Page 399 to 403

Volume 2 • Issue 4 • 2018

Scientia Ricerca

Mini Review

Multidisciplinary Advances in Veterinary Science

ISSN: 2573-3435

Cryptosporidiosis: A Mini Review

Snehangsu Sinha[1]* and JR Joute[2]

[1]*Department of Anatomy & Histology, College of Veterinary Science, AAU, Guwahati, Assam, India*

[2]*Veterinay Officer, Lakhipur, Cachar, Assam, India*

***Corresponding Author:** Snehangsu Sinha, Department of Anatomy & Histology, College of Veterinary Science, AAU, Guwahati, Assam, India.

Received: July 30, 2018; **Published:** August 07, 2018

Abstract

Zoonotic protozoan parasites are increasing concern in both developed and developing countries. They are responsible for acute and chronic diarrhoea in immune compromise and immune competent individuals. Several foodborne and waterborne disease outbreak are associated with them which further highlighted their public health importance. This review highlighted the important emerging protozoan parasites Cryptosporidium with emphasis on its zoonotic significance.

Keywords: *Zoonotic; Cryptosporidium; Parasite*

Volume 2 Issue 4 August 2018

Introduction

Cryptosporidiosis is an important emerging zoonotic disease caused by spp Cryptosporidium. It is a small Apicomplexan protozoan parasite which inhabits the mucosal epithelium of the gastrointestinal tract of a wide range of vertebrate hosts including man. Cryptosporidium spp. was first described by Tyzzer in 1907 but for several decades, it was not considered important to humans. However, in 1976 the pathogenesis of Cryptosporidium species was first recognised in humans and with the recognition of frequent cases in immune-competent individuals along with the number of waterborne outbreaks has changed this image. In fact, Cryptosporidium is now one of the most commonly identified intestinal pathogens throughout the world. At present, 20 valid species of Cryptosporidium have been recognised (Egyed., *et al*. 2003; Thompson and Monis, 2004; Xiao., *et al*. 2004; Power and Ryan, 2008).

But the vast majority of illness in human are caused by Cryptosporidium parvum and recognised as the main zoonotic species. The molecular analysis of human and bovine isolates of C. parvum, indicates the existence of two predominantly distinct genotypes (Xiao 2010 Xiao and Ryan 2004 and Caccio 2005, Peng., *et al*. 1997). Type I genotypes (anthroponotic or humans genotype) and Type 2 genotypes (zoonotic or cattle genotype. Cattle could be infected with at least ten various Cryptosporidium species or genotypes and have been considered the major reservoir of Cryptosporidium spp. For human infections. Calves below one month of age are found to be most susceptible to the infection and major contributors of zoonotic C. parvumthan the other age group (Fayer., *et al*. 2006 and Singh., *et al*.

2006). With the attainment of immunological maturity the infection subsides in older animals though they remain as a source of infection to other susceptible individuals. Its occurrence is dependent on factors that include season, age and other demographic characteristics of a population (Joute., *et al*. 2014, Bhat., *et al*. 2012, Roy., *et al*. 2006). Infection is caused by ingestion of oocysts along with water or food.

The ingested oocyst released sporozoites, which subsequently attached to and infiltrates epithelial cells in the small intestine and result in malabsorptive or secretory diarrhoea. It completes its life cycle in the small intestine and releases enormous amount of robust oocysts which are shed in the faeces of infected people and animal (Adjei., *et al*. 2003). Oocysts of C. parvum are spherical, with a diameter of 4–6 mm, and may be either thick- or thin-walled oocysts. Thin walled oocysts may encyst within the same host and start a new life cycle (autoinfection). Thick-walled oocysts are excreted with the faeces. Cryptosporidium spp. is highly infectious and as low as 30 oocysts can cause infection in healthy volunteers.

