Cryptosporidium Parvum In Patients With And Without Diarrhea In Abuja, Nigeria

M Igbe, J Ajayi, G Anyanwu, C Igwillo, C Ameh, N Nwoke

Citation

M Igbe, J Ajayi, G Anyanwu, C Igwillo, C Ameh, N Nwoke. *Cryptosporidium Parvum In Patients With And Without Diarrhea In Abuja, Nigeria*. The Internet Journal of Health. 2012 Volume 13 Number 1.

Abstract

A cross-sectional study was conducted on patients that attended the Federal Staff Hospital, Abuja for the purpose of establishing whether there was a difference between the prevalence of C. parvum in patients with diarrhea compared with those without diarrhea. The stools of a total of 354 patients were examined for the presence of C. parvum infection. The females were more infected than the males, 18 (10.84%) versus 14 (7.45%). In the individuals with diarrhea, the age group of 41-50 years had the highest prevalence of C. parvum infection (3, 33.33%), followed by those that were >50 years of age (2, 20.0%), and 31-40 years (3, 18.75%). In non-diarrhea individuals, those that were aged 31-40 years had the highest prevalence of C. parvum infection, (4, 10.53%), followed by those that were aged >50 years, (1, 7.69%). The mean age of the patients was 22.96 + 0.1 years (range 1-90 years; SD 0.93), with 188 males and 166 females. Diarrhea was present in 129 patients, and 225 had no diarrhea. In 16.28% (21/129) of the patients with diarrhoea, Cryptosporidium parvum was found, while in the control group 4.89% (11/225) was found to have the parasite. Among those with diarrhea, 21 had C. parvum, while 11 did not have diarrhea but had C. parvum. This study provides data for a more appropriate management and laid credence on the importance of routine stool cultures for the detection of coccidian parasites.

INTRODUCTION

Cryptosporidium is a leading cause of persistent diarrhoea in developing countries. With proper oral hydration therapy, full recovery from this coccidian is expected in immunocompetent individuals[1]. In one study in West Africa, C. parvum was identified to be the most significant pathogen in infections characterized by acute and persistent diarrhea[2]. Cryptosporidiosis is widespread and affects all ages,[3,4,5] and documented evidence indicated the parasite as a cause of diarrhoea in 95 countries[6,7]. Cryptosporidium is recognized as a significant and widespread cause of diarrheal illness in both immunocompetent and immunosuppressed hosts[8]. Cryptosporidium may cause severe symptoms in persons with weak immune systems[9].

The Cryptosporidium species was described as a minute coccidian parasite of the gastric crypts of a laboratory mouse. The first case of human infection was reported in 1978 in a Japanese boy.[10,11]

The oocysts survive considerable periods in cool, moist environment and resist common disinfections including chlorine, even in excess of those used in water treatment[12]. Person -to- person transmission is now recognized to be common by faecal-oral route, directly or through formites[12]. Infected individuals may excrete many millions of oocysts each day during the acute stage[4]. Infected human and animal hosts usually contaminate potable water, food and formities. Open sewage systems provide the commonest routes of discharge of pathogens into freshwater in urban areas. In addition, human and animal waste points constitute a major source.

The genus Cryptosporidium is a phenotypically and genotypically heterogenous assemblage of largely morphologically identified species and genotypes. Fourteen species and twenty-one C. parvum genotypes are currently recognized[13].

Cryptosporidium transmission occurs at a high frequency in day care centers where children are clustered within classrooms, share toilets and common play areas, or necessitate frequent diaper changing[14].

MATERIALS AND METHODS

Study design: A cross-sectional study was conducted on patients that attended the Federal Staff Hospital, Abuja, from June 2005 to April 2006, in order to determine the prevalence of C. parvum. Stool samples were collected from

recruited members and placed in disposable plastic cups, with subsequent addition of 10% formalin as a preservative before analysis, and in accordance with institutional ethical guidelines. All the stool samples for parasitological investigation were processed in the laboratory of the hospital.

Stool examination: the parasitic infections were diagnosed by examination of stool specimens as fresh wet mounts, using formol ether concentration techniques and modified acid-fast stain. Fresh and concentrated stool specimens were examined as saline wet mounts to detect oocysts. Air-dried smears from fresh stool samples were fixed and stained by a modified acid-fast stain to detect C. parvum.

