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Cryptosporidiosis: A Zoonotic Threat to Veterinary Professionals

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Introduction

An emerging coccidian parasite of zoonotic importance is *Cryptosporidium*. It belongs to the family Cryptosporidiidae, order Eucoccidiida, class Sporozoa and phylum Apicomplexa. The parasite's location within the cell membrane and outside the cytoplasm is what makes it unique among other protozoans. There is presence of a distinct parsitophorous vacuole allows the parasite to feed. This gastrointestinal protozoan parasite causes diarrhoea in a variety of neonatal farm animals and can be fatal if not treated timely. Cattle are mostly affected by *Cryptosporidium parvum*, *C. bovis*, and *C. hominis*, which can induce diarrhoea, stunted growth and weight loss in calves, which results in major economic losses to dairy and beef industry. Close association to livestock can put humans in animal related profession at risk for occupational illness. The disease can spread bothways between humans and animals through the faeco-oral pathway. Others ways for human to contract the disease is by drinking contaminated water from lakes, swimming pools, water parks and other recreational areas, contaminated fruits and vegetables if consumed without proper washing. Milk and food products from unpasteurized milk can also predispose one for the disease. In the gastrointestinal tract of host, the organism mostly parasitize the microvillus border of epithelial cells. Concerns over zoonotic transmission—the spread of disease from infected cattle to people who interact closely with animals—and potential repercussions on the human population have been raised by the disease's recent development and improved diagnosis. Concerns about the spread of diseases, which mostly come from fomites such the air, water, and other pollutants found near animals, have lately arisen in India and other affected countries around the world. People from resource limited nations are more a predisposition to illness than people in resource rich nations due of a lack of mechanisation and the intimate interactions between humans and animals. Immunocompromised people confront the

potentially fatal effects of a chronic illness, whereas immunocompetent persons suffer from acute digestive tract infections brought on by *Cryptosporidium* parasites.

Epidemiology

A human or animal species that secretes oocysts in faeces as well as contaminate food or water, can act as source of infection to other humans. Risk of contracting disease is more in farmers and farm workers, people in other animal-related jobs (butcher, hoof trimmer), veterinary professionals(veterinarian, animal handlers, animal researchers) because of close association with infected animals and continous exposure to animal. Children and geriatric humans of 75 or above age are more susceptible for disease. Beside that patients suffering from AIDS, cancer and at immunosuppressive treatment also falls under the category of high risk individuals. In resource rich nations, the prevalence of Cryptosporidium infection is much lower than in developing nations since a large number of individuals in the latter still lack access to basic clean and drinking water. In underdeveloped nations also disease is more prevalent in immunodeficient individuals and account for 10-15% of cases of severe diarrhoeal disease. In recent studies it was concluded that the transmission of oocyst through inhalation route by inhaling contaminated respiratory secretions and coughing which can lead to pulmonary infection is also there for cryptosporidium. Waterborne disease outbreak due to cryptosporidium is common around the globe and can lead to around 50000 death annually. Oocyst of cryptosroridium is quite resistant to disinfectants such as chlorine, chloramines, and chlorine dioxide used for cleaning water.

Life cycle

Asprocystic and tetrasporozoic oocysts of *cryptosporidium*, expelled mainly in faeces and rarely in respiratory secretions of host. The excrement of these contaminate food, including raw milk, water (drinking water sources, recreational water sources). After ingestion, or inhalation in rare cases, sporozoites are released and move towards the brush border epithelium where they perform asexual reproduction(schizogony) before undergoing sexual reproduction (gametogony). This resulted in the formation of micro and macrogamate species. These will fuse to form two different types of oocysts: thin-walled and thick-walled. While the thin-walled excyst within the same host causes the autoinfective cycle, the thick-walled oocyst discharged in faeces starts the new cycle.

Zoonotic species

This apicomplexan protozoan is euryxenous and capable of infecting humans with multiple species and genotypes. Two main zoonotic species of cryptosporidium are *Cryptosporidium hominis* (previously known as *C. parvum* genotype I) *Cryptosporidium parvum* (earlier *C. parvum* genotype II). Additionally, people can contract infections from *C. meleagridis, C. felis, C. canis, C. ubiquitum, C. cuniculus, C. viatorum*, Chipmunk genotype I, *Cryptosporidium* mink genotype, and *C. muris*.

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Pathogenesis

Parasite on entering host body moves towards its predilection site which is intestinal villous. Where it resides in epithellial surface of villi. Constant growth and proliferation of protozoa causes damage to intestinal villi, which impair the intestinal barrier and increases its permeability, absorption and secretion of fluid and electrolytes. The severity of pathogenesis mainly depends upon the immune status of host. Even asymptomatic infections are associated with growth deficits and infants with cryptosporidiosis may have an increased risk of all-cause mortality persisting into the second year of life. However, *Cryptosporidium* also has important public health implications for developed countries.

Clinical signs

In immunocompetent hosts the infection can be present in subclinical form. However, in immunologically compromised individual such as those suffering from HIV/AIDS or on suppressive therapy clinical form of cryptosporidiosis disease will run a chronic phase and can be manifested in the form of symptoms such as fever, vomiting, nausea, diarrhoea, and abdominal pain, cholera-like illness, emaciation, decreased absorption of retroviral drugs and shorter life span. In undernourished children belonging to developing countries cryptosporidiosis have determinantal effects on effects on growth, weight gain, and physical and brain development. Such symptoms appear after 1 wk of contracting of infection and last for few days to weeks, illness may even be fatal for those affected and necessitate hospitalisation. *Cryptosporidium* spp. is known to cause traveller's diarrhoea and to be responsible for outbreaks of diarrhoea that are often associated with recreational water, such as waterparks, or the municipal water supply**.**

Diagnosis

Next to rotavirus cryptosporidiosis is 2nd leading cause of diarrhoeic illness in human infants. Other pathogens that cause similar illness and diarrhoeic symptoms are salmonella, coronavirus which should be ruled out while diagnosing cryptosporidium infection. The easiest and cost-effective method for diagnosing the cryptosporidiosis is microscopic examination of feacal sample for presence oocyst after formal ether sedimentation. Staining of sediment using Ziehl-Neelson staining, phenol-auramine can be done and oocyst will appear as pink against blue background or bright yellow in colour respectively. The limitation of using this method is mainly the lack of sensitivity and accuracy of method rely on the expertise of examiner. Other methods with more sensitivity and specificity include Immunochromatographic testing and ELISA. The limitation of these infections is mainly the minimum threshold value of infection need to be present in body of patients to be detected by these methods. Hence majority of diagnosis has shifted to costly but reliable methods such as PCR which is now considered as gold standard for diagnosis.

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Treatment

In immunocompetent individuals there is no need for treatment as person recover from infection on its own. However, infants, geriatric patients are the on those need to be take care of because it can cause serious implication in such individuals. Although no antibiotic is 100% effective in cryptosporidiosis. However, Nitazoxanide, Paromomycin, Azithromycin, Paromomycin plus azithromycin, Rifaximin can be used. Supportive therapy to compensate fluid loss and boost immune system of host are some important factors to consider while trearting cryptosporidiosis. Due to degeneration of lactase producing cells it is helpful to use lactose free diet. Glutamine which act as important energy source for intestinal cells is rapidly degraded in intestinal cells hence supplementation of alanine-glutamine is important to maintain functioning of intestinal cells.

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