VOLUME - XII
ISSUE - LXXI
SEP/OCT 2015

The Crux

BIMONTHLY FORUM FOR THE LABORATORIANS

CONTENTS

Editorial

Amoebiasis, also known as **amebiasis** or **entamobiasis**, is an infection caused by any of the amoebas of the Entamoeba group. Symptoms are most common upon infection by *Entamoeba histolytica*. Amoebiasis can present with no, mild, or severe symptoms. Symptoms may include abdominal pain, mild diarrhoea, bloody diarrhea or severe colitis with tissue death and perforation. This last complication may cause peritonitis. People affected may develop anemia due to loss of blood.

Invasion of the intestinal lining causes amoebic bloody diarrhea or amoebic colitis. If the parasite reaches the bloodstream it can spread through the body, most frequently ending up in the liver where it causes amoebic liver abscesses. Liver abscesses can occur without previous diarrhea. Cysts of entamoeba can survive for up to a month in soil or for up to 45 minutes under fingernails. It is important to differentiate between amoebiasis and bacterial colitis. The preferred diagnostic method it through faecal examination under microscope, but requires a skilled microscopist and may not be reliable when excluding infection. Increased white blood cell count is present in severe cases, but not in mild ones. The most accurate test is for antibodies in the blood, but it may remain positive following treatment.

Prevention of amoebiasis is by separating food and water from faeces and by proper sanitation measures. There is no vaccine. There are two treatment options depending on the location of the infection. Amoebiasis in tissues is treated with either metronidazole, tinidazole, nitazoxanide, dehydroemetine or chloroquine, while luminal infection is treated with diloxanide furoate or iodoquinoline. For treatment to be effective against all stages of the amoeba may require a combination of medications. Infections without symptoms do not require treament but infected individuals can spread the parasite to others and treatment can be considered. Treatment of other entamoeba infections apart from *E. histolytica* is not needed.

Amoebiasis is present all over the world. About 480 million people are infected with *E. histiolytica* and this results in the death of between 40,000–110,000 people every year. *E. dispar* is more common in certain areas and symptomatic cases may be fewer than previously reported. The first case of amoebiasis was documented in 1875 and in 1891 *E. histiolytica* was identified resulting in the terms amoebic dysentery and amoebic liver abscess. Further evidence from the Philippines in 1913 found that upon ingesting cysts of *E. histiolytica* volunteers developed the disease. It has been known since 1903 that at least one species of non-disease causing entamoeba exist, but it was first formally recognized by the WHO in 1997. In addition to the recognized *E. dispar* evidence shows there is likely another species of *E. moshkovskii* as well. The reason these species haven't been differentiated until recently may be because they look very similar.

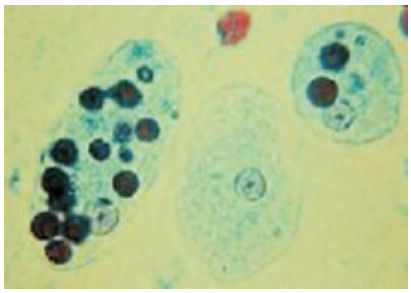
To know the complete clinico-diagnostic approach, please flip over to **"DISEASE DIAGNOSIS".** Stool analysis forms the heart of **"TROUBLESHOOTING"** while diarrhea forms the basis of **"INTERPRETATION.** All inter related**.** Even brain teasers are derived from parasitology. **Happy reading !**

DISEASE DIAGNOSIS

AMEBIASIS

Background

Amebiasis is caused by *Entamoeba histolytica* (see the image below), a protozoan that is found worldwide. The highest prevalence of amebiasis is in developing countries where barriers between human feces and food and water supplies are inadequate.

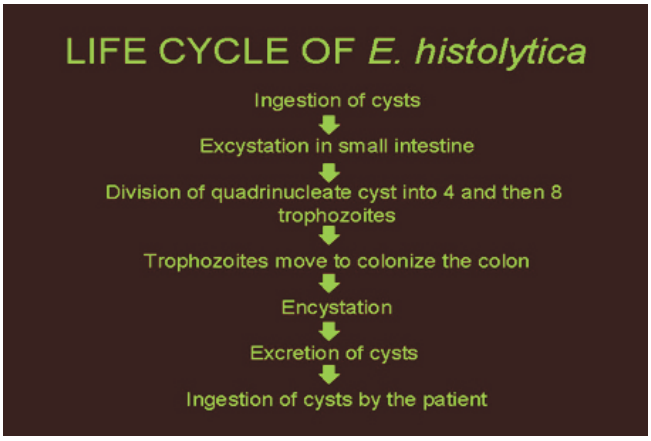


Trichrome stain of Entamoeba histolytica trophozoites in amebiasis. Two diagnostic characteristics are observed. Two trophozoites have ingested erythrocytes, and all 3 have nuclei with small, centrally located karyosomes.

Although most cases of amebiasis are asymptomatic, dysentery and invasive extraintestinal disease can occur. Amebic liver abscess is the most common manifestation of invasive amebiasis, but other organs can also be involved, including pleuropulmonary, cardiac, cerebral, renal, genitourinary, peritoneal, and cutaneous sites. In developed countries, amebiasis primarily affects migrants from and travelers to endemic regions, men who have sex with men, and immunosuppressed or institutionalized individuals. *E. histolytica* is transmitted via ingestion of the cystic form (infective stage) of the protozoa. Viable in the environment for weeks to months, cysts can be found in fecally contaminated soil, fertilizer, or water or on the contaminated hands of food handlers. Fecal-oral transmission can also occur in the setting of anal sexual practices or direct rectal inoculation through colonic irrigation devices. Excystation then occurs in the terminal ileum or colon, resulting in trophozoites (invasive form). The trophozoites can penetrate and invade the colonic mucosal barrier, leading to tissue destruction, secretory bloody diarrhea, and colitis resembling inflammatory bowel disease. In addition, the trophozoites can spread hematogenously via the portal circulation to the liver or even to more distant organs. *E. histolytica* is capable of causing a spectrum of illnesses. Intestinal conditions resulting from *E. histolytica* infection include the following: Asymptomatic infection, Symptomatic noninvasive infection, Acute proctocolitis (dysentery), Fulminant colitis with perforation, Toxic megacolon, Chronic nondysenteric colitis, Ameboma, Perianal ulceration. Extraintestinal conditions resulting from *E. histolytica* infection include the following: Liver abscess, Pleuropulmonary disease, Peritonitis, Pericarditis, Brain abscess, Genitourinary disease. Laboratory diagnosis of amebiasis is made by demonstrating the organism or by employing immunologic techniques. In addition to standard blood tests, other laboratory studies employed for diagnosis include microscopy, culture, serologic testing, and polymerase chain reaction (PCR) assay. Treatment of amebiasis includes pharmacologic therapy, surgical intervention, and preventive measures, as appropriate. Most individuals with amebiasis may be treated on an outpatient basis, though several clinical scenarios may favor inpatient care.

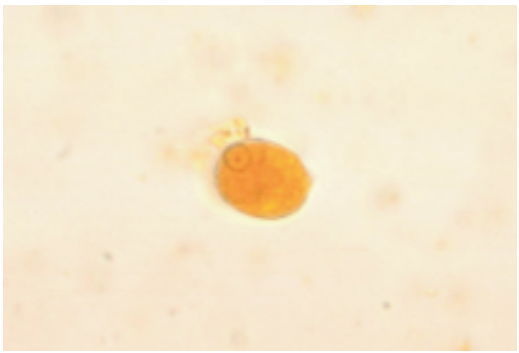
Pathophysiology

E. histolytica is a pseudopod-forming, nonflagellated protozoal parasite that causes proteolysis and tissue lysis (hence the species name) and can induce host-cell apoptosis. Humans and perhaps nonhuman primates are the only natural hosts.

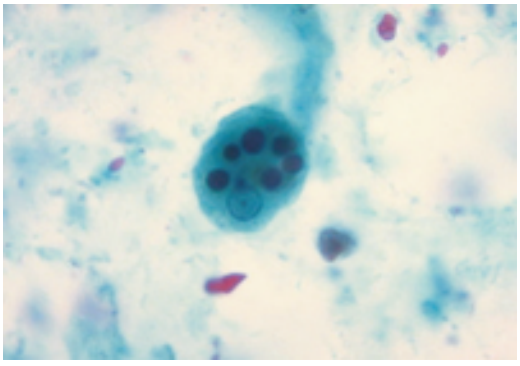


Life cycle of *Entamoeba histolytica*.

