Prevalence of intestinal parasite infections and associated clinical symptoms among patients with end-stage renal disease undergoing hemodialysis

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Abstract

Purpose Intestinal parasitic infections (IPIs) can result in high morbidity and mortality, particularly in immunocompromised patients. Infectious diseases are among the maincauses of death in end-stage renal disease (ESRD) patients due to their impaired immune systems. The aim of this study was to determine the prevalence IPIs and their associated symptoms in ESRD patients. *Methods* In this case–control study, the fecal samples of 78 ESRD patients undergoing hemodialysis and 140 controls without any kidney problems were analyzed for intestinal parasites using direct-smear, formol-ether and modified Ziehl–Neelsen staining techniques. *Results* The difference in the prevalence of IPIs between ESRD patients (30.7 %) and the control group (10.7 %) was significant (OR = 3.7; 95 % CI = 1.8–7.61; $P < 0.001$). *Blastocystis* (14.1 %) and *Cryptosporidium* spp.(11.5 %) were the most common IPIs detected in ESRD patients, and the presence of *Cryptosporidium* spp. was significantly associated with diarrhea in ESRD patients (OR = 16; 95 % CI = 1.54–166.05; $P < 0.05$). Leukocytosis, diarrhea, weight loss, nausea/vomiting and bloating were also significantly higher in the hemodialysis group when compared with the control group. *Conclusion* The current study revealed a high prevalence of intestinal parasites and related clinical symptoms in ESRD patients undergoing hemodialysis. Since hemodialysis patients are immunocompromised and intestinal parasites can cause serious clinical complications, we suggest that stool examination for intestinal parasites, with an emphasis on detection of *Cryptosporidium* spp. and *Blastocystis*, should be incorporated into the routine clinical care for these patients. Measures for preventing the acquisition of IPIs are also recommended.

Keywords Intestinal parasitic infections · Hemodialysis · ESRD patients

Introduction

Failure of renal function is the main cause of death in chronic kidney disease (CKD) patients. The mortality rate increases when CKD develops into end-stage renal disease (ESRD), at which stage it requires the initiation of dialysis or kidney transplantation. The mortality risk in ESRD patients compared to the healthy population is 36-fold and 2-fold greater in patients aged 16–49 years old and those over 65 years old, respectively. Infectious diseases are the second most significant factor responsible for death in ESRD patients. Patients with CKD and those in ESRD have weakened immune systems, because of the increased uremia that is connected to a state of immune dysfunction. In other words, the uremic milieu causes polymorphonuclear leukocyte (PMNL) dysfunction, thereby disabling a major component of the immune system and increasing the risk of infection.

The main objective of this study was to determine the prevalence and clinical significance of intestinal parasitic infections in patients with CKD undergoing hemodialysis who were referred to29-Bahman hospital in Tabriz city, Northwest Iran.

Materials and methods

Study area and population

This case–control study was carried out on 78 hemodialysis patients (54 % male, 46 % female), with a mean age of 51.6 ± 16.4 years, referred to the hemodialysis ward of 29-Bahman hospital in Tabriz city between May 2013 and January 2014. Hemodialysis patients who had not been given any anti-parasitic drugs in the month prior to the study and had been receiving hemodialysis treatment for at least 1 year were included in this study. The control group consisted of 140 healthy individuals without any kidney problems. Based on physician examination and documents, the health condition, residence region, age and sex of the control group were highly similar to patient group.

Fecal sample collection and laboratory analysis

After completing the questionnaire, three stool samples were collected from each individual in pre-labeled, leakfree, plastic specimen containers, on three consecutive days with one-day intervals. The fecal specimens were examined macroscopically. Any diarrheal stool samples were sent immediately to the laboratory for parasitological examination, while formed stool samples were preserved in 10 % formalin for further analysis. For detection of trophozoites, cysts, ova and larvae of intestinal parasites, the stool samples were examined by microscopic observation (Zeiss, Germany, 100× and 400× magnification) of direct smears using normal saline (0.85 % NaCl solution), Lugol's iodine staining, and formalin ether concentration techniques. To identify oocysts of the opportunistic intestinal coccidia *Cryptosporidium* spp., *Isospora belli*, and *Cyclospora cayetanensis*, a permanent slide was prepared for each sample, then stained with the modified Ziehl–Neelsen acidfast technique, as described previously. To measure the hematological parameters, blood samples were collected in EDTA containers from all participants. The Sysmex Hematological Analyzer Model XS-800i (Japan) was used for white blood cell counts and differentials. Prior to each series of blood sample tests, the quality control was completed and recorded using commercial specimens. The examiners were unaware of the patient's clinical condition. Data analysis was carried out using the SPSS software version 21 (SPSS, Chicago, IL, USA).

