Parasitic Infections

Refugee Health Guidelines: Domestic Guidelines

Guidelines for Evaluation of Refugees for Intestinal and Tissue-Invasive Parasitic Infections during Domestic Medical Examination

Background

At least one-third of the world's population is infected with intestinal parasites, making infections with these organisms one of the most common infections of humans and one of the most common conditions detected in newly arrived refugees [Table 1]. An estimated 65 million people in the United States are currently infected with an intestinal parasite. Although these infections are usually asymptomatic and often go unnoticed, some have the potential to become chronic infections and lead to serious health consequences.

Parasites discussed in this document may be classified as either single-celled protozoa or multicellular helminths. The helminths consist of two phyla: the hermaphroditic Platyhelminths (flatworms) and the Nematoda (nematodes or roundworms), each having separate male and female worms. The Platyhelminths are further subdivided into two classes: the trematodes (flukes) and cestodes (tapeworms). General categories of parasites are summarized below; for brief discussions of the most commonly encountered individual parasites, see http://www.health.state.mn.us/divs/idepc/refugee/guide/parasites.pdf.

Classifications of commonly detected intestinal parasites

The ***pathogenic protozoa and coccidia*** most likely to affect refugees include the ameba *Entamoeba histolytica/dispar* and the flagellate *Giardia intestinalis* (also known as *G. lamblia* or *G. duodenalis*). Some evidence suggests that cryptosporidiosis is a common infection in newly arrived refugees (William Stauffer, unpublished data). Although many other protozoa, such as *Cyclospora cayetanensis* and *Balantidium coli*, are known to cause intestinal disease throughout the world, the importance of these organisms in refugee populations remains uncertain. Two protozoa which have the potential to cause illness but are more frequently associated with asymptomatic infection are *Blastocystis hominis* and *Dientamoeba fragilis*. *Blastocystis hominis*, found in 20%-40% of refugees, is the most commonly detected intestinal parasites in all refugee populations arriving to the United States.

Although *Entamoeba histolytica* (*E. histolytica*) is commonly reported in refugees, its true prevalence is unknown, because it is generally not distinguished from the morphologically identical *Entamoeba dispar* (*E. dispar*). In most populations, *E. dispar*, which is considered nonpathologic, accounts for 90% of infections reported as *E. histolytica* (William Stauffer, unpublished data). In addition, another morphologically indistinguishable protozoan, *Entamoeba moshkovskii,* also complicates diagnosis.

Nematodes, or ***roundworms,*** are common parasites infecting humans and are the organisms most frequently associated with the term "parasite" infection, due to their wormlike appearance. Intestinal nematodes are transmitted to humans by one of two routes: 1) ingestion of soil contaminated with infective eggs (e.g., *Ascaris lumbricoides, Trichuris trichiura*) or 2) penetration of skin with infective larvae (e.g., hookworm, *Strongyloides stercoralis*). Although *Ascaris*, *Trichuris,* and hookworm may be associated with eosinophilia and hookworm with anemia, these organisms are rarely associated with disease in refugees after migration. Most pathology associated with these organisms is related to parasite load, which decreases rapidly after migration. In addition, these nematodes have a relatively short lifespan and re-infection occurs only after a life-cycle stage outside the human host. However, *S. stercoralis* is a unique nematode that has an autoinfective cycle and frequently causes chronic infection. In immunosuppressed hosts, *S. stercoralis* may become invasive, causing serious morbidity and mortality. Several studies have demonstrated that refugee populations have very high prevalence rates, with more than 40% of certain populations having serologic evidence of strongyloides infection.[1 2 3]

Important nonintestinal nematodes that may cause disease and eosinophilia include the tissue-dwelling filariae and zoonotic nematodes (*Toxocara canis*, *Angiostrongylus* species, *Gnathostoma* species, and *Trichinella spiralis).* These parasites are rarely detected by routine stool testing and, with the exception of filariasis in certain sub-Saharan African populations, are relatively rare in refugees arriving in the United States.

Trematodes, or ***flukes,*** are a group of parasites with a life cycle that requires an intermediate snail host. They often cause chronic infections, with many important long-term consequences. Two groups may be distinguished by the manner in which the infective larvae enter their human host: the blood flukes and the foodborne flukes. The blood flukes infect humans by penetrating skin surfaces, while the foodborne flukes infect humans through the ingestion of specific foods. All trematodes tend to cause eosinophilia due to the tissue-invasive character of these infections.

