9 Onchocerciasis

An ounce of prevention is worth a pound of cure.
Proverb

Onchocerciasis ('river blindness') is a chronic parasitic infection that can cause corneal and retinal scarring and intraocular damage from uveitis. Approximately 18 million people are infected with the disease in 30 African and six Latin American countries; the great majority of the 270,000 people blind from onchocerciasis are in Africa. Approximately 110 million people are at risk of contracting the disease. Blindness from onchocerciasis is preventable by controlling the infection itself with systemic ivermectin and by effective management of the early stages of resultant keratitis, chorioretinitis, and uveitis.

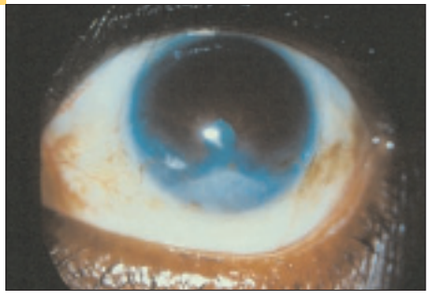
Natural history

Onchocerciasis is caused by a parasitic nematode worm, *Onchocerca volvulus* (**113**), which is transmitted by the bite of a blackfly of the genus *Simulium* (**114**). *Simulium damnosum* is the species most frequently implicated in the transmission of the *Onchocerca volvulus* microfilariae (larvae) in African endemic areas. Onchocerciasis is known as 'river blindness' because the disease occurs near fast-flowing rivers where the blackfly breeds.

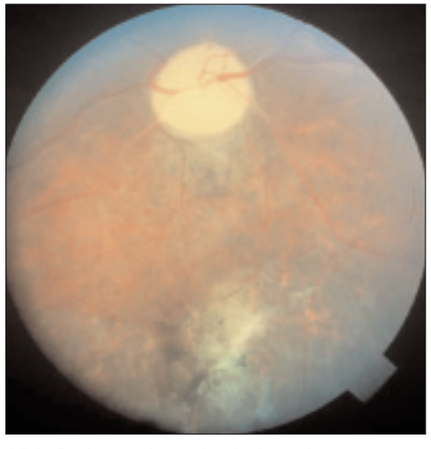
A female blackfly must feed on blood in order to ovulate. When she bites an infected human host she ingests the microscopic microfilariae that are present in the skin. These develop over 2–3 weeks inside the fly to become larger, infective-stage larvae, which are then are transmitted to another human host when she bites. The infectious larvae develop into adult worms, forming nodules beneath the skin.

113 Adult *Onchocerca volvulus*.

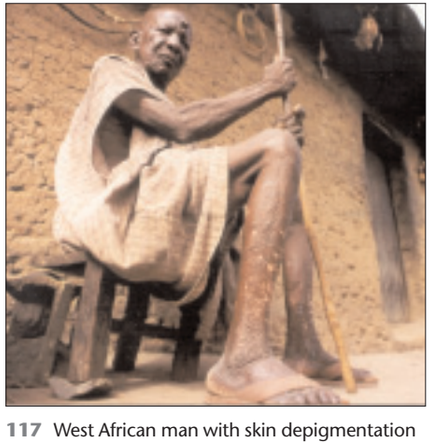
114 Biting *Simulium* blackfly.



115 Advanced inflammatory reaction in the cornea and iris caused by microfilaria in the eye.



116 Optic atrophy and retinal scarring, secondary to onchocerciasis.



117 West African man with skin depigmentation and adult *Onchocerca volvulus* nodules.

These skin nodules are a few millimeters to a centimeter thick, often forming on bony prominences such as the head, shoulder blades, and hips. Adult female worms in the nodules can be up to 1 m long and are coiled up like a ball of string; they can, over their lifespan of 15 years, produce millions of microfilariae. Male worms travel between the nodules to inseminate the females. The microfilariae migrate throughout the body and can be found in the bloodstream and in some internal organs. They are found in high concentration in the skin and eye.

Pathways to blindness from onchocerciasis

Corneal scarring, chorioretinitis and chorioretinal scarring, and optic atrophy from microfilarial invasion of the eye are the major pathways to blindness in onchocerciasis (**115**, **116**). Uveitis (inflammation of a part or all of the uveal tract) may occur when microfilariae penetrate the sclera and enter the eyeball. Onchocerciasis can also result in low vision or permanent blindness by causing secondary cataract and secondary glaucoma.

