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Original Article

Microbiology Section

Spectrum of Intestinal Parasitic Infections (IPIs) in a Tertiary Care Hospital in Varanasi: Need to Protect School aged Children from *Giardia* Infection

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ABSTRACT

Introduction: The ubiquity and widespread distribution of Intestinal Parasitic Infections (IPIs) is equally alarming despite tremendous efforts for their control. Periodic surveillance is required to detect the change in trends of IPIs based on different age groups.

Aim: To determine the prevalence of IPIs among patients in different age groups attending the various departments of a tertiary care hospital in Varanasi.

Materials and Methods: This retrospective study was conducted in the Microbiology Department, Institute of Medical Sciences and associated University hospital over a period of 5 years. Non-repetitive, consecutive stool samples from 2723 patients that had been sent for parasitic examination were processed and examined by microscopy as per standard. Prevalence of IPI was studied in age groups 06-15 years, 16-30 years, 31-50 years, 51-70 years and above 70 years and data was statistically analyzed using Chi-Square test (Medcalc software version 15.11.14).

Results: The prevalence of IPIs among patients attending the hospital was 8.63% (235/2723 cases), of which the most frequent infection was due to *Entamoeba* spp (62, 26.38%) followed by hookworm (59, 25.11%). Prevalence of infections with *Giardia* (2.69%) and *Hymenolepis nana* (2.69%) was significantly more ($p<0.05$) in children in 06-15 years age group whereas hookworm infection (2.54%) was significantly more ($p<0.05$) in adults (>16 years).

Conclusion: Widespread distribution of intestinal parasites is still a major problem. Along with soil transmitted helminths (STHs), giardiasis is a significant problem in children of school going age group. Besides mass drug administration for STHs in this age group, policies should also be directed to treat and eradicate *Giardia* infections.

Keywords: Cyst, Helminths, Hookworm, Prevalence

INTRODUCTION

Intestinal Parasitic Infections (IPIs) continue to be a major cause of morbidity in developing countries and are among the most common infections worldwide [1]. In India too, prevalence of IPI among asymptomatic and symptomatic patients living in urban and rural set up ranges from 11.5% to 97.4% [2]. Owing to the tropical climate and considerable rural population, IPIs are seemingly significant problem in Varanasi, North India, the site of interest in the present study. However, there has been no previous data on prevalence of these parasites in this region of the country. Protozoal infections and Soil Transmitted Helminths (STHs) are the predominant causative agents of IPIs. The widespread nature and global impact of these infections is revealed by the fact that infections by STHs have been included as 'Neglected Tropical Diseases' (NTDs) in the initiative taken by WHO [1]. While giardiasis is the most common water borne parasite, infecting man worldwide [3], roundworms (*Ascaris lumbricoides*) are the most prevalent STHs in the country [4]. These are also the most common cause of infections in school going children ultimately leading to impaired physical and mental development [3-5]. Consequently, a resolution had been passed by the World Health Assembly in 2001 for control of morbidity due to STHs through mass administration of antihelminthics in school children in developing countries [6].

Several studies have dealt with the prevalence and risk factors associated with IPIs and have mostly concluded that the spectrum of IPIs vary according to geographical location and poor hygiene and low socio-economic conditions along with inadequate medical facilities and lack of access to safe drinking water are the common risk factors [7-9]. Most of these factors have been identified by mass survey of specific population in a localized area or by collection of fecal specimens on a household basis. As a result, majority of the IPIs were detected in asymptomatic carriers. This study was

undertaken to study the distribution of IPIs from symptomatic patients from various age groups, who attended the tertiary care hospital in Varanasi, North India, over a period of 5 years.

MATERIALS AND METHODS

This study was undertaken in the Parasitology section of the Microbiology Laboratory and the associated University Hospital in Varanasi, North India. The tertiary care hospital is a 1200 bedded centre serving people from Uttar Pradesh, Bihar, Jharkhand, Madhya Pradesh and Chhattisgarh and the neighboring countries of Nepal and Bangladesh. This was a retrospective study. The study was conducted between the period of 1st January 2011 and 31st December 2015. The study was approved by the Institute ethical committee.

A total of 2723 non-repetitive, consecutive stool samples from 2723 patients comprising of 1707(62.69%) males and 1016 (37.31%) females, with age ranging from 6 years to 84 years, who were attending the various Outpatient Departments and admitted in indoor wards were processed for detection of ova and cysts as per physicians request. As this was not a prevalence based study, we considered only those cases that were referred by the clinicians to the laboratory for stool examination. Majority of these patients presented with chief complaints of bloating, pain abdomen, indigestion, skin irritation, weakness and passage of mucous in stool.