Ingestion of *E. histolytica* cysts (see the first image below) from the environment is followed by excystation in the terminal ileum or colon to form highly motile trophozoites. Upon colonization of the colonic mucosa, the trophozoite may encyst and is then excreted in the feces, or it may invade the intestinal mucosal barrier and gain access to the bloodstream, whereby it is disseminated to the liver, lung, and other sites. Excreted cysts reach the environment to complete the cycle.



Entamoeba histolytica cyst.



Entamoeba histolytica trophozoite.

Disease may be caused by only a small number of cysts, but the processes of encystation and excystation are poorly understood. The adherence of trophozoites to colonic epithelial cells seems to be mediated by a galactose/*N* -acetylgalactosamine (GAL/

GalNAc)–specific lectin, a 260-kd surface protein containing a 170-kd subunit and a 35-kd subunit. A mucosal immunoglobulin A (IgA) response against this lectin can result in fewer recurrent infections. Both lytic and apoptotic pathways have been described. Cytolysis can be undertaken by amebapores, a family of peptides capable of forming pores in lipid bilayers. Furthermore, in animal models of liver abscess, trophozoites induced apoptosis via a non-Fas and non–tumor necrosis factor (TNF)-α1 receptor pathway. The amebapores, at sublytic concentrations, can also induce apoptosis. Cysteine proteinases have been directly implicated in invasion and inflammation of the gut and may amplify interleukin (IL)-1–mediated inflammation by mimicking the action of human IL-1–converting enzyme, cleaving IL-1 precursor to its active form. The cysteine proteinases can also cleave and inactivate the anaphylatoxins C3a and C5a, as well as IgA and immunoglobulin G (IgG). *E. histolytica* possesses about 100 putative transmembrane kinases (TMKs), which are commonly divided into 9 subgroups. Of these, EhTMKB1-9 is expressed in proliferating trophozoites and induced by serum. In an animal model, it was found to be involved in phagocytosis and to play a role as a virulence factor in amebic colitis. These findings suggest that TMKs such as EhTMKB1-9 may be attractive targets for future drug development. Epithelial cells also produce various inflammatory mediators, including IL-1β, IL-8, and cyclooxygenase (COX)-2, leading to the attraction of neutrophils and macrophages. Corticosteroid therapy is known to worsen the clinical outcome, possibly because of its blunting effect on this innate immune response. Additional host defenses, including the complement system, could be inhibited directly by the trophozoites, as is suggested by the finding that a region of the GAL/GalNAc–specific lectin showed antigenic crossreactivity with CD59, a membrane inhibitor of the C5b-9 attack complex in human red blood cells. Spread of amebiasis to the liver occurs via the portal blood. The pathogenic strains evade the complement-mediated lysis in the bloodstream. Trophozoites that reach the liver create unique abscesses with well-circumscribed regions of dead hepatocytes surrounded by few inflammatory cells and trophozoites and unaffected hepatocytes. These findings suggest that *E. histolytica* organisms are able to kill hepatocytes without direct contact. Serum antibodies in patients with amebic liver abscess develop in 7 days and persist for as long as 10 years. A mucosal IgA response to *E. histolytica* occurs during invasive amebiasis; however, no evidence suggests that invasive amebiasis is increased in incidence or severity in patients with IgA deficiency. Cell-mediated immunity is important in limiting the disease and preventing recurrences. Antigen-specific blastogenic responses occur, leading to production of lymphokines, including interferon-delta, which activates the killing of *E. histolytica* trophozoites by the macrophages. This killing depends on contact, oxidative pathways, nonoxidative pathways, and nitric oxide (NO). Lymphokines, such as TNF-α, are capable of activating the amebicidal activity of neutrophils. Incubation of $CD8^+$ lymphocytes with *E histolytica* antigens in vitro elicits cytotoxic T-cell activity against the trophozoites. During acute invasive amebiasis, T-cell response to *E. histolytica* antigens is depressed by a parasite-induced serum factor.

Etiology

Amebiasis is a parasitic infection caused by the protozoal organism *E. histolytica,* which can give rise both to intestinal disease (eg, colitis) and to various extraintestinal manifestations, including liver abscess (most common) and pleuropulmonary, cardiac, and cerebral dissemination. The genus *Entamoeba* contains many species, some of which (ie, *E. histolytica, Entamoeba dispar, Entamoeba moshkovskii, Entamoeba polecki, Entamoeba coli,* and *Entamoeba hartmanni*) can reside in the human interstitial lumen. Of these, *E. histolytica* is the only one definitely associated with disease; the others are considered nonpathogenic. Studies have recovered *E. dispar* and *E. moshkovskii* from patients with gastrointestinal (GI) symptoms, but whether these species cause these symptoms remains to be determined. Although *E. dispar* and *E. histolytica* cannot be differentiated by means of direct examination, molecular techniques have demonstrated that they are indeed 2 different species, with *E. dispar* being commensal (as in patients with HIV infection) and *E. histolytica* pathogenic. It is currently believed that many individuals with *Entamoeba* infections are actually colonized with *E. dispar*, which appears to be 10 times more common than *E. histolytica*; however, in certain regions (eg, Brazil and Egypt), asymptomatic *E. dispar* and *E. histolytica* infections are equally prevalent.. In Western countries, approximately 20%-30% of men who have sex with men are colonized with *E. dispar*. *E. histolytica* is transmitted primarily through the fecal-oral route. Infective cysts can be found in fecally contaminated food and water supplies and contaminated hands of food handlers. Sexual transmission is possible, especially in the setting of oral-anal practices (anilingus). Poor nutrition, through its effect on immunity, has been found to be a risk factor for amebiasis.

Epidemiology

International statistics: Worldwide, approximately 50 million cases of invasive *E. histolytica* disease occur each year, resulting in as many as 100,000 deaths. This represents the tip of the iceberg because only 10%-20% of infected individuals become symptomatic. The incidence of amebiasis is higher in developing countries. Earlier estimates of *E. histolytica* infection, based on examination of stool for ova and parasites, are inaccurate, because this test cannot differentiate *E. histolytica* from *E. dispar* and *E. moshkovskii*. In developing countries, the prevalence of *E. histolytica,* as determined by enzyme-linked immunosorbent assay (ELISA) or polymerase chain reaction (PCR) assay of stool from asymptomatic persons, ranges from 1% to 21%. On the basis of current techniques, it is estimated that 500 million people with *Entamoeba* infection are colonized by *E. dispar*. The prevalence of *Entamoeba* infection is as high as 50% in areas of Central and South America, Africa, and Asia. *E. histolytica* seroprevalence studies in Mexico revealed that more than 8% of the population were positive. In endemic areas, as many as 25% of patients may be carrying antibodies to *E. histolytica* as a result of prior infections, which may be largely asymptomatic. The prevalence of asymptomatic *E. histolytica* infections seem to be region-dependent; in Brazil, for example, it may be as high as 11%. In Egypt, 38% of individuals presenting with acute diarrhea to an outpatient clinic were found to have amebic colitis. A study in Bangladesh indicated that preschool children experienced 0.09 episodes of *E. histolytica* -associated diarrhea and 0.03 episodes of amebic dysentery each year. In Hue City, Vietnam, the annual incidence of amebic liver abscess was reported to be 21 cases per 100,000 inhabitants. An epidemiologic study in Mexico City reported that 9% of the population was infected with *E. histolytica* in the 5-year to 10-year period preceding the study. Various factors, such as poor education, poverty, overcrowding, contaminated water supply, and unsanitary conditions, contributed to fecal-oral transmission. Several studies have evaluated the association of amebiasis with AIDS. The impact of the AIDS pandemic on the prevalence of invasive amebiasis remains controversial. Some reports suggest that invasive amebiasis is not increased among patients with HIV infection; however, others suggest that amebic liver abscess is an emerging parasite infection in individuals with HIV infection in disease-endemic areas, as well as in non–disease-endemic areas. Of 31 patients with amebic liver abscess at Seoul National University Hospital from

1990 to 2005, 10 (32%) were HIV-positive. In a case-control study of persons seeking voluntary counseling and testing for HIV infection, homosexual activity, fecal-oral contamination, lower educational achievement, and older age were associated with increased risk of amebiasis.

Age-related demographics: Symptomatic intestinal amebiasis occurs in all age groups. Liver abscesses due to amebiasis are 10 times more frequent in adults than in children. Very young children seem to be predisposed to fulminant colitis.

Sex-related demographics: Amebic colitis affects both sexes equally. However, invasive amebiasis is much more common in adult males than in females. In particular, amebic liver abscess is 7-12 times more common in men than in women, with a predominance among men aged 18-50 years. The reason for this disparity is unknown, though hormonal effects may be implicated, as the prevalence of amebic liver abscess is also increased among postmenopausal women. Alcohol may also be an important risk factor. Among prepubertal children, amebic liver abscess is equally common in both sexes. Acuna-Soto et al noted that asymptomatic *E. histolytica* infection is distributed equally between sexes. Therefore, the higher proportion of adult males with invasive amebiasis may be due to a male susceptibility to invasive disease.

