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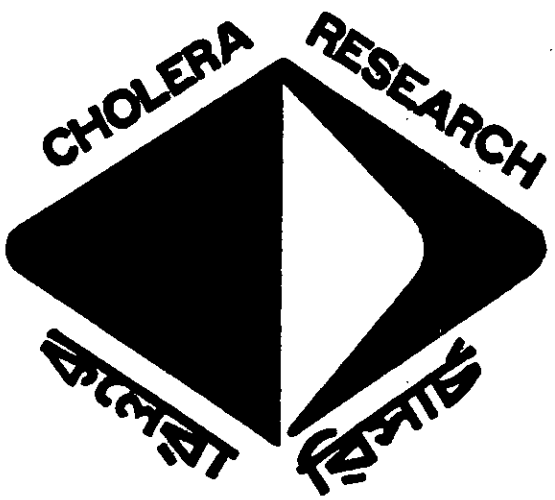

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PREFACE

The International Centre for Diarrhoeal Disease Research, Bangladesh (ICDDR,B) is an autonomous, international, philanthropic and non-profit centre for research, education and training as well as clinical service. The Centre is derived from the Cholera Research Laboratory (CRL). The activities of the institution are to undertake and promote study, research and dissemination of knowledge in diarrhoeal diseases and directly related subjects of nutrition and fertility with a view to develop improved methods of health care and for the prevention and control of diarrhoeal diseases and improvement of public health programmes with special relevance to developing countries. ICDDR,B issues two types of papers: scientific reports and working papers which demonstrate the type of research activity currently in progress at ICDDR,B. The views expressed in these papers are those of authors and do not necessarily represent views of International Centre for Diarrhoeal Disease Research, Bangladesh. They should not be quoted without the permission of the authors.

ABSTRACT

Two groups of adult male patients, one with watery diarrhoea (97) and the other with dysentery (85) were compared with respect to Strongyloides Stercoralis infection by using a string capsule device for sampling the upper intestinal contents and also by conventional stool examination. The watery diarrhoea group included patients with V. cholerae, toxigenic E. coli, non-cholera vibrios and a number with unknown etiology. The patients in the dysentery group were due to E. histolytica and shigella. Strongyloides sterocoralis larvae were diagnosed in 42% of all the patients in both the groups. Significantly higher rate of per cent distribution of strongyloides was found in patients with dysentery than in those with watery diarrhoea (50% Vs 35% $p < .05$). The explanation of increased association of strongyloides with dysentery patients is not apparent but may either reflect an association of increased risk for strongyloides and dysentery causing agents or an effect of dysentery that increases the efficacy of diagnosis of strongyloides.

This study has reconfirmed the earlier findings of Beal (Beal et al 1970) and Bezjack (1972) about the superiority of string capsule over the stool examination of detecting strongyloides larvae. It was concluded that stool exam alone should not be used for excluding a diagnosis of strongyloides infection.

INTRODUCTION

Strongyloides stercoralis infection is common both in developing and developed countries of the world (Amir-Ahmadi et al, 1968; Groove et al, 1975). Prevalence statistics show an extremely wide variation in rates of infection. One reason this range is so great may be the type of examination used to detect the larvae in the stool. Studies have shown that parasitological culture will significantly increases the efficacy of diagnosing strongyloides in a stool sample. Bezjack (1972) took 45 known strongyloides infected patients and studied them comparing duodenal aspirate and a nylon string capsule device. He found the string capsule achieved the highest rate of isolation of strongyloides from these patients. The purpose of our study was to obtain by using a simple and sensitive technique, the prevalence rate for strongyloides infection in Bangladeshi individuals with diarrhoea. Strongyloides infection has been associated with small and large bowel pathology. It may increase susceptibility to or simply be a marker for a specific etiologies of diarrhoea. We report in the present study, the incidence and association of strongyloides infection in patients with dysentery due to shigella or Entamoeba histolytica as compared to those affected by agents which produce only a watery diarrhoea.

MATERIALS AND METHODS

A total of 202 adult male patients aged 18-70 years admitted to the

wards of Cholera Research Hospital, Dacca, Bangladesh from September 1977 to August 1978 with a history of acute onset of watery diarrhoea or dysnetery (loose stool with blood and mucus) within the previous 3 days who voluntarily participated in therapeutic and physiological studies of diarrhoeal disease. They were asked to swallow a string containing capsule on the 4th day of hospitalization.