Diagnosis

Patients with active onchocerciasis with ocular involvement complain of eye pain and loss of vision. The diagnosis can be confirmed by skin snip and examination of the specimen for microfilariae under the microscope. Common clinical signs of systemic onchocerciasis are skin nodules and patchy loss of skin pigment (**117**), along with skin rash and itching.

In patients with severe infection, microfilariae may be seen in the cornea and anterior chamber with the slit lamp. Dead microfilarie in the cornea appear as straight, transparent needles, whereas

living microfilariae are coiled up, and usually seen in the peripheral cornea, particularly at 3 and 9 o'clock positions (×25 magnification required). To easily see swimming microfilariae in the anterior chamber, the patient should keep the head down for 2 minutes before examination with the slit lamp (×10 magnification sufficient). There is often a chronic 'torpid' iritis in these cases, and the beam of the slit lamp will show in the anterior chamber (flare) and cells can be seen under high magnification. Iritis may be present with corneal infiltration.

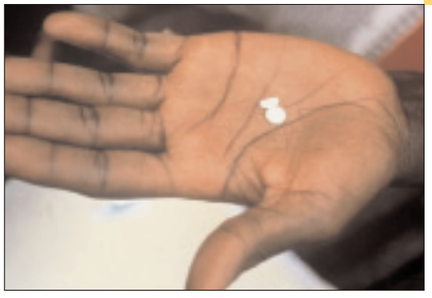
Punctate keratitis with snowflake-like stromal opacities may occur with corneal microfilarial lesions. A whitish patch in the cornea, initially as a limbal infiltrate at 3 and 9 o'clock, indicates deep corneal scarring (sclerosing keratitis) which may be progressive, semilunate, and blinding.

Indirect ophthalmoscopy will be required to fully visualize chorioretinal changes, which usually occur in the posterior pole and midperiphery. Inactive chorioretinitis from onchocerciasis – a black or darkly pigmented scar with large whitish patches – may be seen with careful ophthalmoscopy. In advanced cases there is often also optic nerve disease (atrophy) present.

Management

Medical management

Systemic treatment of onchocerciasis can control generalized onchocercal infection. Treatment cannot reverse permanent visual disability or blindness from the disease but often halts further progression. In the past, diethylcarbamazine citrate (DEC) and suramin sodium were used to control systemic onchocerciasis, but they have been replaced by ivermectin (Mectizan), a broad-spectrum antiparasitic drug (**118**). Ivermectin is a much safer drug for human use than DEC and suramin



118 Ivermectin (Mectizan) dose.

sodium, which are now considered dangerous for the treatment of onchocerciasis because of serious side effects.

Ivermectin acts by killing microfilariae in infected patients. Thus, the progression of onchocercal eye infections that produce blindness can be prevented. Ivermectin can also reduce or stop dermatitis and itching caused by microfilariae and can prevent progression of disfiguring skin changes caused by onchocerciasis. Ivermectin also suppresses the release of viable microfilariae by the adult female worm.

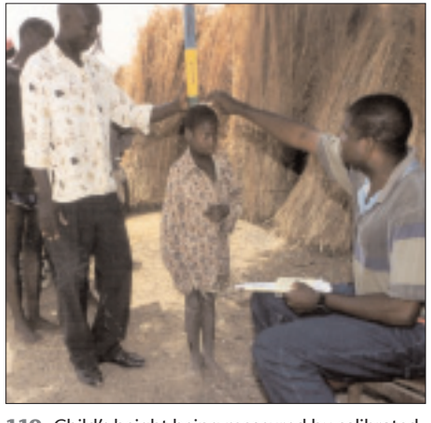
By reducing the microfilariae population with ivermectin treatment of individual patients and of communities, there is less chance for the microfilariae to be transmitted by the *Simulium* blackfly vector. In this way, transmission of the disease can be reduced by means of large-scale treatment with ivermectin.

Ivermectin does not kill the adult *Onchocerca* worms nor does it reverse blindness or advanced skin changes due to scarring. Infective larvae introduced into humans by the blackfly are not killed by the drug and can still develop into adult worms.

Minor side effects associated with ivermectin may include headache, skin rash, itching, muscle pain, and fever. These conditions usually settle quickly with aspirin or acetaminophen.