Race-related demographics: In Japan and Taiwan, HIV seropositivity is a risk factor for invasive extraintestinal amebiasis. This association has not been observed elsewhere. Among HIV-positive patients, homosexual intercourse, and not immunosuppressed status, seems to be a risk factor for amebic colitis.

Prognosis

Amebic infections can lead to significant morbidity while causing variable mortality. In terms of protozoan-associated mortality, amebiasis is second only to malaria. The severity of amebiasis is increased in the following groups: Children, especially neonates; Pregnant and postpartum women; Those using corticosteroids; Those with malignancies; Malnourished individuals. Intestinal infections due to amebiasis generally respond well to appropriate therapy, though it should be kept in mind that previous infection and treatment will not protect against future colonization or recurrent invasive amebiasis. Asymptomatic intestinal amebiasis occurs in 90% of infected individuals. However, only 4%-10% of individuals with asymptomatic amebiasis who were monitored for 1 year eventually developed colitis or extraintestinal disease. With the introduction of effective medical treatment, mortality has fallen below 1% for patients with uncomplicated amebic liver abscess. However, amebic liver abscess can be complicated by sudden intraperitoneal rupture in 2-7% of patients, and this complication leads to a higher mortality. Case-fatality rates associated with amebic colitis range from 1.9% to 9.1%. Amebic colitis evolves to fulminant necrotizing colitis or rupture in approximately 0.5% of cases; in such cases, mortality may exceeds 40% or even, according to some reports, 50%. Pleuropulmonary amebiasis has a 15-20% mortality rate. Amebic pericarditis has a case-fatality rate of 40%. Cerebral amebiasis carries a very high mortality (90%). A study of 134 deaths in the United States from 1990 to 2007 found that mortality was highest in men, Hispanics, Asian/Pacific Islanders, and people aged 75 years or older. An association with HIV infection was also observed. Although deaths declined during the course of the study, more than 40% occurred in California and Texas. US-born persons accounted for the majority of amebiasis deaths; however, all of the fatalities in Asian/Pacific Islanders and 60% of the deaths in Hispanics were in foreign-born individuals.

Patient Education

Individuals traveling to endemic areas should be advised on practices that minimize the risk of amebiasis, such as the following: Avoid drinking contaminated water; use bottled water while traveling if possible. If local water is to be drunk, purify it by (a) boiling it for more than 1 minute, (b) using 0.22 µm filtration, or (c) iodinating it with tetraglycine hydroperiodide, Avoid eating raw fruits and salads, which are difficult to sterilize; eat only cooked food or self-peeled fruits if possible, Wash uncooked vegetables and soak them in acetic acid or vinegar for 10-15 minutes.

History

The incubation period for *E. histolytica* infection is commonly 2-4 weeks but may range from a few days to years. The clinical spectrum of amebiasis ranges from asymptomatic infection to fulminant colitis and peritonitis to extraintestinal amebiasis, the most common form of which is amebic liver abscess. Amebiasis is more severe in very young patients, in elderly patients, and in patients receiving corticosteroids. The clinical expression of amebiasis may be related to geography. For instance, amebic colitis is the predominant presentation in Egypt, whereas amebic liver abscesses predominate in South Africa. Asymptomatic infections are common after ingestion of the parasite. *E. dispar* does not cause invasive disease or antibody production. As many as 90% of *E. histolytica* infections are also asymptomatic. The infection is self-limited but may be recurrent. It is not possible to distinguish between *E. histolytica* and *E. dispar* on clinical grounds; only antigen detection tests can make this distinction.

Amebic colitis: Amebic colitis is gradual in onset, with symptoms presenting over 1-2 weeks; this pattern distinguishes this condition from bacterial dysentery. Diarrhea is the most common symptom. Patients with amebic colitis typically present with cramping abdominal pain, watery or bloody diarrhea, and weight loss or anorexia. Fever is noted in 10-30% of patients. Intestinal amebiasis may mimic acute appendicitis. Rectal bleeding without diarrhea can occur, especially in children. Fulminant amebic colitis is a rare complication of amebic dysentery (< 0.5% of cases). It presents with the rapid onset of severe bloody diarrhea, severe abdominal pain, and evidence of peritonitis and fever. Predisposing factors for fulminant colitis include poor nutrition, pregnancy, corticosteroid use, and very young age (< 2 years). Intestinal perforation is common. Patients may develop toxic megacolon, which is typically associated with the use of corticosteroids. Mortality from fulminant amebic colitis may exceed 40%. Chronic amebic colitis is clinically similar to inflammatory bowel disease (IBD). Recurrent episodes of bloody diarrhea and vague abdominal discomfort develop in 90% of patients with chronic amebic colitis who have antibodies to *E. histolytica*. Amebic colitis should be ruled out before treatment of suspected IBD because corticosteroid therapy worsens amebiasis.

Amebic liver abscess: Amebic liver abscess is the most common form of extraintestinal amebiasis. It occurs in as many as 5% of patients with symptomatic intestinal amebiasis and is 10 times as frequent in men as in women. Approximately 80% of patients with amebic liver abscess present within 2-4 weeks of infection. An estimated 95% of amebic liver abscesses related to travel develop within 5 months, though some may not manifest until years after travel to or residency in an endemic area. The most typical presentation of amebic liver abscess is fever (in 85-90% of cases, in contrast to amebic colitis), right upper quadrant pain, and tenderness of less than 10 days' duration. Involvement of the diaphragmatic surface of the liver may lead to right-side pleuritic pain or referred shoulder pain. Acute abdominal symptoms and signs should prompt rapid investigation for intraperitoneal rupture. Associated gastrointestinal (GI) symptoms occur in 10-35% of patients and include nausea, vomiting, abdominal distention, diarrhea, and constipation. Approximately 40% of patients who have amebic liver abscess do not have a history of prior bowel symptoms. Although 60-70% of patients

with amebic liver abscess do not have concomitant colitis, a history of dysentery within the previous year may be obtained.In a recent study of routine colonoscopy in patients with amebic liver abscess, colonic involvement was noted in two thirds of cases. When colon was involved, right colonic lesion was universally present. A small subset of patients with amebic liver abscess have a subacute presentation with vague abdominal discomfort, weight loss or anorexia, and anemia. Jaundice is unusual. Cough can occur. A history of alcohol abuse is common, but whether a causal relation exists is unclear.

Other manifestations of amebiasis: ***Ameboma:*** Ameboma, a less common form of intestinal disease, arises from the formation of annular colonic granulation in response to the infecting organisms, which results in a large local lesion of the bowel. It presents as a right lower quadrant abdominal mass, which may be mistaken for carcinoma, tuberculosis, Crohn disease, actinomycosis, or lymphoma. Biopsy findings assist in establishing the correct diagnosis. Rectal masses that resemble carcinoma on colonoscopy have also been noted. ***Pleuropulmonary amebiasis:*** Pleuropulmonary amebiasis is most commonly the result of contiguous spread from a liver abscess rupturing through the right hemidiaphragm. However, a case of amebic lung abscess acquired through hematogenous spread has been reported. The typical age group is 20-40 years. The male-to-female ratio is 10:1. Approximately 10% of patients with amebic liver abscess develop pleuropulmonary amebiasis, which presents with cough, pleuritic pain, and dyspnea. A hepatobronchial fistula is an unusual problem characterized by the expectoration of sputum resembling anchovy paste. The trophozoites of *E. histolytica* may be found in the sputum sample. Primary amebic pneumonia as a result of hematogenous spread has been reported, though rarely. ***Cerebral amebiasis:*** Amebic abscesses resulting from hematogenous spread have occasionally been described in the brain. Cerebral amebiasis occurs in 0.6% of amebic liver abscess cases. Patients commonly present with the abrupt onset of nausea, vomiting, headache, and mental status changes. Computed tomography (CT) reveals irregular lesions without a surrounding capsule or enhancement. A tissue biopsy sample reveals the trophozoites. Progression can be very rapid, sometimes leading to death within 12-72 hours. ***Amebic peritonitis:*** Amebic peritonitis is generally secondary to a ruptured liver abscess. Left-lobe liver abscesses are more likely to rupture. Patients present with fever and a rigid distended abdomen. Roughly 2-7% of liver abscesses rupture into the peritoneum. ***Amebic pericarditis:*** Amebic pericarditis is rare but is the most serious complication of hepatic amebiasis. It is usually caused by a rupture of a left-liver lobe abscess and occurs in 3% of patients with hepatic amebiasis. It presents with chest pain and the features of congestive heart failure. ***Genitourinary amebiasis:*** Genitourinary involvement may cause painful genital ulcers or fallopian tube amebiasis. ***Amebic appendicitis:*** In countries of high prevalence, amebiasis occasionally presents as acute appendicitis.

