Intestinal parasites and diarrhoea in a childrens hospital in Sri Lanka

Jennifer Perera[1], Innocent Jayawardene[1], Lalitha Mendis[1] and Kamalika Abeyratne[2]

Summary

The objective of the study was to determine the prevalence of parasitic infestations in children with diarrhoea and its effect on the course of the diarrhoea. A case control study was carried out at the Lady Ridgeway Hospital, Colombo, Sri Lanka.

The study population consisted of 940 children with acute diarrhoea and 260 children admitted for conditions other than diarrhoea. The first sample of stool was examined for bacteria (*Salmonella spp, Shigella spp, Aeromonas spp, Campylobacter spp, Vibrio cholerae, Vibrio parahaemolyticus* and *Enteropathogenic E.coli*), viruses (rotavirus and adenoviruses) and parasites *(Entamoeba histolytica, Cryptosporidium spp, Giardia lamblia, Ascaris lumbricoides, Trichuris trichiura, Necator americanus and Enterobius vermicularis)* using standard techniques.

Among children with diarrhoea, 9.3% had parasitic infections and 6.5% were infected with parasites which are known to cause diarrhoea. In 4.5%, the parasite was the only pathogen that was detected. Malnutrition was found to be more prevalent in children whose diarrhoeal illness was associated with parasites especially in children who had *G. lamblia and T.trichiura* infections. When *Salmonella* and rotavirus diarrhoea was associated with 'non-diarrhoeal' parasitic agents more severe symptoms were observed and the duration of the illness was prolonged in rotavirus diarrhoea.

The results show that parasites may alter the course of acute diarrhoea due to bacteria and viruses. Therefore parasitological investigations should complement bacterial and viral diagnosis in patients with diarrhoea as specific therapy could be instituted.

Introduction

Diarrhoea is an important cause of morbidity and mortality in most developing countries and is the second commonest cause of morbidity among Sri Lankan children. Acute watery diarrhoea caused by bacteria and viruses can lead to death or dehydration. In contrast, intestinal parasitic infections associated with diarrhoea are less immediately dangerous, but the part they play in chronic diarrhoea and malnutrition is well documented (1, 2, 3).

The protozoans *Entamoeba histolytica, Giardia lamblia and Cryptosporidium* species and the helminth, *Trichuris trichiura* are causally associated with diarrhoea. These organisms interact with the intestinal mucosa in several ways. Pathogenic amoebae can cause tissue damage through contact cytotoxicity and by production of cytotoxins (4). Diarrhoea caused by *T.trichiura* is attributable to mechanical irritation and mucosal damage. Many of these parasites cause loss of body salts and minerals, but some (eg. *E. histolytica* and *T. trichiura)* cause loss of blood and proteins from damaged intestinal mucosa.

The influence of parasites on episodes of childhood diarrhoea has not been examined in Sri Lanka. We report here our observations on the interactions and effects of parasitic infestation in children presenting with diarrhoea.

1. *Department of Microbiology, Faculty of Medicine, University of Colombo.*
2. *Lady Ridgeway Childrens Hospital, Colombo.*

Material and Methods

We examined 940 consecutive faecal specimens from children aged one month to twelve years who were admitted from August 1987 to April 1989 to Ward number 2 of Lady Ridgeway Childrens Hospital with acute diarrhoea and 260 age matched controls admitted for conditions other than diarrhoea.

The first sample of stool obtained after hospitalisation was examined for the presence of bacterial, viral and parasitic agents. Trophozoites and cysts of *E. histolytica* and *G. lamblia* and ova of *Ascaris lumbricoides. T. trichiura, Necator americanus* and *Enterobius vermicularis* were detected in fresh stools by observing unstained direct mounts and iodine stained mounts. *Cryptosporidium* oocysts were detected by staining faecal smears by a modified Ziehl-Neelsen technique (5).

Rotavirus was detected by *Enzyme Immunoassay* (EIA) (DAKOPATTS, Denmark) and enteric adenoviruses, by latex agglutination (Adenolexorion Diagnostic, Finland).