The five blood flukes of human importance are all *Schistosoma* species. *Schistosoma mansoni* and *S. haematobium* are the most important trematodes in newly arriving refugees because of their high prevalence rates in sub-Saharan Africa, their potential for chronic infection, and their ability to cause liver and urologic disease complications, including a high association with cancer. Close to 50% of some sub-Saharan refugee populations have ongoing infection after migration. [3] [4] [5]

Foodborne trematodes can be divided into the biliary liver flukes (*Opisthorchis* species, *Clonorchis sinensis* and *Fasciola* species), intestinal flukes (*Fasciolepsis buski*, heterophyids and echinostomes), and lung flukes (*Paragonimus* spp.). These organisms tend to chronically infect specific populations, depending on dietary consumption of certain types of raw fish, crustaceans, or aquatic plants contaminated with the infective stages. The biliary liver flukes, particularly *Opisthorchis* spp. and *C. sinesis*, are of special concern because of their association with the development of cholangiocarcinoma, an invasive cancer of the bile ducts.

The ***cestodes***, or ***tapeworms***, commonly infect humans and are distinguished by their physical characteristic during the adult phase, when the worms are divided into segments, or proglottids. Except for the human dwarf tapeworm, cestodes are transmitted to humans through consumption of undercooked meats. When humans eat undercooked beef, pork or fish with encysted larvae, they become infected with the adult form of *Taenia saginata*, *Taenia solium,* and *Diphyllobothrium latum*, respectively. The most common cause of serious morbidity and mortality is *T. saginata*. If eggs, passed in the human feces of individuals harboring an adult *T. solium* worm, are subsequently ingested by another human, the developing larval stage may become ectopic and migrate to various organs, causing symptomatic disease termed cysticercosis. Although neurologic complications, particularly seizures, are the most common sequelae, many complications may occur, including hydrocephalus and ocular and musculoskeletal complications.

Infection with adult *Hymenolepis nana*, the dwarf tapeworm, is an exception, as it is not acquired by consumption of undercooked meat. Its simple fecal-oral transmission and its ability to persist in a cycle of autoinfection make it the most commonly detected human cestode in nearly all refugee populations.

Nonpathogenic parasites. Although all intestinal helminths are potentially pathogenic and should be treated, many protozoan parasites detected in screening stool ova and parasite (O&P) examination specimens are nonpathogenic [Table 2]. These organisms are very common and should not be treated. When detected, their presence indicates time spent in areas where poor sanitation and past fecal-oral contamination are common.

Epidemiology

All refugees, regardless of region of origin, are at risk for harboring intestinal parasites (Table 1). Prevalence data for parasitic infections in refugees groups in the United States come primarily from state refugee screening programs and published reports of convenience samples. Little data are available on the prevalence of tissue-invasive parasites, as there is no standard screening for these parasites and routine stool examination is not a sensitive method of detecting infection for most of these organisms.

The prevalence rates of pathogenic intestinal parasites among refugees in North America have been reported to range from 8% to 86%.[6] This large range can be explained by differences in geographic origin and ages of the populations studied, living conditions (including quality of drinking water, sanitation, and access to footwear), dietary habits, and previous countries of asylum. Studies done after 1999 have noted large decreases in prevalence. [7] [8] Other determinants include educational level and past occupational exposures. In addition, methodologic differences likely account for some of the variability in reported

prevalence. For example, intestinal parasitosis rates among a population of Cambodian refugees in New York varied from 31% to 86%, depending on the method of stool examination. [9]

Of particular concern are two parasitic infections that are commonly encountered in refugee populations, *Schistosoma* spp. (fluke) and *Strongyloides stercoralis* (roundworm) infections. *Strongyloides stercoralis* infection is found in virtually all groups of refugees but is particularly prevalent in Southeast Asia; *Schistosoma* spp. is encountered predominantly in sub-Saharan refugees. Infections with these two parasites carry the risk of chronicity and have been associated with both morbidity and mortality years after migration. Studies of parasite prevalence that used stool microscopy for O&P to determine the prevalence of these infections have underestimated the true prevalence due to the lack of sensitivity of this test for both strongyloides and schistosomiasis. [1] [2] [10] [12]

As many as 100 million persons worldwide are estimated to be chronically infected with *S. stercoralis*.[6] A recent serosurvey by CDC found a 44% prevalence rate of strongyloides in Sudanese refugees after arrival in the United States. In Australia, a recent study of newly arrived refugees found seroprevalence rates ranging from 11% in East Africans to 42% in Cambodian refugees.[1] If the condition id not detected promptly after arrival, screening data indicate that the average time to diagnosis of *S. stercoralis* in the United States is 61 months after migration. [10] In fact, one study found that 24% of Laotian refugees had continued *S. stercoralis* infection for an average of 12 years after migration. [12] Strongyloidiasis hyperinfection or dissemination may occur years after exposure, with reports of two cases occurring >50 years after last known host exposure in an endemic area. [13] [14] [15] The fatality rate of disseminated/hyperinfection strongyloidiasis exceeds 50%. [13] [15] Although antecedent treatment with corticosteroids accounts for a majority of reported iatrogenic cases, numerous case reports have been published of strongyloidiasis hyperinfection that resulted from the immunosuppression associated with human immunodeficiency virus (HIV), as well as with the use of chemotherapeutic agents. [13] [15]

