BLASTOCYSTIS HOMINIS-POTENTIAL DIAHOREAL AGENT: A REVIEW

Haider Syeda Sadaf 1*, Sherwanii Sikander Khan2, Kazmi Shahana Urooj3, Bashir Asma3, Shah Muhammad Ajmal4

1Department of Microbiology, University of Karachi, Karachi, Pakistan
2Department of Microbiology, Federal Urdu University of Arts Science and Technology Karachi, Pakistan
3Department of Biosciences, SZABIST, Karachi, Pakistan
4Department of Pharmacognosy Federal Urdu University of Arts Science and Technology Karachi, Pakistan

Article Received on: 09/11/12 Revised on: 11/12/12 Approved for publication: 21/12/12

*Email: fluorescentpearl@yahoo.com

ABSTRACT
Blastocystis hominis is a protozoan intestinal parasite and it has a widespread geographic distribution in countries of all income levels globally. A true pathogenic status of Blastocystis hominis is yet controversial; while it has been found in patients with gastrointestinal symptoms mainly. Moreover, Blastocystis is usually found in people who report no symptoms, and it has been estimated that most cases may be asymptomatic. The plausible reasons could be Blastocystis’ lack of pathogenicity or personal immunity of the host. Research on Blastocystis hominis is scarce with large gaps remaining in complete understanding. In this regard, this review highlights its life cycle, transmission mechanisms, incubation period, epidemiology, and treatment options.

KEYWORDS: Blastocystis hominis, diathorreal agent, intestinal parasite, diathorrea

INTRODUCTION
History of Blastocystis:
Blastocystis spp. is the anaerobic, cosmopolitan, eukaryotic, and enteric protozoan inhabits the intestinal tract of human1. Blastocystis revealed by a Russian physician, Fedor Aleksandrovich Lesh in 18702. Brumpt was chosen the name Blastocystis hominis in 19123.

Classification of Blastocystis:
Blastocystis has been established in birds, wild boars, domestic pigs, rodents, horses, amphibians, reptiles and insects4. Blastocystis spp. from different non-human hosts are morphologically identical to B. hominis; and these different isolates from different hosts have been reported as Blastocystis spp5,6. According to recent classification Class: Blastocystiea, Subphylum: Obalinata, infra Kingdom: Heterkonda, subkingdom: Chromotopia, and Kingdom: Chromista7.

Morphology of Blastocystis:
Cystic, vacuolar, a vacuolar, multivacuolar, granular and amoeboid form of Blastocystis spp. have been recognized8, 9. These morphologies have important implications on diagnosis, because Blastocystis in faecal samples is generally identified by the 10-15 μ in diameter through a large central vacuole10.

Vacuolar and granular forms of Blastocystis:
The vacuolar form has been considered to be the classic Blastocystis cell form10. This form is usually used for diagnosis of Blastocystis, with a range of 10-50 μm diameters, large central body and a rim of cytoplasm and nucleus. Granular form of Blastocystis having cytochemically and morphologically dissimilar central vacuole11. The cells range between an averages of 4 - 15 μm in diameter12.

Multivacuolar and a vacuolar form of Blastocystis:
The multivacuolar forms are approximately 5-8 μ in diameter. Small vacuoles and one or rarely two nucleuses have been found in the multivacuolar forms12.

Amoeboid structure of Blastocystis:
Amoeboid form is a very unusual form with irregularly shaped cells from 2.6 - 7.8 μm in diameter has extended pseudopodia and having one or two nuclei located at the middle of the cell13.

Cyst type of Blastocystis:
This form is a solid, resistive and between 3 - 10 μm in diameter14.

Mitochondrion - like organelles:
The organelles in Blastocystis similar to mitochondria are a mystery like the organism is a strict anaerobe15.

Life cycles of Blastocystis:
Blastocystis inhabits the intestinal tract of human mostly caecum and colon15. Binary fission is the only method of reproduction for Blastocystis17.

The cysts forms found in human stools, varies in size from 6 - 40 μm. Solid-walled cyst present in the faecal samples has considered being responsible for external transmission, all through in the faecal - oral way by means of intake of contaminated food or water. Cysts transmit a disease into epithelial tissues of digestive region and than multiply asexually.