The isolation and identification of *Salmonella species, Shigella species, Vibrio species, Aeromonas species* and *Enteropathogenic E.coli* (EPEC) were carried out using standard laboratory techniques (6). Cold enrichment followed by culture on MacConkey agar was used for the isolation of *Yersinia enterocolitica.* Labile toxin (LT) of Enterotoxigenic *E.coli* (ETEC) was detected by EIA (7). Stable toxin (ST) of ETEC was detected by DNA hybridization using an enzyme labelled probe SNAPR (Dupont - NEN research product) (8).

Each patient's clinical history, examination, nutritional status treatment and response to therapy was recorded on a clinical history sheet by the Senior House Officer. The nutritional status was determined by using the weight relative to age. Data were analysed using the standard error of difference of proportions.

Results and Discussion

Of 940 cases 87 (9.3%) had parasitic infection which was significantly higher than among controls. Only 11 of 260 (4.3%) controls had parasites in their stools. Sixty one of the 87 cases (70.1%) had parsites which are known to cause diarrhoea among which *Cryptosporidium species* and *T. trichiura* were the predominant parasites (Table 1). In 39 of these 87 patients (44.8%), the parasite was the only pathogen that was detected. In 48 patients parasites were found concomitantly with bacterial and viral pathogens.

Cryptosporidium was the commonest parasite detected indicating that it would be good practice to seek this pathogen routinely in stools of children with diarrhoea (Table 1). This would prevent unnecessary treatment with antibiotics. In fact it has been reported that treatment with antibiotics prolonged the duration of diarrhoea due to *Cryptosporidium (9).*

Children affected with *Cryptosporidium* and *G.lamblia* were younger than children with worm infestations. However this finding was not statistically significant (Table 2). Malnutrition was observed in a significantly higher proportion of children infected with *G.lamblia* and *T.trichiura* (p < 0.05) than those who were infected with other parasites (Table 2). Diarrhoea associated with parasites was seen significantly more in malnourished than in well nourished children (Table 3).

In the present series 28.7% and 9.7% of children with Salmonella and rotavirus diarrhoea respectively had blood and mucus stools (Table 4). However in instances where rotavirus infection was associated with parasitic infections blood and mucus stools were observed in 50% of cases. Similarly, when Salmonella diarrhoea was associated with parasitic infestations blood and mucus stools occurred in 87.5% of cases. Both these differences were statistically significant, p < 0.05. (Table 4). Therefore the presence of parasites seem to produce more severe disease in children with diarrhoea. Table 5 shows the associated parasitic infections and the nature of the stool in diarrhoea caused by *Salmonella species* and rotavirus.

Although it is documented that *Cryptosporidium* infection caused either a watery or mucoid diarrhoea (5), in the present study blood and mucus stools was observed when *Cryptosporidium* was associated with bacterial or viral pathogens. Five out of 9 cases presented with blood and mucus diarrhoea (Table 5).

In this study 10 cases were observed with only *T.trichiura* infection among which 5 or 50% had blood and mucus stools. Six patients had either Salmonella or rotavirus in addition to *T.trichiura* infection, and all 6 had blood and mucus stools (Table 5). *T.trichiura* infections lead to blood and mucus stools only when the worm load is very heavy (10). We are unable to comment on the worm load, but, none of these children had rectal prolapse which is a feature of heavy worm load.

Table 1

Prevalence of intestinal parasites in children presenting with acute diarrhoea (n=940) and control group (n=260)

Parasite	Parasites among cases (n=87)		Parasites among controls (n=11)	
	Number	%	Number	%
Cryptosporidium	26	(2.7)	1	(0.4)
Trichuris trichiura	21	(2.2)	2	(0.7)
Giardia lamblia	9	(0.9)	-	
Entamoeba histolytica	5	(0.5)	-	
Trichomonas hominis	1	(0.1)	-	
Ascaris lumbricoides	22	(2.3)	8	(3.0)
Necator americanus	3	(0.3)	-	
Total	87*	(9.3)	11*	(4.2)