In developed countries, various modes of transmission have also been identified like close person to person contact e.g. hospital cross infections and through zoonotic sources (Koch., *et al*. 1985). Contaminated water and food have been implicated as the main source of infection in human and serious outbreaks of cryptosporidiosis such as the Milwaukee outbreak in 1993 (MacKenzie., *et al*. 1994). The contact with infected calves has also been implicated as a major cause of outbreaks among veterinary students and research workers and children attending agricultural camps and fairs (Preiser., *et al*. 2003; Smith., *et al*. 2004; Chalmers., *et al*. 2005). The micro-organism is ubiquitous in environment (Navin and Junarek 1984). So, there is every possibility of zoonotic transmission of infection from animals to human beings, especially under poor hygienic condition in developing countries.

Cryptosporidiosis remains one of the most important health problem globally and leading cause of morbidity and mortality especially in developing countries (WHO 2006). It gives rise to a chronic, life threatening condition particularly in those with Human Immunodeficiency Virus (HIV) and person with acute gastro-enteritis (Pieniazak., *et al*. 1999). Mortality in immunocompetent patients is generally low. In an immune-competent host, the organism usually produces short-term and self-limited diarrhoea, while in immune-deficient individuals or that undergoing cancer chemotherapy infection is often prolonged resulting in significant morbidity due to diarrhoea and dehydration (Aboul-Magd., *et al*. 2000). No consistently effective therapeutic agent has been found (Griffiths., *et al*. 1998). The prevalence rates of 10 to 33 per cent in those with AIDS have been reported from developing countries. Malnutrition, which impairs cellular immunity, is another recognized risk factor for cryptosporidiosis (Gendrel., *et al*. 2003). It is also reported that pregnancy may predispose to Cryptosporidium infection (Ungar, 1990). Unlike bacterial pathogens, Cryptosporidium oocysts are resistant to chlorine disinfection and can survive for days in treated recreational water venues (e.g., public and residential swimming pools and community and commercial water parks) (Le Chevallier., *et al*. 1991). Due to the size and frequency of these outbreaks, cryptosporidiosis became a serious public health issue worldwide and prompted revaluation of the microbiological standards for drinking water by health authorities in developed and developing countries. The guidelines of World Health Organisation (WHO) for drinking water, classifies Cryptosporidium as a pathogen of significant public health importance (WHO 2006). The estimated prevalence of Cryptosporidium spp. in people with diarrhoea is 1% to 3% in developed countries and about 10% in developing country (Chen., *et al*. 2002).

Waterborne and foodborne outbreaks

Parasitic protozoa have been recognised as having great potential to cause waterborne and foodborne disease. Several outbreaks have been associated with parasitic protozoa worldwide. Although other parasitic protozoa can be spread by food or water, current epidemiological evidence suggests that Cryptosporidium, Cyclospora and Giardia present the largest risks. (Dawson 2005). They are widespread in the environment, particularly the aquatic environment, and major outbreaks occurred as a result of contaminated drinking water especially cryptosporidiosis. The organisms are also of great concern in food production worldwide. Parasitic protozoa do not multiply in foods, but they may survive in or on moist foods for months in cool, damp environments.

However outbreaks of foodborne disease have occurred but tended to involve fewer reported cases than those attributed to the drinking water supply. Worldwide Report of outbreaks due to the waterborne transmission of parasitic protozoa during the time period from 2004 to 2010 Cryptosporidium spp. was reported to be most common waterborne parasite responsible for 60% of the outbreak. More than 160 waterborne outbreaks of cryptosporidiosis have been reported worldwide, with most cases reported in the US and UK. Cryptosporidium has been implicated as the cause of numerous outbreaks of watery diarrhea associated with contaminated food or water supplies (Fayer., *et al.* 2000) and some cases of water-borne transmission have been linked to domestic livestock, especially cattle. Water is the most commonly reported vehicle of transmission in Cryptosporidium outbreaks. For example, in a review of 89 waterborne outbreaks of infectious intestinal disease (IID) involving 4321 cases in England and Wales, Cryptosporidium was the causative agent in 69% The largest documented outbreak of gastrointestinal disease due Cryptosporidium occurred in Milwaukee, Wisconsin, USA, in 1993, during which there were an estimated 403,000 cases of illness as a result of a contaminated drinking water supply (Mackenzie., *et al.* 1994).

