diarrhea, observed in many neonatal foals between six to 14 days after birth (11), was unlikely to be caused by *Cryptosporidium* sp. The present report describes two cases of the disease in apparently immunocompetent foals.

### Case 1 — History

The horse was a male Percheron foal, the result of a normal gestation and delivery. The dam and foal were the only livestock on a farm in Choiceland, Saskatchewan. The colt received colostrum and initially appeared to be normal. Two days after birth, diarrhea was observed and the foal was treated with parenteral and oral antibiotics and an intestinal protectant. The foal's condition improved during the next

two days but it was found recumbent and unable to rise at five days of age. The animal was anorectic and lethargic with intermittent episodes of abdominal pain. There was no response to antimicrobial therapy and the foal was referred to the Veterinary Teaching Hospital at the University of Saskatchewan.

#### Clinical Findings

The foal weighed 70 kg and could not stand unassisted. The rectal temperature was 38.7°C, the heart rate was 104 beats/min and the respiratory rate was 24/min. The oral mucous membranes were congested and the capillary refill time was four seconds. Continuous, prominent intestinal sounds were audible and fluid could be heard on simultaneous auscultation and succussion of the abdomen. Occasionally, the foal passed small volumes of greenish-yellow, pasty, foul-smelling feces. Decubitus ulcers were present on several bony prominences and the right periorbital region had been recently traumatized.

#### Laboratory Analyses

Samples were obtained for a complete blood count, serum electrolytes, venous blood gases, serum urea nitrogen, serum creatinine and whole blood IgG. Isolation of pathogenic bacteria, viruses and endoparasites from feces was attempted. The total white blood cell count was  $13.6 \times 10^9/L$  comprised of  $5.7 \times 10^9/L$  segmented neutrophils,  $6.1 \times 10^9/L$  band neutrophils and  $1.8 \times 10^9/L$  lymphocytes. Marked toxic changes were observed in the neutrophils. The packed cell volume was 0.34 L/L, the total serum protein concentration was 65 g/L and the fibrinogen concentration was 14 g/L. Blood glucose, serum electrolytes and acid base values were within normal ranges. Results of the latex agglutination test indicated an adequate level of IgG. Pathogenic bacteria were not detected on fecal culture and viruses were not observed by electron microscopy. However numerous oocysts of *Cryptosporidium* sp. were detected in sugar flotation of fecal samples (Figure 1).

#### Diagnosis and Treatment

Complete blood count results were indicative of an overwhelming inflammation. Neonatal septicemia of

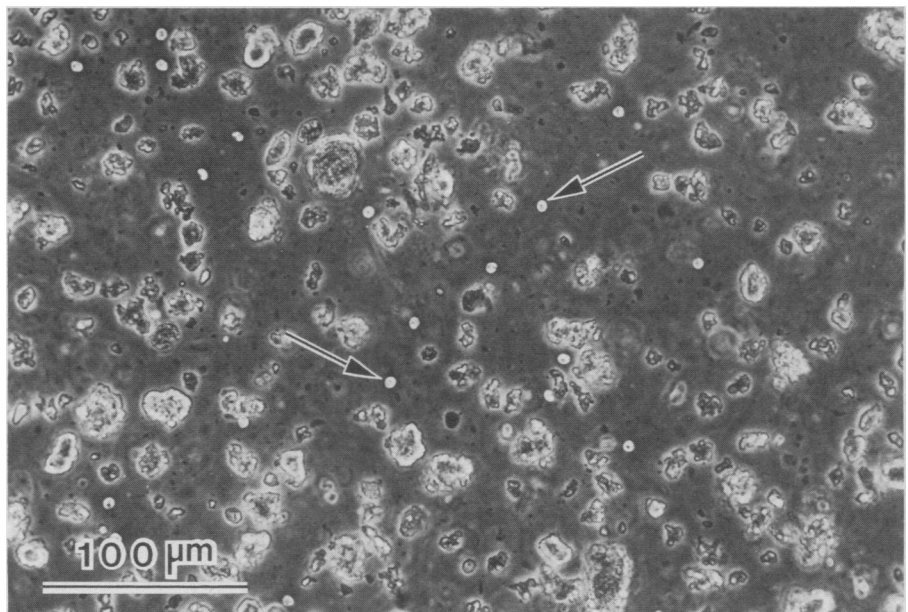


FIGURE 1. Phase contrast photomicrograph of oocysts of *Cryptosporidium* sp. (arrows) in equine fecal flotation smears.