Physical Examination

Patients with acute amebic colitis may have lower quadrant abdominal tenderness (12-85% of cases). Fever is noted in only a minority of patients (10-30%). Weight loss occurs in 40%. Dehydration is uncommon. Occult blood is nearly always present in stools (70-100%). Fulminant amebic colitis is commonly characterized by abdominal pain, distention, and rebound tenderness. Amebic liver abscess may present with fever (85-90% of cases) and tender hepatomegaly (30-50%). Right lower intercostal tenderness may be elicited, particularly posteriorly (84-90%). Weight loss is noted in 33-50%. Breath sounds may be diminished at the right lung base, and rales may be heard. A small subset of patients has a subacute presentation with hepatomegaly, weight loss, and anemia. Jaundice is unusual (6-10%). Other physical findings in amebiasis include the following: Pleuropulmonary amebiasis may produce right-side pleural effusions, empyema, basilar atelectasis, pneumonia, and lung abscess; Patients with amebic peritonitis have fever and a tender, rigid, and distended abdomen; Amebic pericarditis presents with features of congestive heart failure; a pericardial friction rub may be audible; Cerebral amebiasis presents with altered consciousness and focal neurologic signs; Genital ulcers due to amebiasis have a punched-out appearance and profuse discharge.

Complications

Complications of amebic colitis include the following: Fulminant or necrotizing colitis, Toxic megacolon, Ameboma, Rectovaginal fistula.

Complications of amebic liver abscess include the following: Intraperitoneal, intrathoracic, or intrapericardial rupture, with or without secondary bacterial infection, Direct extension to pleura or pericardium, Dissemination and formation of brain abscess.

Other complications due to amebiasis include the following: Bowel perforation, GI bleeding, Stricture formation, Intussusception, Peritonitis, Empyema.

Diagnostic Considerations

In addition to the conditions listed in the differential diagnosis, other problems to be considered include the following: Infection by *Campylobacter, Yersinia*, or enteroinvasive or enterohemorrhagic *Escherichia coli,* Perforated abdominal viscus, Pericarditis, Peritonitis, Right lower lobe pneumonia. Amebic liver abscess should be distinguished from pyogenic liver abscess, necrotic hepatoma and echinococcal cyst. The likelihood that a liver abscess is amebic rather than pyogenic is increased by a history of residence in or recent travel to endemic areas; male sex; increased age (> 50 years); the presence of a single lesion in the right lobe of the liver; and the absence of jaundice, biliary disease, or diabetes mellitus.

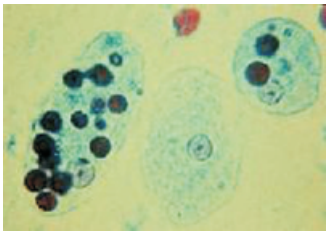
Differential Diagnoses

Abdominal Abscess, Arteriovenous Malformations, Campylobacter Infections, Cholecystitis, Colitis, Ischemic, Diverticulitis, Echinococcosis, Escherichia Coli Infections, Hepatitis A, Hepatitis, Viral, Hepatocellular Adenoma, Inflammatory Bowel Disease, Pyogenic Hepatic Abscesses, Salmonellosis, Shigellosis.

Laboratory Studies

Laboratory diagnosis of amebiasis is made by demonstrating the organism or by employing immunologic techniques. Findings from basic blood tests may include the following: Leukocytosis without eosinophilia (80% of patients), Elevated alkaline phosphatase level (80%), Elevated transaminase levels, Mildly elevated bilirubin level, Reduced albumin level, Mild anemia, Elevated erythrocyte sedimentation rate (ESR). Other laboratory studies employed for diagnosis include microscopy, culture, serologic testing, and polymerase chain reaction (PCR) assay.

Microscopy: Microscopic examination of fresh stool smears for trophozoites that contain ingested red blood cells (RBCs) is commonly done (see the image below). The presence of intracytoplasmic RBCs in trophozoites is diagnostic of *E. histolytica* infection, though some studies have demonstrated the same phenomenon with *E dispar*.



Trichrome stain of Entamoeba histolytica trophozoites in amebiasis. Two diagnostic characteristics are observed. Two trophozoites have ingested erythrocytes, and all 3 have nuclei with small, centrally located karyosomes.

Examination of a single stool sample has a sensitivity of only 33-50%; however, examination of 3 stool samples over no more than 10 days can improve the detection rate to 85-95%. It should be kept in mind that routine microscopy cannot be relied on to distinguish the pathogenic *E. histolytica* from the nonpathogenic *E. dispar* and *E. moshkovskii.* Stool leukocytes may be found, but in fewer numbers than in shigellosis. Stool examination findings in patients with amebic liver abscess are usually negative. Repeated stool sampling in patients with proven amebic liver abscess is positive in 8-40% of cases. Identification of the parasite in a liver abscess aspirate is only 20% sensitive. The World Health Organization (WHO) recommends that intestinal amebiasis be diagnosed with an *E. histolytica* -specific test, thus rendering the classic ova-and-parasite stool examination obsolete.

Culture: Cultures can be performed either with fecal or rectal biopsy specimens or with liver abscess aspirates. Culture has a success rate of 50-70%, but it is technically difficult. Overall, culture is less sensitive than microscopy. Xenic cultivation, first introduced in 1925, is defined as the growth of the parasite in the presence of an undefined flora. This technique is still in use today, using modified Locke-egg media. Axenic cultivation, first achieved in 1961, involves growing the parasite in the absence of any other metabolizing cells. Only a few strains of *E. dispar* have been reported to be viable in axenic cultures.

Antigen detection: Enzyme-linked immunosorbent assay (ELISA) is used to detect antigens from *E. histolytica* in stool samples. Several kits are commercially available. Antigen-based ELISA kits using monoclonal antibodies against the galactose/*N* -acetylgalactosamine (GAL/GalNAc)–specific lectin of *E. histolytica* (*E. histolytica* II, TechLab, Blacksburg, VA) yield an overall sensitivity of 71-100% and a specificity of 93-100%. One study showed a much lower sensitivity (14.2%). In patients with amebic liver abscess, serum and liver aspirate antigen detection using the same kit was shown to yield a sensitivity of 96% in serum and 100% in liver aspirate. Other stool detection kits use monoclonal antibodies against the serine-rich antigen of *E. histolytica* (Optimum S; Merlin Diagnostika, Bornheim-Hersel, Germany) or against other specific antigens (*Entamoeba* CELISA-PATH, Cellabs, Brookvale, Australia; ProSpecT EIA, Remle Inc, Lenexa, KY). No specific antigen tests are available for the detection of *E. dispar* and *E. moshkovskii* from clinical samples.

Antibody detection: Serum antibodies against amebae are present in 70-90% of individuals with symptomatic intestinal *E. histolytica* infection. Antiamebic antibodies are present in as many as 99% of individuals with liver abscess who have been symptomatic for longer than 1 week. Serologic examination should be repeated 1 week later in those with negative test on presentation. However, serologic tests do not distinguish new from past infection, because the seropositivity persists for years after an acute infection. ELISA, the assay most commonly used worldwide, measures the presence of serum antilectin antibodies (immunoglobulin G [IgG]). The galactose lectin antigen is present in the serum of 75% of subjects with amebic liver abscess and may be particularly useful in patients presenting acutely, before an IgG antiamebic antibody response occurs. The sensitivity of ELISA for detection of antibodies to *E. histolytica* in patients with amebic liver abscess is 97.9%, and its specificity is 94.8%. False-negative results can occur within the first 7-10 days after infection. Immunofluorescent assay (IFA) is also rapid, reliable, and reproducible. In the setting of amebic liver abscess, the sensitivity and specificity of IFA were shown to be 93.6% and 96.7%, respectively. Indirect hemagglutination assay (IHA) detects antibody specific for *E. histolytica*. The antigen used in IHA consists of a crude extract of axenically cultured organisms. Antibody titers of more than 1:256 to the 170-kd subunit of the galactose-inhibitable adherence lectin are noted in approximately 95% of patients with extraintestinal amebiasis, 70% of patients with active intestinal infection, and 10% of asymptomatic individuals. IHA is very specific (99.1%), but it is less sensitive than ELISA. It is not useful in differentiating acute infection from previous infection, because high titers may persist for years after successful treatment. False-positive reactions at titers higher than 1:256 are rare. ELISA has replaced IHA in most laboratories. Immunoelectrophoresis, counterimmunoelectrophoresis (CIE), and immunodiffusion (ID) use the precipitation property of antigen-antibody complexes in agar. CIE is time-consuming but has a sensitivity of 100% in invasive amebiasis. ID is simple to perform and thus ideal for laboratories that only rarely perform amebic serology; however, it requires a minimum of 24 hours, compared with 2 hours for IHA or ELISA. ID is slightly less sensitive than IHA and ELISA but is equally specific. Complement fixation (CF) is less sensitive than other techniques. Although detection of immunoglobulin M (IgM) antibodies specific for *E. histolytica* has been reported, sensitivity in patients with current invasive disease is only about 64%.