Schistosomiasis is known to persist in humans for more than 30 years and has been associated with many chronic illnesses, depending on the species, the parasite load and the host response. A CDC serosurvey of Sudanese refugees found seroprevalence rates of 46%, while the recent study from Australia found a seroprevalence rate of 15% in East African refugees. [6] Current data from CDC indicate rates exceeding 40% in several refugee groups, including Somali and Liberian refugees [3] (personal communication, Marianna Wilson, Centers for Disease Control and Prevention). Schistosomiasis is associated with liver cirrhosis and resulting clinical complications (*S. mansoni, S. japonicum*), squamous cell carcinoma of the bladder (*S. haematobium*), and urinary tract obstruction and renal failure (*S. haematobium*). Potentially devastating clinical manifestations occasionally occur when an egg enters the systemic circulation and travels to a normally sterile site within the body, causing severe inflammation. Eggs may travel to virtually any part of the body, including the brain and spinal cord where, when deposited in the nerve plexus, they may cause paralysis or myelitis (inflammation of the spinal cord).

Pre-departure albendazole therapy

In 1997, CDC and the International Organization for Migration (IOM) detected a 38% prevalence of potentially pathogenic intestinal parasite infections in a group of Somali refugees living in refugee camps in Kenya. In response, CDC recommended presumptive treatment for all nonpregnant refugees over the age of 2 years with a single 600-mg dose of albendazole 3 days prior to departure to the United States. In May 1999, CDC extended this recommendation to refugees from throughout sub-Saharan Africa. Subsequently, some populations migrating from Southeast Asia also began receiving this presumptive therapy.

Pre-departure albendazole treatment has dramatically decreased the prevalence of parasitic infections detected in stool samples in newly arrived refugees. A reduction from 24% to 4% in the prevalence of intestinal helminth infections has been documented in African refugees arriving in Massachusetts before and after May 1999, respectively (OR=0.15, 95% CI 0.09-0.24). In this study, those who arrived after the widespread initiation of pre-departure treatment (n=636) were over 90% less likely to have *Ascaris* (OR=0.07, 95% CI 0.01-0.58), hookworm (OR=0.03, 95% CI 0.00-0.29), or *Trichuris* (OR=0.05, 95% CI 0.02-0.13) infections than were those who arrived before 1999 (n=618). Surprisingly, a less dramatic but still significant decrease in *Entamoeba histolytica/dispar* infections was also detected (OR=0.47, 95% CI 0.26-0.86). [7] This is an interesting finding, since albendazole is an antihelminthic treatment that is not used to treat this protozoal infection.

A recent study of refugee arrivals to northern California from Africa, South Central Asia, Eastern Europe and the Middle East found a relatively low intestinal helminth prevalence of 6% during 2001--2004, after implementation of universal predeparture treatment. [16] This regimen, however, is not adequate treatment for either *Strongyloides stercoralis* or *Schistosoma* spp.

Future overseas management of intestinal parasitic infections

Despite decreased overall prevalence of intestinal parasitic infection as detected by stool O&P examination, a single dose of albendazole may not treat the parasites of most concern for chronic infection and associated serious morbidity and mortality. The parasites of particular concern are *Strongyloides stercoralis*, *Schistosoma* spp., and other flukes and trematodes. New overseas treatment guidelines that have been issued with these domestic guidelines will recommend expanded presumptive treatment to address these concerns. However, institution of any guidelines may be variable and dependent on funding and population. Therefore, domestic guidelines are individualized and dependent on the overseas presumptive therapy received.

Guidelines for Screening

General Guidelines for adults and children

Overseas guidelines and implementation of presumptive therapy will vary over time, depending on cost, availability of medications, implementation of administration strategies, and evolving epidemiology. Some refugees will receive no overseas treatment, others a single dose of albendazole and/or praziquantel, and still others, a comprehensive treatment for all nonprotozoal parasitic infections with ivermectin or high dose albendazole in combination with praziquantel (for sub-Saharan African refugees). Thus, screening guidelines must be implemented based on the individual refugee's point of departure for the United States [Table 1] and whether the refugee received pre-departure presumptive therapy.

