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News  
Chasing the worm  
Michelle Lodge  
  
1 Juba  
  
New cases of guinea worm disease in southern Sudan have recently  
fallen from 20 000 a year to an estimated 1500, and doctors are hoping  
that the disease will become the second in history to be eliminated  
  
  
Any observer of guinea worm disease, or dracunculiasis, will tell you  
that this waterborne parasitic disease should be simple to eradicate.  
After all, no vaccinations or costly drugs are needed, the disease  
cannot be passed from one person to another, and the wounds that the  
worm itself causes on a patient’s body are handled effectively with  
what you would use for a scraped knee: clean water, antiseptic, gauze,  
and an antibacterial ointment.  
  
But eradication of the nematode, Dracunculus medinensis, requires that  
most slippery of ingredients: a change in human behaviour. In fact it  
requires two changes, one of which is particularly difficult to effect  
because of the parasite’s wily ways.  
  
The life cycle of the worm begins when a person drinks water infected  
with its larvae (see box). So the first change that health campaigners  
are pursuing is to persuade people to filter their water before  
drinking it.  
  
Then over the course of a year the larvae mature and grow into long,  
spaghetti-like white worms that live in the body’s subcutaneous and  
intramuscular tissues. When the female worms are ready to emerge and  
lay their eggs, they ingeniously cause such blistering of the skin and  
such a fiery pain that the host naturally seeks out cool water for  
relief, thus enabling the worm to lay its eggs in water and continue  
its life cycle.  
  
  
  
  
Life cycle of the guinea worm  
The adaptable guinea worm begins life as an independent larva in a  
pool of stagnant water after its mother, emerging from the body of a  
person with guinea worm disease, has sprayed her cloud of eggs. Tiny  
freshwater fleas, or copepods, then ingest the larvae or eggs.  
  
The larvae require 10 to 14 days of development inside the copepods  
before becoming infective to humans. Once a person drinks water  
infested with larvae-bearing copepods, the flea’s shell disintegrates  
on contact with digestive juices, and the larvae are released. From  
there the parasites make their way into the small intestines, from  
which they bore through the intestinal wall into the abdominal cavity.  
Eventually they mate. The male dies, and the impregnated female  
matures to be a slender white worm of up to 1 m long.  
  
After living in the body for a year the pregnant guinea worm is ready  
to lay her eggs in water. In preparation she burrows through the  
patient’s skin, usually in the lower extremities, forming a painful  
blister from which she emerges. Patients can have several guinea worms  
living in their bodies at once, compounding the suffering. To relieve  
the fiery agony caused by the worm, a patient may seek the coolness of  
water. This water then becomes recontaminated with larvae, and the  
cycle is repeated.  
  
  
  
  
  
  
To interrupt the cycle health campaigners have to effect the second  
change: to try to persuade the parasite’s human prey to refrain from  
going into ponds, rivers, or other communal bathing areas when they  
have a guinea worm emerging from their bodies.  
  
As any public health doctor knows, old habits die hard. Moreover,  
those working to eradicate the disease in Sudan, the worst affected  
country, have several other major problems to contend with, namely the  
after effects of a 20 year civil war, ongoing violence, a mobile and  
illiterate population, and a vast underdeveloped land.  
  
Sudan is one of six remaining countries where the disease, which can  
make it impossible for those infected to walk, work, or care for a  
family, still exists; the others are Ghana, Ethiopia, Mali, Niger, and  
Nigeria, although transmission seems to have been arrested this year  
in Niger and Nigeria.  
  
"In principle, a 14 month period is good enough to result in zero  
cases, provided that all guinea worm cases that occur during this  
period are fully contained," said Gautam Biswas, of the World Health  
Organization, who surveyed regions in southern Sudan in June. "This is  
a challenging task but is still doable."  
  
Today provisional figures indicate that just over 1500 indigenous  
cases exist in southern Sudan, a big fall from the more than 20 000  
indigenous cases reported three years ago. Several players have  
contributed to this success, the most important probably being the  
government of the autonomous region of Southern Sudan.  
  
Its project, the Southern Sudan guinea worm eradication programme, is  
an immense operation of 14 000 people, made up of village volunteers  
and an army of experts. Its programme director, Makoy Samuel Yibi  
Logora, reports directly to the health minister.  
  
But another important player is the Carter Center, an Atlanta based  
foundation set up by the former US president Jimmy Carter and his  
wife, Rosalyn, which underwrites the project with the help of donors  
and partners such as the US Centers for Disease Control and Prevention  
in Atlanta and WHO. The foundation took on the eradication of guinea  
worm disease as one of its goals in the 1980s after the Carters  
encountered a young Ghanaian woman with a worm emerging from her  
swollen breast. At that time about 3.5 million cases thrived in 20  
African and Asian nations.  
  
Fund raising has shored up the programme with tens of millions of US  
dollars since its inception. In December, for instance, the Bill and  
Melinda Gates Foundation and the United Kingdom’s Department for  
International Development pledged a combined $55m (£34m; 38m) for the  
Carter Center led guinea worm programme. Of that amount $32m from the  
Gates Foundation must be matched one to one with the centre’s fund  
raising.  
  