In recreational waters, Cryptosporidium is also the leading microbial cause of outbreaks in both the UK and USA. One of these occurred in Sydney, Australia, in 1994, when 70 people contracted cryptosporidiosis. Most Cryptosporidium drinking water outbreaks are attributed to chronic filtration failures or livestock and rainfall in the catchment. Cattle are a significant source of C. parvum in surface waters. During a waterborne outbreak of cryptosporidiosis in British Columbia, oocysts were detected in 70% of the cattle faecal specimens collected in the watershed close to the reservoir intake (Ong., *et al*. 1997). Several outbreaks have occurred in close social groups such as households, nurseries, and hospital or nursing home settings. Cryptosporidium transmission occurs frequently in nurseries, where infants are clustered within classrooms, and share toilets and play areas. An outbreak was reported in a bone marrow transplant unit when five patients developed cryptosporidiosis after an infected patient was admitted to the unit (Casemore 1990). Foodborne outbreak of cryptosporidiosis on larger scale occurred in the USA in 1993 arising from the consumption of infected fresh-pressed apple cider.

Conclusions

Protozoan parasites are responsible for a significant public health impact because of the high prevalence and severity of the infection. Its inclination in causing major food and waterborne disease outbreaks have become a great burden among medical practitioner, food producers, veterinarian and wildlife personnel. Although these parasitic infections are distributed worldwide, their prevalence is higher in developing compared to developed countries. However the relative importance of zoonotic infections specially developing countries has not been studied in detail. Disease surveillance and case reporting from both human and animal along with advance disease diagnostic technique are necessary in studying the disease condition and better understanding of their zoonotic importance. Better communication and cooperation among medical and veterinary personnel are necessary in future to know the status of the disease and to formulate control strategies.

References

1. Aboul-Magd LA., *et al*. "A preliminary study of human cryptosporidiosis associated with gastrointestinal infection in acquired immunodeficiency syndrome". *Journal of the Egyptian Society of Parasitology* 16 (2000): 573-577.
2. Adjei A., *et al*. "Cryptosporidium oocysts in Ghanaian AIDS patients with diarrhoea". *East African Medical Journal* 80.7 (2003): 369-372.
3. Bhat SA., *et al*. "Prevalence of Cryptosporidiosis in neonatal Buffalo calves in Ludhiana district of Punjab, India". *Asian Journal of Veterinary and Animal Advances* 7.6 (2012): 512-520.
4. Caccio SM. "Molecular epidemiology of human cryptosporidiosis". *Parassitologia* 47.2 (2005): 185-192.
5. Casemore DP., *et al*. "Screening for Cryptosporidium in stools". *The Lancet* (1984): 734-735.
6. Chalmers RM., *et al*. "Direct comparison of selected methods for genetic categorisation of Cryptosporidium parvum and Cryptosporidium hominis species". *International Journal for Parasitology* 35.4 (2005): 397-410.
7. Chen XM., *et al*. "Cryptosporidiosis". *The New England Journal of Medicine* 346 (2002): 1723-1731.

