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GIARDIASIS: A REVIEW

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Abstract

Giardia lamblia is one of the most prevalent parasites in the world and affects a large number of people, especially children, causing Giardiasis. It is easily transmitted through ingesting food and drink water contaminated with cysts of parasite or directly by hands contaminated with feces, especially in areas with high population density. Some infections with this parasite are asymptomatic but acute cases are characterized by fatty diarrhea, nausea, abdominal pain, vomiting, fever, poor absorption of carbohydrates and fats and a deficiency of vitamin B12, infection diagnosed by examining the Stool microscopically to detect parasite cysts. Prevention of this parasite depends on caring for personal hygiene and washing hands well before preparing food, and treatment is carried out using the drug Metronidazole according to the doctor's prescription.

Key words: *Giardia lamblia*, Giardiasis, Trophozoite stage, Parasitic cyst and Metronidazole.

1. Introduction

Giardia lamblia (also named *Giardia intestinalis* or *Giardia duodenalis*) was isolated for the first time in 1682 by Antonie Van Leeuwenhoek when he examined a sample of his feces (Zeibig, 1997), previously it was believed that researcher Grassi who discovered cyst stage of this parasite in 1879, while some references indicate that cyst stage has been described in schemes of the researcher Vilem Lamble in 1860 (Faubert, 2000). In 1882, Kanster who discovered a parasite similar *Giardia* parasite in Todpoles named it *Giardia lamblia* (Farthing, 1995), in 1921 Fantham was able to isolate *Giardia* from cows and in the same year isolated it from horses (Kulda and Nohnykova, 1978), in 1915 this parasite was named *Giardia lamblia* to commemorate scientists who studied it, Professor A. Giard in Paris and Dr. F. Lambl in Paraguay (Rockwell, 2002).

In 1960, many people in Russia and Europe were infected because drinking water contaminated with this parasite (Gardner and David, 2001). In late 1970, *Giardia lamblia*

was diagnosed as a pathogen by clinical studies conducted by Kulda and Nohnykova (1978), who found *Giardia lamblia* causes disease for humans, the main symptoms of which were the Malabsorption of fats and pathological changes observed in the upper part from the small intestine. In 1981, the parasite was added to the list of pathogenic parasites by the World Health Organization (WHO, 1981).

2. Taxonomy of *Giardia lamblia*

According to Roberts and John (1996) classify parasite into:

Sub kingdom: Protozoa
Phylum: Sarcomastigophora
Sub Phylum: Mastigophora
Class: Zoomastigophora
Order: Diplomonadida
Sub Order: Diplomonadina
Family: Hexamitidae
Genus: *Giardia*
Species: *lamblia*

In 1952, Filice classified species belonging to the genus *Giardia* spp. into three groups based on the median body shape:

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- a) *Giardia agilis* infects the amphibian group and it is characterized by the median body of trophozoite stage elongated resembles a drop of tears.
- b) *Giardia muris* infects rodents and birds, and it is characterized by containing two medians bodies, and the median body of the trophozoite stage is small and circular.
- c) *Giardia lamblia* or *Giardia duodenalis* or *Giardia intestinalis* infects not only humans but infect mammals, birds, and reptiles, the median body of the trophozoite stage is a single or double hammer-like (Faubert, 2000).

Recently Trophozoite stage of *Giardia* isolated from both Budgerigar bird and named *Giardia psittaci* (Erlandsen and Bemrick, 1987), from the great blue heron bird and was named *Giardia ardea* (Erlandsen, 1990) and from *Microtus ochrogaster* named *Giardia microti* (Feely, 1988).

3. Description of parasite

This parasite has two stages, the Trophozoite stage and the Cyst stage:

a) Trophozoite stage

It affects the duodenum and the upper part of the jejunum, sometimes found in the bile ducts and gallbladder (Brown and Neva, 1983), characterized by pear shape has a wide and rounded front end, and the back end is pointed, the length is 9 - 21 mm, width 5 - 15 mm and its thickness is 2 - 4 mm, the dorsal side is convex, and the ventral side is slightly concave and contains two sucking disks helps to stick to the intestinal mucosa (Dey and Dey, 1997). There are two nuclei with a large karyosome, two axostyles, two basal bodies and two median bodies (Brown and Neva, 1983), also have four pairs of flagellaso its movement is similar to that of a falling leaf. It does not have a Golgi apparatus and mitochondria (Marquardt *et al.*, 2000), and it does not have special organelles used for feeding but absorbs food from the intestinal cavity through Pinocytotic (Farthing, 1995). Trophozoite stage usually does not penetrate epithelial tissue (Ferguson *et al.*, 1990), but when it has the right conditions, it

will penetrate some tissues such as gallbladder and urinary tract (Faubert, 2000).