Information on presumptive therapy received

All eligible refugees from the Middle East, South Asia, Southeast Asia and Africa are currently receiving a single dose of predepature albendazole (as of June 2010). All sub-Saharan Africa refugees are currently receiving praziquantel presumptively prior to departure for schistosomiasis (began January, 2010). Records of presumptive treatment received by the refugee are currently available in the IOM or Blue and White bag carried by the refugee. The refugee should be directed to bring the IOM/blue and white bag to the clinic at the time of appointment. The provider may also check with the volunteer agency coordinating the refugee care if they have a copy of the records. In addition, records will be made available to State Refugee Health Coordinators through the Electronic Data Network (EDN) and through WRAPS. If documentation of treatment is not available it should be assumed the refugee did not receive presumptive therapy.

Screening for parasitic infection in asymptomatic refugees who had <u>no documented pre-departure treatment</u>

A refugee who received no overseas predeparture antiparasitic treatment should receive post-arrival intestinal parasite screening tests [Figure 1]. This evaluation should include O&P examinations performed on separate morning stools by the concentration method. All potentially pathogenic parasites detected should be treated [Table 2]. In addition, serological studies should be performed for strongyloides (all refugees) and for schistosomiasis (sub-Saharan African refugees). Alternatively, presumptive therapy for strongyloides and schistosomiasis, as described in the overseas guidance is acceptable (hyperlink to overseas guidelines). It should be noted that currently (June, 2010) all eligible sub-Saharan African refugees are receiving predeparture praziquantel therapy so serologies and/or post-arrival presumptive therapy is not needed.

An eosinophil count should be routinely performed as part of the domestic medical screening examination. An absolute eosinophil count of $\geq$ 400 cells/mL is considered elevated. If the refugee does not have an elevated eosinophil count, no further evaluation is needed. If a refugee has an elevated eosinophil count, and has a parasite infection that is known to cause eosinophilia [Table 3] identified in the stool O&P examination and/or by serology, appropriate therapy should be provided (for treatment recommendations, see The 2004 Medical Letter on Drugs and Therapeutics, at http://medicalletter.org/hidden/parasitic2004.pdf. The updated

2007 Medical Letter on Drugs and Therapeutics can be purchased at www.themedicalletter.org). If the refugee has an elevated eosinophil count they should have this re-checked in 3-6 months. If still elevated, further evaluation is warranted. [Figure 1]

Screening for parasitic infection in asymptomatic refugees who received single-dose pre-departure albendazole +/- pre-departure praziquantel

Refugees who received one dose of presumptive albendazole overseas, or one dose of albendazole plus treatment for schistosomiasis with praziquantel (sub-Saharan African refugees), should have an absolute eosinophil count as part of their hematologic profile during domestic routine screening and serological testing for strongyloides and schistosomiasis in sub-Saharan African refugees (if not previously treated with praziquantel) [Figure 2]. An absolute eosinophil count exceeding 400 cells/mL is most likely a residual eosinophilia due to an already-treated parasitic infection (e.g. hookworm) or due to ongoing infection with strongyloides (all refugees) and/or schistosomiasis. (sub-Saharan African refugees). [17] An acceptable alternative to serologic testing is to presumptively treat refugees for strongyloides and/or schistosomiasis (if not previously done). Guidelines for presumptive therapy are the same as recommended for overseas treatment. [18] For refugees with an elevated absolute eosinophil count a follow-up eosinophil count in 3-6 months is suggested. If elevated, further diagnostic evaluation is recommended.

Screening for parasitic infection in asymptomatic refugees who received high-dose pre-departure albendazole (7 days) OR ivermectin +/- praziquantel

Refugees who receive high-dose presumptive pre-departure albendazole or ivermectin plus praziquantel treatment (sub-Saharan African refugees) should have an absolute eosinophil count as part of their routine domestic hematologic [Figure 3]. An absolute eosinophil count exceeding 400 cells/mL is most likely a residual eosinophilia due to an already-treated parasitic infection. It is reasonable to obtain stool O&P examinations on these individuals but is likely more cost-efficient to repeat an eosinophil count 3-6 months after arrival. If the repeat eosinophil count remains elevated further diagnostic evaluation is warranted.

Considerations in Special Populations

Pregnant women and young children and treatment for parasitic infection:

When deciding to initiate therapy for any asymptomatic infection, the risk of consequences of the infection compared with the cost and risk of the medication must be considered. This is particularly true when a medication has not been shown to be safe during pregnancy or in young children. Each medication has a lower age or weight limit for approved use. For example, albendazole and ivermectin are not FDA-approved for use in children less than 1 year of age, ivermectin should also not be used in children weighing less than 15 kg, and praziquantel has not been approved in children less than 4 years of age. Although these medications should not generally be used as presumptive therapy, when a pathogenic organism is detected, depending on the organism identified and the clinical scenario, it may be necessary to use these medications off-label in these special populations; however, expert consultation should be sought before doing so.

