Cryptosporidiosis in children who visited an open farm

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Summary

In the summer of 1995, cryptosporidiosis was diagnosed in a child in hospital. This child had taken part in a summer activity project involving 161 children and nine adults. Reports of a similar illness among a number of other participants prompted an outbreak investigation. A cohort study was conducted in two phases. Thirteen children (aged 6 to 15 years) out of 161 respondents to the first questionnaire met the case definition for illness and cryptosporidium was detected in stools from seven of the 13. Illness was significantly associated with child participants who had visited an open farm ($p<.000005$). Nine of the cases sought medical attention, and two were admitted to hospital. The second phase of the cohort study was conducted among 52 of the 55 people who had visited the open farm. Illness was significantly associated with playing in sand to which animals had access, at the edge of a stream beside a picnic area ($p<.005$). Contact with various animals was not associated with illness. This outbreak emphasises the risk for children of visiting open farms. Managers of open farms need to be aware of the potential for transmission of infectious diseases to visiting children. Strict implementation of hygiene measures is essential to minimise risk.

Introduction

Cryptosporidium, first recognised in 1907[1], was identified as a human pathogen in 1976[2]. It can be acquired from young animals, through drinking contaminated water, and from infected people [3]. A two year study of patients with presumed infective diarrhoea, carried out by 16 public health laboratories in England and Wales, found that cryptosporidium was the second commonest pathogen in children after campylobacter [4]. Educational farm visits have previously been described as a potential source of zoonotic infection in children [3,5-7]. We report an outbreak of cryptosporidiosis, in which an additional risk factor for infection was identified. To our knowledge, this is the first description of an outbreak of cryptosporidiosis in the Republic of Ireland.

Case report

In the summer of 1995, a 7 year old girl was admitted to hospital with dehydration, abdominal colic, profuse watery diarrhoea, and weight loss. Full blood count was normal. Her serum sodium was 134mmol/l (normal range 135-145mmol/l) on admission and fell to 127mmol/l as her symptoms persisted over the next two days. Cryptosporidium was identified in her stools. In view of the severity and persistence of her symptoms, the child was treated with paromomycin 30mg/kg/day for six days. The child recovered and, when tested five days after starting paromomycin, no pathogen was found in her stool.

It transpired that other children in the neighbourhood had a similar illness. All those who were ill had taken part in a summer activity project, and some had visited an open farm. The medical officer of health (MOH) was alerted. Animals on the farm were not tested following consultation with a veterinary officer who felt there was little value in doing so, as excretion of cryptosporidium might be expected in young animals. The MOH and a senior environmental health officer (SEHO) visited the farm and recommended infection control measures. A cohort study was initiated to investigate the outbreak.

Investigations

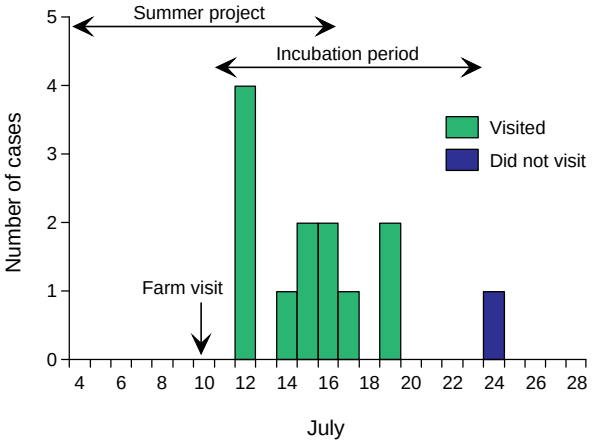
The index case had been taking part in a summer activity project attended by 161 children with nine adult committee members. Activities included crafts, bingo, swimming, bowling, puppet show, fancy dress, a concert, and visits to a pet farm, cinema, and an amusement centre. Participants had to register for most project events, and an organising committee kept a list of participants. A few events, such as the fancy dress and the concert, were open to all and no register was kept. A cohort study was undertaken to ascertain associations between various exposures and the subsequent development of illness. All activities for which participants had to register were examined in the first phase of the study, in which a self administered (with parental help for younger participants) questionnaire was used to describe the outbreak in terms of person, place, and time, define the clinical features of the illness, and measure the risks from various environmental exposures.