Once that goal has been met the Carter Center, WHO, and the remaining  
affected countries will have $87m to finish the job. Most of that will  
go to efforts in Southern Sudan.  
  
"We are fighting the worm, one case at a time," said Ernesto  
Ruiz-Tiben, the Carter Center’s director of the programme,  
acknowledging the labour intensive effort needed to avert or treat  
even one case of the disease.  
  
Apart from trying to effect behaviour change, the programme also aims  
to treat the water with Abate, a larvicide that is not toxic to humans  
and animals, but this has to be done within 10 days of the eggs’  
release.  
  
Despite the recent fighting in parts of the region, Dr Ruiz-Tiben said  
that the civil disruption has not hindered the progress of the  
eradication programme. Bismarck Swangin, a communications officer for  
Unicef in Juba, said that the conflicts over the past month have not  
been in areas where the disease is endemic. But he added that the  
fighting has severely curtailed the borehole well programme in the  
affected states, which can lead to other illnesses, such as cholera.  
  
After the comprehensive peace agreement signed between Khartoum and  
the south in 2005, and which set up a temporary autonomous government  
in Juba, more aid organisations have built compounds in Southern  
Sudan. But they are ever vigilant about violence that still breaks out  
over livestock theft and grazing rights.  
  
Yibi Logora, the director of the project in Southern Sudan, has been  
working on his country’s guinea worm problem since 1995. He notes the  
encouraging progress—an 80% drop in cases—yet adds that "the postwar  
challenges have been massive." Among them are the scant supply of  
clean water; lack of infrastructure, such as paved roads and  
healthcare facilities; landmine scares, intertribal fighting and  
population displacement; and the nomadic nature of its people, many of  
whom are pastoralists who perpetually move their herds of goats and  
cattle in search of food and water.  
  
The land and weather can impede success as well. Treating guinea worm  
disease in Southern Sudan requires regular travel on rough terrain to  
thousands of villages (the region has 17 000 such settlements) in an  
area the size of Austria and Switzerland combined. When the rains  
come, dry river beds swell and flood with raging currents, and the  
region’s dampened black sand causes vehicles to spin out of control.  
  
During the rainy period, which coincides with the disease transmission  
season (typically April to September), workers in the field often have  
to sit out the foul weather before resuming their work.  
  
To tackle the latest cases of guinea worm in the area, the programme  
has opened three case containment centres this year in the Eastern  
Equatoria state and is considering adding others. Patients stay  
voluntarily at these centres and may have visitors and family members  
to live with them. Twice daily the centre’s nurses treat the patient’s  
wounds. In addition, patients are served three hot meals a day and  
receive health education.  
  
Several times a day the centres broadcast an upbeat guinea worm  
disease song. The staff also teach patients how to counsel neighbours  
on ways to avoid the disease, with pictures on a cloth flip chart.  
These reinforce the essential messages of persuading people not to go  
into communal water sources and to place cloth filters over the mouths  
of the plastic jerry cans typically used by women to collect family  
drinking water. They also encourage people to suck through a pipe  
filter when drinking water. These filters can be worn on a string or  
beaded necklace.  
  
Critical to the success of the case containment centres, and the  
project itself, are the village volunteers, who often refer new cases  
for treatment. The volunteers are highly motivated. Nakura Agata, of  
Morvangilimo, one of the volunteer army, told the BMJ, one scorching  
afternoon in June, "A lot of my relatives, including one of my  
daughters, have had the worm this year. It hurts me to see them in  
pain. As a volunteer I can help them."  
  
  
  
  
Milestones in eradication of guinea worm disease  
  
1986 The Carter Center sets the eradication of guinea worm disease as a goal  
  
1993 Pakistan becomes the first country where transmission is stopped  
  
1994 Kenya is the first African nation in which transmission is stopped  
  
1996 Transmission is stopped in India  
  
1997 Transmission is stopped in Cameroon, Senegal, and Yemen  
  
1998 Transmission is stopped in Chad  
  
2001 Transmission is stopped in Central African Republic  
  
2003 Transmission is stopped in Uganda  
  
2004 Transmission is stopped in Benin and Mauritania  
  
2005 The comprehensive peace agreement is signed in Sudan, ending the  
major north-south civil war and separating the two regions politically  
for six years  
  
2006 Transmission is stopped in Burkina Faso, Côte d’Ivoire, and Togo  
  
2008 The Bill and Melinda Gates Foundation and the UK Department for  
International Development pledge $55m to the guinea worm eradication  
programme led by the Carter Center, with the option of matching $32m  
from the Gates Foundation one to one with funds raised by the centre  
  
2009 Geneva Declaration sets the year for stopping transmission  
worldwide; transmission is halted in Niger and Nigeria (to be verified  
in spring 2010)  
  
  
  
  
  
  
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The Carter Center contributed to the cost of Michelle Lodge’s trip to  
Southern Sudan.  
Michelle Lodge is a New York based writer.