The following patient groups should not receive ivermectin:

- Children, either younger than 5 years of age, or weighing less than 15 kg, or less than 90 cm in height (**119**).
- Pregnant women.
- Women breastfeeding children who are younger than 1 week of age.
- Persons with meningitis or other serious acute or chronic illness.



119 Child's height being measured by calibrated stick to determine Mectizan® dosage.

Table 7 **Ivermectin dosage**

Body weight (kg)	**Height** (cm)	**Annual dose** (mg)
<15	<90	do not give
15–24	90–119	3
25–44	120–140	6
45–64	141–158	9
>64	>158	12

The correct dosage of ivermectin, given once per year, is determined by either weight or height (*Table 7*). Originally distributed as 6-mg tablets, ivermectin is now available as 3-mg tablets; this simplifies dosage. Patients should be observed by treatment staff as they receive and swallow the correct number of tablets.

Management of ocular onchocerciasis

Management of patients with ocular onchocerciasis is directed toward control of keratitis, chorioretinitis, secondary complications, and, occasionally, anterior uveitis. (See Chapter 12 for more detailed discussion of the management of uveitis.) While cure of ocular complications from onchocerciasis is not possible, vision may be preserved and improved with good management of ocular complications secondary to the disease. Onchocerciasis uveitis and its sequelae make filtering surgery for glaucoma and cataract surgery risky, but such surgery can be performed provided that the uveitis is controlled at the time of surgery. Eyes with severe uveitis from onchocerciasis and other causes may develop phthisis bulbi after intraocular surgery. The prognosis in corneal grafting for onchocercal scarring is poor because patients frequently have extensive and blinding chorioretinitis. Cataract surgery in a patient with corneal damage may not be beneficial.

Surgical management

Nodulectomy (surgical removal of large nodules of adult worms, larvae, and microfilariae) from the skin may reduce the parasite load somewhat but does not necessarily improve or prevent eye complications. Many nodules are deeply buried in the skin and subcutaneous tissue and cannot be surgically excised. In most cases nodulectomy is not warranted.

Elimination of onchocerciasis blindness

The strategy for reducing ocular morbidity, visual disability, and blindness from onchocerciasis is twofold:

- To reduce microfilarial loads in infected individuals and in communities in endemic areas by use of ivermectin.
- To interrupt the transmission of the disease by controlling the *Simulium* blackfly vector.

Merck & Co., Inc. (which operates as Merck, Sharp & Dohme in many countries outside of the United States) provides ivermectin (Mectizan) free of charge to all endemic countries for the elimination of onchocerciasis, through the Mectizan Donation Program (MDP). Ministries of Health and any interested collaborative organization can apply for Mectizan for large-scale public health use. The World Bank has provided major funding for ivermectin distribution since the Mectizan Donation Program began in 1988 through the Onchocerciasis Control Program in West Africa (OCP, 1974–2002), and currently through the African Programme for Onchocerciasis Control (APOC), which is managed by WHO as the coordinating body for ivermectin distribution in the African region. In Latin America, the Onchocerciasis Elimination Program of the Americas (OEPA) is successfully pursuing the ultimate elimination of the disease from the Western Hemisphere; current progress indicates that there should be no more eye lesions from onchocerciasis after 2007 in the six countries concerned.

Non-governmental organizations working in areas where onchocerciasis is endemic collaborate with national ministries of health to distribute the medication to those infected or at risk of infection. Distribution of ivermectin was initially usually conducted in communities by rural health care teams, but a community-directed treatment scheme is being successfully implemented in the APOC countries, covering at present approximately 45 million people annually. It is carefully supervised to ensure appropriate surveillance and reporting of any adverse reactions to treatment, particularly in areas co-endemic for Loiasis, another filarial disease known to (rarely) provoke serious adverse experiences in highly infested patients being treated with Mectizan. Caution must therefore be exercised when treating an onchocerciasis patient, who may also have a high load of Loa loa.

The WHO implemented a long-term blackfly control program in West Africa from 1974 (OCP, see above). It aimed to reduce transmission of onchocerciasis by controlling the *Simulium* vector by aerial spraying of environmentally friendly insecticides (**120**). The aerial spraying program was one of the largest public health projects ever undertaken, but it encountered problems with insecticide resistance, and therefore switched much of its operations to large-scale Mectizan distribution since 1988. The OCP closed down in 2002, having successfully controlled onchocerciasis in most of the 11 West African countries in the OCP region.

120 Aerial spraying of *Simulium* blackfly breeding site in West Africa.