*Parasite infection was significantly higher among cases compared to controls (p < 0.001)

Jennifer Perera, Innocent Jayawardene, Lalitha Mendis and Kamalika Abeyratne

Table 2

Mean age and nutritional status of children with diarrhoea in whom the parasite was the only pathogen detected (n=39)

Parasite	Number of Patients	Mean age (Years)	Nutritional status PCM3*	%
Cryptosporidium	17	2.20	1/15	(7)
T.trichiura	12	5.13	6/10*	(60)
G.lamblia	5	1.80	3/5*	(60)
A.lumbricoides	5	2.00	1/5	(20)

** ** According to Gomez classification

* Malnutrition was observed significantly more in children infected with *T. trichiura* and *G. lamblia* compared to other parasites ($p < 0.05$)

Table 3

Nutritional status (Gomez classification) of children with diarrhoea in relation to the pathogen detected

Organism	Nutritional status			
	Normal / PCM1		PCM2 / PCM3	
	Number	(%)	Number	(%)
Bacteria + Virus	425	(55.4)	342	(44.6)
Parasites	18	(46.2)	21	(53.8)*
Bacteria + Virus + parasites	17	(35.5)	31	(64.5*)

* Children in PCM2 \ PCM3 groups had more parasite associated diarrhoea compared to children in normal / PCM1 group ($p < 0.01$)

Table 4
A comparison of stools in cases with *Salmonella* and rotavirus infection alone *versus* those with *Salmonella* or rotavirus infection combined with a parasitic infection

Organism	Number of Infections	Nature of stool	
		blood & mucus (%)	watery & mucoid (%)
Salmonella	63	19 (30.1)	44 (69.8)
Salmonella + Parasites	8	7 (87.5)*	1 (12.5)
Rotavirus	314	30 (9.5)	284 (90.4)
Rotavirus + Parasites	14	7 (50)#	7 (50)

Salmonella in association with parasites* and rotavirus in association with parasites# result in a significantly higher number of patients with blood and mucus stools when compared to diarrhoea caused by *Salmonella* or rotavirus alone (* and # $p < 0.05$).

Table 5
Nature of stool when parasites were associated with either a bacterial or viral pathogen

Parasite + pathogen	Number of infections studied	Pattern of diarrhoea	
		blood & mucus	watery & mucoid
A.lumbricoides + Rotavirus	4	2	2
Cryptosporidium + Rotavirus	6	3	3
T.trichiura + Rotavirus	4	2	2
A.lumbricoides + *Salmonella spp*	2	2	-
T.trichiura + *Salmonella spp*	2	2	-
N. americanus + *Salmonella spp*	1	1	-
Cryptosporidium + *Salmonella spp*	3	2	1
Total number	22	14	8

The average duration of diarrhoea due to rotavirus was prolonged to over 14 days when associated with roundworm, whereas the mean duration of uncomplicated rotavirus diarrhoea is about 8 days (11). This may suggest that concomitant roundworm infestation predisposes to a more prolonged and severe clinical illness. However the stools were not examined for all known bacterial and viral pathogens ie, Entero-haemorrhagic and Entero-invasive E coli (which give rise to blood and mucus diarrhoea), Norwalk virus etc, which is a limitation in the study.

From the above results and discussion it appears that parasites alter the course of an acute diarrhoea. This may be due to direct action of the parasite or parasite products on the intestinal mucosa or due to indirect factors such as malnutrition and malabsorption. Further studies should be carried out to determine the pathogenic mechanisms exerted by parasites on the intestinal mucosa. Furthermore multiple aetiological agents may be responsible for severe and prolonged diarrhoea and should be investigated for, when facilities are available.

In most laboratories in Sri Lanka, diarrhoea stools are often examined for bacterial pathogens and sometimes for amoebae when there is blood and mucus. A simple faecal smear is adequate for screening for parasites. We recommend that in developing countries parasitological investigation should complement bacterial and viral diagnosis in patients presenting with diarrhoea illness because specific therapy instituted against the parasite may alter the course of that diarrhoeal episode as well as future episodes.

Acknowledgements

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