Statistical Analysis: Difference between proportions was evaluated using the chi-square test. Student T-test for continuous parameter for mean age was performed according to Student, 1907[15]. Statistical significance was achieved if $P < 0.05$.

RESULTS

The stools of a total of 354 patients were examined for the presence of C. parvum infection. The females were more infected than the males, 18 (10.84%) versus 14 (7.45%). Statistical analysis showed an insignificant difference in the association between sexes and C. parvum infection ($?^2$ =1.233, P >0.05. df = 1)(See Table 1). In the individuals with diarrhoea, the age group of 41-50 years had the highest prevalence of C. parvum infection (3, 33.33%), followed by those that were >50 years of age (2, 20.0%) and 31-40 years (3, 18.75%). Statistically there exists no significant difference in the trend ($?^2$=2.557, P>0.05, df=4)(See table 2). In non diarrhea individuals, those that were aged 31-40 years had the highest prevalence of C. parvum infection (4, 10.53%), followed by those that were aged >50 years (1, 7.69%). It was not statistically significant ($?^2$=4.711, P>0.05, df=4)(See table 3).

The mean age of the patients was 22.96 + 0.1 years (range 1-90 years; SD 0.93), with 188 males and 166 females. Diarrhea was present in 129 patients and 225 had no diarrhea. Among those with diarrhea, 21 had C. parvum while 11 did not have diarrhea but had C. parvum.

DISCUSSION

The present study, to the best of our knowledge, is the first report of the detection of C. parvum in Abuja. The isolation rate of C. parvum in diarrhea stool was high in our study (16.28%) compared to other studies[16,17] and correlates with other reports[18-20]. There was no significant difference in the prevalence among the cases and controls, indicating an existing high risk of infection by this parasite in Abuja. Some other studies highlighted C. parvum as the predominant pathogen with significant association to diarrhea cases.[17,19, 21] The high prevalence of Cryptosporidium among both control and test population was observed ealier[20]. In a study in India, a prevalence of 25.2% was reported for diarrhea and 4.7% for controls[22]. In another study in India, Cryptosporidium was found in 40% of cases. C. parvum was detected in 20.6% of chronic diarrhea and 2.5% in non diarrhea cases[23]. A prevalence of 30% was reported in Zaire[24]. In a study on children in Uganda, 25% was reported for diarrhea and 8.5% for non-diarrhea[25]. In Malawi, in 11% of individuals with diarrhea, C. parvum were detected[26]. Patients seropositive for HIV who presented with chronic diarrhea had an infection rate of 32% for Cryptosporidium. In Lusaka, Zambia individuals had Cryptosporidium in 32% of cases[27].

This organism usually causes a self-limiting illness in immunocompetent individuals, but as the immune status of the patient falls they are known to cause life-threatening, profuse, watery diarrhea[28]. The role of C. parvum as a cause of acute diarrhea in developing countries is well documented[29].

The epidemic potential of cryptosporidial diarrhea has been documented[30,31], as have the implications of Cryptosporidiosis in HIV/AIDS and immunosuppressed individuals.[19,32] Cryptosporidiosis can be acquired at any time during the course of HIV infection. Major mortality and morbidity occur in patients with multiple parasites and CD4 count below 116 /cmm[33].

The present study documented the prevalence of C. parvum with diarrhea in Abuja. C. parvum was associated with diarrhea more often than in the control cases studied. This study has provided additional baseline information on the prevalence of C. parvum infection in Nigeria as part of developing strategies towards effective management of C. parvum individuals. In conclusion, this study laid credence on the importance of routine stool cultures for the detection of coccidian parasites, especially if the patients are immunocompromised.

Figure 1

Table 1: Gender related prevalence of C. parvum in Abuja, Nigeria.

Character	total Examined	number infected	infection rate
Gender ($X^2 = 1.233$, $P>0.05$)			
Males	188	14	7.45
Females	166	18	10.84
Total	**354**	**32**	**9.04**

Figure 2

Table 2: Age and diarrhea related prevalence of C.parvum in Abuja, Nigeria.

Age group (years)	total Examined	number infected	infection rate
($X^2=2.557$, $P>0.05$)			
<20	75	10	13.33
21-30	19	3	15.79
31-40	16	3	18.75
41-50	9	3	33.33
≥50	10	2	20.00
Total	**129**	**21**	**16.28**

Figure 3

Table 3: Age and Non diarrhea related prevalence of C. parvum in Abuja, Nigeria.

