Risk Management and Healthcare Policy

Dovepress
open access to scientific and medical research

Open Access Full Text Article

SHORT REPORT

Contamination of irrigation systems of dental units with *Cryptosporidium* species in Alexandria, Egypt: a neglected disinfection pitfall

This article was published in the following Dove Press journal:
Risk Management and Healthcare Policy
16 August 2012
Number of times this article has been viewed

Azza Hassan[1]
Hanan Farouk[1]
Rashad Abdul-Ghani[2,3]
Faika Hassanein[1]

[1]Tropical Health Department, High Institute of Public Health, Alexandria University, Alexandria, Egypt; [2]Parasitology Department, Medical Research Institute, Alexandria University, Alexandria, Egypt; [3]Department of Medical Parasitology, Faculty of Medicine and Health Sciences, Sana'a University, Sana'a, Yemen

Purpose: To investigate the contamination of the dental irrigation systems with *Cryptosporidium* species in Alexandria, Egypt.

Methods: Forty water samples from all 20 working dental irrigation machines in a dental center in Alexandria were included in the study. Water samples were taken from the handpieces of dental irrigation machines in all studied units. After filtration through a membrane filter, water sample residues were stained using modified Ziehl–Neelsen staining and examined microscopically for *Cryptosporidium* spp.

Results: *Cryptosporidium* spp. was found as a contaminant in 27.5% of water samples taken from dental irrigation machines.

Conclusion: This indicates a contamination by the public water supplies to which these dental irrigation machines are connected. This disinfection pitfall may pose an infection risk to those seeking dental care.

Keywords: *Cryptosporidium*, contamination, dental irrigation machines, Alexandria

Introduction

The specific structure of dental units favors the presence of biofilm and microbial contamination of dental unit water lines.[1] Dental practices may be associated with the acquisition of a variety of infections; however, great interest has so far been focused on blood-borne agents, such as viruses. *Cryptosporidium* is an obligatory, intracellular, coccidian parasite that infects the intestinal epithelial cells, causing diarrhea. It is classified as an emerging pathogen by the Centers for Disease Control and Prevention,[2] and can cause infection in people, cattle, and other animals.[3] *Cryptosporidium* may be transmitted by direct person-to-person contact, contact with infected animals, or ingestion of contaminated water or food.[4] The parasite can complete its life cycle within one host, and is known to be resistant to antiparasitic drugs. Upon infection with *Cryptosporidium,* immunocompetent individuals may experience a self-limiting, acute, watery diarrhea lasting for about a week; however, the immunocompromised typically develop chronic or persistent diarrhea, leading to wasting and even death.[5] Further, chemotherapeutic agents have been shown to have low efficacy in those immunocompromised individuals who are most affected by the disease.[6]

The resistance of *Cryptosporidium* spp. to the typical concentrations of chlorine used to disinfect water has made this an important issue.[7] The ability of *Cryptosporidium* oocysts to survive conventional water treatment, and to withstand chlorine disinfection, make control of water-borne infection particularly challenging in developed and developing countries alike.[8] Many microbial studies have

Correspondence: Rashad Abdul-Ghani
Parasitology Department,
Medical Research Institute,
Alexandria University, Egypt
Tel +20 3 591 8407
Email rashadqb@yahoo.com

reported the presence of bacteria and biofilm formation in dental unit water lines.[1] This prompted us to search for the possible contamination of dental irrigation systems with *Cryptosporidium* spp., one of the most commonly known water-borne parasites.

The availability of simple, inexpensive methods to detect *Cryptosporidium* spp. in the hospital environment may promote regular monitoring for the parasite in resource-limited countries. Modified Ziehl–Neelsen (MZN) is an inexpensive and readily available stain in Egypt. In the present study, we used MZN stain to detect *Cryptosporidium* spp. in water samples collected from the dental irrigation systems in a dental center. Despite its recognition as a risk factor to patients in dental clinics, contamination of irrigation water in such clinics has not been given any interest, and no previously published study has dealt with this topic. Therefore, the purpose of this preliminary study was to uncover such potential risk in the clinics of a dental health center in Alexandria, Egypt.

Materials and methods

The present study was conducted on dental irrigation machines in a dental center in Alexandria, Egypt, during the period from June to August, 2011. Forty 500 mL water samples were collected from the handpieces of all 20 dental irrigation system machines in the dental center, using sterile containers. Water samples were then filtered through sterile 0.45 μm membrane filters (Sartorius Stedim Biotech, Goettingen, Germany) within 2 hours of collection. Smears were prepared from the residues collected on membrane filters, air-dried, and fixed. Duplicate smears were stained with MZN,[9] according to standard procedures. The stained smears were then examined under a light microscope using 1000× magnification. At least, 200 oil immersion fields of the stained smears were examined for cryptosporidia.