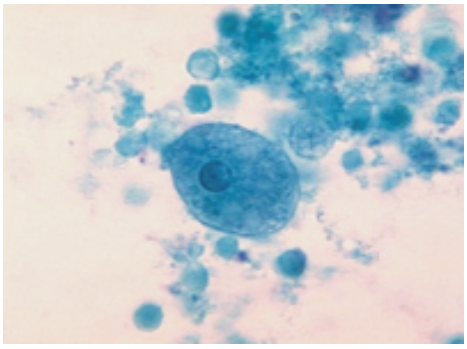
Polymerase chain reaction assay: A wide variety of PCR-based methods targeting different genes, including a small-subunit rRNA gene (18S rDNA), a 30-kd antigen gene, a serine-rich protein gene, a chitinase gene, a hemolysin gene, and extrachromosomal circular DNA, have been described for the detection and differentiation of *E. histolytica, E. dispar,* and *E. moshkovskii*. Sensitivities can vary according to sampling and the specific target gene used. Field studies that directly compared PCR with stool culture or antigen-detection tests for the diagnosis of *E. histolytica* infection found these methods to be comparably effective. PCR assay can also be used for detection of *E. histolytica* in liver aspirates for the diagnosis of amoebic liver abscess. PCR-based tests have been strongly endorsed by the WHO. However, application of PCR-based methods in routine diagnosis is still very limited; the generation of nonspecific DNA fragments from environmental and clinical samples often leads to false-positive results.

Loop-mediated isothermal amplification assay: The loop-mediated isothermal amplification (LAMP) assay has been applied to the detection of *E. histolytica* in cases of hepatic amebiasis. A study that compared this test with PCR testing in 50 patients with clinical suspicion of amebic liver abscess found that LAMP assay detected 5 additional abscesses that were missed by PCR assay. The rapidity, operational simplicity, high specificity and sensitivity, and high yield of LAMP assay suggest that it may prove to be a better diagnostic tool than PCR assay for diagnosis of hepatic amebiasis.

Radiography, Ultrasonography, CT, and MRI: Chest radiography may reveal an elevated right hemidiaphragm and a right-side pleural effusion in patients with amebic liver abscess. Both ultrasonography and CT scanning are sensitive but nonspecific for amebic liver abscess. Ultrasonography is preferred for the evaluation of amebic liver abscess because of its low cost, rapidity, and lack of adverse effects. CT may be slightly more sensitive than ultrasonography. In cerebral amebiasis, CT shows irregular lesions without a surrounding capsule or enhancement. On ultrasonograms, amebic liver abscesses usually appear as a solitary homogenous hypoechoic round lesion in the posterosuperior aspect of the right lobe of the liver (70-80% of cases), though multiple abscesses may occur in some patients. In an ultrasonographic evaluation of 212 patients, 34 (16%) had multiple abscesses, 75 (35%) had an abscess in the left lobe, and the remaining 103 (49%) had a solitary abscess in the right lobe. On CT scans with intravenous (IV) contrast, amebic liver abscess can appear as a rounded, low-attenuation lesion with an

enhancing rim. Furthermore, the abscess may be homogenous or septated, with or without observable fluid levels. Magnetic resonance imaging (MRI) reveals high signal intensity on T2-weighted images. Perilesional edema and enhancement of rim are noted after injection of gadolinium (86% of cases). Complete resolution of liver abscess may take as long as 2 years. Repeat imaging is not indicated if the patient is otherwise doing well.

Liver Aspiration: Ultrasound- or CT-guided needle aspiration of the liver should be performed when a diagnosis must be established very rapidly; pyogenic liver abscess can present and appear in similarly to amebic liver abscess. Liver abscess aspirate is usually an odorless thick yellow-brown liquid classically referred to as "anchovy paste." This liquid lacks white blood cells (WBCs) as a result of lysis by the parasite. Amebae are visualized in the abscess fluid in a minority of patients with amebic liver abscess (see the image below). Liver aspiration is indicated only if abscesses are large (> 12 cm), abscess rupture is imminent, medical therapy has failed, or abscesses are present in the left lobe.



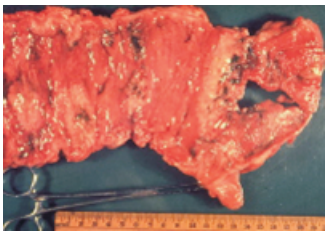
Entamoeba histolytica in liver aspirate, trichrome stain.

The aspirate can be sent for microscopy, culture, antigen detection, and PCR, where available. A Gram stain should also be performed if a pyogenic etiology is suspected clinically.

Lower GI Endoscopy: Rectosigmoidoscopy and colonoscopy with biopsy or scraping at the margin of a colonic mucosal ulcer provide valuable materials for diagnostic information in intestinal amebiasis. Tissue can be sent for microscopic evaluation, culture, and PCR assay, where available. Indications for endoscopy in suspected intestinal amebiasis include the following: Stool examination findings are negative, but serum antibody test findings are positive; Stool examination findings are negative, but immediate diagnosis is required; Stool examination and antibody test results are negative, but amebiasis is strongly suspected; Evaluation of chronic intestinal syndromes or mass lesions is desired. Fulminant colitis is a relative contraindication to colonoscopy, because it increases the risk of intestinal perforation. On endoscopic examination, small mucosal ulcers covered with yellowish exudates are observed. The mucosal lining between the ulcers appears normal. The mucosa resembles that seen in inflammatory bowel disease (IBD). Biopsy results and a scraping of ulcer edge may reveal trophozoites. Ameboma (a carcinomalike annular lesion) can also be seen, usually in the cecum and ascending colon. Rectosigmoidoscopy and colonoscopy should be considered before steroids are used in patients with suspected IBD. In a multivariate analysis, the best combination of findings for predicting amebic colitis was the combination of cecal lesions, multiple lesions, and exudates.

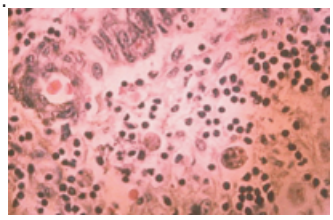
Histologic Findings

The intestinal biopsy specimen should be taken from the edge of ulcers and evaluated for motile trophozoites. Histopathologic findings may include nonspecific mucosal thickening, multiple discrete ulcers separated by regions of normal-appearing colonic mucosa, diffusely inflamed and edematous mucosa, necrosis, or wall perforation (see the image below).

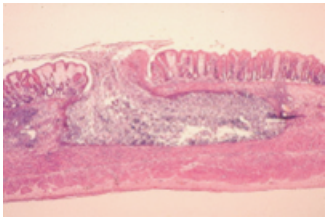


Gross pathology of intestinal ulcers due to amebiasis.

Amebic invasion through the mucosa and into submucosal tissues is the hallmark of amebic colitis; lateral extension through the submucosal tissues gives rise to the classic flask-shaped ulcer of amebic colitis (see the images below).

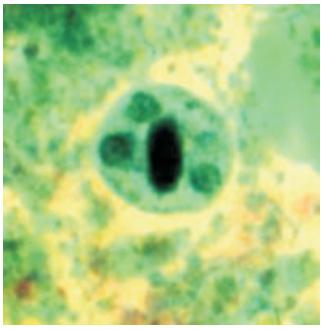


Histopathology of amebiasis.



Histopathology of typical flask-shaped ulcer of intestinal amebiasis.

Different chemical stains can be used (see the image below), including periodic acid- Schiff stain, which makes *E. histolytica* appear magenta in color.



Trichrome stain of Entamoeba histolytica cyst in amebiasis.

Each cyst has 4 nuclei with characteristically centrally located karyosomes. Cysts measure 12-15 mm.