b) Cyst Stage

Its oval with a length (8 - 12 mm) and width (6 - 9 mm) contain four nuclei and often found in one side of the cyst, flagella and the sucking discs lose from the mature cyst, but axonemes and median bodies are present (Rockwell, 2002). The cyst wall appears under an electron microscope composed of a layer of fibers and chitin-like materials, these materials help cyst to resist inappropriate environmental conditions, and it's able to spread and cause infection (Arcueilo *et al.*, 2002). The cyst can survive for 2 - 3 months in cold water (Backer, 2000) and itis easily transported by surface water because its relative resistance to chlorination (De Regnier *et al.*, 1989), but it cannot resistance dehydration and freezing (Olson, 2001).

4. Life Cycle of *Giardia lamblia*

This parasite causes Giardiasis (also named traveler's diarrhea or beaver fever), infection occurs by ingesting food and drink water contaminated with cysts of parasite or directly by hands contaminated with feces (Adam, 2001), parasite released from cyst due to stomach acid and gastric enzymes and formation of Trophozoite stage by a process called excystation (Dawson, 2010),After a short time the Trophozoite stage leaves the host's stomach in response to low PH (Faubert, 2000) and adheres to the surfaces of the intestinal epithelial cells by using their ventral sucking disks,when it begins to multiply by binary fission (Hagen *et al.*, 2011), binary fission occurs approximately every 12 hours so that one parasite can be more than one million parasites within 10 days, and one billion parasites within 15 days (Rockwell, 2002), then Trophozoite encystation in the distal part of the small intestine, whenreleasing with host's stool and ingested by another host the life cycle is repeated again (Brown *et al.*, 2016) (Figure - 1).



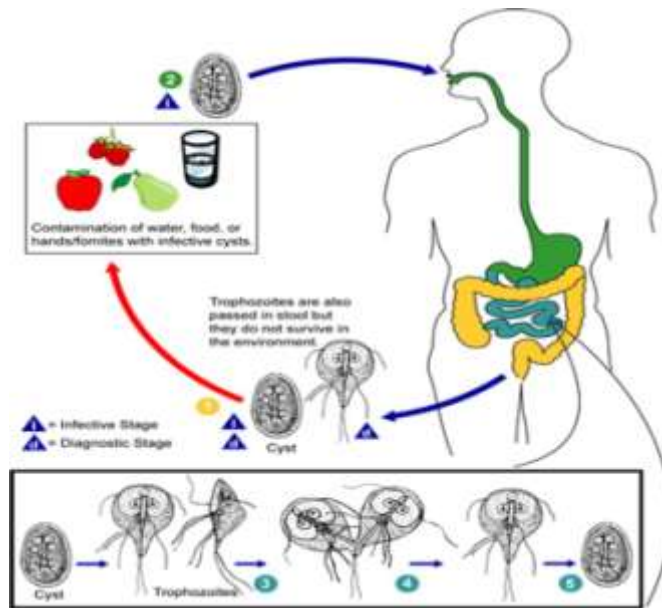


Figure - 1: Scheme show life cycle of *Giardia lamblia*

5. Clinical Signs and Symptoms of Giardiasis

Clinical signs vary and depending on the virulence of the parasite strains, many cysts ingestion, hostage, and immune system status at infection (Faubert, 2000).

Apparent symptoms

Symptoms usually start 1 - 3 weeks after cyst stage is swallowed, these signs are diarrhea, abdominal pain anorexia, weight loss, nausea, vomiting and fever (Smith *et al.*, 1992), although diarrhea is the hallmark of Giardiasis in some cases the infection appears asymptomatic (Lengerich *et al.*,1994). In chronic cases, poor absorption of carbohydrates, fats, vitamin A and B12 occur (Gardner and David, 2001). Heresi and Cleary (1997) revealed to the possibility of Trophozoites swimming and their rise to the bile duct causing cholecystitis, and appearance of jaundice symptoms.

Histological changes

Most cases of infections are mild and do not show histological changes (Ichhpujani and Bhatia, 1994), when the biopsy is taken from infected patients, large numbers of Trophozoites are clearly present in the duodenum and jejunum region adhesion to the mucosa of the intestine leading to inflammation and edema in lamina propria (Brown and Neva, 1983) with infiltration of the mucous layer, especially monocytes and

inflammation cells (Hill and Tbeodore, 1999), in chronic case, the villi shorten, crypts hyperplasia and an increase in the number of lymphocytes (Ebert, 1999), these changes disappear and tissues return to normal after treatment, or when the immune system gets rid of the parasite (Faubert, 2000).

