Ivermectin has a side effect profile similar to that of DEC when used in lymphatic filariasis. In patients infected with *L. loa* who have high levels of microfilaremia, DEC—like ivermectin (see "Loiasis," below)—can elicit severe encephalopathic complications. When used in single-dose regimens for the treatment of lymphatic filariasis, albendazole is associated with relatively few side effects.

PREVENTION AND CONTROL

To protect themselves against filarial infection, individuals must avoid contact with infected mosquitoes by using personal protective measures, including bed nets, particularly those impregnated with insecticides such as permethrin. Community-based intervention is the current approach to elimination of lymphatic filariasis as a public health problem. The underlying tenet of this approach is that mass annual distribution of antimicrofilarial chemotherapy—albendazole with either DEC (for all areas except those where onchocerciasis is coendemic; see section on onchocerciasis treatment, below) or ivermectin—will profoundly suppress microfilaremia. If the suppression is sustained, then transmission can be interrupted.

Created by the World Health Organization in 1997, the Global Programme to Eliminate Lymphatic Filariasis is based on mass administration of single annual doses of DEC plus albendazole in non-African regions and of albendazole plus ivermectin in Africa. Available information from late 2013 indicated that more than 792 million persons in 53 countries had thus far participated. Not only has lymphatic filariasis been eliminated in some defined areas, but collateral benefits—avoidance of disability and treatment of intestinal helminths and other conditions (e.g., scabies and louse infestation)—have also been noted. The strategy of the global program is being refined, and attempts are being made to integrate this effort with other mass-treatment strategies (e.g., deworming programs, malaria control, and trachoma control) in an integrated control strategy.

TROPICAL PULMONARY EOSINOPHILIA

Tropical pulmonary eosinophilia (TPE) is a distinct syndrome that develops in some individuals infected with the lymphatic-dwelling filarial species. This syndrome affects males and females in a ratio of 4:1, often during the third decade of life. The majority of cases have been reported from India, Pakistan, Sri Lanka, Brazil, Guyana, and Southeast Asia.

Clinical Features The main features include a history of residence in filarial-endemic regions, paroxysmal cough and wheezing (usually nocturnal and probably related to the nocturnal periodicity of microfilariae), weight loss, low-grade fever, lymphadenopathy, and pronounced blood eosinophilia (>3000 eosinophils/μL). Chest x-rays or CT scans may be normal but generally show increased bronchovascular markings. Diffuse miliary lesions or mottled opacities may be present in the middle and lower lung fields. Tests of pulmonary function show restrictive abnormalities in most cases and obstructive defects in half. Characteristically, total serum IgE levels (4–40 KIU/mL) and antifilarial antibody titers are markedly elevated.

Pathology In TPE, microfilariae and parasite antigens are rapidly cleared from the bloodstream by the lungs. The clinical symptoms result from allergic and inflammatory reactions elicited by the cleared parasites. In some patients, trapping of microfilariae in other reticuloendothelial organs can cause hepatomegaly, splenomegaly, or lymphadenopathy. A prominent, eosinophil-enriched, intraalveolar infiltrate is often reported, and with it comes the release of cytotoxic proinflammatory eosinophil granule proteins that may mediate some of the pathology seen in TPE. In the absence of successful treatment, interstitial fibrosis can lead to progressive pulmonary damage.

Differential Diagnosis TPE must be distinguished from asthma, Löffler's syndrome, allergic bronchopulmonary aspergillosis, allergic granulomatosis with angiitis (Churg-Strauss syndrome), the systemic vasculitides (most notably, periarteritis nodosa and granulomatosis with polyangiitis), chronic eosinophilic pneumonia, and the idiopathic hypereosinophilic syndrome.

TREATMENT TROPICAL PULMONARY EOSINOPHILIA

DEC is used at a daily dosage of 4–6 mg/kg for 14 days. Symptoms usually resolve within 3–7 days after the initiation of therapy. Relapse, which occurs in ~12–25% of cases (sometimes after an interval of years), requires re-treatment.

ONCHOCERCIASIS

EPIDEMIOLOGY

Onchocerciasis ("river blindness") is caused by the filarial nematode *O. volvulus*, which infects an estimated 37 million individuals in 35 countries worldwide. The majority of individuals infected with *O. volvulus* live in the equatorial region of Africa extending from the Atlantic coast to the Red Sea. In the Americas, isolated foci were identified in Mexico, Guatemala, Colombia, Ecuador, Venezuela, and Brazil. The infection is also found in Yemen.

ETIOLOGY

Infection in humans begins with the deposition of infective larvae on the skin by the bite of an infected blackfly. The larvae develop into adults, which are typically found in subcutaneous nodules. About 7 months to 3 years after infection, the gravid female releases microfilariae that migrate out of the nodule and throughout the tissues, concentrating in the dermis. Infection is transmitted to other persons when a female fly ingests microfilariae from the host's skin and these microfilariae then develop into infective larvae. Adult *O. volvulus* females and males are ~40–60 cm and ~3–6 cm in length, respectively. The life span of adults can be as long as 18 years, with an average of ~9 years. Because the blackfly vector breeds along free-flowing rivers and streams (particularly in rapids) and generally restricts its flight to an area within several kilometers of these breeding sites, both biting and disease transmission are most intense in these locations.

PATHOLOGY

Onchocerciasis primarily affects the skin, eyes, and lymph nodes. In contrast to the pathology in lymphatic filariasis, the damage in onchocerciasis is elicited by microfilariae and not by adult parasites. In the skin, there are mild but chronic inflammatory changes that can result in loss of elastic fibers, atrophy, and fibrosis. The subcutaneous nodules (*onchocercomata*) consist primarily of fibrous tissues surrounding the adult worm, often with a peripheral ring of inflammatory cells (characterized as lymphatic in origin) surrounded by an endothelial layer. In the eye, neovascularization and corneal scarring lead to corneal opacities and blindness. Inflammation in the anterior and posterior chambers frequently results in anterior uveitis, chorioretinitis, and optic atrophy. Although punctate opacities are due to an inflammatory reaction surrounding dead or dying microfilariae, the pathogenesis of most manifestations of onchocerciasis is still unclear.

CLINICAL FEATURES

Skin Pruritus and rash are the most common manifestations of onchocerciasis. The pruritus can be incapacitating; the rash is typically a papular eruption (Fig. 258-3) that is generalized rather than localized to a particular region of the body. Long-term infection results in exaggerated and premature wrinkling of the skin, loss of elastic fibers, and epidermal atrophy that can lead to loose, redundant skin and hypo- or hyperpigmentation. Localized eczematoid dermatitis can cause hyperkeratosis, scaling, and pigmentary changes. In an immunologically hyperreactive form of onchodermatitis (commonly termed *sowdah* or *localized onchodermatitis*), the affected skin darkens as a consequence of the profound inflammation that occurs as microfilariae in the skin are cleared.

Onchocercomata These subcutaneous nodules, which can be palpable and/or visible, contain the adult worm. In African patients, they are common over the coccyx and sacrum, the trochanter of the femur, the lateral anterior crest, and other bony prominences; in patients from South and Central America, nodules