Immunocompromised Hosts:

In addition, immunocompromised hosts with *Strongyloides stercoralis* infection should have close follow-up with documentation of successful eradication of the infection, which may necessitate referral to an infectious disease or tropical medicine specialist. Increased risk associated with *Strongyloides* infection should be considered in refugees with AIDS/HIV infection (regardless of CD4 count), or cancer; chronic steroid users or those who may require future steroid use; and persons who have had or may receive an organ transplant.

Precautions and contraindications to presumptive treatment

Exceptions to presumptive treatment are as follows:

1. Children

Children under 1 year of age should not receive presumptive treatment with ivermectin or albendazole. Children older than 1 year of age can receive albendazole therapy. Children weighing less than 15 kg should not receive ivermectin. However, there has been extensive overseas use of these medications during World Health Organization (WHO) helminth control activities. For overseas situations in which therapy for children may otherwise be indicated, CDC's Division of Global Migration and Quarantine (DGMQ) should be contacted at RefGuidelines@cdc.gov. For questions regarding treatment of children within the United States, the CDC Division of Parasitic Diseases (DPD) should be contacted.

2. Pregnant women

   In general, presumptive treatment for pregnant women should be deferred until after delivery. However, an exception to this rule is that presumptive therapy with a single dose of albendazole for pregnant women during the second and third trimesters from areas with high rates of hookworm, trichuris and ascaris (exceeding 20% prevalence) is recommended during the pre-departure visit and is in accordance with current WHO guidelines. See overseas pre-departure guidelines for details . Treatment for pregnant women who were immunocompromised prior to pregnancy or have clinical signs and/or symptoms of disease should be discussed with clinicians in CDC-DPD.

3. Women who are breastfeeding

   Albendazole therapy may be administered to women who are breastfeeding.
   Ivermectin is excreted in human milk in low concentrations. Lactating women who are breastfeeding should not use during the first week after birth.
   Praziquantel can be administered to lactating women who are breastfeeding (WHO). The manufacturer suggests discarding milk for 72 hours following the administration of the dose.

4. Refugees who are immunocompromised [1]

   Refugees who are immunocompromised, including refugees with AIDS, HIV infection, or cancer; chronic steroid users; and persons who have had or may receive an organ transplant should have documented negative serologic tests or should receive presumptive treatment for strongyloidiasis, especially before planned immunosuppressive therapy. Immunocompromised refugees should have documented successful treatment of this infection by follow-up laboratory examination (i.e., repeat serologic tests).

5. Refugees with cysticercosis infection

   Persons who have neurocysticercosis infection may have seizures following treatment with albendazole or praziquantel. This reaction may occur when these medications kill *Taenia solium* cysticerci in the brain parenchyma, causing inflammation and provoking seizure activity. Although the disease is clearly more prevalent in some populations (e.g., Latin America), the true prevalence of cysticercosis in refugee populations is not well documented. Refugees with a history of seizures should be evaluated for cysticercosis prior to receiving these anti-parasitics. Refugees with known neurocysticercosis, an unexplained seizure disorder or subcutaneous nodules consistent with cystercercosis should not receive presumptive treatment with either albendazole or praziquantel. Physicians with questions regarding cysticercosis infection and its evaluation can consult clinicians from DGMQ at RefGuidelines@cdc.gov.

Physicians should consult the package inserts for additional information about ivermectin, albendazole and praziquantel prior to use.

1. Except women who are pregnant or breastfeeding. See previous discussion regarding pregnant and lactating women.

Post-Treatment Guidelines and Follow-Up

Persons who are immunocompromised or may become immunocompromised in the near future, including persons with AIDS, HIV infection, or cancer; chronic steroid users or those who may need future steroid use (i.e. persons with asthma); and persons who have had a transplant or who may receive a transplant are at high risk for *Strongyloides* hyperinfection syndrome. All refugees who have been treated should be counseled about this risk, and refugees who are immunocompromised will need follow-up as described above. Persons who have symptoms that suggest failure of cure or morbidity from these diseases should have appropriate follow-up evaluation, which may necessitate referral to an infectious disease or tropical medicine specialist.

Physicians should consult the package inserts for additional information about ivermectin, albendazole and praziquantel.

For questions regarding these guidelines, please contact the Division of Parasitic Diseases at the Centers for Disease Control and Prevention.

