River Blindness: The Problem of Onchocerciasis as the Second Leading Infectious Cause of Blindness

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Onchocerciasis is a parasitic disease that is known as the second leading infectious cause of blindness in the world. Onchocerciasis is known as river blindness because it is most common near fast flowing rivers and streams in Africa and some Latin and South American countries. “The World Health Organization estimates that 750,000 people are blind or have reduced vision as a result of the disease” (Nettleman). Onchocerciasis, also known as river blindness, is often overlooked throughout sub-Saharan Africa but has been a major problem in causing serious skin diseases and eye infections that can eventually lead to blindness and disfiguring skin changes. River blindness is a slow occurring disease and can take nine months to almost two years for the symptoms to occur. This causes Onchocerciasis to be considered even more serious because individuals can live with the disease for a long time without knowing they are infected. The parasite, Onchocerca volvulus, which causes the disease, is transmitted to humans through the Simulium black fly’s bite. Once the worm infects the human host, they can live for several years in the body. In order to fully understand the problem of Onchocerciasis, we must first define the disease more fully and examine the role of Onchocerca volvulus in the progression of the disease. Next, we will take a look at where Onchocerciasis is most commonly located. The problems and consequences caused by river blindness will then be explored. Finally, we will look at the steps that have been taken to prevent this disease from spreading and how effective they have proven to be. (Nettleman; Pearson; Onchocerciasis).
First, we must understand the definition and parasitology of Onchocerciasis in order to fully understand how the disease operates. The nematode, Onchocerca volvulus, is transmitted to the human host through the bite of the female Simulium black fly. These flies bite during the day and are located near fast moving rivers, where they tend to breed. These flies are small, black, and hard to decipher from other everyday black flies. Figure 1 shows a picture of the Simulium blackfly feeding off of a human host. In order to contract Onchocerciasis, a human has to be bitten by the infected blackflies hundreds of times. “The cycle of infection begins when a blackfly bites an infected person and is infected with pre-larval forms of the worm, called microfilariae” (Pearson). The larvae, or microfilaria, that is not ingested by the fly will stay on the human host’s body and usually die after about six months to two years of being in the human. Back to the now infected blackfly, some of the microfilariae are not able to be digested by the fly, which causes them to move to the fly’s thoracic muscles. In about six to twelve days the microfilariae usually transform to the third larva stage, called L3. The L3 form of the microfilariae is the infective form, and the larva then moves to the head of the blackfly, where they can now infect a human host during the next bite of the blackfly. An important aspect of Onchocerciasis is that “a microfilaria has to pass through the blackfly vector to become infectious and to be able to grow into an adult worm” (Helen Keller). Once within the human host, the now infectious microfilariae develop into adult worms after about twelve or more months. The adult worms can then live inside the human’s body for up to fifteen years. These adult worms tend to cluster in the nodules of the human, which are located in the bony parts of the body. Several adult female and male worms can live together inside the nodules. The mature worms can mate within the body, resulting in the female worm producing thousands of microfilariae per day for nine too eleven years. The microfilariae can live for up to two years in the human body, and they...
often migrate to the skin and eyes of the individual. However, the microfilariae can live anywhere throughout the entire human body, which is why Onchocerciasis has several different damaging symptoms. Continued exposure to black fly bites will increase the amount of worms and microfilariae in the human’s body. This will cause the disease to worsen and possibly progress much farther. Figure 3 shows the cycle of Onchocerciasis, starting with how the disease is contracted and where the worms migrate to in the human host. Figure 3 then shows the steps of how the human host contracts infection from the parasite, starting with reproduction of the adult worms and resulting in the production of microfilaria. Onchocerciasis is shown to be a complex cycle of infectious parasites and it often underestimated in its severity. (Nettleman; Pearson; Helen Keller; The Carter).

Now that the parasitology of Onchocerciasis is more fully understood, we must look at the location and distribution of river blindness. About ninety-nine percent of the people with the disease, Onchocerciasis, reside in Africa. “Onchocerciasis is most common in tropical and southern (sub-Saharan) areas of Africa” (Pearson). There have also been several cases of Onchocerciasis in South and Latin America also. Altogether, “there are 34 countries in Africa, Latin America, and the Arabian Peninsula that are endemic for Onchocerciasis” (Helen Keller). The disease is thought to have travelled to Yemen, in the Arabian Peninsula, and Latin America, through the exports of slave trading. “The distribution of
Onchocerciasis is linked to the location of blackflies which are naturally found close to fast-running streams and rivers in the inter-tropical zones” (Onchocerciasis). Therefore, Onchocerciasis is most common among individuals living near flowing bodies of water and large rivers, which gives this disease the name “river blindness.” Fertile and arable lands are located near rivers and streams, causing many fertile river valleys to be left “uninhabited and uncultivated due to the severity of the disease” (Helen Keller). “This impact is particularly negative in the Sahel region of West Africa because these fertile areas could serve as a major source to much of that area’s malnourished population” (Helen Keller). Map 1 shows the distribution of Onchocerciasis. The areas indicated in red are the countries with the disease River Blindness. As noticed on the map, Onchocerciasis occurs mostly in the tropical areas of the world located near the equator, such as central Africa and the North Eastern part of South America. The map shows how Onchocerciasis is restricted and clustered and has no signs of spreading or interfering with other parts of the world. Onchocerciasis only affects the poor people of the areas shown in the red region in figure 3. This is because a person “must be bitten hundreds of times by infected blackflies” before they contract the disease (The Carter). Therefore, it is very rare for travelers or visitors to contract the disease while visiting the endemic countries. (The Carter; Helen Keller; Onchocerciasis; Pearson).

