

# Human Cryptosporidiosis Associated with an Epizootic in Calves

JOHN S. REIF, DVM, MSc(MED), LYNNE WIMMER, DVM, JOHN A. SMITH, DVM, MS,  
DAVID A. DARGATZ, DVM, MS, AND JOHN M. CHENEY, DVM, MS

**Abstract:** An outbreak of human cryptosporidiosis occurred among previously healthy persons in a veterinary medical teaching hospital. Human illness began after admission of calves from a farm which had been experiencing an epizootic of neonatal diarrhea due to *Cryptosporidium*. The clinical syndrome in humans was characterized by watery diarrhea, abdominal cramping, flatulence, and headache. Cryptosporidiosis was confirmed by zinc sulfate flotation of fecal specimens in four persons, three of whom had been responsible for the care and treatment of infected calves. A fourth

patient had washed her husband's soiled clothing and appeared to have been infected indirectly through fomite contamination. Among 112 persons surveyed, 26 (23.2 percent) had a diarrheal illness during the outbreak and nine met the case definition of a diarrheal illness lasting at least three days. These persons were more likely to have had contact with a calf with diarrhea than were 52 referents who did not become ill during the outbreak. (*Am J Public Health* 1989; 79:1528-1530.)

## Introduction

*Cryptosporidium* is an intestinal protozoan parasite, recognized relatively recently as a human pathogen,<sup>1</sup> despite its original identification over 70 years earlier.<sup>2</sup> Following the description of the first human case of cryptosporidiosis in 1976, the disease was reported rarely, and primarily in immunocompromised persons.<sup>3</sup> Since 1982, the number of reported cases has increased dramatically.<sup>4</sup> Initially this increase was noted in patients with acquired immunodeficiency syndrome<sup>5</sup> but recent reports indicate that cryptosporidiosis also occurs in immunologically normal persons.<sup>6-8</sup> In immunocompetent persons, cryptosporidiosis is manifested as an acute, self-limiting diarrheal illness lasting five to six days.<sup>4,6-8</sup> Cases of cryptosporidiosis have been described in travelers,<sup>9</sup> residents of day care centers,<sup>10</sup> animal handlers,<sup>8,11</sup> veterinary students,<sup>12-14</sup> and following consumption of contaminated community water supplies<sup>15</sup> or surface waters.<sup>16</sup> A previous description of an outbreak of cryptosporidiosis among five veterinary medical students<sup>13</sup> was ascribed to contact with experimentally infected calves. Recently, infection of at least 10 students who had had contact with 1-to-3-day-old calves in a laboratory setting was described.<sup>14</sup> We report here an outbreak of cryptosporidiosis among previously healthy veterinary students associated with a spontaneous epizootic of bovine cryptosporidiosis in a clinical setting.

## Methods

### Outbreak in Humans

The index case was a 34-year-old female veterinary student whose duties included nursing care, sample collection, and treatment of calves with diarrhea which were subsequently identified as infected with cryptosporidia. On April 6, 1987, one week after her initial contact with the calves, she complained of watery diarrhea, abdominal cramps, nausea, fever (greater than 99°F), headache, vom-

iting and flatulence; she was ill for two weeks. She received medical attention and was found to have cryptosporidiosis after parasitologic examination of her stools.

During the next two weeks, several additional students and faculty members complained of gastrointestinal symptoms. A large proportion of these persons were associated with the food animal services. When cryptosporidia were identified in calves hospitalized in the isolation unit, a potential relationship between the animal and human diarrheal illnesses became apparent.

An investigation was initiated on April 17, 1987. A questionnaire distributed to all students and food animal hospital staff included items on recent gastrointestinal illness, and exposure to potential risk factors in the hospital and at home. Dates of potential exposure to calves in the isolation unit were determined from student duty rosters. Persons experiencing diarrheal illness and others with food animal contact were asked to submit stool samples.