Table 1: Predominant geographic distribution of intestinal parasites found in refugee populations

Global	Africa*	Asia*	Latin America*	Middle East*	Eastern Europe*
Ascaris lumbricoides *Trichuris trichiura* Hookworm *Strongyloides stercoralis* *Enterobius vermicularis* *Fasciola* *Hymenolepis* Most protozoa, especially *Giardia intestinalis (lamblia)*	*Schistosoma mansoni* *haematobium* *intercalatum* *Taenia saginata* (especially Ethiopia and Eritrea)	*Fasciolopsis buski* Southeast Asia: *Opisthorchis viverrini* *Clonorchis sinensis* *Schistosoma japonicum* *mekongi* South Asia *Taenia solium*	*Taenia solium* *Schistosoma mansoni* *Opisthorchis guayaquilensis* (Ecuador)	*Echino-coccus* *Giardia*	*Diphyllobothrium latum* *Opisthorchis felineus*

*organisms either unique to the location or particularly common or over-represented.

Table 2. Common organisms detected on stool examination and potential pathogenesis

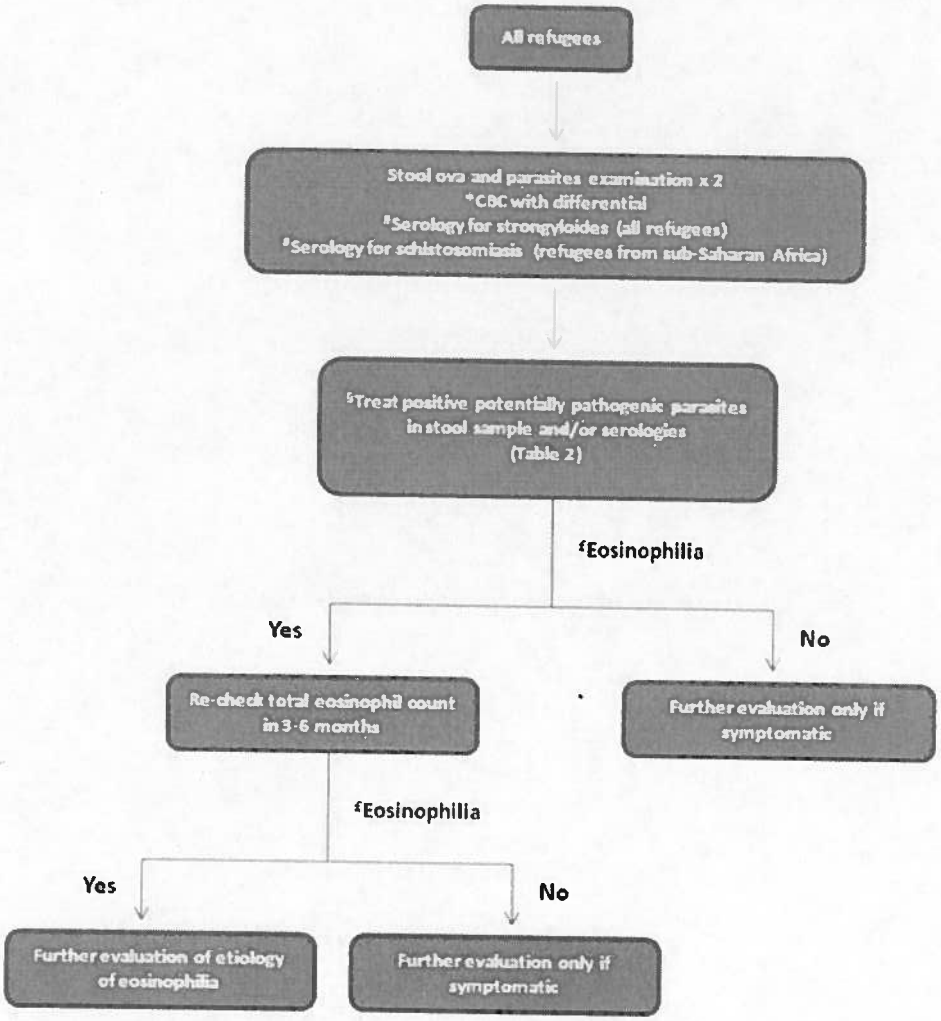
Potentially pathogenic					Controversial	Nonpathogenic
Nematodes	**Trematodes**	**Cestodes**	**Protozoa**	**Other**	**Protozoa**	**Protozoa**
Ascaris lumbricoides Hookworm (*Necator americanus* & *Ancylostoma braziliense*) *Trichuris trichiura* *Strongyloides stercoralis*	*Ophisthorchis* spp. *Fasciola* *Paragonimus westermani* *Schistosoma* (*S. mansoni, S. haematobium, S. japonicum*)	Tapeworm (*Taenia solium* and *T. saginatum*)	*Entamoeba histolytica*	*Toxocara*	*Blastocystis hominis* (diarrhea) *Dientamoeba fragilis* (diarrhea) *Entamoeba polecki* (diarrhea)	*Entamoeba dispar* *Entamoeba moshkowskii* *Entamoeba coli* *Entamoeba hartmanii* *Endolimax nana* *Iodamoeba butschlii* *Chilomastix mesnili* *Trichomonas hominis*