Table 1 Demographic characteristics of hemodialysis patients, according to the presence or absence of intestinal parasites

Variable	Parasitized ($n = 24$)		Non-parasitized ($n = 54$)		Odds ratio (95 % CI[2])	*P* value
	N	%	*N*	%		
Sex						
Male	14	58.3	36	46.1	0.7 (0.26–1.88)	0.479
Female	10	41.7	18	23.1	1.42 (0.53–3.84)	
Age						
20–34[a]	4	16.7	10	18.6	1	0.65
35–49	5	20.8	14	25.9	0.89 (0.19–4.19)	
50–64	7	29.1	9	16.6	1.94 (0.42–8.92)	
≥65	8	33.4	21	38.9	0.95 (0.23–3.93)	
Residence						
Urban	11	45.8	42	77.8	0.24 (0.09–0.67)	<0.05
Rural	13	54.2	12	22.2	4.13 (1.48–11.56)	
Hemogram						
Leukocytosis	13	54.1	3	5.5	20.09 (4.88–82.65)	<0.001
Leukopenia	4	16.6	5	9.2	1.96 (0.48–8.06)	0.445
Type of stool sample						
Diarrhea	13	54.1	4	7.4	14.77 (4.03–54.03)	<0.001
Normal	11	45.9	50	92.6	0.07 (0.02–0.25)	

[a] The first subgroup of age is considered as the reference

Results

Across the 218 participants, the overall prevalence of intestinal parasites was 17.8 % (39/218). No helminth infections were observed among either patients or controls. Based on parasitological examination of the stool specimens, the frequency of parasites was 30.7 % (24/78) in hemodialysis patients and 10.7 % (15/140) in the control group. Patients undergoing hemodialysis were significantly more likely to be infected with intestinal parasites than healthy individuals (OR = 3.7; 95 % CI = 1.8–7.61; $P < 0.001$).

Table 2 Comparison of prevalence and identified symptoms of intestinal parasites between hemodialysis patients and control group

Variable	Hemodialysis patients ($n = 78$)		Control group ($n = 140$)		Odds ratio (95 % CI[2])	*P* value
	N	%	*N*	%		
Sex						
Male	14	18.0	9	6.4	0.93 (0.25–3.47)	0.918
Female	10	12.8	6	4.2	1.07 (0.28–3.98)	
Age						
20–34[a]	4	5.1	2	1.4	1	0.853
35–49	5	6.4	5	3.6	0.50 (0.06–4.09)	
50–64	8	10.2	4	2.8	1 (0.12–7.99)	
≥65	7	9.0	4	2.8	0.87 (0.11–7.11)	
Hemogram						
Leukocytosis	16	20.5	7	5	4.90 (1.92–12.53)	<0.001
Leukopenia	9	11.5	7	5	2.48 (0.88–6.94)	0.076
Type of stool sample						
Diarrhea	17	21.8	7	5	5.29 (2.08–13.43)	<0.001
Normal	61	78.2	133	5	0.18 (0.07–0.47)	
Symptoms						
Weight loss	26	33.3	20	14.2	3 (1.54–5.85)	<0.001
Feeling of weakness	47	60.2	10	7.1	19.71 (8.97–43,30)	<0.001
Stomach pain	32	41	55	39.2	1.07 (0.61–1.89)	0.801
Abdominal pain	25	32	38	27	1.27 (0.69–2.31)	0.443
Nausea or vomiting	19	24.3	15	10.7	2.68 (1.27–5.65)	<0.05
Bloating	25	32	4	2.8	16.04 (5.33–48.28)	<0.001

[a] The first subgroup of age is considered as the reference

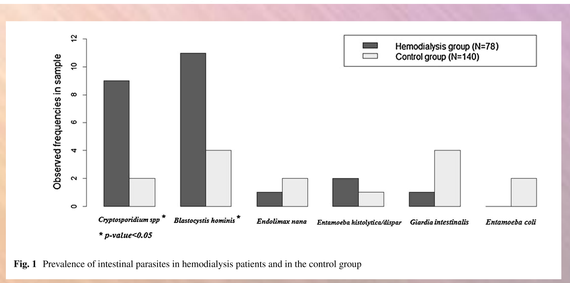


Fig. 1 Prevalence of intestinal parasites in hemodialysis patients and in the control group

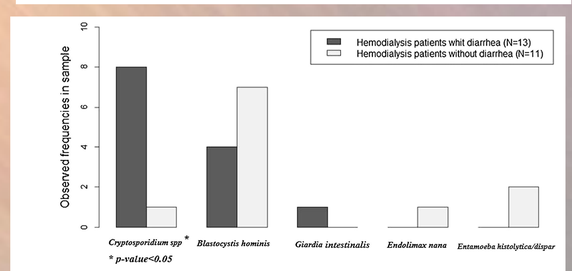


Fig. 2 Prevalence of intestinal parasites in hemodialysis patients with and without diarrhea

