J. Hyg., Camb. (1986), **96**, 107–111
Printed in Great Britain

The incidence of cryptosporidiosis: a two-year prospective survey in a children's hospital

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(*Received 4 September 1985; accepted 18 September 1985*)

SUMMARY

A two-year prospective survey of patients with diarrhoea at a children's hospital detected 65 cases of cryptosporidiosis; 56 were index cases representing 1·4% of patients examined. There was a marked seasonal variation with fewer index cases in July–September (0·4–0·6%) than February–April (3–5%). All four adult cases were contacts of infected children and 21 (32%) of the patients were 12 months old or younger. *Cryptosporidium* was the fourth commonest diagnosed cause of gastroenteritis, the second most common non-viral cause, was responsible for 7·2% of all cases, and 14·7% of non-viral cases where a cause was identified. As such it should be sought routinely in cases of gastroenteritis in children.

INTRODUCTION

Evidence is accumulating on the role of *Cryptosporidium* as a cause of gastroenteritis in immunocompetent individuals, although its precise importance is unclear (Editorial, 1984). A more recent editorial suggests that diagnostic laboratories should consider it only in relation to zoonoses, diarrhoea in day-care centres, and AIDS, until more information comes to hand (Editorial, 1985). There is good evidence that cryptosporidiosis is clinically important particularly in children and the immunocompromised (Current *et al.* 1983; Hunt *et al.* 1984; Hart, Baxby & Blundell, 1984; Isaacs *et al.* 1985) but detailed information is lacking on the incidence of infection. Geographical, environmental, and seasonal factors might affect the incidence. In the UK the first case was reported to the Public Health Laboratory Service in June 1983, and increasing numbers have been reported since. This increase has occurred largely because more laboratories are starting to investigate the infection, and this obscures data on possible seasonal variation. The numbers reported also include outbreaks and imported cases, and so data on the basic endemic incidence are obscured.

Figures from the UK vary from 1·1% of 2174 patients seen during six months in Blackburn (Wright, Harrison & Byrom, 1984) to 7·2% of 166 patients seen in two months in rural Yorkshire (Wyllie, 1984). We present here information on the total, seasonal and relative incidence of cryptosporidiosis seen during a two-year prospective survey in a children's hospital drawing patients from an urban area.

METHODS

All faecal samples received from patients with diarrhoea referred by their doctor to Alder Hey Children's Hospital, or brought by their parents to the Accident and Emergency Department, were examined for *Cryptosporidium* oocysts (Baxby, Blundell & Hart, 1984). No other selection was used, except that contacts of cases were examined where possible. The survey period was June 1983 to May 1985 inclusive. Throughout the survey all samples were examined for enteropathogenic bacteria and *Giardia*. All samples received during April 1984 to March 1985 inclusive were also examined for viruses by electron microscopy. Faeces from all cases of cryptosporidiosis were examined for viruses and *Clostridium difficile* toxin. Faecal samples from 435 patients who had not recently had diarrhoea were also screened for *Cryptosporidium* oocysts.

RESULTS

Total incidence

Sixty-five cases of cryptosporidiosis were detected among 4028 patients, an overall incidence of 1·6 %. Fourteen of the patients were children brought by their parents to the Accident and Emergency Department. Clinical details of the first 26 immunocompetent patients have been described elsewhere and may be taken as representative of the remainder (Hart, Baxby & Blundell, 1984). Sixty-one of the patients were children, three of whom were immunocompromised. One was receiving immunosuppressive therapy for leukaemia (Lewis, Hart & Baxby, 1984) and two had an IgA deficiency. One of these last two remains particularly ill with intestinal and respiratory cryptosporidiosis and requires intravenous support more than 4 months after diagnosis despite spiramycin therapy.

Fifty-six cases could be regarded as index cases. In some instances there was case-to-case spread (Baxby, Hart & Taylor, 1983) but in others a common source could not be excluded. No connection was found between the index cases and they can be regarded as representing 56 incidents or outbreaks, giving an incidence of 1·4 % outbreaks among the total patients examined. The actual number of cases involved could have been much higher. There was a slightly higher incidence of index cases in the second year, 1·7 % compared to 1·2 %. The difference however was not statistically significant (χ^2, $P > 0{\cdot}1$). No oocysts were found in the faeces of the 435 control patients.

Seasonal incidence

The two-year period allowed a preliminary estimate to be made of possible seasonal variations (Fig. 1). During the first year there was a significantly lower incidence of index cases during July–September (0·6 %, 4/707 patients) than in February–April (3·3 %, 13/396 patients; χ^2 with Yates's correction, $P < 0{\cdot}01$). The peak incidence of 5·8 % in the first year occurred in March (8/137 patients). This pattern was repeated in the second year with significantly different incidences of index cases of 0·4 % (2/455 patients) in July–September and 5·2 % (19/363 patients) in February–April (χ^2 with Yates's correction, $P < 0{\cdot}001$). The peak incidence of

https://doi.org/10.1017/S0022172400062598 Published online by Cambridge University Press