A case was defined as a person who had taken part in the summer project and who had developed diarrhoea and vomiting between 4 and 28 July 1995. The identification of

Box Guidelines for safe farm visits

Managers of farms	Farm visitors
Have clear legible notices of farm hazards.	Do not taste animal food
Keep picnic area free of animals.	Do not drink unpasteurised milk
Provide adult supervision of visitors, especially chidren, and discourage children from placing their fingers in their mouth.	Drink water only from a designated tap
Isolate sick animals.	Wash hands thoroughly after visit including after removing footwear
Remove animal excreta from public areas regularly.	Wash hands before eating food or sweets
Provide adequate accessible toilet and handwashing facilities.	Pregnant women should avoid handling any animals

Figure Cases of cryptosporidiosis (n=13) related to a farm visit



cryptosporidial oocysts in stool specimens was a further criterion used to confirm cases and to assist the diagnosis of children who did not fulfil the clinical case definition. Oocysts of cryptosporidium were sought on light microscopical examination of faecal concentrates stained by a modified Ziehl-Nielsen stain. Water samples were obtained from the well on the farm and tested for cryptosporidium using standard methods[8]. The following preparation was made before the water was taken. The water tap was sterilised by flaming with a blow torch for about two minutes. The tap water was then run for two minutes before taking the sample. A 20 gallon sample of water was then sealed in a large plastic container and taken to the microbiology laboratory.

The second phase of the investigation focused on those who had visited an open farm. A telephone questionnaire was used to obtain demographic details, information about farm animal exposures, environmental exposures on the farm, and refreshments taken on the farm, and ask about the usual health of the project member and medical consultations and medications taken for illness related to the outbreak. Information about secondary cases in households was requested.

Data were analysed using the statistical package Epi Info Version 5[9]. Proportions were analysed using chi squared analysis and Fisher's exact two tailed test where appropriate. Stratified analysis was performed using the Mantel-Haenszel method.

Results

Environmental

A visit to the farm showed that visitors had unrestricted access to calves, goats, rabbits, and lambs, and that other penned animals could be stroked. Children were encouraged to milk the goat. A stream flowed through the farm next to the picnic area where there was a sand pit. Animals roamed the picnic area and sand pit. There were animal and bird droppings throughout the farm and cow pats on the sand. The farm's water supply came from a shallow well. Handwashing facilities were inadequate for the numbers visiting the farm. There were cold water taps only, the towels were dirty, and the facilities were far from the picnic area. The SEHO gave the farm manager guidelines to improve hygiene (box).

Epidemiological/microbiological

One hundred and sixty-one of the 170 participants (161 children and 9 adults) completed the first, self administered questionnaire. The 161 comprised 152 children and nine adults. Eight per cent of respondents, all children, (13/161) met the case definition. Stool specimens were submitted by seven of the 13 who fulfilled the case definition and cryptosporidium oocysts were detected in all. No deaths occurred but two children were admitted to hospital. The mean duration of illness was 8.5 days (range 3 to 17 days). Six stool specimens submitted by individuals who were ill but did not fulfil the case definition were all negative.

Project participants ranged in age from 4 to 46 years. The median age of the 152 children who responded was 11 years and the median age of the cases was 10 years (range 6 to 15 years). Ten of the cases were female, not significantly different from the sex distribution of the cohort of children who visited the farm, 16 males and 27 females (p=0.16). Cases arose over a 13 day period in July 1995 (figure) and symptoms are listed in table 1.

Relative risks of illness associated with various potential exposures were calculated. Illness was significantly related only to visiting the open farm and the cinema (table 2). Following stratified analysis, controlling for exposure to the farm and cinema, only exposure to the farm remained significantly associated with illness. One child who had not visited the farm met the case definition. It is likely that she was a secondary case as her two siblings had visited the farm and had positive stool specimens.

In the second phase of the study, 52 out of 55 (aged 6 to 46 years) who had visited the farm were interviewed. Twelve met the case definition, nine of whom sought medical attention for their illness. Ten cases took medication, including antimotility drugs and antibiotics. Underlying chronic illness – for example, asthma – did not predispose to cryptosporidiosis. None of the patients was immunocompromised.