Table 3. Causes of eosinophilia

Parasites that cause eosinophilia commonly found in stool examination	Parasites commonly found in the stool NOT typically associated with eosinophilia	Common non-parasitic causes of eosinophilia	Tropical infections NOT associated with eosinophilia	Other tropical infections commonly associated with eosinophilia but less likely to be found in stool specimens
Ascaris lumbricoides Hookworm (*Ancylostoma spp, Necator spp*) *Trichuris trichiura* *Strongyloides stercoralis** Tapeworm (*Taenia solium* and *T. saginatum*) *Ophisthorchis spp.* *Fasciola spp.* *Schistosoma* (*S. mansoni**, *S. haematobium**, *S. japonicum*) *Toxocara spp.*	*Entameoba histolytica*, *Entameoba dispar*, other *Entamoeba spp.* *Cryptosporidium spp.* *Giardia intestinalis (lamblia)*	Asthma Atopy Drug allergy Eosinophilic leukemia Hodgkin's lymphoma Hyper-eosinophilic syndrome Pemphigoid Pemphigus Polyarteritis nodosa	Arboviral infections Brucellosis Enteric fever Leishmaniasis Leprosy Malaria Trypanosomiasis Tuberculosis	Angiostrongylus Anasaciasis *Capillaria spp.* Cysticercosis (*Taenia solium)* *Echinococcus spp.* *Fasciola spp.* Filariasis (*Wuchereria bancrofti, Brugia spp, Mansonella spp, Onchocerca volvulus, Dracunculus medinensis. Loa loa*) *Gnathostoma spp.* *Paragonimus spp.* *Schistosoma* (*S. mansoni**, *S. haematobium**, *S. japonicum*)* Strongyloides *stercoralis** *Toxocara* spp. *Trichinella spiralis*

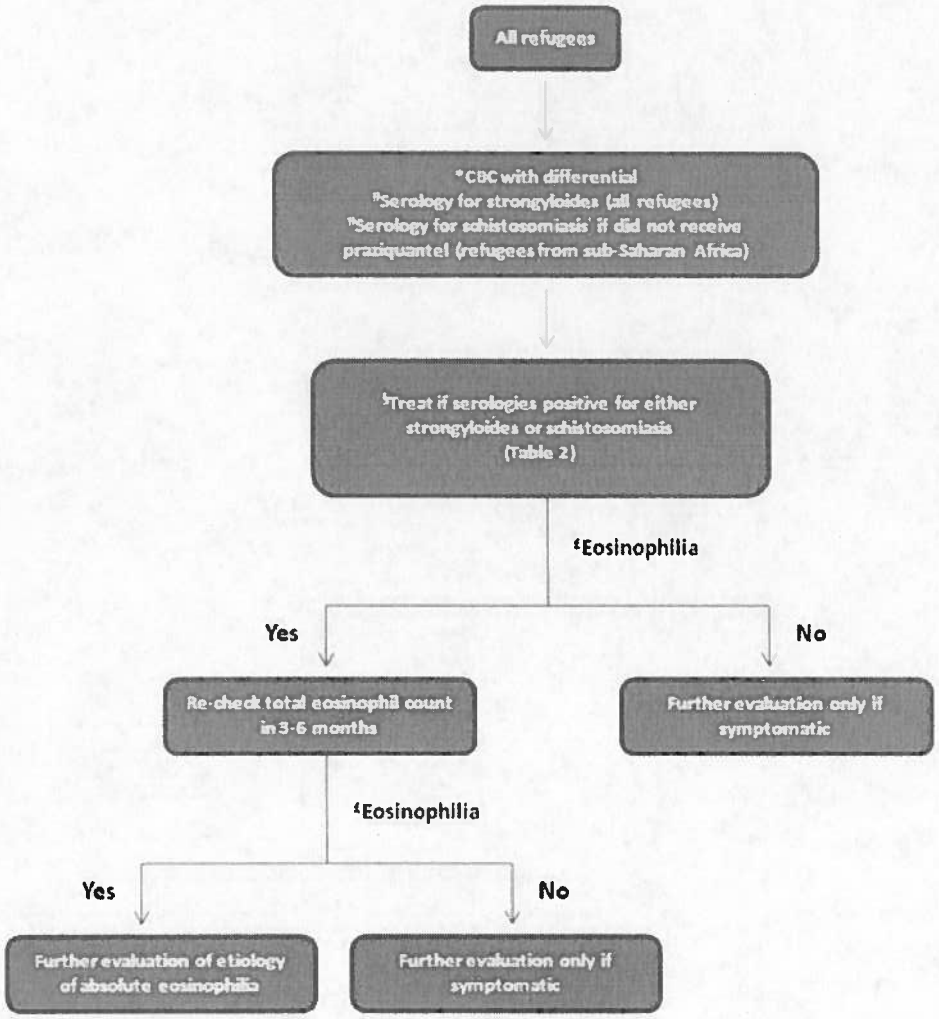
*Particularly common causes of eosinophilia which may be found in stool but special testing and/or multiple samples are frequently needed.