Vacuolar forms provide source to multi vacuolar or amoeboid forms. Then the multi-vacuolar forms convert into a pre-cyst form that provide base for a thin-walled cyst, possibly to be accountable for causing autoinfection. The amoeboid form provides source to a pre-cyst, which converts into thick-walled cyst through schizogony. And than the thick-walled cyst expelled by faeces15.

Occurrence of Blastocystis:
Blastocystis infection is familiar in increasing countries in the tropical and subtropical regions16,19. Infection rate can differ from 1.6 % in industrialized countries to more than 50 % in different developing countries2,10.

Age and sex distribution of Blastocystis:
Blastocystis infection was more in individuals between 1 - 10 years of age (46 %) than in other age group20. Adults are more infected than children1. Higher prevalence was found in adults2 and young adults appear to have the highest rates of infection22. Inferior socioeconomic groups and those living along with low values of hygiene showed elevated incidence rates than the other group of the community23.
Seasonal pattern of Blastocystis spp:

The incidence of Blastocystosis was more common in hot climate34. Variations at different periods all over the year have not found35.

Pathogenicity of Blastocystis spp.: 

Human infections with Blastocystis spp. are called “Blastocystosis”36 and is present in both asymptomatic and symptomatic individuals. Blastocystis consider as a pathogen, when present in 5 per high power magnification field, when diagnosed in the absence of other pathogens and amoeboid form indicating the pathogenicity of this organism16. Blastocystis causes different diseases19, 28. The role of Blastocystis like a intestinal pathogen relating to travelers29 irritable bowel syndrome14, immunosuppressed patients including cancer and HIV / AIDS30,31 hyperalbuninemia and anasarca32 acute and chronic urticaria33. Different environmental factors like geography, seasonal factors and genetic diversity also associated with prevalence rate, pathogenicity, and symptomology of Blastocystis infections34, 35. B. hominis played a pathogenic position presence with a plentiful number in the faecal sample of the patient including chronic myeloid leukemia subsequent bone marrow transplantation36.

Gastrointestinal symptoms of Blastocystis spp.: 

Symptoms frequently distinguished along with Blastocystis are usually abdominal pain, diarrhea and nausea37. Blastocystis infection presents with fever, abdominal pain and diarrhea38. Abdominal pain, constipation, diarrhea, constipation, vomiting and fatigue are the mainly common symptoms, while patients had different underlying disease like duodenal ulcer, leukaemia, ulcerative colitis, kidney transplant, peptic ulcer, breast cancer and bleeding hemorrhoids39.

Extra intestinal symptoms of Blastocystis spp.: 

Anorexia, fatigue, flatulence and other nonspecific gastrointestinal effects also connected with Blastocystosis30. Itching, cutaneous rashes with hepatosplenomegaly41, eosinophilia42, rectal bleeding28 and infection of synovial fluids43 have also been reported. Blastocystis might be responsible for allergic manifestations44.

Blastocystis in combination with other pathogens: 

G. lamblia was the parasite most commonly identified with B. hominis45. B. hominis was present with association with other pathogens in 15 cases, while as a sole organism in 81 samples46. Blastocystis was present in 21 % from 56 % positive samples with parasites47. B. hominis was 60 % in faecal samples as a single pathogen while associated with E. coli (14 %), H. nana (8 %), I. butschlii (4 %) and E. histolytica (2 %)48.

Blastocystis in Immunocompromised patients: 

High prevalence of 72 % was reported in HIV / AIDS patients suffering from diarrhea in Indonesia49. The infection with Blastocystis was more common in patients with basic chronic-immunosuppressive diseases45.

Blastocystis in irritable bowel syndrome patients: 

Blastocystosis has been reported to be connected with irritable bowel syndrome (IBS)50. Patients with IBS were considerably possible to have more then 5 B. hominis / HPF. 18 % of IBS patients had B. hominis51. Symptoms that recognized to infection with Blastocystosis including abdominal pain, diarrhea, cramps and nausea52. Level of IgG antibody of B. hominis present in IBS patients were more significantly high compared with asymptomatic individuals14.