Age group (years)	total Examined	number infected	infection rate
($X^2 =4.711$, $P>0.05$)			
<20	95	2	2.11
21-30	50	2	4.00
31-40	38	4	10.53
41-50	29	2	6.90
>50	13	1	7.69
Total	**225**	**11**	**4.89**

ACKNOWLEDGEMENT

This work was conducted with the technical assistant of Mrs. Mba G., Mr. Oga E.O. of Federal Staff Hospital, Abuja. The authors are grateful to the physicians in the hospital for their cooperation during the study.

References

1. Clark DP. (1999). New insights into human Cryptosporidium. Clin Microbial Rev 12:554-563.
2. Walker-Smith JA. (2001) Post-infective diarrhea. Curr Opin Infect Dis. 14:567-571.
3. Lisle JT, Rose JB. (1995). Cryptosporidium contamination of the water in The USA and UK: Rev Aqua. 44: 103-117.
4. Casemore D.P (1990). The epidemiological aspects of human cryptosporidiosis epidemiology of infection 104:1-28.
5. Casemore D.P. and Mahoney G.O. (1994) Cryptosporidium infection with special reference to nosocomial transmission of Cryptosporidium parvum: A Review. Folia Parasitologica 41:17-21.
6. Gerba C.P, Johnson D.C and Hassan M.N (1997). Efficiency of iodine water purification tablets against Cryptosporidium oocysts and Giardia cysts. Wilderness and Environmental Medicine. 8(2): 75-77.
7. Dupont, H.L; Chappell C.L Sterling C.R; Okhuysen P.C Rose J.B and Jakuboski W. (1995). The infectivity of Cryptosporidium parvum in healthy volunteers. New England Journal of Medicine 332. 855-859.
8. Eckman L F. Kagnoff MNF (2000). Intestinal Epithelial cells Apoptosis following Cryptosporidium parvum infection. Infection and Immunity 68: 1710-3.
9. Langer R, Riggs MW. (1999). Cryptosporidium parvum apical complex glycoprotein CSL contains a sporozoite ligand for intestinal epithelial cells. Infect Immune 67:5282-52.
10. O'Donogue PJ (1995). Cryptosporidium and cryptopsoridiosis in man and animals. Int. Journal of Parasit. 25(2)
11. Pitik SD, Fainstein V, Garza D, et al., (1983). Human crypotosporidiosis: Spectrum of disease. Report of six cases and review of the literature. Arch Intern Med. 143:2269-2275.
12. Casemore D.P (1989). Human cryptosporidiosis. In: D.S Reeve A.M Geddes (Eds) Recent Advances in infection. Churchill Livingstone, Edinburgh, pp 209-236.
13. Nagamani K, Rao PPR, Mathur G, Krishna GTP, Rajalingam AP and Saxena NK (2008). Prevalence of Cryptosporidium, Cyclospora cayeatanensis and Isospora belli infection among diarrhea patients in south India. Trop Med and Hyg. 36(3):131-136.
14. Xiao L, Fayer R, Ryan U, Upton SJ. (2004). Cryptosporidium Taxonomy: Recent Advances and Implications for public Health. Clin Microbiol Rev. 17:72-97.
15. student. "On the Error of Counting with Haemacytometer." Biometrika 5:351-360, 1907
16. Malla N, Sehgal R, Ganguly N.K. and Mahajan R.C. (1987). Cryptosporidiosis in children in Chandigarh. India J Med Res.86:722.
17. Cegielski JP, Ortega YR, McKee S, Madden JF, Gaido L, Schwartz DA, Manji K, Jorgensen AF, Miller SE, Pulipaka UP, Msengi AE, Mwakyusa DH, Sterling CR, Reller LB. (1999). Cryptosporidium, enterocytozoon, and Cyclospora infections in pediatric and adult patients with diarrhea in Tanzania. Clin Infect Dis. 28(2):314-21.
18. Pape J.W., Levine E, Beaulieu M.E., Marshall F, Verdier R, Johnson WD Jr. (1987). cryptosporidiosis in Haitan children. Am J Trop Med Hyg. 36:333-337.
19. Weber R., LedergerberB., Zbinden R., Altwegg M., Pfyffer G.E., et al., (1999). enteric infections and diarrhea in human immunodeficiency virus infected persons. Prospective community-based cohort study. Arch intern med. 159 :1473-1480.
20. Kumar SS, Ananthan S and Lakshmi P. (2002). Intestinal parasitic infection in HIV infected patients with diarrhea in Chennai. Indian Journal of Medical Microbiology. 20:88-91.
21. Tarimo DS, Killewo JZJ, Minijas JN, Msanga GI (1996). Prevalence of intestinal parasites in adult patients with enteropathic AIDS in North Eastern Tanzania. East African Med. J. 73:397-9.
22. Muthusamy D, Rao SS, Ramani S, Monica B, Banerjee I, Abraham OC, Mathai DC, Primrose B, Muliyil J, Wanke