Discussion

In conclusion, the results of this study revealed that intestinal parasites and related clinical symptoms in ESRD patients undergoing hemodialysis were more frequent than in a matched control group. Considering that patients under hemodialysis are immunocompromised, intestinal parasites could cause them serious clinical complications due to their weakened immune system. Some recommendations for better management and treatment of hemodialysis patients and subsequent studies are as follows:

1. We suggest that stool examination for intestinal parasites, with special attention to *Cryptosporidium* spp., *Blastocystis hominis* and *Strongyloides stercoralis*, should be incorporated into the routine clinical care of these patients.
2. Periodic repetition of the stool examinations with the use of sensitive methods such as Baermann and agar plate culture is strongly suggested for the detection of *Strongyloides stercoralis.*
3. Measures to prevent acquisition of intestinal parasites are also recommended.
4. It is strongly suggested that additional tests should be done, particularly for common bacterial, viral and fungal agents known to be responsible for symptoms reported in this study.
5. More studies are recommended to evaluate the sideeffects of metronidazole on ESRD patients.

References

1. Kato S, Chmielewski M, Honda H, Honda H, Pecoits-Filho R, Matsuo S, Yuzawa Y. Aspects of immune dysfunction in endstage renal disease. Clin J Am Soc Nephrol. 2008;3:1526–33.
2. Drey N, Roderick P, Mullee M, Rogerson M. A population-based study of the incidence and outcomes of diagnosed chronic kidney disease. Am J Kidney Dis. 2003;42:677–84.
3. Tonelli M, Wiebe N, Culleton B, House A, Rabbat C, Fok M, McAlister F, Garg AX. Chronic kidney disease and mortality risk: a systematic review. J Am Soc Nephrol. 2006;17:2034–47.
4. Glorieux G, Vanholder R, Lameire N. Uraemic retention and apoptosis: what is the balance for the inflammatory status in uraemia? Eur J Clin Invest. 2003;33:631–4.
5. Haag-Weber M, H◌rl WH. Dysfunction of polymorphonuclear leukocytes in uremia. Semin Nephrol. 1996;16:192–201.
6. World Health Organization. Division of control of tropical diseases (CTD), progress report 1996. Geneva: World Health Organization; 1997. p. 15–6.
7. Gumbo T, Sarbah S, Gangaidzo IT, Ortega Y, Sterling CR, Carville A, Tzipori S, Wiest PM. Intestinal parasites in patients with diarrhea and human immunodeficiency virus infection in Zimbabwe. Aids. 1999;13:819–21.
8. Sadraei J, Rizvi MA, Baveja UK. Diarrhea, CD4+ cell counts and opportunistic protozoa in Indian HIV-infected patients. Parasitol Res. 2005;97:270–3.
9. Sammet S, Wieser A, Müller S, Huber M, Schubert S, Seybold U. Triple worm infestation in an HIV-infected patient. Infection. 2013;41:1053–4.
10. Kulik RA, Falavigna DLM, Nishi L, Araujo SM. Blastocystis spp. and other intestinal parasites in hemodialysis patients. Braz J Infect Dis. 2008;12:338–41.
11. Gil FF, Barros MJ, Macedo NA, J◌̊nior GEC, Redoan R, Busatti H, Gomes AM, Santos FGJ. Prevalence of intestinal parasitism and associated symptomatology among hemodialysis patients. Rev Inst Med Trop Sao Paulo. 2013;55:69–74.
12. Karadag G, Tamer GS, Dervisoglu E. Investigation of intestinal parasites in dialysis patients. Saudi Med J. 2013;34:714–8.
13. Bagheri P, Rakhshanpour A, Farhangnya M, Alizadeh H, Lotfi H, Sobhani H. A systematic review and meta-analysis of prevalence of intestinal parasitic infections in Iran (Article in Persian). Iranian J Infect Dis Trop Med. 2011;16:1–12.
14. Sardarian K, Hajilooi M, Maghsood A, Moghimbeigi A, Alikhani M. A study of the genetic variability of *Blastocystishominis* isolates in Hamadan, West of Iran. Jundishapur J Microbiol. 2012;5:555–9.
15. Sharifdini M, Kia EB, Ashrafi K, Hosseini M, Mirhendi H, Mohebali M, Kamranrashani B. An analysis of clinical characteristics of *Strongyloidesstercoralis* in 70 indigenous patients in Iran. Iran J Parasitol. 2014;9:155–62.
16. World Health Organization. Basic Laboratory methods in medical parasitology. Geneva: World Health Organization; 1991. p. 10–7.
17. Henricksen SA, Pohlenz JFL. Staining of Cryptosporidia by a modified Ziehl Neelsen technique. Acta Vet Scand. 1981;22:594–6.