undetermined etiology and cryptosporidiosis were considered responsible for the foal's condition. Treatment consisted of continuous intravenous administration of Ringer's solution and 3 mL/45 kg of a trimethoprim potentiated sulfonamide (Trivetrim, Burroughs-Wellcome, Kirkland, Quebec), intravenously, twice daily. The animal was provided with supplemental heat and was bottle-fed mare's milk at regular intervals. Despite continued therapy and nursing care the foal died two days following admission.

#### Postmortem Findings

The foal was in poor physical condition and had generalized serous atrophy. The pleural and peritoneal cavities contained abnormally large amounts of yellow fluid. A similar fluid and fibrin clots were observed in all joints examined and a fibrinous meningitis was present. Microscopic examination revealed a suppurative meningitis extending into the parenchyma of the brain and spinal cord. The lumen of the entire intestine was filled with a yellow fluid and numerous organisms of *Cryptosporidium* sp. were present, apparently attached to the surface of epithelial cells of intestinal villi (Figure 2). On electron microscopy various stages of the parasite were seen throughout the length

of the small intestine. Nonhemolytic *Escherichia coli* was isolated from the umbilicus, spinal cord, spleen, pleural fluid and from two appendicular joints.

#### Case 2

A six week old female Arabian foal with an angular limb deformity of the carpus was presented to the Veterinary

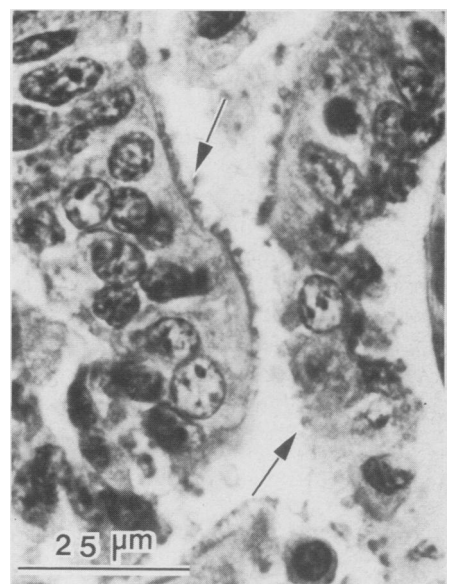


FIGURE 2. *Cryptosporidian* organisms (arrows) in the microvillous borders of equine intestinal villi.

Teaching Hospital. The animal originated from a farm in Red Deer, Alberta where no other livestock were kept. It was systemically normal but passed greenish-yellow pasty feces frequently.

Feces were examined by the sugar flotation method and several oocysts of *Cryptosporidium* sp. were seen. No treatment was administered and the diarrhea abated within a few days. One month later, the feces of both the mare and foal were free of oocysts. Radial immunodiffusion revealed adequate IgM concentrations and a serum electrophoretogram was normal.

### Discussion

The lymphocyte counts of both foals were within normal limits. Results of the latex agglutination test in the Percheron foal indicated adequate passive transfer of immunity. The Arabian foal had electrophoretic evidence of satisfactory passive transfer and also showed normal serum concentrations of IgM. This combined with the lack of systemic illness and the spontaneous abatement of diarrhea in the Arabian foal, suggests adequate immune function in these horses. This report is the first to describe cryptosporidiosis in apparently immunocompetent foals. Many reports of the disease in various hosts indicate a close correlation between clinical illness and passage of numerous oocysts in the feces; however asymptomatic cryptosporidian infection in horses may be more prevalent than is indicated in some reports (7,10).

Immunodeficiency in foals probably allows for a heavier infection and may contribute to neonatal diarrhea (7). Despite the heavy infection and passage of numerous oocysts in the Percheron foal, the significance of this finding cannot be evaluated. The infection in the Arabian foal, which was shedding few oocysts, did not appear to be significant. In both animals oocysts were passed with greenish-

yellow unformed feces which were similar to excreta from other species of young animals with cryptosporidiosis, observed at this institution.