Samples were collected in wide mouthed containers provided by the Department of Microbiology containing no preservative and were transported to the laboratory within 2-3 hours of collection. All the samples were subjected to gross physical examination and preparation of saline and iodine mount for microscopy [10]. Samples without any positive finding but with strong clinical suspicion of IPIs were repeatedly examined following formol-ether concentration technique [10]. Identification of *Strongyloides* larva was done by studying the morphological details of the larva following modified Harada-Mori nematode culture method [11].

STATISTICAL ANALYSIS

Relevant data and available patient details were recorded in Microsoft excel 2010 sheet and were analyzed. Cases were divided into 5 age groups comprising of 06-15 years, 16-30 years, 31-50 years, 51-70 years and above 70 years. Prevalence of IPIs in these age groups was compared using the Chi-square test by statistical software MedCalc version 15.11.14.

RESULTS

A total of 2723 cases were studied comprising of 1707 (62.69%) males and 1016 (37.31%) females. The prevalence of IPIs in and around our setup was 8.63% (235 cases). The spectrum of various IPIs has been shown in [Table/Fig-1]. Majority of the infections occurred in males in the age group 6-15 years (11.08%) followed by males in 51-70 years age group (10.98%). In the females, age group 31-50 years was mostly affected (9.12%). Among the protozoans, the prevalence of *Entamoeba* spp was highest (26.38%) and among the STHs, the prevalence of hookworm infections was highest (25.11%) as shown in [Table/Fig-2]. Prevalence of mixed infection was 1.27% (3 cases). On comparison of the prevalence of IPIs among the school aged children and others, it was found that prevalence of *Giardia* and *H.nana* infection was significantly higher among the school aged children ($p<0.05$) while hookworm infection significantly affected the adult population ($p=0.01$) as shown in [Table/Fig-3].

Agents causing IPIs	n (%)
Cyst of *Entamoeba* spp	62 (26.38)
Cyst of *Giardia*	45 (19.15)
Hookworm	59 (25.11)
H.nana	34 (14.47)
Ascaris	26 (11.06)
Strongyloides	6 (2.55)
Taenia spp	2 (0.85)
Trichuris trichura	1 (0.43)
Total	235

[Table/Fig-1]: Isolation of intestinal parasites from stool samples.

Agents (Total No.)	Age groups (in years)				
	06-15 n (%)	16-30 n (%)	31-50 n (%)	51-70 n (%)	Above 70 n (%)
Cyst of *Entamoeba* spp (62)	9 (14.51)	20 (32.25)	23 (37.09)	10 (16.13)	0
Cyst of *Giardia* (45)	13 (28.8)	20 (44.4)	9 (20)	2 (4.4)	1 (2.2)
Hookworm (59)	2 (3.3)	17 (28.8)	20 (33.89)	17 (28.8)	3 (5.08)
H.nana (34)	13 (38.23)	12 (35.29)	6 (17.64)	3 (8.8)	0
Ascaris (26)	3 (11.53)	13 (50)	8 (30.76)	2 (7.69)	0

[Table/Fig-2]: Prevalence of IPIs in various age groups.

Agents (Total)	Age groups in years (Total No. of patients)		p-value
	06-15 (482) (%)	16 and above (2241) (%)	
Cyst of *Entamoeba* spp (62)	9 (1.86)	53 (2.36)	0.5
Cyst of *Giardia* (45)	13 (2.69)	32 (1.42)	0.05*
Hookworm (59)	2 (0.41)	57 (2.54)	0.01*
H.nana (34)	13 (2.69)	21 (0.93)	0.002*
Ascaris (26)	3 (0.62)	23 (1.02)	0.41

[Table/Fig-3]: Comparison of prevalence of IPIs between school aged children (6-15 years) and others.
*$p<0.05$

DISCUSSION

This study showed wide spectrum of IPIs prevalent in this part of the country. The worldwide endemicity of IPIs has added to the global health burden, often crippling about 450 million people, mostly children and women in reproductive age group [12]. Though, poor socioeconomic and unhygienic conditions have been largely implicated for this global burden, their ubiquity has been demonstrated not only in studies from rural and slum areas [6,13,14] but also from urban areas [2,5]. In fact, rapid industrialization and mass movement of population from rural to urban areas has made situations worse, thus facilitating the rapid spread of IPIs [6].

In this study, we found a prevalence of 8.63% of IPIs in our locality, which is comparably low against studies reported elsewhere. While prevalence of 38%, 51.5% and 31.5% has been reported from rural areas of Ghaziabad [6], Karnataka [13] and Pauri Garhwal [14] respectively by survey of target population, prevalence of 12.5% and 15.19% has been reported from urban slum areas of Chandigarh [5] and central `Gujarat [2] respectively. Likewise, prevalence of IPIs in Nepal and Sri Lanka has been reported as 29.4% and 34.56% respectively [15]. In context to our finding, low prevalence of 11.5% has been reported in a study from our vicinity [16] . In all the above studies, survey of asymptomatic population dwelling in certain areas or a specific age group with most of the associated risk factors like poverty, poor sanitation has been studied. On the other hand, in this study prevalence of IPI among the symptomatic patients attending the tertiary care hospital have been considered which is the probable reason for the low prevalence, as reported. Therefore, it should be emphasized that as revealed by our finding and other relevant studies discussed above, perhaps for IPIs asymptomatic carriers make up the bulk of the global burden. In this respect, it is really one of the challenging task to screen and treat the entire community. The predominance of male gender might be coincidental or due to behavioral factors like increased mobility in males [17].