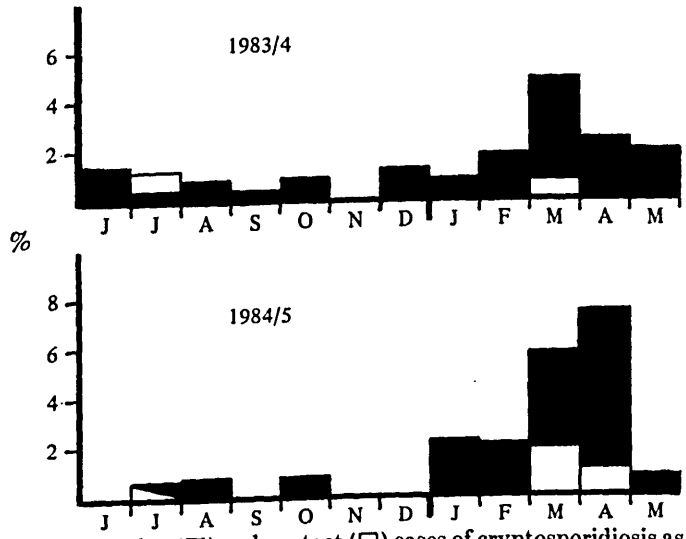

Fig. 1. Incidence of index (■) and contact (□) cases of cryptosporidiosis as percentage of patients examined per month. Top, June 1983 to May 1984 inclusive; 28 index cases, 2341 patients (1·2%). Bottom, June 1984 to May 1985 inclusive; 28 index cases, 1687 patients (1·7%).

Table 1. *Age distribution of 65 cases of cryptosporidiosis seen at a children's hospital*

	Months			Years					
Age...	< 4	... 8	... 12	... 2	... 3	... 4	... 5	... 12	... Adult
No....	9	6	6	19	8	6	2	5	4
%	13·8	9·2	9·2	29·2	12·3	9·2	3·1	7·7	6·2

6·4% (17/265 patients) occurred in March–April. The incidence so far in June–August of the third year is again low (3/418 patients, 0·7%).

Age-related incidence

The age-distribution of cases is shown in Table 1. A preponderance of cases in children was expected and the four adult patients were a nurse and parents of child cases. Forty cases (62%) occurred in children under 2 years old, 21 (32%) in children less than 12 months and 9 (14%) in children less than 4 months old.

Relative incidence

The relative incidence of cryptosporidiosis can be seen from Table 2, which summarizes the results of the 12-month comprehensive survey within the two-year cryptosporidiosis survey. The results show that *Cryptosporidium* is important, even when viruses are included. *Cryptosporidium* was the second most commonly detected non-viral enteropathogen and was responsible for 7·2% of all cases, and 14·7% of non-viral cases where a cause was identified. In only five cases was another

Table 2. *Causes of gastroenteritis diagnosed during a twelve-month survey in a children's hospital**

Virus, 237 (51·5)		Bacteria, 160 (34·8)		Protozoa, 63 (13·7)	
Rotavirus	154 (33·5)	Aeromonas	63 (13·7)	Cryptosporidium	33 (7·2)
Adenovirus	38 (8·3)	Salmonella	28 (6·1)	Giardia	29 (6·3)
Astrovirus	19 (4·1)	Shigella	26 (5·7)	Blastocystis	1 (0·2)
Calicivirus	14 (3·0)	Campylobacter	23 (5·0)		
SRV†	11 (2·4)	Escherichia	19 (4·1)		
Breda	1 (0·2)	Plesiomonas	1 (0·2)		

* Figures in parentheses give % of total pathogens recognized.
† SRV = 'small round viruses'

enteropathogen detected in patients with cryptosporidiosis, viz. *Escherichia coli* O111 (2 patients), rotavirus (2), *Aeromonas* sp. (1).

DISCUSSION

These results describe the endemic incidence of cryptosporidiosis seen at a children's hospital serving the suburbs of a large city. Our incidence of index cases (1·4%) compares with total incidences in the UK of 1·1% in Blackburn (Wright *et al.* 1984) and 1·6% in N. Wales (Casemore & Jackson, 1984). Our peak incidence of index cases in March–April (5·8–6·4%) compares with total incidences of 5 and 7% in short UK surveys in the Bristol and Northallerton areas (Hunt *et al.* 1984, Wyllie, 1984), and with 7·9% in Liberia (Hojlyng *et al.* 1984). That we had as high an incidence as others working in rural areas supports the view that cryptosporidiosis may not be principally a large animal zoonosis (Casemore & Jackson, 1984). We detected a slightly higher incidence of index cases in early 1985 than in 1984. This slight difference which was not statistically significant might indicate that the infection is becoming more common, or may be year-to-year fluctuation.

A seasonal peak occurred in February–April with a low incidence in summer. This occurred in both years, and appears to be extending again into the third year. A survey in Costa Rica detected peaks in two summers (Mata *et al.* 1984) and a 16-month survey in Australia detected a summer peak which did not occur the following year (Tzipori *et al.* 1983); a 12-month survey in the USA noted a late summer, early autumn peak (Wolfson *et al.* 1985). In livestock farming areas the incidence of human infection may be affected by that in newly born animal hosts, and more information is needed to establish other reasons for seasonal variations.

Our information on age-related incidence shows the importance of cryptosporidiosis in children under 2 years old, with 14% of patients less than 4 months old. This probably reflects a genuine susceptibility of, and greater severity in, young children but will also reflect their parents' enhanced concern. However others (Mata *et al.* 1984; Wolfson *et al.* 1985) have noted the absence of infection in children less than 12 months old, and cite breast-feeding as a possible explanation.

The relative importance of cryptosporidiosis is clear. Our results confirm and extend those obtained in short UK surveys in Bristol and Blackburn (Hunt *et al.* 1984; Wright, Harrison & Byron, 1984), and a one-year survey in Costa Rica (Mata *et al.* 1984). The precise ranking order of the pathogens varies in these surveys,

but it is evident that in general cryptosporidiosis is at least as common as infection with most of the accepted enteropathogenic bacteria.

Attention was first drawn to cryptosporidiosis in immunocompetent individuals in 1983 (Current *et al.* 1983). Since then sufficient information has been collected to establish the clinical importance of cryptosporidiosis in immunocompetent children. The present paper provides more evidence that the incidence of infection in children is sufficient to warrant routine investigation.

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