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Original article

Intestinal parasitosis: data analysis 2006-2011 in a teaching hospital of Ancona, Italy

Parassitosi intestinali: casistica 2006-2011 nell'ospedale di Ancona

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INTRODUCTION

Enteric parasites are the most common cause of parasite diseases; they cause significant morbidity and mortality and constitute a major public health problem especially in developing countries [1]. Children and young adults are the most commonly affected group, particularly in regions with limited resources and those in which observation of hygienic measures is lacking [2]. Intestinal symptoms are frequent and include abdominal pain and acute or chronic diarrhoea and or constipation, but systemic manifestations are by no means uncommon [3].

Intestinal parasites, once considered rare phenomena confined to tropics, are now being diagnosed with increased frequency in Europe and other industrialised countries. This trend can be attributed to various factors such as globalisation of the food supply, increased consumption of fresh food, increased travel to the developing countries, more intensive immigration originating from the latter areas and the important phenomenon of international child adoption [4-6]. Most intestinal parasites are transmitted by the faecal-oral route due to ingestion of water, vegetables and or soil contaminated with ova, cysts or oocysts. In some cases transmission occurs via the skin through direct penetration by larvae living in the soil (e.g. *Anchylostoma duodenale*) [7].

Epidemiological data on the diffusion and prevalence of intestinal parasitic disease in developing countries are numerous but in the industrialized countries such infections are rarely reported [8]. Therefore the aim of this study was to evaluate the distribution of intestinal parasites isolated in Italian and non-Italian adults and children over the period 2006-2008 and 2009-2011.

PATIENTS AND METHODS

Between January 2006 to December 2011, the stool specimens and scotch tests of 5323 Italian and non-Italian patients (adults and children) attending the laboratory of the Infectious Diseases Clinic in a teaching hospital at Ancona were analyzed in the specific search for intestinal parasites.

These samples were collected from different departments, namely Infectious Diseases, Gastroenterology, Dermatology and Paediatrics at the General Hospital in Ancona.

From each patient, three faecal samples were collected on alternate days. All faecal samples fixed in 10% formalin were observed under a 40x light microscope after concentration in accordance with Ritchie and stained with Lugol

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[9, 10]. To differentiate the various amoebas, the use of the micrometric eyepiece was crucial for exact determination of average cystic diameter. The number of nuclei within them, with or without peripheral nuclear chromatin, the glycogen and the chromatoid bodies were then estimated.
Trichrome Ryan-Blue staining was performed to detect Microsporidia and modified Ziehl-Neelsen for *Cryptosporidium spp*. and other alcohol-acid-resistant protozoa [11]. The scotch-test was performed to recover the ova of *Enterobius vermicularis* both in adults and children, and smears were observed with a light microscope at 40x [12]. To detect the proglottids of *Taenia spp*. or adult worms we performed macroscopic examination of the stools.

RESULTS

Results were analyzed by grouping within two three-year periods (2006 to 2008 and 2009 to 2011) and into Italian and non-Italian patients, adults and children. Of the non-Italian children, 60% of these were adopted and came from various non-EU countries (Russia, Lithuania, Albania, Ukraine, Colombia, Cambodia, Brazil, Ethiopia, India, Bolivia, Peru and Ecuador).
During the period 2006-2008, a total of 2389 patients were examined. Of these167 were positive for intestinal parasites: 92/167 (55%) were Italian and 75/167 (45%) were non-Italian. Of the Italian patients, 56/92 (60%) were adults and 36/92 (40%) were children: 24 (43%) of the adults and 19 (53%) children were positive for pathogenic intestinal parasites, while non-pathogenic parasites were found in 32/56 (57%) adults and 17/36 (47%) children. As regards the non-Italian patients, 19/75 (25%) and 56/75 (75%) were adults and children, respectively; of these pathogenic parasites were found in 7/19 (37%) adults and in 33/56 (59%) children; while 12/19 (63%) adults and 23/56 (41%) children were positive for non-pathogenic intestinal parasites.
During the second period 2009-2011 a total of 2934 patients were analyzed: of these 138 harboured intestinal parasites, 53/138 (38%) were Italian and 85/138 (62%) were non-Italian. Among Italian patients, 28/53 (53%) were adults and 25/53 (47%) were children, of these 12/28 (43%) adults and 16/25 children (64%) were positive for pathogenic intestinal parasites, while non-pathogenic parasites were found in 16/28 (57%) adults and 9/25 (36%) children. As regards the non-Italians, 22/85 (26%) were adults and 63/85 (74%) children: of these 10/22 (45%) adults and 38/63 (60%) children were positive for pathogenic parasites, while non-pathogenic parasites were found in 12/22 (55%) adults and in 25/63 (40%) children (Tables 1 and 2).
Protozoa pathogenic accounted for the vast majority of infections with respect to helminths both in Italian and non-Italian patients. Of the protozoa, *Balantidium coli* and *Cyclospora cayetanensis* parasite species were less frequent both in Italians and non-Italians, while *G. lamblia* was the most common parasite.