Approach Considerations

Treatment of amebiasis includes pharmacologic therapy, surgical intervention, and preventive measures, as appropriate. Most individuals with amebiasis may be treated on an outpatient basis. Several clinical scenarios may favor inpatient care, as follows: Severe colitis and hypovolemia requiring intravenous (IV) volume replacement; Liver abscess that is of uncertain etiology or is not responding to empiric therapy; Fulminant colitis requiring surgical evaluation; Peritonitis and suspected amebic liver abscess rupture. Intestinal amebiasis may be

mistakenly treated as if it were inflammatory bowel disease (IBD). Accordingly, in all patients with suspected IBD, lower gastrointestinal (GI) endoscopy should be performed before treatment with steroids is initiated. The following consultations may be helpful: Infectious disease specialist; General surgeon; GI specialist. Follow-up stool examination after therapy completion is recommended to ensure intestinal eradication. No special diet is recommended.

Pharmacologic Therapy: In endemic areas, asymptomatic infections are not treated. In nonendemic areas, however, asymptomatic infection should be treated luminal agents that are minimally absorbed by the GI tract (eg, paromomycin, iodoquinol, and diloxanide furoate) are best suited for such therapy. This recommendation is based on 2 arguments: first, that invasive disease may develop, and second, that shedding of *E. histolytica* cysts in the environment is a public health concern. Asymptomatic *E. dispar* infections should not be treated, but because this organism is a marker of fecal-oral contamination, educational efforts should be initiated. Metronidazole is the mainstay of therapy for invasive amebiasis. Tinidazole has been approved by the US Food and Drug Administration (FDA) for intestinal or extraintestinal amebiasis. Other nitroimidazoles with longer half-lives (ie, secnidazole and ornidazole) are currently unavailable in the United States. Nitroimidazole therapy leads to clinical response in approximately 90% of patients with mild-to-moderate amebic colitis. Because intraluminal parasites are not affected by nitroimidazoles, nitroimidazole therapy for amebic colitis should be followed by treatment with a luminal agent (eg, paromomycin or diloxanide furoate) to prevent a relapse. Amebic liver abscess of up to 10 cm can be cured with metronidazole without drainage. Clinical defervescence should occur during the first 3-4 days of treatment. Failure of metronidazole therapy may be an indication for surgical intervention. Treatment with a luminal agent should also follow. Chloroquine has also been used for patients with hepatic amebiasis. Dehydroemetine has been successfully used but, because of its potential myocardial toxicity, is not preferred. Broad-spectrum antibiotics may be added to treat bacterial superinfection in cases of fulminant amebic colitis and suspected perforation. Bacterial coinfection of amebic liver abscess has occasionally been observed (both before and as a complication of drainage), and adding antibiotics to the treatment regimen is reasonable in the absence of a prompt response to nitroimidazole therapy.

Surgical and Percutaneous Intervention: Surgical intervention is required for acute abdomen that is due to any of the following: Perforated amebic colitis; Massive GI bleeding; Toxic megacolon (rare and typically associated with the use of corticosteroids). Surgical intervention is usually indicated in the following clinical scenarios : Uncertain diagnosis (possibility of pyogenic liver abscess); Concern about bacterial suprainfection in amebic liver abscess; Failure to respond to metronidazole after 4 days of treatment; Empyema after amebic liver abscess rupture; Large left-side amebic liver abscess representing risk of rupture in the pericardium; Severely ill patient with imminent amebic liver abscess rupture. Unlike pyogenic liver abscess, uncomplicated amebic liver abscess generally responds to medical therapy alone; drainage is seldom necessary and is usually best avoided. When drainage is necessary, image-guided percutaneous intervention (ie, needle aspiration or catheter drainage) has replaced surgical intervention as the procedure of choice. The indications for drainage of amebic liver abscess include the following: Presence of a left-lobe abscess more than 10 cm in diameter; Impending rupture and abscess that does not respond to medical therapy within 3-5 days. Percutaneous catheter drainage improves treatment outcomes in amebic empyema and is life-saving in amebic pericarditis. It should be used judiciously in the setting of localized intra-abdominal fluid collections.

Prevention

Amebiasis is prevented by eradicating fecal contamination of food and water through improved sanitation, hygiene, and water treatment. In nonendemic areas, disease transmission can be reduced by early treatment of carriers. Amebic cysts are not killed by soap or low concentrations of chlorine or iodine; therefore, water in endemic areas should be boiled for more than 1 minute and vegetables should be washed with a detergent soap and soaked in acetic acid or vinegar for 10-15 minutes before consumption. Avoiding sexual practices that involve fecal-oral contact may reduce the risk of sexual transmission of infective cysts. Because reinfection is possible, family members or close contacts of an index case should be screened. In humans, natural *E. histolytica* infection does not seem to result in long-term immunity: individuals with a previous amebic liver abscess are as susceptible to a new infection as other members of the population are. Vaccinations using native and recombinant forms of Gal-lectin have been successful in protecting animals against intestinal amebiasis and amebic liver abscess. Protection against amebic liver abscesses has also been reported by targeting other *E. histolytica* components, including the serine-rich protein and the 29-kDa-reductase antigen. To date, vaccines against the Gal-lectin hold the most promise, but clinical trials are required to validate its efficacy in humans. Development of a vaccine for invasive amebiasis is still in its infancy. Many components of the ameba are immunogenic and may serve as targets for a future vaccine, including the galactose/*N* -acetylgalactosamine lectin, the serine-rich *E. histolytica* protein, cysteine proteinases, lipophosphoglycans, amebapores, and the 29-kd protein. Quach et al recently reviewed current strategies involved in the development of a vaccine against *E. histolytica*.

Medication Summary

Asymptomatic amebiasis in nonendemic areas should be treated with a luminal agent (iodoquinol, paromomycin, or diloxanide furoate) to eradicate infection. Asymptomatic *Entamoeba dispar* infections should not be treated, but education should be pursued. Amebic colitis is treated first with a nitroimidazole derivative and then with a luminal agent to eradicate colonization. Paromomycin is safe, well tolerated, and effective in the treatment of intestinal amebiasis, including in patients with HIV infection. Diloxanide is a dichloroacetamide derivative that is amebicidal against trophozoite and cyst forms of *E. histolytica*. Amebic liver abscess can be cured without drainage by using metronidazole. Treatment with a luminal agent should also follow. Disseminated amebiasis should be treated with metronidazole, which can cross the brain-blood barrier. Empirical antibacterial therapy should be used concomitantly if perforated bowel is a concern.

Antibiotics, Other Class Summary: Several agents are active against anaerobic bacteria and protozoa. Metronidazole is the drug of choice for symptomatic, invasive disease; paromomycin is the drug of choice for noninvasive disease. Because parasites persist in the intestines of 40-60% of patients treated with metronidazole, this drug should be followed with paromomycin to cure luminal infection. Do not give the 2 medications at the same time; the diarrhea that often results from paromomycin might be confused with continuing active intestinal disease from the parasite.

TROUBLESHOOTING

STOOL ANALYSIS

Test Overview

A stool analysis is a series of tests done on a stool (feces) sample to help diagnose certain conditions affecting the digestive tract. These conditions can include infection (such as from parasites, viruses, or bacteria), poor nutrient absorption, or cancer. For a stool analysis, a stool sample is collected in a clean container and then sent to the laboratory. Laboratory analysis includes microscopic examination, chemical tests, and microbiologic tests. The stool will be checked for color, consistency, amount, shape, odor, and the presence of mucus. The stool may be examined for hidden (occult) blood, fat, meat fibers, bile, white blood cells, and sugars called reducing substances. The pH of the stool also may be measured. A stool culture is done to find out if bacteria may be causing an infection.

Why It Is Done

Stool analysis is done to: Help identify diseases of the digestive tract, liver, and pancreas. Certain enzymes (such as trypsin or elastase) may be evaluated in the stool to help determine how well the pancreas is functioning. Help find the cause of symptoms affecting the digestive tract, including prolonged diarrhea, bloody diarrhea, an increased amount of gas, nausea, vomiting, loss of appetite, bloating, abdominal pain and cramping, and fever. Screen for colon cancer by checking for hidden (occult) blood. Look for parasites, such as pinworms or *Giardia*. Look for the cause of an infection, such as bacteria, a fungus, or a virus. Check for poor absorption of nutrients by the digestive tract (malabsorption syndrome). For this test, all stool is collected over a 72-hour period and then checked for fat (and sometimes for meat fibers). This test is called a 72-hour stool collection or quantitative fecal fat test.