6. Diagnosis

There are several ways to diagnose infection with *G. lamblia*, including:

- a) Note symptoms and clinical signs.
- b) Presence of motile trophozoite stage in wet stool smears.
- c) Use concentration method to find the cyst stage (Marquardt *et al.*, 2000). Sometimes fecal examination may give the wrong result for several reasons, including an absence of cyst stage in the stool, taking many radio-opaque drugs which lead to the disappearance of parasites from the stool, also concentration method leads to the killing of the parasite, and delaying examination of feces cause decomposition of Trophozoite stage (Ichhpujani and Bhatia,1994).
- d) Development of the parasite on the culture media. This method was used when the parasites small numbers, or when samples cannot be examined by



light microscope, the most cultures media used for the development of the *G. lamblia* parasite were (TYI-S-33), (TP-S-1) and (HSP-3) (Clark and Louis, 2002).

- e) Radiography - In general, it is inaccurate, so it is used little in the diagnosis of Giardiasis (Hill and Theodore, 1999).
- f) Biopsies - It is taken from the lining of the intestine, especially duodenum, and is one of the most accurate methods of diagnosis (Erb and Barrs, 1992).
- g) Examining the contents of the duodenum - To observe the trophozoite stage, this test gives a high positive result (Brown and Neva, 1983).
- h) Immunological tests - For the detection of parasite antigens in feces, the most important of these tests are (ELISA), and (DFA) (Behr *et al.*, 1997).
- i) Polymerase Chain Reaction (PCR) - It depends on the DNA of the parasite to differentiate between pathogenic strains (Roberts and John, 1996).

7. Prevention and control of Giardiasis

Several measures that must be taken to reduce infection with *Giardia lamblia* are care of personal hygiene and washing hands well before preparing food, also not eating food or drink produced by street vendors (Arcueilo *et al.*, 2003). In addition must treating wastewater continuously and preventing human waste from mixing with a drinking water source, as well as treat infected animal waste and preventing its use in agriculture (Farthing, 1995).

8. Treatment

Although *Giardia lamblia* was identified as an important human pathogen, few drugs have been used to treat it (Gardner and David, 2001), Nitroimidazole is the most important drug used in the treatment of *Giardia lamblia*, it is highly effective in treating the infection with protozoa (Tracy and Webster, 1996).

9. References

- 1) Adam, R. D. (2001). Biology of *Giardia lamblia*. *Clinical Microbiology Reviews*, 14(3): 447 - 475.
- 2) Arcueilo, R., Arcueilo, C and Gonzaleza, R. (2002). Sequential exposure and assembly of cyst wall filament on the surface of encystating *Giardia duodenalis*. *Parasitology*, 125 (3): 9 - 11.
- 3) Backer, H. D. (2000). Giardiasis: an elusive cause of gastrointestinal distress. *The Physician and Sports medicine*, 28(7): 46 - 57.
- 4) Behr, M. A., Kokoskin, E., Gyorkos, T. W., Cedilotte, L., Faubert, G. M and Maclean, J. D. (1997). Laboratory Diagnosis for *Giardia lamblia* Infection: A Comparison of Microscopy, Coprodiagnosis and Serology. *Canadian Infectious Disease*, 8(1): 33 - 38.
- 5) Brown, H. W and Neva, F. A. (1983). Basic Clinical Parasitology, 5th Ed., Pp: 34 - 46.
- 6) Brown, J. R., Schwartz, C. L., Heumann, J. M., Dawson, S. C and Hoenger, A. (2016). A detailed look at the cytoskeletal architecture of the *Giardia lamblia* ventral disc. *Journal of Structural Biology*, 194(1): 38 - 48.
- 7) Clark, C. G. and Louis S. D. (2002). Methods for cultivation of luminal parasitic protists of clinical importance. *Clinical Microbiology Reviews*, 15(3): 329 - 341.
- 8) De Regnier, D. P., Cole, L. A., Schupp, D. G. and Erlandsen, S. L. (1989). Viability of *Giardia* cysts suspended in lake, river, and tap water. *Applied Environmental Microbiology*, 55: 1223 - 1229.
- 9) Dey, N. C and Dey T. K. (1997). Medical Parasitology, 10th Ed., New Central Book. Agency, India, Pp: 100 - 110.
- 10) Dawson, S. C. (2010). An insider's guide to the microtubule cytoskeleton of *Giardia*. *Cellular Microbiology*, 12(5): 588 - 598.
- 11) Ebert, E. C. (1999). *Giardia* induces proliferation and interferon γ production by intestinal lymphocytes. *Gut*, 44(3): 342 - 346.
- 12) Erb, H. N and Barrs, S. C. (1992). Evaluation of tow test procedure for diagnosis of *Giardiasis* in dogs.