Table 1 - Data analysis of intestinal parasitosis in the period 2006-2008.

Positive patients	*Italian 92 (55%)*		*Non-Italian 75 (45%)*		*Total*
	Adults	*Children*	*Adults*	*Children*	
	56 (60%)	36 (40%)	19 (25%)	56 (75%)	167
Pathogenic parasites	24 (43%)	19 (53%)	7 (37%)	33 (59%)	83
Non-pathogenic parasites	32 (57%)	17 (47%)	12 (63%)	23 (41%)	84

Table 2 - Data analysis of intestinal parasitosis in the period 2009-2011.

Positive patients	*Italian 53 (38%)*		*Non-Italian 85 (62%)*		*Total*
	Adults	*Children*	*Adults*	*Children*	
	28 (53%)	25 (47%)	22 (26%)	63 (74%)	138
Pathogenic parasites	12 (43%)	16 (64%)	10 (45%)	38 (60%)	76
Non-pathogenic parasites	16 (57%)	9 (36%)	12 (55%)	25 (40%)	62

Table 3 - Pathogenic and non-pathogenic parasites isolated from Italian and non-Italian patients over the period 2006-2011.

Pathogenic parasites	*Italian*		*Non-Italian*	
	Adults	*Children*	*Adults*	*Children*
Protozoa				
Cyclospora cayetanensis	1 (4%)	0	0	0
Balantidium coli	0	1 (4%)	0	0
Giardia lamblia	26 (96%)	24 (96%)	11 (100%)	38 (100%)
Total	27	25	11	38
Helminths				
Anchilostoma duodenale	1 (11%)	0	0	1 (4%)
Ascaris lumbricoides	1 (11%)	0	2 (33%)	1(4%)
Diphyllobothrium latum	0	1 (10%)	0	0
Enterobius vermicularis	2 (22%)	6 (60%)	2 (33%)	4 (17%)
Hymenolepis nana	1 (11%)	1 (10%)	1 (17%)	4 (17%)
Strongyloides stercoralis	1 (11%)	0	1 (17%)	5 (23%)
Taenia spp.	3 (34%)	1 (10%)	0	3 (13%)
Trichuris trichiura	0	1 (10%)	0	5 (22%)
Total	9	10	6	23
Non-pathogenic parasites				
Blastocystis hominis	38 (79%)	11 (42%)	11 (46%)	11 (23%)
Entamoeba coli	9 (19%)	6 (23%)	5 (21%)	27 (56%)
Entamoeba hartmanni	1 (2%)	5 (20%)	5 (21%)	6 (12%)
Endolimax nana	0	3 (11%)	3 (12%)	3 (6%)
Iodamoeba butschlii	0	1 (4%)	0	1 (2%)
Total	48	26	24	48

Table 4 - Italian and non-Italian patients with mixed infections, by combination of pathogenic and non-pathogenic parasites over the period 2006-2011.

Combination of pathogenic and non-pathogenic parasites	*Total*	*Italian*	*Non-Italian*
G. lamblia/E. coli	3	2	1
G. lamblia/E. nana	1	1	
G. lamblia/H. nana	2	1	1
G. lamblia/Taenia	1	1	
G. lamblia/S. stercoralis	1	1	
H. nana/A. lumbricoides	1		1
B. hominis/E. coli	1		1
B. hominis/E. nana	2	1	1
B. hominis/E. hartmanni	2	1	1
E. hartmanni/E. nana	1		1
A. lumbricoides/A. duodenale/T. trichiura	1		1
E. coli/E. nana	1		1
E. coli/E. hartmanni	1		1
Total	18	8	10

As regards helminths, *E. vermicularis* was identified in 14 patients, eight of whom were Italian. This parasite species was found in 13 out of 14 patients in the scotch test; only one Italian adult had ova of *E. vermicularis* in stools. *Hymenolepis nana*, *Strongyloides stercoralis* and *Trichuris trichiura* were more common in non-Italian children than in Italian and non-Italian adults. The parasites *Anchilostoma duodenalis* and *Diphyllobothrium latum* were less frequently found both in Italian and non-Italian patients.
Among non-pathogenic parasites, *Blastocystis hominis* was the most common species detected in 38/48 of Italian adults (79%), while *Entamoeba coli* was the most common parasite detected in 27/48 of non-Italian children (56%) (Table 3). Besides, a total of 18 patients, 8 Italian patients and 10 non-Italian patients, were infected by a combination of pathogenic parasites. The combination most frequently found was *Giardia lamblia/Entamoeba coli* (Table 4).