<table>
<thead>
<tr>
<th>Skin signs /symptoms</th>
<th>Eye signs/ symptoms</th>
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<tbody>
<tr>
<td>* Intense itching</td>
<td>* Red eyes</td>
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<tr>
<td>* Skin rash</td>
<td>* Irritated eyes and/or tearing</td>
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<tr>
<td>* Nodules containing adult worms (firm, painless lumps</td>
<td>* Light sensitivity</td>
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<td>on the hips, the head, or joints)</td>
<td>* Night blindness</td>
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<tr>
<td>* Leopard skin (skin depigmentation)</td>
<td>* Reduced field of vision</td>
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<tr>
<td>* Very dry or wrinkled skin, or stretched skin in the</td>
<td>* Reduced visual acuity</td>
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<tr>
<td>groin area</td>
<td>* Sclerosing keratitis (corneal opacity evolving from the</td>
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<td></td>
<td>bottom periphery towards the center)</td>
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<td>* Blindness</td>
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Now that we know where Onchocerciasis is located, we can now divulge into the symptoms of the disease. “Onchocerciasis is more than a blinding disease, it’s a chronic systemic disease, capable of causing extensive and disfiguring skin changes, musculoskeletal complaints, weight loss, changes in immune system, and perhaps epilepsy and growth arrest as well” (Helen Keller). Symptoms are not present until usually after 9 months to almost two years. This is because symptoms are caused by the death of the microfilariae. “In a heavily infected person there can be 100,000 or more microfilariae dying every day” (Helen Keller). The microfilariae’s death in the human body is very toxic and can cause severe itching of the skin and serious eye manifestations due to an inflammatory reaction. Microfilariae like to live within the human host’s skin, which causes the severe itching and eventually harsh and damaging skin conditions, such as changes in pigmentation and elasticity. Depigmentation of the skin can lead to a development of white spots, known as leopard skin. “Elastic fibers in the skin are also destroyed, resulting in a wrinkled, cigarette paper appearance, which can lead to a situation in which the groin prolapses, called hanging groin” (Helen Keller). If the microfilariae have migrated towards the eyes of the individual then serious eye problems are likely to occur. An immune reaction to the microfilaria occurs, causing red irritated eyes, light sensitivity, and night blindness. In severe cases of Onchocerciasis, reduced visual activity and sclerosing keratitis, which is corneal opacity evolving from the bottom periphery towards the center, occurs. Chart 1 shows the several different skin and eye symptoms that can occur from the disease, River Blindness. After having Onchocerciasis for several years, it can lead to “irreversible blindness and disfigurative skin diseases” (Neglected Tropical; River Blindness; Helen Keller).

Now that the symptoms of Onchocerciasis are recognized we can now become aware of the consequences of river blindness. “In most affected communities, over fifty percent of the population can be expected to go blind before their demise” (Helen Keller). A person in Africa who contracts Onchocerciasis and becomes blind because of the disease is expected to die a “premature death of 10
years” (Helen Keller). According to The World Bank, for every year a person is blind it is expected that a year will be taken from their life. Women are at a greater risk of having problems if infected with Onchocerciasis. Women in Africa infected with river blindness are at a “risk of being abandoned by their husbands when they go blind” and having a reduced chance of marrying because of the disfigurative skin and eye conditions associated with Onchocerciasis (Helen Keller). Having a blind woman for a wife is not a prospective idea for many men, so women are continually left by their husbands and have to provide for themselves. Women who are not yet married and contract the disease have a very low chance of gaining a husband, because most men will not want a diseased woman who will have to be provided for. If the woman cannot take care of the kids and chores at home, it is likely she will be left by her husband, or not married at all. Onchocerciasis can also affect the children of the infected area and ruin their future.
Children usually have to give up their education to stay at home and tend to their parents infected with the disease. Giving up their education greatly diminishes their chances of success in the future. Tending to blind parents can be a stressful and tiring chore, and it is very hard of the children of the family. River blindness also affects the household economically because it costs a great deal of money to care for a blind person. Blind people need special care and equipment, including medicine and other items. In order to provide successful treatment, a great amount of money is used to care for the blind.