- American Journal of Veterinary Research*, 53(11): 2028 - 2031.
- 13) Erlandsen, S. L. and Bemrick W. J. (1987). Evidence for a new species *Giardia*. *Journal of Parasitology*, 73: 623 - 629.
 - 14) Erlandsen, S. L. (1990). Axenic culture and characterization of *Giardia ardeae* from the Great Blue Heron (*Ardea herodias*). *Journal of Parasitology*, 76: 717 - 724.
 - 15) Farthing, M. J. G. (1995). *Giardia lamblia*: infections of the gastrointestinal tract (ed.). Blaser, M. J.; P. P. Smith; J. I. Ravdin; H. B. Greenberg and R. L. Guerrant, Raven Press. Ltd., New York. Pp: 1088-1104.
 - 16) Faubert, G. (2000). Immune response to *Giardia duodenalis*. *Clinical Microbiology Reviews*, 13(1): 35 - 54.
 - 17) Feely, D. E. (1988). Morphology of the cyst of *Giardia microti* by light and electron microscopy. *Journal of Protozoology*, 35: 52 - 54.
 - 18) Ferguson, A., J. Cillon and G. Munro (1990). Pathology and pathogenesis of intestinal mucosal damage in Giardiasis in: *Giardiasis*, (ed.). Meyer, E. A. Elsevier Publishing Co., New York, N. Y.
 - 19) Furness, B. W., Michael, J. B and Jacquelin, M. R. (2000). Giardiasis surveillance - United States, 1992-1997. *mor. mortal. wkly. rep. Edc. Surveill. Summ.*, 49(7): 1 - 13.
 - 20) Gardner, T. B and David R. H. (2001). Treatment of Giardiasis. *Clinical Microbiology Reviews*, 14(1): 114 - 128.
 - 21) Hagen, K. D., Hirakawa, M. P., House, S. A., Schwartz, C. L., Pham, J. K., Cipriano, M. J and Dawson, S. C. (2011). Novel structural components of the ventral disc and lateral crest in *Giardia intestinalis*. *PLoS Negl Tropical Disease*, 5(12): e1442.
 - 22) Heresi, G and Cleary T. G. (1997). Recurrent acute *Giardia intestinalis*, gastro-entero. *Clinical Biology*, 21(5): 438 - 439.
 - 23) Hill, D. R. and Theodore E. N. (1999). Intestinal flagellate and ciliate Infections In: *Tropical Infections Disease, Principle, Pathogens and Practice*, by: Generrant, Richard I.; David H. Walker and Peter F. Weller, 1(38):703-712.
 - 24) Ichhpujani, R. L. and Bhatia R. (1994). *Medical Parasitology*, Japee Bros, Med. Pub. I. New Delhi, Pp: 384.
 - 25) Kulda, J. and Nohynkova, E. (1978). Flagellates of human intestine and of intestines of other species In: *Protozoa of Veterinary and Medical Interest* (ed.). Kreier, J. P. Academic Press, Inc., New York, N. Y.
 - 26) Lengerich, E. J., Addiss, D. G and Juranek, D. D. (1994). Severe giardiasis in the United States. *Clinical Infectious Diseases*, 18: 760 - 763.
 - 27) Marquardt, W. C., Richard S. D. and Robert B. G. (2000). *Parasitology and Vector Biology*, 2nd Ed., Academic Press, U.S.A, Pp: 89 - 96.
 - 28) Olson, M. E. (2001). Human and animal pathogens in manure. Conference on livestock options for the future, Winnipeg, Manitoba.
 - 29) Roberts, L. S. and John. J. (1996). *Foundations of Parasitology*, 5th Ed., WM. C. Brown Publishers. U.S.A.
 - 30) Rockwell, R. L. (2002). *Giardia lamblia* and Giardiasis with particular attention to the sierra nevada. pp:1-11.
 - 31) Smith, P. D., Quinn T. C., Strober W., Janoff E. N. and Masur, H. (1992). Gastrointestinal Infections in AIDS. *Annals of International Medicine*, 116: 63 - 77.
 - 32) Tracy, J. W and Webster, L. T. (1996). Drugs used in the chemotherapy of protozoal infections in: *the pharmacological basis of therapeutics*, by: Hardman, J. G. and L. F. Limbird, 9th Ed., McGraw-Hill Book Co., New York, N. Y.
 - 33) W.H.O. Expert Committee (1981). Intestinal protozoan and helminthic infections. *WHO Tech. Rep. Ser.*, 58: 666 - 671.
 - 34) Zeibig, E. A. (1997). *Clinical Parasitology*, 9th Ed., W. B. Saunders Company, Philadelphia, London, Sydney.



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