DISCUSSION

The problem of intestinal parasitosis is particularly serious in endemic areas with poor sanitation, but has also recently become more common in non-endemic areas. Several studies report issues related to intestinal parasitosis caused by protozoa and helminths in various Italian regions [8, 13-18].
The present study shows that, over a six-year period, 305 out of 5323 patients harboured at least one species of parasite (5.7%). The prevalence of pathogenic protozoa and helminths was higher in children than adults both in Italian and non-Italian patients.
Overall, *Giardia lamblia* was the most common parasite encountered in this study. This common flagellated protozoan has a significant impact on public health.
This species is responsible for diarrhoea, abdominal cramps, bloating, weight loss and malabsorption, with infection rates being generally lower in industrialised countries. In Italy *Giardia lamblia* is reported in a prevalence ranging from 0.4% to 6.2%. In the present study the overall prevalence of giardiasis was 1.8% (99/5323) [19, 20].
Blastocystis hominis was the second species encountered in this study, being detected in 1.3% (71/5323) of the patients examined, especially in the adults. Epidemiological data strongly suggest that *B. hominis* is a pathogen. Many genotypes exist in nature and recent observation indicates numerous zoonotic genotypes that can infect humans. Tan et al. have suggested that both pathogenic and non-pathogenic genotypes could be correlated with the controversial pathogenicity of *B. hominis* [21, 22].
Entamoeba coli was detected in 0.9% of the patients (47/5323), most frequently in non-Italian children. *Entamoeba spp*. can cause harmless colonisation of the intestine or severe infections with invasion of the colon wall and damage to other host tissues [23].
Helminths were found in 0.9% of the patients (48/5323). As noted above, *Hymenolepis nana*, *Strongyloides stercoralis* and *Trichuris trichiura* were the most common helminths recovered in non-Italian children, indicating that certain intestinal parasites are restricted to endemic areas in the tropics. Intestinal parasitosis in Italian patients caused by helminths found in endemic areas may be explained by increasing travel abroad both for tourism and for religious purposes, immigration, adoptions and increased imports of food [4-6].
In conclusion, our findings demonstrate that intestinal parasites must be considered even in industrialised countries. Knowledge of the organisms responsible for intestinal parasite infections in non-endemic areas is an essential step towards effective patient care and the implementation of appropriate control measures. Examination of multiple stool specimens for patient is still the recommended approach for excluding parasitic infections.
Good collaboration between physicians and clinical microbiologists, supported by epidemiological data and clinical features should produce positive effects [24].

Keywords: parasitosis, immigrants, developing countries.

SUMMARY

Intestinal parasites are a serious problem in developing countries, but should not be underestimated in industrialised countries either. Between January 2006 and December 2011, stool specimens and the scotch tests of 5323 Italian and non-Italian patients (adults and children) attending the laboratory of our Infectious Diseases Clinic in a teaching Hospital at Ancona were analyzed specifically for intestinal parasites. The present study shows that, over a six-year period, of a total of 5323 patients 305 harboured at least one species of parasite (5.7%). Among the pathogenic protozoa *Giardia lamblia* was the most common, the overall prevalence of giardiasis being 1.8% (99/5323). Helminths were found in 0.9% of the patients (48/5323). In particular, *Hymenolepis nana*, *Strongyloides stercoralis* and *Trichuris trichiura* were most commonly recovered in non-Italian children, suggesting that certain intestinal parasites are restricted to endemic areas in the tropics. Eighteen of the 305 infected patients had more than one parasite in their stools. Our study demonstrates that intestinal parasites must be considered even in industrialised areas and stool examination should be supported by epidemiological data and clinical features.

RIASSUNTO

Nei paesi in via di sviluppo le parassitosi intestinali rappresentano un problema serio, che non dovrebbe essere sottovalutato nei paesi industrializzati. Nel periodo compreso tra gennaio 2006 e dicembre 2011, presso il laboratorio della Clinica Malattie Infettive, Ospedali Riuniti Ancona, campioni fecali e scotch-test di 5323 pazienti italiani e non-italiani (adulti e bambini), sono stati analizzati per la ricerca di parassiti intestinali.
Per ogni paziente, tre campioni fecali sono stati raccolti a giorni alterni. I risultati ottenuti indicano che nel periodo considerato il 5,7% (305/5323) dei pazienti è stato positivo almeno per una specie di parassiti.
Tra i protozoi patogeni, Giardia lamblia *è stata la specie più comune, sia nei pazienti italiani sia non-italiani (adulti e bambini), con una prevalenza complessiva di giardiasi dell'1,8% (99/5323).*
Gli elminti sono stati riscontrati nello 0,9% dei pazienti (48/5323); in particolare, Hymenolepis nana, Stongyloides stercoralis *e* Trichiuris trichiura *sono risultati più frequenti nei bambini stranieri, a conferma che certi parassiti intestinali sono presenti nelle aree endemiche.*
Diciotto dei 305 pazienti infestati aveva più di un parassita nelle feci. Il nostro studio dimostra che i parassiti intestinali devono essere considerati anche nelle aree industrializzate e che l'esame parassitologico dovrebbe essere supportato dai dati epidemiologici e dalle caratteristiche cliniche.

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