Entamoeba sp. was the most prevalent parasite in this study. It could not be commented whether the cysts of *Entamoeba* sp. were from pathogenic variety (*E.histolytica*) or non-pathogenic variety (*E.dispar/moshkovskii*). Additionally, due to several problems like inaccessibility to the sample collection centre, delay in transportation, we were unable to detect motile trophozoites in these parasites. However, all the *Entamoeba* sp. were isolated from symptomatic patients with abdominal discomfort unlike others who have reported asymptomatic carriage.

Among the STHs, overall prevalence of hookworm infection was the highest and was significantly more in the adult population as compared to school aged children. This is of immense importance due to varying amount of blood loss associated with hookworm infections, adding to the burden of iron deficiency anemia in the community [18]. Besides, in the tropical and subtropical areas like ours, hookworm is a leading cause of maternal and child morbidity often leading to delayed growth and cognitive malfunctions [19]. While on one side advances in treatment through mass drug administration and control of hookworm is available, on the other nearly 740-1300 million are affected worldwide presently, thus complicating the situations for control [20].

In the children of school going age, infection with *H.nana* was more prevalent. *H.nana* is endemic in Asia, South east and Eastern Europe, South and Central America and Africa [21]. Studies by Mirdha and Samantaray have documented the prevalence of *H.nana* as a common cause of pediatric diarrhea among slum dwellers in cities [22]. Cases are on record where this infection has been reported abroad in children adopted from India [21]. The importance of *H.nana* infection is that it is the only tapeworm transmitted among humans and can also internally auto infect the patients. Therefore, *H.nana* infection in school aged children can be important epidemiologically as it can affect family units.

A remarkable portion of our study population the school aged children were significantly associated with infection with *Giardia* as compared to the adult population. Whereas the prevalence of Giardiasis is 3-7% in developed countries, it is as high as 20-30% in developing countries [23]. Giardiasis can present with a spectrum of signs and symptoms which are mostly self limiting. In context to school children, the extra intestinal and long term consequences of Giardiasis is of recent interest and are equally alarming [3]. Ocular complications, arthritis, skin allergies, myopathy can occur in affected children besides the well established complications like failure to thrive, stunting and growth retardation, cognitive disorders and chronic fatigue. All these factors are of immense public health importance owing to the high occurrence of Giardiasis in young children.

Another important aspect revealed in this study should be discussed. STHs account for 27% of entire school-age and preschool-age children population worldwide [15]. Consequently in 2001 the World Health Assembly resolved to control them by mass scale drug administration especially in less developed countries [8]. WHO recommended MDA to all residents of endemic areas with frequency once or twice a year based on the prevalence [15]. The widespread administration of anti-helminthic drugs have already shown striking reduction in STHs burden in some parts of India [8]. As a result, in the target population particularly in school aged children due to effects of anti-helminthics the relative prevalence of protozoal infection (Giardiasis) has risen as expected and explicitly demonstrated in this study. Therefore,

a precise epidemiological study is needed and policy makers should consider the high prevalence of Giardiasis along with STHs for effective control.

LIMITATIONS

Though, a sincere effort was made to conduct this study in a scientific manner, it was not without limitations. This was not a prevalence study as we did not survey the entire population but screened only the patients attending the hospital. Therefore, we missed asymptomatic parasitic carriage which is also considerable in our setup. Secondly, we considered only a single stool sample whereas more than one sample could have increased the positivity. Lastly, due to unavoidable delay in specimen transport, detection of protozoan trophozoites was not done.

CONCLUSION

The study revealed the widespread distribution of intestinal parasites among symptomatic patients from various age groups as well as the difference in parasite occurrence in adult and children population. It highlights the much needed efforts from both the administration and society to curb the ever increasing menace of IPIs. It has been demonstrated that control of such infections especially in underprivileged settings is challenging and requires combined approach of medical therapy and improvement in living standards. Several issues concerning limitations of mass deworming, inadequate global coverage, problem of open field defecation, improper sewage systems have often posed as obstacles in the management of IPIs. However, widespread cleanliness campaigns, awareness among the low socioeconomic population and continued mass deworming will definitely have an impact in reducing the prevalence of IPIs in the near future.

AUTHOR CONTRIBUTION

MKP collected data and performed the laboratory tests while TB planned the study and drafted the manuscript.

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