Infection of Blastocystis in food handlers: 

Blastocystis was frequently found in food handlers33, 34. Incidence of B. hominis was 8 % in symptomatic and 4 % in asymptomatic food handlers in Egypt35. E. nana (68 %) was the most predominant parasites along with E. coli (36 %), B. hominis (28 %), E. histolytica / dispar (10 %) and G. duodenalis (8 %) were found in food handlers56.

Blastocystis as a zoonotic infection: 

Zoonosis is a possible factor for rising prevalence of Blastocystosis. The organism could be zoonotic, since high prevalence was observed variety of animals, primates,
livestock, pigs, birds, reptiles, rodents, amphibians and insects. 38% of Blastocystis spp. was found in five farms in Brazil while, Blastocystis spp. found in 71% and 67% of domestic dogs and cats, respectively, in Australia. Prevalence of Blastocystis spp. is highly considered in different groups of primates, pheasants and ducks.

Transmission of Blastocystis:
Transmission of Blastocystis occurs through the faecal–oral route. Food borne and water borne transmission through untreated or raw water, poor sanitary conditions with low environmental hygiene are also responsible for Blastocystosis. Infective cysts could possibly be obtained from contaminated drinking water. Blastocystis cysts remain viable under suitable conditions and they could survive in chlorinated water at standard concentrations.

Diagnosis of Blastocystis:
Identification of different intestinal parasites in stool samples is the basic diagnosis and direct microscopy of faecal samples without with concentration method is the main process of diagnosis. Wet mount, trichrome-stained, Giemsa stain, Gram stain and iron haematoxylins are also recommended for stool examination for Blastocystosis. Formalin ethyl concentration technique (FECT) is more considered to be not sensitive for the diagnosis of Blastocystis. In vitro cultivation for the intestinal parasites is a known established method. Culture was successful if large numbers of Blastocystis were present in the faecal material and it is useful when microscopic diagnosis is not sure and culture method used to confirm the presence of Blastocystis because of its specificity and sensitivity. Blastocystis is a firmly anaerobic organism and grows in culture when incubated at 37°C an anaerobically. Pre reduced Boeck and Drbohla's inspissated egg medium, Dobell and Laidlaw medium covered with Ringer solution supplemented along with 20% human serum and streptomycin sulfate, minimal essential medium having 10% horse serum, Diamond's Trypticase panmade serum (TP-S-1) monophasic medium, Löffler medium covered with Ringer solution containing 20% human serum and Iscove's modified Dulbecco's medium supplemented along with 10% horse serum also used for culturing of Blastocystis. Maintaining continuous cultures is time-consuming and costly, and the parasites may be prone to genetic drift. Di methyl sulfoxide (DMSO) used commonly in cryopreservation apply toxic effects on the fragile Blastocystis isolates.

Other diagnostic procedures for Blastocystis:
Different techniques including aspirated intestinal fluid duodenal aspirate by string test, colonic scrapings during colonoscopy, touch cytology, endoscopy and sigmoidoscopy detected B. hominis in the intestine. An ELISA-based diagnosis for detection of Blastocystis spp. from antigens and antibodies has been used for diagnosis of the infection in asymptomatic and symptomatic individuals. In the indirect immunofluorescence test (IFA), 70% of individuals were infected with serum positive for detection of Blastocystis antibodies.

Sub types of Blastocystis:
Different sub types of Blastocystis may potentially be the pathogenic one. A different number of subtypes can be recognized in humans and animals both, which indicate a zoonotic potential of these subtypes. Subtype 1 also could be observed in humans and an extensive range of different animals as like; horses, pigs, monkeys, chickens, cattle, rodents, quails, and pheasants.

Genotypic studies of Blastocystis:
Blastocystis has a heterogeneous species. Aside from heterogeneity in morphology, Blastocystis is antigenically and genetically dissimilar. Genetic diversity between B. hominis and Blastocystis spp. has been considered through random amplified polymorphic DNA (RAPD) and restriction fragment length polymorphism (RFLP) examination of PCR-amplified small – sub unit (SSU) r RNA.