Parasitologic examination for cryptosporidia oocysts consisted of fecal flotation by centrifugation of zinc-sulfate (sp. gr. 1.18) to which aqueous iodine had been added.<sup>17</sup> Cover slips from these flotations were examined by light and phase contrast microscopy. Fecal smears were examined after methanol fixation and Ziehl-Nielsen staining.<sup>18</sup> Analysis of risk for specific exposures was accomplished by calculation of odds ratios (OR) for persons experiencing a diarrheal illness, using those who remained clinically normal as the comparison group.<sup>19</sup> Confidence intervals (95% CI) for these risk estimates were obtained by exact testing.<sup>20</sup>

### Epizootic in Calves

An outbreak of diarrheal illness in beef calves occurred on a farm in northern Colorado. Virtually all of the 91 calves born after February 1987 developed postnatal diarrhea. Newborn calves continued to develop diarrhea during the first week of life as the calving season progressed. Due to the continuing nature of the diarrheal disorder, four newborn calves with severe diarrhea and dehydration were admitted to the Veterinary Teaching Hospital on March 23, 1987 and placed in the isolation unit. Additional affected calves were admitted weekly until June 6. On April 16, 1987 a fecal flotation performed on one of the inpatient calves revealed the presence of cryptosporidia oocysts. Upon testing of additional inpatient calves, 6/6 (100 percent) were positive for *Cryptosporidium*. Among 20 calves tested which remained on the farm, 17 (85 percent) were positive. Other potential enteric pathogens identified in calves from this farm included

From the Departments of Environmental Health (Reif, Wimmer), and Clinical Sciences (Dargatz, Smith) and the Diagnostic Laboratory (Cheney), College of Veterinary Medicine and Biomedical Sciences, Colorado State University. Address reprint requests to Dr. John S. Reif, Department of Environmental Health, College of Veterinary Medicine and Biomedical Sciences, Colorado State University, Fort Collins, CO 80523. This paper, submitted to the Journal October 24, 1988, was revised and accepted for publication April 27, 1989.

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*Campylobacter*, *E. coli*, bovine coronavirus, and bovine rotavirus.

### Results

Diarrhea occurring between March 16 and April 26, 1987 was reported by 26 of 112 questionnaire respondents (Table 1). With the exception of one unconfirmed illness, all cases were clustered in the three-week period between April 6 and April 26, 1987. In order to attempt to exclude short-lived illness due to viral and bacterial enteric pathogens and dietary upset, a case definition of diarrheal illness lasting at least three days was adopted. Nine respondents (7.4 percent) met this criterion and were defined as cases in subsequent analyses. Cryptosporidiosis was confirmed by identifying oocysts in stool specimens from four persons among six who reported diarrhea. Conversely, cryptosporidia were not detected in any of nine other individuals without a history of recent diarrhea.

Fourth year students had more frequent direct contact with diarrheic calves, adult cattle, and other animals than third year students during the outbreak. Three of the confirmed cases were fourth year students who had responsibility for therapy of the diarrheic calves in the isolation unit between April 1 and the date of diagnosis. The fourth was a female hospital employee whose spouse was a student. She denied contact with calves in the isolation unit. However, her husband had contact with the calves during the weeks of April 6 and 13 and she had washed his fecally contaminated clothing. She became ill during the week of April 13, complaining of a mucoid and watery stool, abdominal cramps, fever, nausea, vomiting, and flatulence.

A watery stool was reported by all patients. Abdominal cramping, flatulence, and headache were predominant features of the clinical disorder. The symptoms reported by persons with parasitologically confirmed cryptosporidiosis were generally similar to those reported by the unconfirmed cases.\* The mean duration of illness in confirmed cases was seven days; the illness lasted over two weeks in one person.

The association between personal and occupational risk factors and the occurrence of gastrointestinal illness during the outbreak was examined.\* The reference group comprised all fourth year student and staff respondents without a history of gastrointestinal illness (N = 52). Odds ratios of 13.2 and 11.8 were found for contact with a calf with diarrhea and having taken a calf's temperature, while intubating a calf for anesthesia carried no excess risk. The exact confidence intervals around these risk estimates were wide due to the small number of persons affected but did not include one.

\*Complete data available on request to authors.

**TABLE 1—Frequency of Symptoms, Duration of Illness and Isolation of *Cryptosporidium* during Outbreak of Gastrointestinal Illness in a Veterinary Teaching Hospital, March 16 to April 26, 1987**

	Fourth Year Students	Third Year Students	Hospital Personnel	Total
Persons Responding	45	47	20	112
Persons with Diarrhea	10	13	3	26
Persons with Symptoms				
≥3 Days	8	0	2	9
Confirmed Cases	3	0	1	4

Contact with dogs, cats, or foals with diarrhea did not increase risk.