The string capsule (Health Development Corporation, Palo Alto, California, USA) is a commercially available device for obtaining the intestinal mucus, originally developed by Beal (Beal et al, 1970). A weighted 1 m. nylon string is packed in a gelatin capsule. A hole in the capsule allows one end of the string to come out. This free end is taped to the angle of the mouth and the capsule swallowed in the evening. The next morning the string is pulled out and the pH tested. If bile staining is present and the pH alkaline (determined by an indicator stick included in the package), the mucus is stripped off the string between two fingers (a sterile glove is worn) and then examined microscopically for the presence of protozoa and the helminthic ova.

A total of 202 patients swallowed the string. Most patients were between 20 and 70 years old but the group included two patients aged 13 and 18 years. In 182 of these 202 patients (90%), the string device passed into the duodenum as determined by pH and bile staining. There were 48 patients with shigellosis, of which 7 had watery diarrhoea in whom enterotoxigenic E.coli was not isolated and the rest had a dysenteric symptoms.

There were also 37 patients with amoebic dysentery containing blood and mucus and haematophagous E.histolytica trophozoites. Patients with watery diarrhoea studied included 23 cholera patients and 22 patients in whom toxigenic E.coli (ST and LT producing type) were found (Sack et al, 1975). There were also 5 patients from whom non cholera vibrios were isolated. Finally 47 patients had watery diarrhoea but no agent was isolated. Of 182 patients who had a properly passed string, all had 2 stool examinations (done on the day of admission and day 4); 152 cases had 3 stool examinations (done on admission day,day 4 and day 7) to determine the presence of ova and parasites. Those patients who had the string and only one stool examined and in whom strongyloides was not isolated were not analysed. Patients in whom strongyloides larvae were isolated by any method (string capsule or stool examination) were included in the analysis except when comparing the efficacy of string in detecting strongyloides larvae. Stool was examined by emulsifying a fresh sample in saline and examining two 18mm X 18mm areas for protozoa and helminths. Concentration technique was not used. Complete blood count was done on 7th day after hospitalization to determine the haematocrit, specific gravity, eosinophil and total WBC count.

RESULTS

Prevalence rate of strongyloides infection in the present study was found to be 42% (77/182) in hospitalized diarrhoea patients diagnosed by both methods (string capsule and stool exam). Giardia lambia was found to be present in 32% (58/182) cases (not shown in the table) diagnosed by

TABLE 1

Clinical characteristics (mean ± SD) of patients with watery diarrhoea and dysentery

Characteristics	Watery Diarrhoea (97)	Dysentery (85)
Age (years)	33.6 ±3.2	38.3 ±2.5
Sex	All Male	All Male
Discharge Weight(kg)	40.3 ±2.1	38.6 ±1.8
Total WBC (/cmm)	8.6 ±2.6	10.3 ±3.4
Hematocrit (%)	37.3 ±5.8	38.6 ±6.2
Blood Sp. Gr.	1.0256 ±1.023	1.0268 ±1.022

both string capsule and stool examination. Strongyloides was found in 35% of cases who had watery diarrhoea and in 50% cases who had dysentery due to shigella or E.histolytica. Mild eosinophilia was observed in both groups of patients who were found to be infected with strongyloides (mean 13%) and those non-infected (mean 11%). Although the older patients tended to have higher rates of infection in comparison to both young groups, this difference was not statistically significant. Finally no significant difference was found in total protein, haematocrit and total WBC count in patients with strongyloides compared to those patients in whom no strongyloides was found. In diagnosing strongyloides infection the string capsule device appeared to be a more sensitive method than the conventional stool examination (Table 2). By doing 3 stool examinations on each patient, on 3 different days, no more than 58.3% (35/60) of positive cases were diagnosed as compared to 88.3% (53/60) recognized by the string capsule done only once. All patients tolerated the string well.

DISCUSSION

In recent surveys done in the developing countries strongyloides has wide variation in its prevalence rates. We suspect that many of the reported studies in which low rates were found were secondary to the poor efficiency of the technique used to examine patients. In our study the most efficient method for isolating the larvae of strongyloides was the string capsule device. If 3 stool examinations alone had been used we would have missed the diagnosis in over 41% of the cases. Isolation of strongyloides from patients was quite efficient when the string alone was used,

TABLE 2

Strongyloides stercoralis infection in diarrhoea patients using both string capsule and stool examination