Illness was significantly associated with play in sand at the edge of a stream beside the picnic area to which animals had access (table 3). Eating chips was also significantly associated with illness, but when the data were stratified into adults and children, playing in the sand remained significant while eating chips did not. Handwashing appeared to be protective among children: the attack rate was 50% for those who did not wash hands compared with 22% for those who did, but the difference was not significant (p=.055). No significant difference in exposures to various farm animals was identified between

Table 1 Symptoms reported by 13 cases of cryptosporidiosis

Symptoms	Number with symptoms
Diarrhoea, vomiting, nausea	13
Abdominal pain, listlessness	12
Fever, loss of appetite	11
Weight loss	10
Headache, cough	7
Aching muscles or joints, sore throat, chest pain	6

Table 2 Relationship between activities and the development of illness

Activity		Exposed		Not exposed		Relative risk (95% confidence interval)	p value
		Ill/n	Attack rate (%)	Ill/n	Attack rate (%)		
Farm visit		12/52	23.1	1/109	0.9	25.51 (3.36 - 188.32)	0.000
Swimming pool	1st visit	3/41	7.3	10/120	8.3	0.88 (0.25 - 3.04)	NS
Swimming pool	2nd visit	6/45	13.3	7/116	6.6	2.21 (0.79 - 6.22)	NS
Amusement centre		6/78	7.6	7/83	8.4	0.91 (0.32 - 2.60)	NS
Bowling alley	1st visit	5/54	9.3	8/107	7.5	1.24 (0.43 - 3.60)	NS
Bowling alley	2nd visit	7/56	12.5	6/105	5.7	2.19 (0.77 - 6.20)	NS
Crafts	1st session	7/66	10.6	6/95	6.3	1.68 (0.59 - 4.77)	NS
Crafts	2nd session	7/60	11.7	6/101	5.9	1.96 (0.69 - 5.57)	NS
Puppet show		3/39	7.7	10/122	8.2	0.94 (0.27 - 3.24)	NS
Cinema visit		9/50	18.0	4/111	3.6	5.00 (1.61 - 15.46)	0.004

n - total number in each category. Ill - number fulfilling case definition.

those who became ill and those who remained well (table 4).

A further 14 stool specimens were received from participants in the second phase of the study. All were negative for cryptosporidium. One specimen was from a child who had previously submitted a specimen positive for cryptosporidium. The other 13 had not previously submitted a specimen. A water sample from the well on the farm was negative for cryptosporidium.

Discussion

This outbreak repeats the observation that children who visit open farms may be exposed to risk of cryptosporidiosis[3,5-7]. The response rate to our investigations was high, which may be because the community was close-knit and many were concerned by the admission to hospital of two of the affected children.

Cryptosporidiosis is generally a self limiting illness in immunocompetent people. Nonetheless, in this outbreak, medical attention was sought by three quarters of those affected, two of whom were admitted to hospital. In healthy children, cryptosporidiosis typically causes symptoms for about 10 to 14 days, but symptoms may persist for up to a month[10,11]. Many cases in this outbreak suffered not only diarrhoea and vomiting but also other gastrointestinal symptoms, weight loss, and fever. Over half had a cough. Transitory cryptosporidial infection of the respiratory tract due either to inhalation of the oocysts or aspiration of vomit that contains oocysts may be common in immunocompetent children and has been previously reported[12]. Paromomycin has been found to be of use in the treatment of cryptosporidiosis in immunocompromised patients[13] and was used to treat the index case, but coincidental resolution of symptoms cannot be ruled out.

Our experience with this outbreak suggests that cryptosporidiosis is an underrecognised cause of enteritis in the Republic of Ireland. In this outbreak a specific diagnosis was made at the time of illness in the index case only, underscoring the need to remember that this organism can cause enteritis in children. Avoiding delays in diagnosis may reduce unnecessary prescribing of antimotility drugs and antibiotics, which should not usually be given for acute diarrhoea, particularly in young children. The epidemic curve is consistent with a point source, which is likely to have been the open farm. The first child became ill within two days of visiting the farm and the

Table 3 Environmental exposures and refreshments served on the farm and the development of illness