CA, Ward HD and Kang G. (2006). Multilocus Genotyping of Cryptosporidium sp. Isolate from human immunodeficiency virus-infected individuals in South India. Journal of Clin Microbial. 44(2):632-634.
23. Gupta S, Narang S, Nunavath V, Singh S. (2008). Chronic diarrhea in HIV Patients: prevalence of coccidian parasites. Indian J Med Microbial. 26:172-5.
24. Colebunders R, Lusakumuni K, Nelson A M, Gigase P, Lebughe I, van Marck E, Kapita B, Francis H, Salaun J J, Quinn T C, et al. (1988). Persistent diarrhea in Zairian AIDS patients: an endoscopic and histological study. Gut. 29(12): 1687–1691.
25. Tumwine J.K., Kekitiinwa A, Nabukeera N, Akiyoshi DE., Rich SM., Widmer G, Feng X and Tzipori S. (2003). Cryptosporidium parvum in children with diarrhea in Mulago hospital, Kampala, Uganda Am. J. Trop. Med. Hyg. 68(6): 710-715.
26. Cranendonk RJ, Kodde CJ, Chipeta D, Zijlstra EE, Sluiters JF. (2003). Cryptosporidium parvum and Isospora belli infections among patients with and without diarrhea. East Afr Med J. 80(8):393-4.
27. Conlon CP, Pinching AJ, Perera CU, Moody A, Luo NP, Lucas SB. (1990). HIV-related enteropathy in Zambia: a clinical, microbiological, and histological study. Am J Trop Med Hyg. 42(1):83-8.
28. Meisel JF, Perera DR, Meligrilo C, Rubin CB. (1976). Overwhelming watery diarrhea associated with Cryptosporidium in an immunosuppresed patient. Gastroenterology 70:1156-66.
29. Griffiths JK, (1998). Human cryptosporidiosis: epidemiology, transmission, clinical disease treatment, and diagnosis. Adv Parasitol 40: 38–87.
30. Graczyk T.K; Fayer R. and Cranfied M.R. (1997). Zoonotic transmission of Cryptosporidium parvum; implication for water-borne Cryptosporidiosis. Parasitology Today 13(9): 348-350.
31. Mackenzie WR, Hoxie NJ, Proctor ME, et al. (1994). A massive outbreak in Milwaukee of a Cryptosporidium infection transmitted through the water supplies. New Engl J Med.331(3): 161 - 167.
32. Goodgame R. W. (1996). Understanding the intestinal spore-forming protozoa: Cryptosporidia, Microsporidia, Isospora and Cyclospora. Annals of Internal Medicine 124(4) 429-441.
33. Shah UV, Purohit BC, Chandralekha D, Mapara MH, (2003). Coinfection with Cryptosporidium, Isospora and S. stercoralis in a patient with AIDS-a case report. Indian J Med Microbiol. 21(2)137-138.

Author Information

M.A. Igbe, M.Sc.
Ph.D Candidate, Department of Zoology, Applied Entomology and Parasitology Unit, University of Jos

J.A. Ajayi, Ph.D
Department of Zoology, Applied Entomology and Parasitology Unit, University of Jos

G.I. Anyanwu, Ph.D
Department of Zoology, Applied Entomology and Parasitology Unit, University of Jos

C.I. Igwillo, MBBS
Federal Ministry of Health

C. Ameh, M.Sc.
Federal Ministry of Health

N. Nwoke, M.Sc.
Federal Ministry of Health