8. Dawson David. "Foodborne protozoan parasites". *International Journal of Food Microbiology* 103.2 (2005): 207-227.
9. Egyed Z., *et al*. "Characterization of Cryptosporidium spp.—recent developments and future needs". *Veterinary Parasitology* 111.2.3 (2003): 103-104.
10. Fayer R., *et al*. "Prevalence of Cryptosporidium, Giardia and Eimeria infections in postweaned and adult cattle on three Maryland farms". *Veterinary Parasitology* 93.2 (2000): 103-112.
11. Gendrel D., *et al*. "Parasitic diarrhoea in normal and malnourished children (Review)". *Fundamental and Clinical Pharmacology Journal* 17.2 (2003): 189-197.
12. Griffiths JK., *et al*. "Paromomycin and geneticin inhibit intracellular Cryptosporidium parvum without trafficking through the host cell cytoplasm: implications for drug delivery". *Infection and immunity* 66.8 (1998): 3874-3883.
13. International Symposium on Waterborne Cryptosporidium, March 2–5, 1997, Newport Beach, CA. C.R. Fricker and J.L. Clancy (eds.). American Water Works Association, Denver, Colorado. 1997.
14. Joute JR., *et al*. "Prevalence and molecular epidemiology of Cryptosporidium parvum in dairy calves in Punjab (India)". *Journal of Parasitic Diseases* 40.3 (2014): 745-749.
15. Koch KL., et al. "Cryptosporidiosis in hospital personnel. Evidence for person-to-person transmission". *Annals of Internal Medicine* 102.5 (1985): 593-596.
16. Le Chevalier MW., et al. "Occurrence of Giardia and Cryptosporidium spp. in surface water supplies". *Applied Environmental Microbiology* 57.9 (1991): 2610-2616.
17. MacKenzie WR., *et al*. "A massive outbreak in Milwaukee of Cryptosporidium infection transmitted through the public water supply". *New England Journal of Medicine* 331.3 (1994): 161-167.
18. Navin TR and Junarek DD. "Cryptosporidiosis; clinical, epidemiological and parasitologic-review". *Reviews of Infectious Disease* 6.3 (1984): 313-327.
19. Ong CSL., *et al*. "An outbreak of cryptosporidiosis in southeastern British Columbia, Canada". In: Proceedings of the (1997).
20. Peng MM., *et al*. "Genetic polymorphism among Cryptosporidium parvum isolates: evidence of two distinct human transmission cycles". *Emerging Infectious Diseases journal* 3.4 (1997): 567-573.
21. Pieniazek N., *et al*. "New Cryptosporidium genotypes in HIV-infected persons". *Emerging Infectious Disease* 5.3 (1999): 444-449.
22. Power ML and Ryan UM. "A new species of Cryptosporidium (Apicomplexa: Cryptosporidiidae) from eastern grey kangaroos (Macropusgiganteus)". *Journal of Parasitology* 94.5 (2008): 1114-1117.
23. Preiser G., *et al*. "An outbreak of cryptosporidiosis among veterinary science students who work with calves". *Journal of American College Health* 51.5 (2003): 213-215.
24. Roy SS., *et al*. "Observations on the epidemiology of bovine cryptosporidiosis in India". *Veterinary Parasitology* 141.3.4 (2006): 330-333.
25. Singh BB., *et al*. "Prevalence of Cryptosporidium parvum infection in Punjab (India) and its association with diarrhoea in neonatal dairy calves". *Veterinary Parasitology* 140.1.2 (2006): 162-165.
26. Smith KE., *et al*. "Outbreaks of enteric infections caused by multiple pathogens associated with calves at a farm day camp". *The Pediatric Infectious Disease Journal* 23.12 (2004): 1098-1104.
27. Thompson RC and Monis PT. "Variation in Giardia: implications for taxonomy and epidemiology". *Advances in Parasitology* 58 (2004): 69-137.
28. Unger BL. "Enzyme-Linked Immunoassay for detection of Cryptosporidium antigens in faecal specimens". *Journal of Clinical Microbiology* 28.11 (1990): 2491-2495.
29. Xiao L., *et al*. "Cryptosporidium taxonomy: recent advances and implications for public health". *Clinical Microbiology Reviews* 17.1 (2004): 72-97.
30. Xiao L and Ryan UM. "Cryptosporidiosis: an update in molecular epidemiology. Current Opinion in Infectious Disease". *Current Opinion in Infectious Diseases* 17.5 (2004): 483-490.
31. Xiao L. "Molecular epidemiology of cryptosporidiosis: An update". *Experimental Parasitology* 124.1 (2010): 80-89.