How To Prepare

Many medicines can change the results of this test. You will need to avoid certain medicines depending on which kind of stool analysis you have. Patinet may need to stop taking medicines such as antacids, antidiarrheal medicines, antiparasite medicines, antibiotics, laxatives, or nonsteroidal anti-inflammatory drugs (NSAIDs) for 1 to 2 weeks before you have the test. The patient must tell the doctor about all the nonprescription and prescription medicines are being taken. The patient must inform the consultant: Recently had an X-ray test using barium contrast material, such as a barium enema or upper gastrointestinal series (barium swallow). Barium can interfere with test results. Traveled in recent weeks or months, especially if you have traveled outside the country. This helps your doctor look for the parasites, fungi, viruses, or bacteria that may be causing a problem. If the patient's stool is being tested for blood, they may need to avoid certain foods for 2 to 3 days before the test. This depends on what kind of stool test they are undergoing. And they should not do the test during menstrual period or if you they have active bleeding from hemorrhoids. They should not use a stool sample for testing that has been in contact with toilet bowl cleaning products that turn the water blue.

How It Is Done

Stool samples can be collected at home, in the doctor's office, at a medical clinic, or at the hospital. If patients collect the samples at home, they will be given stool collection kits to use each day. Each kit contains applicator sticks and two sterile containers. They may need to collect more than one sample over 1 to 3 days. Follow the same procedure for each day. Collect the samples as follows with instructions to the patient as given below: Urinate before collecting the stool so that you do not get any urine in the stool sample. Put on gloves before handling your stool. Stool can contain germs that spread infection. Wash your hands after you remove your gloves. Pass stool (but no urine) into a dry container. You may be given a plastic basin that can be placed under the toilet seat to catch the stool. Either solid or liquid stool can be collected. If you have diarrhea, a large plastic bag taped to the toilet seat may make the collection process easier the bag is then placed in a plastic container. If you are constipated, you may be given a small enema. Do not collect the sample from the toilet bowl. Do not mix toilet paper, water, or soap with the sample. Place the lid on the container and label it with your name, your doctor's name, and the date the stool was collected. Use one container for each day's collection, and collect a sample only once a day unless your doctor gives you other directions. Patients must take the sealed container to doctor's office or the laboratory as soon as possible. They may need to deliver their sample to the lab within a certain time. Any delay must be informed to the Laboratory. If the stool is collected in doctor's office or the hospital, the patient will pass the stool in a plastic container that is inserted under the toilet seat or in a bedpan. A health professional will package the sample for laboratory analysis. The patient will need to collect stool for 3 days in a row if the sample is being tested for quantitative fats. They will begin collecting stool on the morning of the first day. The samples are placed in a large container and then refrigerated. They may need to collect several stool samples over 7 to 10 days if they have digestive symptoms after traveling outside the country. Samples from babies and young children may be collected from diapers (if the stool is not contaminated with urine) or from a small-diameter glass tube inserted into the baby's rectum while the baby is held on an adult's lap. Sometimes a stool sample is collected using a rectal swab that contains a preservative. The swab is inserted into the rectum, rotated gently, and then withdrawn. It is placed in a clean, dry container and sent to the lab right away.

How It Feels

There is no pain while collecting a stool sample. If patient is constipated, straining to pass stool may be painful. If the health professional uses a rectal swab to collect the sample, patient may feel some pressure or discomfort as the swab is inserted into patient's rectum.

Risks

Any stool sample may contain germs that can spread disease. It is important to carefully wash your hands and use careful handling techniques to avoid spreading infection.

Results

A stool analysis is a series of tests done on a stool (feces) sample to help diagnose certain conditions affecting the digestive tract. The normal values listed here—called a reference range—are just a guide. These ranges vary from lab to lab, and your lab may have a different range for what's normal. The lab report should contain the range your lab uses. Also, the clinician will evaluate the results based on the patient's health and other factors. This means that a value that falls outside the normal values listed here may still be normal for the patient or his lab. Stool analysis test results usually take at least 1 to 3 days.

Stool analysis

Normal: The stool appears brown, soft, and well-formed in consistency. The stool does not contain blood, mucus, pus, undigested meat fibers, harmful bacteria, viruses, fungi, or parasites. The stool is shaped like a tube. The pH of the stool is 7.0–7.5. The stool contains less than 0.25 grams per deciliter (g/dL)[less than 13.9 millimoles per liter (mmol/L)] of sugars called reducing factors. The stool contains 2–7 grams of fat per 24 hours (g/24h).

Abnormal: The stool is black, red, white, yellow, or green. The stool is liquid or very hard. There is too much stool. The stool contains blood, mucus, pus, undigested meat fibers, harmful bacteria, viruses, fungi, or parasites. The stool contains low levels of enzymes, such as trypsin or elastase. The pH of the stool is less than 7.0 or greater than 7.5. The stool contains 0.25 g/dL (13.9 mmol/L) or more of sugars called reducing factors. The stool contains more than 7 g/24h of fat (if your fat intake is about 100 g

a day). Many conditions can change the results of a stool analysis. The clinician will talk to the patient about any abnormal results that may be related to his/her symptoms and past health.

Abnormal values

High levels of fat in the stool may be caused by diseases such as pancreatitis, sprue (celiac disease), cystic fibrosis, or other disorders that affect the absorption of fats. The presence of undigested meat fibers in the stool may be caused by pancreatitis. A low pH may be caused by poor absorption of carbohydrate or fat. Stool with a high pH may mean inflammation in the intestine (colitis), cancer, or antibiotic use. Blood in the stool may be caused by bleeding in the digestive tract. White blood cells in the stool may be caused by inflammation of the intestines, such as ulcerative colitis, or a bacterial infection. Rotaviruses are a common cause of diarrhea in young children. If diarrhea is present, testing may be done to look for rotaviruses in the stool. High levels of reducing factors in the stool may mean a problem digesting some sugars. Low levels of reducing factors may be caused by sprue (celiac disease), cystic fibrosis, or malnutrition. Medicine such as colchicine (for gout) or birth control pills may also cause low levels.

What Affects the Test

Reasons why a patient may not be able to have the test or why the results may not be helpful include: Taking medicines such as antibiotics, antidiarrheal medicines, barium, bismuth, iron, ascorbic acid, nonsteroidal anti-inflammatory drugs (NSAIDs), and magnesium. Contaminating a stool sample with urine, blood from a menstrual period or a bleeding hemorrhoid, or chemicals found in toilet paper and paper towels. Exposing the stool sample to air or room temperature or failing to send the sample to a laboratory within 1 hour of collection.

What To Think About

Stool may be checked for hidden (occult) blood for Colorectal Cancer. A stool culture is done to find the cause of an infection, such as bacteria, a virus, a fungus, or a parasite. A bowel transit time test is done to help find the cause of abnormal movement of food through the digestive tract. The D-xylose absorption test is done to help diagnose problems that prevent the small intestine from absorbing nutrients in food. This test may be done when symptoms of malabsorption syndrome (such as chronic diarrhea, weight loss, & weakness) are present. A stool analysis to measure trypsin or elastase is not as reliable as the sweat test to detect cystic fibrosis.

BOUQUET

In Lighter Vein

Wife : Whenever we keep the money in the bags our son steals it, I don't know what to do?

.

.

Husband : Keep it in his books. I know he will never touch them…

"Best catch line Ever On the WALL of Canteen :
"This Food Must Be Good. Ten Thousand FLIES Can't Be Wrong.

New way of writing answers in exams.
If you don't know the answer, then put lines like this :
||||||||||
and write below : "Scratch here for ANSWERS"

Brain Teasers

1. The following parasites cause fever except :
   A. Trichinella spiralis
   B. Naegleria fowleri
   C. Hymenolepis nana
   D. Plasmodium vivax

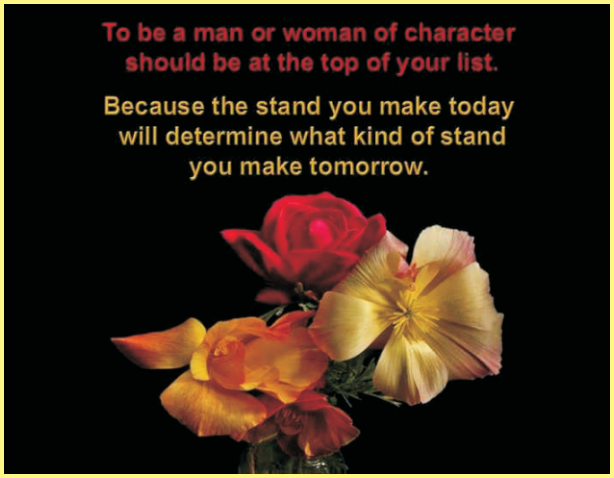
2. There is lymphadenopathy in the following disorders except
   A. African trypanosomisasis
   B. Toxoplasmosis
   C. Schistosomiasis
   D. Kala azar

