SECTION 17 PROTOZOAL AND HELMINTHIC INFECTIONS: GENERAL CONSIDERATIONS

245e Laboratory Diagnosis of Parasitic Infections

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The cornerstone for the diagnosis of parasitic infections is a thorough history of the patient's illness. Epidemiologic aspects of the illness are especially important because the risks of acquiring many parasites are closely related to occupation, recreation, or travel to areas of high endemicity. Without a basic knowledge of the epidemiology and life cycles of the major parasites, it is difficult to approach the diagnosis of parasitic infections systematically. Accordingly, the medical classification of important human parasites in this chapter emphasizes their geographic distribution, their transmission, and the anatomic location and stages of their life cycle in humans. The text and tables are intended to serve as a guide to the correct diagnostic procedures for the major parasitic infections; in addition, the reader is referred to other chapters that contain more comprehensive information about each infection **(Chaps. 247–260)**. **Tables 245e-1, 245e-2, and 245e-3** summarize the geographic distributions, the anatomic locations, and the methods employed for the diagnosis of flatworm, roundworm, and protozoal infections, respectively.

In addition to selecting the correct diagnostic procedures, physicians must counsel their patients to ensure that specimens are collected properly and arrive at the laboratory promptly. For example, the diagnosis of bancroftian filariasis is unlikely to be confirmed by the laboratory unless blood is drawn near midnight, when the nocturnal microfilariae are active. Laboratory personnel and surgical pathologists should be notified in advance when a parasitic infection is suspected. Continuing interaction with the laboratory staff and the surgical pathologists increases the likelihood that parasites in body fluids or biopsy specimens will be examined carefully by the most capable individuals.

INTESTINAL PARASITES

Most helminths and protozoa exit the body in the fecal stream. Many laboratories now use a stool collection kit with instructions for patients to transfer portions of the sample directly into bacterial carrier medium and fixative, which increases yield. If kits are not available, the patient should be instructed to collect feces in a clean waxed or cardboard container and to record the time of collection on the container. Refrigeration will preserve trophozoites for a few hours and protozoal cysts and helminthic ova for several days. Contamination with water (which could contain free-living protozoa) or with urine (which can damage trophozoites) should be avoided. Fecal samples should be collected before ingestion of barium or other contrast agents for radiologic procedures and before treatment with antidiarrheal agents and antacids; these substances change the consistency of the feces and interfere with microscopic detection of parasites. Because of the cyclic shedding of most parasites in the feces, a minimum of three samples collected on alternate days should be examined. Examination of a single sample can be up to 50% less sensitive.

Analysis of fecal samples entails both macroscopic and microscopic examination. Watery or loose stools are more likely to contain protozoal trophozoites, but protozoal cysts and all stages of helminths may be found in formed feces. If adult worms or tapeworm segments are observed, they should be transported promptly to the laboratory or washed and preserved in fixative for later examination. The only tapeworm with motile segments is *Taenia saginata*, the beef tapeworm, which patients sometimes bring to the physician. Because the ova of *T. saginata* are morphologically indistinguishable from those of *Taenia solium* (the cause of cysticercosis), motility is an important distinguishing characteristic.

Microscopic examination of feces is not complete until direct wet mounts have been evaluated and concentration techniques as well as permanent stains have been applied. Before accepting a report of negativity for ova and parasites as final, the physician should insist that the laboratory undertake each of these procedures. Some intestinal parasites are more readily detected in material other than feces. For example, examination of duodenal contents is sometimes necessary to detect *Giardia lamblia*, *Cryptosporidium*, and *Strongyloides* larvae. Use of the "cellophane tape" technique to detect pinworm ova on the perianal skin sometimes also reveals ova of *T. saginata* deposited perianally when the motile segments disintegrate **(Table 245e-4)**.

Two routine solutions are used to make wet mounts for identification of the various life stages of helminths and protozoa: physiologic saline for trophozoites, cysts, ova, and larvae and dilute iodine solution for protozoal cysts and ova. Iodine solution must never be used to examine specimens for trophozoites because it kills the parasites and thus eliminates their characteristic motility.

The two most common concentration procedures for detecting small numbers of cysts and ova are formalin-ether sedimentation and zinc sulfate flotation. The formalin-ether technique is preferable because all parasites sediment but not all float. Slides permanently stained for trophozoites should be prepared before concentration. Additional slides stained for cysts and ova may be made from the concentrate.

In many instances, especially in the differentiation of *Entamoeba histolytica* from other amebas, identification of parasites from wet mounts or concentrates must be considered tentative. Permanently stained smears allow study of the cellular detail necessary for definitive identification. The iron-hematoxylin stain is excellent for critical work, but trichrome staining, which can be completed in 1 h, is a satisfactory alternative that also reveals parasites in specimens preserved in polyvinyl alcohol fixative. Modified acid-fast staining and fluorescent auramine microscopy are useful adjuncts for detection and identification of several intestinal protozoa, including *Cryptosporidium* and *Cyclospora*, while direct fluorescent antibody testing is in common use for *Cryptosporidium* and *Giardia.* Microsporidia, which cause chronic diarrhea in HIV-infected patients, may be missed unless a special modified trichrome stain or fluorescent screening with calcofluor white is requested (Table 245e-3).

BLOOD AND TISSUE PARASITES

Invasion of tissue by protozoa and helminths renders the choice of diagnostic techniques more difficult. For example, physicians must understand that aspiration of an amebic liver abscess rarely reveals *E. histolytica* because the trophozoites are located primarily in the abscess wall. They must remember that the urine sediment offers the best opportunity to detect *Schistosoma haematobium* in the young Ethiopian immigrant or the American traveler who returns from Africa with hematuria. Tables 245e-1, 245e-2, and 245e-3, which offer a quick guide to the geographic distribution and anatomic locations of the major tissue parasites, should help the physician to select the appropriate body fluid or biopsy site for microscopic examination. **Tables 245e-5 and 245e-6** provide additional information about the identification of parasites in samples from specific anatomic locations. The laboratory procedures for detection of parasites in other body fluids are similar to those used in the examination of feces. The physician should insist on wet mounts, concentration techniques, and permanent stains for all body fluids. The trichrome or iron-hematoxylin stain is satisfactory for all tissue helminths in body fluids other than blood,