Early studies suggested that *Cryptosporidium* species are host-(12) and site-specific (13). More recently, a wide host range of a single species of *Cryptosporidium* in mammals, regardless of the host's immune status has been supported (3). Nevertheless, a comparative study of the parasite in horses has not been reported.

Oocysts were not seen in the feces of the dams and the source of the infection is not known. Other livestock or pets were not present on the two farms and during their lives the foals were not in contact with other animals. Oocysts were not observed in over 1600 fecal samples taken from clinically normal adult cows on farms where cryptosporidiosis of young calves was highly prevalent (14). In the present cases, it seems likely that transmission of the infection was from the dams because of the absence of other domestic animals. However, because of the demonstrated broad host range of the parasite (2), the possibility of transmission to these foals from wild hosts, such as rodents, cannot be disregarded.

Due to the difficulty in recognizing the small oocysts, it is possible that cryptosporidiosis is more prevalent in horses than has been previously reported (7,10). Routine flotation examinations of horse feces to detect parasite eggs are usually scanned at relatively low magnification. Such examinations may not reveal cryptosporidian oocysts which measure between 3 and 5  $\mu$ m in diameter. In fecal flotation smears, these oocysts were shown to be easily detected by phase contrast microscopy (15).

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### References

1. LEVINE ND. Protozoan parasite of domestic animals and man. 2nd ed. Minneapolis: Burgess Publications, 1973: 229-230.
2. TZIPORI S. Cryptosporidiosis in animals and humans. Microbiol Rev 1983; 47: 84-96.
3. LEVINE ND. Taxonomy and review of the coccidian genus *Cryptosporidium* (Protozoa, Apicomplexa). J Protozool 1984; 31: 94-98.
4. VETTERLING JM, TAKEUCHI A, MADDEN PA. Ultrastructure of *Cryptosporidium wairi* from the guinea pig. J Protozool 1971; 18: 248-260.
5. HOERR FJ, RANCK FM, HASTINGS TF. Respiratory cryptosporidiosis in turkeys. J Am Vet Med Assoc 1978; 173: 1591-1593.
6. CURRENT WL, REESE NC, ERNST JV, BAILEY WS, HEYMAN MB, WEINSTEIN WM. Human cryptosporidiosis in immunocompetent and immunodeficient persons. N. Engl J Med 1983; 21: 1252-1257.
7. SNYDER SP, ENGLAND JJ, McCHESNEY AE. Cryptosporidiosis in immunodeficient Arabian foals. Vet Pathol 1978; 15: 12-17.
8. QUEENSLAND DEPARTMENT OF PRIMARY INDUSTRIES. Annual Report 1981-1982. Brisbane, Australia, 1982.
9. TZIPORI S, CAMPBELL I. Prevalence of *Cryptosporidium* antibodies in 10 animal species. J Clin Microbiol 1981; 14: 455-466.
10. REINEMEYER CR, KLINE RC, STAUFFER GD. Absence of cryptosporidium oocysts in faeces of neonatal foals. Equine Vet J 1984; 16: 217-218.
11. MARTENS RJ, STRUTCHFIELD WL. Foal diarrhea: Pathogenesis, etiology and therapy. Compend Contin Educ 1982; 4: 175-187.
12. ISEKI M. *Cryptosporidium felis* sp. n. (Protozoa: Eimeriorina) from the domestic cat. Jpn J Parasitol 1979; 28: 285-307.
13. TYZZER EE. *Cryptosporidium parvum* (sp. nov.) a coccidium found in the small intestine of the common mouse. Arch Protistenkd 1912; 26: 394-412.
14. ANDERSON BC. Cryptosporidiosis in calves: epidemiologic question, diagnosis and management. Proc 11th Annu Meet Am Assoc Bovine Practitioners 1982; 92-94.
15. WILLSON PJ, ACRES SD. A comparison of dichromate solution floatation and fecal smears for diagnosis of cryptosporidiosis in calves. Can Vet J 1982; 23: 240-246.