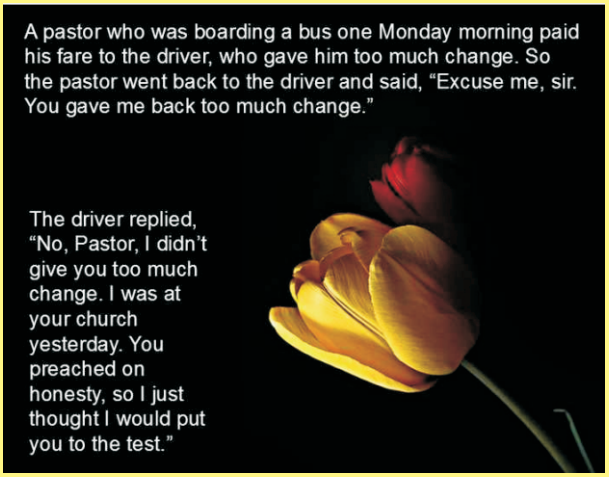
3. Skin myiasis is due to invasion of skin by :
   A. Sarcoptes scabiei
   B. Trematode cercariae
   C. Lice
   D. Fly larvae

4. In malaria sporogony takes place in :
   A. Human blood
   B. The liver cells
   C. Mosquitoes
   D. Other sites

5. Contamination of eye lenses could lead to infection by :
   A. Acanthamoeba
   B. Entamoeba coli
   C. Onchocerca volvulus
   D Toxocara cani

Wisdom Whispers





ANSWERS: 1. C, 2. C, 3. D, 4. C, 5. A

INTERPRETATION

DIARRHEA

Differential Diagnoses And Workup

- Appendicitis
- Carcinoid Tumor
- Giardiasis
- Intussusception
- Pediatric Crohn Disease
- Protein Intolerance
- Shigella Infection
- Ulcerative Colitis Imaging
- Glucose-galactose malabsorption
- Intestinal Enterokinase Deficiency
- Intestinal Protozoal Diseases
- Meckel Diverticulum Imaging
- Microvillus Inclusion Disease
- Pediatric Hyperthyroidism
- Pediatric Irritable Bowel Syndrome
- Pediatric Short Bowel Syndrome
- Pediatric Malabsorption Syndromes
- Sinonasal Manifestations of Cystic Fibrosis

The following may be noted in patients with diarrhea:

- In patients with diarrhea, a stool pH level of 5.5 or less or presence of reducing substances indicates carbohydrate intolerance, which is usually secondary to viral illness and transient in nature.
- Enteroinvasive infections of the large bowel cause leukocytes, predominantly neutrophils, to be shed into stool. Absence of fecal leukocytes does not eliminate the possibility of enteroinvasive organisms. However, presence of fecal leukocytes eliminates consideration of enterotoxigenic *E. coli, Vibrio* species, and viruses.
- Examine any exudates found in stool for leukocytes. Such exudates highly suggest colitis (80% positive predictive value). Colitis can be infectious, allergic, or part of inflammatory bowel disease (Crohn disease, ulcerative colitis).
- Many different culture mediums are used to isolate bacteria. Table 3 lists common bacteria and optimum culture mediums for their growth. A high index of suspicion is needed to choose the appropriate medium.
- With stool not cultured within 2 hours of collection, refrigerate at 4°C or place in a transport medium. Although stool cultures are useful when positive, yield is low.
- Always culture stool for *Salmonella, Shigella,* and *Campylobacter* organisms and *Y. enterocolitica* in the presence of clinical signs of colitis or if fecal leucocytes are found.
- Look for *C. difficile* in persons with episodes of diarrhea characterized by colitis and/or blood in the stools. Remember that acute-onset diarrheal episodes associated with *C. difficile* may also occur without a history of antibiotic use.
- Bloody diarrhea with a history of ground beef ingestion must raise suspicion for enterohemorrhagic *E. coli.* If *E. coli* is found in the stool, determine if the type of *E. coli* is O157:H7. This type of *E. coli* is the most common, but not only, cause of HUS.
- History of raw seafood ingestion or foreign travel should prompt additional screening for *Vibrio* and *Plesiomonas* species.
- Culture mediums used to isolate bacteria include the following:

Blood agar	-	All aerobic bacteria and yeast detects cytochrome oxidase production
MacConkey EMB agar	-	Inhibits gram-positive organisms permits lactose fermentation
XLD agar; HE agar	-	Inhibits gram-positive organisms and nonpathogenic GNB permits lactose fermentation H2S production
Skirrow agar	-	Selective for *Campylobacter* species
SM agar	-	Selective for enterohemorrhagic *E. coli*
CIN agar	-	Selective for *Y. enterocolitica*
TCBS agar	-	Selective for *Vibrio* species
CCFE agar	-	Selective for *C. difficile*

Table: Common Bacteria and Optimum Culture Mediums

Organism	Detection Method	Microbiologic Characteristics
Aeromonas species	Blood agar	Oxidase-positive flagellated gram-negative bacillus (GNB)
Campylobacter species	Skirrow agar	Rapidly motile curved gram-negative rod (GNR); Campylobacter jejuni 90% and Campylobacter coli 5% of infections
C difficile	Cycloserine-cefoxitin-fructose-egg (CCFE) agar; enzyme immunoassay (EIA) for toxin; latex agglutination (LA) for protein	Anaerobic spore-forming gram-positive rod (GPR); toxin-mediated diarrhea; produces pseudomembranous colitis
C perfringens	None available	Anaerobic spore-forming GPR; toxin-mediated diarrhea
E coli	MacConkey eosin-methylene blue (EMB) or Sorbitol-MacConkey (SM) agar	Lactose-producing GNR
Plesiomonas species	Blood agar	Oxidase-positive GNR
Salmonella species	Blood, MacConkey EMB, xylose-lysine-deoxycholate (XLD), or Hektoen enteric (HE) agar	Nonlactose non–H2S-producing GNR

- Rotavirus antigen can be identified by enzyme immunoassay and latex agglutination assay of the stool. The false-negative rate is approximately 50%, and false-positive results occur, particularly in the presence of blood in the stools.
- Adenovirus antigens can be detected by enzyme immunoassay. Only serotypes 40 and 41 are able to induce diarrhea.
- Examination of stools for ova and parasites is best for finding parasites. Perform stool examination every 3 days or every other day.
- The leukocyte count is usually not elevated in viral-mediated and toxin-mediated diarrhea. Leukocytosis is often but not constantly observed with enteroinvasive bacteria. *Shigella* organisms cause a marked bandemia with a variable total white blood cell count.
- At times, a protein-losing enteropathy can be found in patients with extensive inflammation in the course of enteroinvasive intestinal infections (eg, *Salmonella* species, enteroinvasive *E. coli).* In these circumstances, low serum albumin levels and high fecal alpha1-antitrypsin levels can be found.

Because the pathogenesis of diarrhea can be either osmolar (due to the presence of an excess of unabsorbed substrates in the gut lumen) or secretory (due to active anion secretion from the enterocytes), the anion gap in the stools is occasionally used to ascertain the nature of the diarrhea. The stool anion gap is calculated according to the formula: 290 - [(Na+K) X 2]. If the value is more than 100, osmolar diarrhea can be assumed to be present. If the value is less than 100, the diarrhea has a secretory origin.

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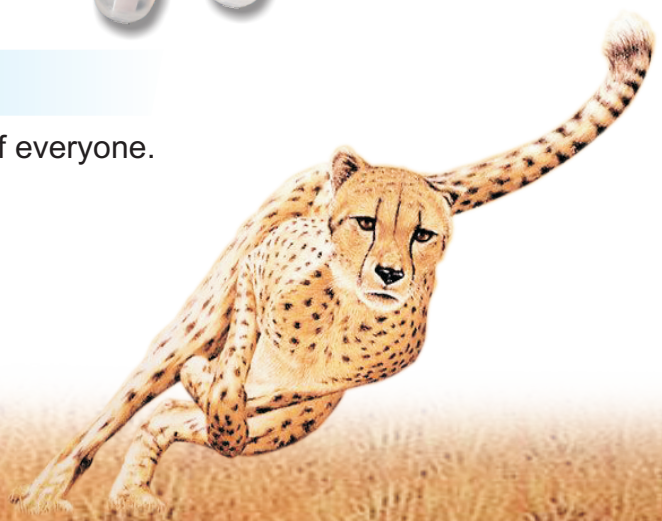

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Printed and published by D.G. Tripathi, Edited by Dr. Ramnik Sood, M.D. (Path.) for and on behalf of Tulip Diagnostics Private Ltd., Gitanjali, Tulip Block, Dr. Antonio Do Rego Bagh, Alto Santacruz, Bambolim Complex Post Office, Goa - 403 202, INDIA.
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