Treatment of Blastocystosis:
Treatment of Blastocystis infections is necessary when symptoms are present and no other cause of disease is understandable. Emetine, Furazolidone, Iodochlorhydroxyquin, Metronidazole, Pentamidine and Trimethoprim-Sulfamethoxazole (TMP - SMX) were observed to be the mainly antimicrobial agents in opposition to B. hominis. Commonly recommended drug is Metronidazole for treatment with a dosage of 250 -750 mg 3 days, or 2 g per day for five days. Co-Trimoxazole had a very good effect on the cure rate without side effects for the treatment of Blastocystosis. Nitazoxanide had much more positive effects with effectively cured. Treatment with Rifaximin was effective in solving the clinical symptoms and clearing B. hominis infections connected with enteropathogenic bacteria in HIV-1 infected patients.

Prevention and Control of Blastocystosis:
B. hominis is transmitted by the faecal-oral by unhygienic food and water, and the cyst form is the infective part of transmission. Control measures on the person level are good quality individual hygiene, community sanitary facilities, instruction to keep away from faecal contamination of the surroundings and ingestion of contaminated material. Biochemistry information of the organism is still undeveloped; the specific metabolic sites with drugs could not be satisfactorily targeted. The CDC has the same following instructions, though as potentially useful preventative and control measures. Hand hygiene with soap and water before usage food and after using the toilet. Stay away from infected water and food. Wash and peel the entire raw fruits and vegetables. Avoid raw tap water and half or uncooked foods during travelling. Clean hands properly with soap and water after changing the children’s diapers.

CONCLUSION
Blastocystis hominis, a potential diarrheal agent particularly cause serious infection in children of low socio-economic status and attacks those who have impaired immune system or a much weakened digestive tract. Its prevalence is more where there is no paid attention by authorities regarding hygienic measures, as the major mode of transmission is fecal oral route. Keeping into consideration, there is a dire need to create health awareness and to maintain hygienic standards in terms of sanitation promote hand washing with soap before having meal and using toilet, avoid potentially infected food and water.

REFERENCES
5. Chen XQ, Singh M, Ho LC, Tan SW, Ng GC, Moe KT, Yap EH. Description of a Blastocystis species from Rattus norvegicus. Parasitol...
Blastocystis hominis; origin and significance of vacuolar and granular forms. Parasitol Res. 2000; 89 (3): 301-306


Ghosh N, V, Ayyaril M, and Ateez ACV. GVDH involving the gastrointestinal tract and infection with Blastocystis hominis in a patient with chronic myeloid leukaemia following allogeneic bone marrow transplantation. Bone Marrow Transplant. 1998; 22 (11): 1115-1117


Devara R, Azacon B, and Jiménez M. Blastocystis hominis in patients at the Ruiz y Paez University Hospital from Bolivar City, Venezuela. Bol Chim Parasitol; 1998; 53 (3): 64-70


Abe N, Wu Z, Yoshikawa H. Molecular characterization of Blastocystis isolates from birds by PCR with diagnostic primers and restriction fragment length polymorphism analysis of the small sub unit ribosomal RNA gene. Parasitol Res. 2003a; 89 (5): 393-396

Abe N, Nagoshi M, Takami K, Saviano Y, Yoshikawa H. A survey of
Blastocystis spp. in livestock, pets, and zoo animals in Japan. Vet Parasitol. 2002; 106 (3): 203-212
68. Guimarães S, and Sogayar MIL. Blastocystis hominis: occurrence in children and staff members of municipal day - care centers from Botucatu, Sao Paulo State, Brazil. Mem Inst Oswaldo Cruz. 1993; 88 (3): 427-429
73. Ho LC, Singh M, Suresh G, Ng GC, Yap EH. Axenic culture of Blastocystis hominis in Jacove’s modified Dulbecco’s medium. Parasitol Res. 1993; 79 (7): 614-616
84. Tan KSW, Singh M, and Yap EH. Recent advances in Blastocystis hominis research: hot spot in terra incognita. Int J Parasitol. 2002; 32 (7): 789-804

Source of support: Nil, Conflict of interest: None Declared