Result

Cryptosporidium spp. was prevalent in 27.5% (11/40) of water samples collected from the handpieces of dental machines.

Discussion

Conventional water treatment involving coagulation/flocculation, sedimentation, filtration, and disinfection may not be sufficient to clear water contamination with *Cryptosporidium* spp.[10] Therefore, *Cryptosporidium* oocysts may escape water-treatment disinfection procedures. Recently, 15% of public water coolers have been found to be contaminated with *Cryptosporidium* spp., in Alexandria[11] indicating the contamination of public water supplies.

To our knowledge, the present study is the first report on detection of *Cryptosporidium* spp. in the irrigation systems of dental units. It was found that 27.5% of water samples from the handpieces of dental irrigation machines were contaminated with *Cryptosporidium* spp. This indicates the contamination of water supplies of dental units with this parasite. This is a particularly important finding because the infectious dose of *Cryptosporidium* is so low that only a few oocysts can initiate infection in healthy individuals.[12,13]

The connection of dental units to public water supplies necessitates the investigation of these units for possible contamination. The presence of *Cryptosporidium* spp. in the irrigation systems of dental units has clinical implications as it may be associated with diarrhea in those ingesting water contaminated with oocysts in such units. This is particularly important if the patients seeking dental care are immunocompromized or young children. To avoid possible infection with *Cryptosporidium,* water should not be delivered to patients via dental irrigation systems connected to the public water system. Instead, the use of independent water supplies and the provision of disinfected water in dental units are encouraged.

The result of the present study is limited by the fact that only morphological criteria were evaluated; nevertheless, this study is very important due to its preliminary nature. Further large-scale studies to investigate the viability of *Cryptosporidium* oocysts besides the molecular detection and genotyping of *Cryptosporidium* to the species and genotype levels in dental unit irrigation systems are recommended.

Acknowledgments

The authors gratefully thank those who provided assistance in the dental center.

Disclosure

The authors report no conflict of interest in this work.

References

1. Szymańska J, Sitkowska J, Dutkiewicz J. Microbial contamination of dental unit waterlines. *Ann Agric Environ Med*. 2008;15:173–179.
2. Guerrant RL. Cryptosporidiosis: an emerging, highly infectious threat. *Emerg Infect Dis*. 1997;3:51–57.
3. Davies AP, Chalmers RM. Cryptosporidiosis. *BMJ*. 2009;339: 963–967.
4. Griffiths JK. Human cryptosporidiosis: epidemiology, transmission, clinical disease, treatment, and diagnosis. *Adv Parasitol*. 1998;40: 37–85.

5. Pantenburg B, Castellanos-Gonzalez A, Dann SM, et al. Human CD8(+) T cells clear *Cryptosporidium parvum* from infected intestinal epithelial cells. *Am J Trop Med Hyg*. 2010;82:600–607.
6. Mead JR. Cryptosporidiosis and the challenges of chemotherapy. *Drug Resist Updat*. 2002;5:47–57.
7. Rochelle PA, Marshall MM, Mead JR, et al. Comparison of in vitro cell culture and a mouse assay for measuring infectivity of *Cryptosporidium parvum*. *Appl Environ Microbiol*. 2002;68:3809–3817.
8. Chalmers RM, Campbell B, Crouch N, Davies AP. Clinical laboratory practices for detection and reporting of *Cryptosporidium* in community cases of diarrhoea in the United Kingdom, 2008. *Euro Surveill*. 2010; 15:1–5.
9. Casemore DP. ACP Broadsheet 128: June 1991. Laboratory methods for diagnosing cryptosporidiosis. *J Clin Pathol*. 1991;44:445–451.
10. Collinet-Adler S, Ward HD. Cryptosporidiosis: environmental, therapeutic, and preventive challenges. *Eur J Clin Microbiol Infect Dis*. 2010;29(8):927–935.
11. Hussein RA, Hassan AA, Bakr WM. Assessment of the quality of water from some public coolers in Alexandria, Egypt. *J Egypt Public Health Assoc*. 2009;84:197–217.
12. DuPont HL, Chappell CL, Sterling CR, Okhuysen PC, Rose JB, Jakubowski W. The infectivity of *Cryptosporidium parvum* in healthy volunteers. *N Engl J Med*. 1995;332:855–859.
13. Okhuysen PC, Chappell CL, Crabb, JH, Sterling CR, DuPont HL. Virulence of three distinct *Cryptosporidium parvum* isolates for healthy adults. *J Infect Dis*. 1999;180:1275–1281.