Figure 1. Screening of asymptomatic refugees for parasitic infection if they received no pre-departure treatment



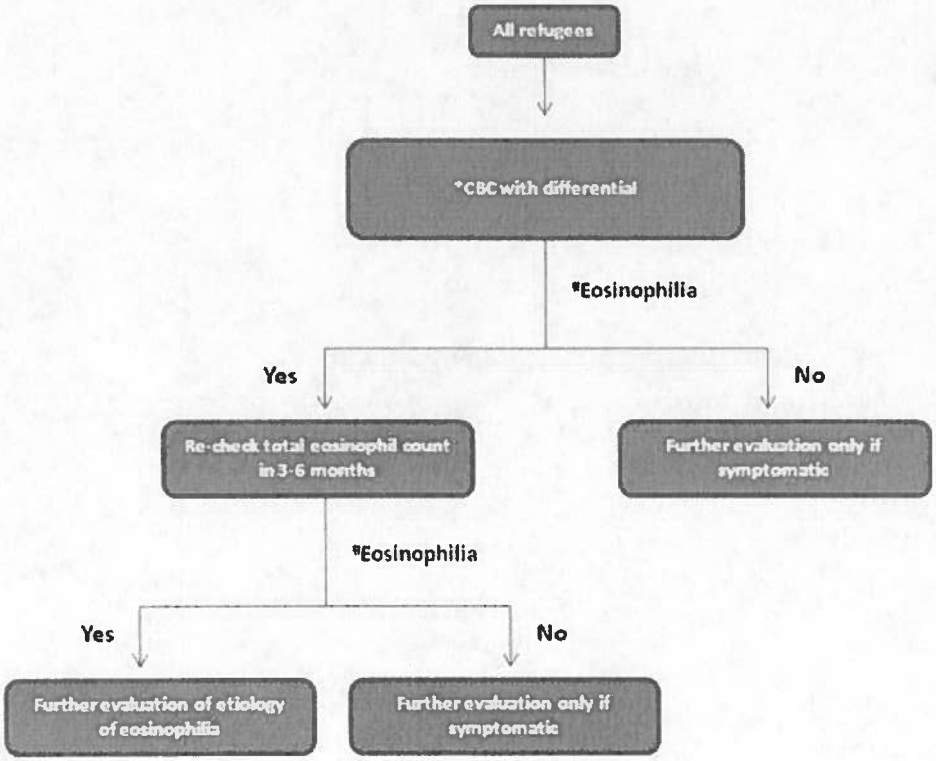
*CBC Complete blood count and differential (this is routinely recommended for all arriving refugees as part of their general health screening)
‡Presumptive treatment is an acceptable alternative
§See http://medicalletter.org/hidden/parasitic2004.pdf, the updated 2007 Medical Letter on Drugs and Therapeutics can be purchased at www.themedicalletter.org
£Eosinophilia = an eosinophil count of >400 µL

Figure 2. Screening of asymptomatic refugees forparasitic infection who received pre-departure single dose albendazole +/- praziquantel



*CBC Complete blood count and differential (this is routinely recommended for all arriving refugees as part of their general health screening)
[a]Presumptive treatment is an acceptable alternative
[b]See http://medicalletter.org/hidden/parasitic2004.pdf, the updated 2007 Medical Letter on Drugs and Therapeutics can be purchased at www.themedicalletter.org
[c]Eosinophilia = an eosinophil count of >400 µL

Figure 3. Screening of asymptomatic refugees for parasitic infection who received pre-departure treatment for both strongyloides (ivermectin or 7 days of albendazole) and schistosomiasis (praziquantel)



*CBC Complete blood count and differential (this is routinely recommended for all arriving refugees as part of their general health screening)
#Eosinophilia = an eosinophil count of >400 µL

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