WATERY DIARRHOEA (97)			DYSENTERY (85)			
	Nos positive/ Total examined	Percent Isolated		Nos positive/ Total examined	Percent Isolated	Significance Watery VS Dysentery
E.coli (ST & LT + ve)	7/22	32.0	Amoebiasis	19/37	51.0	
Unknown etiology	18/47	38.0	Shigellosis	19/41	46.0	t 3.85
V.cholerae.	8/23	34.0	Shigella (watery)	5/7	71.0	p <.05
NAG Vibrios	1/5	20.0				
Total	34/97	35.0		43/85	50.0	
All Patients (182) (watery & dysentery combined)	77/182	42.0				

TABLE 3

Rates of Percent Isolation in 60 strongyloides Positive Patients Using String Capsule, stool examination and both combined

String alone		Stool Only			String + Stool		
		No. of stool sample examined Per patient			No. of stool sample examined Per patient		
		1	2	3	1	2	3
No +ve/Tot examined	53/60	14/60	30/60	35/60	53/60	58/60	60/60
Percent	88.3	23.3	50	58.3	88.3	96.3	100

since only 12% of the cases were missed. Thus in developed countries where immune suppressed patients are highly susceptible to strongyloides hyperinfection, use of either a string device or stool culture for strongyloides should be performed. Stool examinations in our study and duodenal aspirate in Bezjack's study were inferior to a string device in detecting strongyloides. Stool examinations alone should not be used to exclude a diagnosis of strongyloidiasis. In Bezjack's study, saline purged stool was found to increase the efficiency of detecting strongyloides larvae in stool smears. However purging in severely ill patients is often not possible. The high frequency (42%) of infection found may probably be related to a lowering of host resistance or it may reflect a high level of fecal contamination in the environment and that the majority of people go barefoot, though auto infection may also occur.

The reason for the apparent increased incidence of strongyloides infection in patients with dysentery (50%) than in watery diarrhoea (35%) is difficult to explain at the present moment. No significant difference in age, sex, season or nutritional status was found in patients who had watery diarrhoea and those who had dysentery. One possible explanation for this difference may be the particular egg hatching process seen in strongyloides. As the eggs are normally hatched inside the gut wall and the larvae are released into the gut lumen, the shedding of epithelial mucus and blood in dysentery may expose the larvae and increase their availability to stick to the string. This however implies that the destructive effects of dysentery extend higher in the small intestines than

TABLE 4

Eosinophil in Patients with and without Strongyloides stercoralis

Mean ± SD	Patients with Strongyloides (56)	Patients without Strongyloides (86)
Eosinophil (percent)	12.85 ±9.1	11.23 ±6.4

is usually thought to be present.

Infection rates of strongyloides and Giardia are high and possibly over 50% of an adult Bangladeshi population may be infected with one or both of these parasites. Both these agents can cause malabsorption and their role in producing the changes commonly seen in Bangladeshi jejunum (flattended microvilli and lamia propria cellular infiltration) is at present unanswered (Lindenbaum et al, 1966). Strongyloidiasis was not associated with higher rates of eosinophilia as compared to a non-infected group. In USA children in the nursing homes infected with strongyloides had increased eosinophilia compared to non infected children (Yoeli, 1963). In Bangladesh, mild eosinophilia is the norm, since infection with multiple parasites is usual. The high background of eosinophilia present in the Bangladeshi population may obscure the effect of strongyloides larvae alone on eosinophilia.

Significant difference ($p < .05$) was found when the etiological agents which produce a watery diarrhoea and those producing dysentery was compared in patients infected with strongyloides and non infected patients. Evidence of increased susceptibility to agents like shigella or E.histolytica was found to be associated with strongyloides infection. The number of strongyloides larvae found was not quantitated however. The association of Trichuris trichuria infection with amoebiasis and shigellosis occurs only when there is a high worm burden (Gilman et al, 1976). Increased susceptibility to an agent may only occur when infection with strongyloides

is unusually heavy.

As a group these patients were probably not immune suppressed. Strongyloidiasis has been associated with bacterimia and colitis in immune deficient patients (Purtilo, 1974, and De Paola, 1962). In a recent study it has been shown that rats given strongyloides larvae can become partially immune to reinfection and can limit the number of worms which develop to maturity. Bangladeshi patients in contrst to Caucassians or hypo-immune patients are probably exposed to frequent strongyloides infection from the childhood. It is likely that these patients are partially resistant to the invasive effects of strongyloides larvae. Therefore the hyperinfection syndrome would not be expected to occur in adult Bangladeshi patients. Changes due to parasite are probably mild except possibly when disease (such as malnutrition) occurs which produces severe hypo-immunity.

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