No association was found between human gastrointestinal illness during the outbreak and having a child in a day care center, or consumption of untreated surface water. The community is served by a municipal water system which uses complete conventional treatment consisting of chlorination, alum and polyelectrolyte coagulation and flocculation and rapid sand filtration through multimedia filters. Cases were not more likely than members of the comparison group to have had another illness, a history of frequent diarrhea or blood transfusion, or to have taken oral antibiotics during the previous month. A high proportion of both affected and unaffected students claimed to be under physical or psychological stress.

### Discussion

The outbreak of cryptosporidiosis reported here reemphasizes the importance of this organism as a cause of gastrointestinal illness in previously healthy, immunocompetent persons.<sup>6-8,15,16,21,22</sup> Travelers, residents of day care centers, homosexual males, and children in developing countries constitute important risk groups for this cosmopolitan parasite.<sup>23</sup>

In the current outbreak, calves served as the source of human infection. This occurred despite the facts that veterinary students have frequent contact with diarrheic patients of many species, and that *Cryptosporidium* is reported to display little, if any, host specificity.<sup>4</sup> However, it is not clear if *Cryptosporidium* oocysts from animals other than cattle are infectious for humans. Previous reports of cryptosporidiosis in veterinary medical students have also involved contact with calves. In one, a student who provided supportive care of two calves with cryptosporidiosis became ill,<sup>12</sup> and in another, five students caring for experimentally infected newborn calves were affected.<sup>13</sup> In a recent report,<sup>14</sup> *Cryptosporidium* was detected in 10 of 20 students who had contact with 1-to-3-day-old calves in a student laboratory. The incubation period ranged from five to 14 days after exposure and the diarrhea lasted 30 hours to 16 days. Two infected students had only nausea or headache, suggesting that unrecognized infections may occur.

Reports of cryptosporidiosis in research workers<sup>11,24</sup> and animal handlers<sup>8,24</sup> with direct contact with feces from experimentally and naturally infected calves add to the evidence that the young calf is an important source of human infection. The reason for the consistent role of the calf as a source of cryptosporidiosis for humans is not clear, but may be related to the high prevalence of infection among calves,<sup>25</sup> and shedding of large numbers of oocysts for prolonged periods.<sup>26</sup> The preeminence of diarrheic calves as a source of transmission for zoonotic cryptosporidiosis dictates the necessity for exposed persons to adopt stringent hygienic precautions including protective clothing when working in an environment potentially contaminated with *Cryptosporidium*.

Fomites appear to constitute a hazard for the indirect transmission of *Cryptosporidium*. In the current outbreak, one confirmed human case had contact with clothing soiled with fecal material from infected calves as the likely source of infection. The oocysts of *Cryptosporidium* are resistant to desiccation and several disinfectants<sup>27</sup> and are thus likely to persist in the environment. Evidence that waterborne transmission occurs supports this hypothesis.<sup>15,16</sup>

The outbreak began approximately two weeks after the first calves were admitted, but the status of shedding of *Cryptosporidium* by specific animals was not determined until after the onset of the epidemic in humans. Instituting hygienic measures and awareness of the existence of an epidemic of gastrointestinal illness among students with contact with calves may have contributed to the cessation of clinical cases after the week of April 20, despite the fact that calves continued to be admitted to the hospital from the farm in question.

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### Public Health Service Implementation Plan for Responding to Nursing Shortage

The US Public Health Service has developed an implementation plan in response to the recommendations of the Secretary's Commission on Nursing, according to O. Marie Henry, RN, DrPH, PHS Chief Nurse Officer. Reporting recently to the Advisory Council on Nurses Education of the Health Resources and Services Administration, in Rockville, MD, Dr. Henry indicated that the plan is intended to coordinate activities and resources among PHS agencies and establish a focus within the US Department of Health and Human Services for responding to the nursing shortage.

In general, the plan continues current activities in such areas as research, financial assistance, and program development, within available resources, and also establishes new initiatives. The plan is organized around nine major objectives in the general categories of resource development, maintenance, and utilization, Dr. Henry said.

Copies of the 16-page "Public Health Service Implementation Plan for the Secretary's Commission on Nursing Final Report" are available from the Office of the USPHS Chief Nurse Officer, Room 14A-40, 5600 Fishers Lane, Rockville, MD 20857. Tel: (301) 443-0577.