Blindness affects the poor people in Africa even greater because they do not have the medical supplies and medicines to care for the blind and diseased, and they do not have to option to “protect themselves or escape from the blackflies” (The Carter). In the poorest areas of Africa, people can get bitten 20,000 times a year by the blackflies.

According to the World Health Organization, ninety percent of blindness occurs in low income areas and families, and eighty percent of the blindness is preventable with the right treatment. As a result, Onchocerciasis greatly damages families and causes severe problems and consequences. (The Carter; Helen Keller; Global; Vision).

Onchocerciasis is now fully understood, revealing what the disease is, the parasitology, the symptoms and consequences of the disease, and where river blindness is located. After exploring all of these topics, we can now look into the steps that have been taken to prevent river blindness. The Onchocerciasis Control Program has been one of the most successful organizations in preventing Onchocerciasis. Map 2 shows the countries involved in controlling Onchocerciasis with the
OCP. The World Health Organization launched the OCP in 1974 and collaborated with three other agencies. The OCP “stretched over 1,200,000 km2 to protect thirty million people in eleven countries from the debilitating effects of river blindness” (Onchocerciasis). The OCP first specialized in delivering insecticide sprays over the sites of the breeding blackflies. In 1987 the program switched to treating the infected individuals with a new drug, Ivermectin. The OCP has prevented 600,000 cases of blindness from occurring and has allowed eighteen million children to be born in “now controlled areas spared from the risk of river blindness” (Onchocerciasis). The African Program for Onchocerciasis Control was developed after the major success of the OCP in 1995. “APOC is a bigger partnership program than OCP including nineteen participating countries with effective and active involvement” (Onchocerciasis). Map 3 shows the different countries in Africa involved with APOC. APOC uses the Ivermectin treatment and “empowers local communities to fight river blindness in their own villages, relieving suffering and slowing transmission” (Onchocerciasis). APOC’s goal is “to treat over ninety million people annually in nineteen countries, protecting an at risk population of 115 million, and to prevent over 400,000 cases of blindness every year” (Onchocerciasis). APOC will continue to control River Blindness until 2015. “The Onchocerciasis Elimination Program for the Americas is a regional initiative with the goal of eliminating morbidity and interrupting transmission of river blindness in six endemic countries in the Americas” (Onchocerciasis). Map 4 shows all of the countries in the Americas that are being treated by OEPA. OEPA’s goal is to deliver a mass Ivermectin treatment to the infected area of the Americas every six months. Since 2007, OEPA has had “no new cases of blindness attributable to Onchocerciasis in the American region”
(Onchocerciasis). The development of the drug, Ivermectin, has greatly treated individuals with river blindness, and can prevent Onchocerciasis’ severe symptoms. Ivermectin is the only known drug to treat Onchocerciasis by “reducing the microfilarial density in the skin to near zero” (Helen Keller). Ivermectin can benefit the individuals with Onchocerciasis because it not only kills the microfilarial and prevents the symptoms, but it can also stop the symptoms altogether and the individuals’ health. Ivermectin prevents worsening of vision and stops the itching, and the drug also eventually expels the worms. The drug overall reduces the pain and suffering of the individuals with the disease, however, Ivermectin has its limits. Ivermectin cannot get rid of the existing skin nodules or wrinkled, de-pigmented skin, or reverse blindness. Ivermectin may kill the microfilarial, but the drug has no effect on the adult worms in the human host’s body, for they can live up to fifteen years inside the body. Individuals infected with Onchocerciasis have to take Ivermectin “for several years while waiting for the natural death of the adult worms” (Helen Keller). Although there have been many great steps and programs to prevent and treat Onchocerciasis with the use of insecticides and Ivermectin, there is still no cure for the disease. (Helen Keller; Onchocerciasis; Ivermectin; Onchocerciasis: More frequent).

Onchocerciasis has been defined as a parasitic disease that can destroy not only the body of the infected individuals, but also the lives and family of the infected humans. River Blindness has been shown to be mostly distributed in the tropical areas of the world, and most commonly in the poor places of Africa. Ivermectin has been one of the greatest possible solutions to Onchocerciasis, along with the programs and organizations that have teamed up to eliminate the disease. Onchocerciasis, however, is still
common in the poor and overlooked areas of Africa and still infecting the people with the horrible
disfiguring skin and eye symptoms. As Onchocerciasis continues to infect people, organizations continue
to seek out solutions to the disease. People infected with River Blindness will always remember the
horrible effects of the disease. “They call me “monnu” (white Man). They laugh at me. So I prefer to stay
home or if I go out I try to hide in my clothes so that people do not know” (Ivermectin).

Works Cited


*University of Michigan-Flint Journal of Student Research, 2011*