Exposure	Exposed		Not exposed		Relative risk (95% confidence interval)	p value
	Ill/n	Attack rate (%)	Ill/n	Attack rate (%)		
Playing in the sand	12/33	36.3	0/19	0	- - -	0.0019
Paddling in the stream	11/40	27.5	1/12	8.3	3.30 (0.45 - 23.03)	NS
Playing in the stream	12/42	28.6	0/10	0	- - -	0.056
Handwashing	8/44	18.2	4/8	50.0	0.36 (0.14 - 0.93)	0.07
Nailbiting	4/16	25.0	8/35	22.9	1.09 (0.38 - 3.11)	NS
Ingestion of chips	12/41	29.3	0/11	0	- - -	0.0427
Ingestion of sausage(s)	11/42	26.2	1/10	10.0	2.62 (0.38 - 18.00)	NS
Ingestion of buscuit (s)	10/31	32.3	2/21	9.5	3.39 (0.82 - 13.92)	NS
Ingestion of orange juice	10/38	26.3	2/13	15.4	1.71 (0.43 - 6.80)	NS

n - total number in each category. Ill - number fulfilling case definition.

Table 4 Exposure to animals and the development of illness

Exposure	Exposed		Not exposed		Relative risk (95% confidence interval)	p value
	Ill/n	Attack rate (%)	Ill/n	Attack rate (%)		
Pet calf	7/26	26.9	5/25	20.0	1-35 (0.49 – 3.69)	NS
Calf's mouth	1/4	25.0	11/48	22.9	1-09 (0.18 – 6.44)	NS
Fox	0/2	0	12/50	24.0	0 – –	NS
Guinea pig	0/2	0	12/49	24.5	0 – –	NS
Kitten	1/8	12.5	11/44	25.0	0-50 (0.07 – 3.35)	NS
Rabbit	11/44	25.0	1/8	12.5	2-00 (0.30 – 13.42)	NS
Donkey	3/7	42.9	9/45	20.0	2-14 (0.76 – 6.04)	NS
Deer	2/3	66.6	10/49	20.4	3-27 (1.24 – 8.64)	NS
Lamb	2/11	18.2	9/39	23.1	0-79 (0.20 – 3.13)	NS
Chickens	5/15	33.33	7/37	18.9	1-76 (0.66 – 4.69)	NS
Horse	0/3	0	12/49	24.5	0 – –	NS
Cows	2/9	22.2	10/43	23.3	0-96 (0.25 – 3.64)	NS
Pig	0/2	0	12/50	24.0	– – –	NS
Fed the animals	7/28	25.0	5/24	20.8	1-2 (0.44 – 3.29)	NS

N - total number in each category. Ill - number fulfilling case definition

twelfth within nine days. The thirteenth case was a child who had not visited the farm but lived in a household with two other cases. A household outbreak has been reported previously[14].

Cryptosporidiosis is recognised as a zoonosis and contact with farm animals has previously been associated with transmission to children[5-7,15]. Although we investigated the farm visit in detail, the number of visitors was so small that risks associated with specific animals or activities may have been obscured. The children were quite young, and their recall of events may have been a factor in the lack of association of the various exposures. Nonetheless, playing in the sand beside the stream to which animals had access was significantly associated with becoming ill ($p<.005$) and playing in the stream almost attained significance ($p=.056$). The sand was not sampled but, as multiple cowpats and other droppings were seen in the area, it is reasonable to suggest that sand contaminated with animal faeces may have been the vehicle of infection. We are not aware that contaminated sand has previously been described as a vehicle for transmission of cryptosporidiosis.

Consistent with other studies, data reported here support the role of handwashing in preventing the spread of cryptosporidiosis. Inadequate handwashing assists the spread of infection in an outbreak[7]. In this outbreak eating chips was associated with illness in the group as a whole. Chips are usually eaten with fingers, whose hygiene depends on handwashing. Guidelines have been produced to reduce the risk of infection to farm visitors[3]. When assessing risks for farm visitors, the farm environment, livestock and feeding practice, and the provision and safe handling of food and drink all need to be considered[3]. For farm visitors, safe hygiene practices are probably the most important preventive measure for gastrointestinal infections such as cryptosporidiosis[3] and farm managers should stress this to visitors, if further outbreaks are to be prevented. This outbreak could have easily been missed. Currently cryptosporidiosis is not a statutorily notifiable disease in the Republic of Ireland. We would recommend that it should become statutorily notifiable in order to obtain a more realistic picture of its incidence and impact.

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