

Modern Approaches to Ancient Diseases

The treatment room had no examination table, no charts on its peach and white walls, no panes in the single window, no electricity, no running water. On the smooth cement floor on a teal woven blanket lay Nieba. At her head was seated an ophthalmic nurse, his back against one wall, legs extended on either side of his elderly patient. He washed her face with orange-brown Betadine disinfectant, patted her dry, then covered her face with a linen cloth into which a small hole had been cut, leaving only her right eye visible.

In the village of N’Gara in western Mali, Nieba was going blind. Trachoma, the result of numerous *Chlamydia trachomatis* infections, had inflamed and warped the skin on the underside of Nieba’s eyelid, pulling her eyelashes inward so they scraped her cornea. It’s “like sand scratching your eyeball every time you blink,” one woman told me. The unrelenting pain drives many people to pluck out their eyelashes. This advanced stage of trachoma, called trachomatous trichiasis (TT), usually precedes corneal opacity and permanent blindness.

Nieba lay on the floor, her face—her identity—covered, except for that eye, which was the demarcation between two lives. Without sight, could she continue to farm, cook, and sell her vegetables at the weekly village market? How would her role in her family change? How would her family change? Nieba’s greatest concern, she’d told me that morning, was that if she were blind

she would not be useful. Being a burden on others was a worse prospect than the constant pain and severe sensitivity to light she now experienced.

Trachoma spreads by contact with contaminated people and by flies that carry *Chlamydia trachomatis* bacteria from one person to the next. Eye discharges attract the flies, as do human feces. Places with endemic trachoma—rural parts of Africa, Asia, the Middle East, the Pacific islands, and Latin America—have several common features: overcrowded dwellings, little or no clean water or sewage disposal, and, typically, a dry, dusty landscape (though in recent years, severe trachoma has been found in several populations in the Amazon region). Children are most likely to be affected; as the primary caregivers, women are three times more likely than men to develop TT. A person usually needs more than 150 *C. trachomatis* infections to reach TT; in other words, people with TT have basically lived with an ongoing eye infection throughout their lives.

Sightsavers, a UK-based NGO, was underwriting Nieba's surgery, one of thousands it organized and paid for in 2012. Almost immediately upon meeting me, Caroline Harper, the CEO of Sightsavers, had insisted I witness a trachoma surgery. "You'll never forget it," she'd said, and put me in touch with a local team, which had brought me to N'Gara and Nieba.

The simplicity of the undertaking was remarkable. The nurse was in effect a mobile surgical unit, riding his motorbike on unpaved roads to operate on people who could not reach a medical clinic. Working with an assistant, he sometimes performed more than twenty procedures in a day. I'd watched as he'd taken from his satchel his surgical equipment and his lunch. The treatment room was bare but for the blanket Nieba lay on. During my time working at Operation Smile, I had watched numerous surgeries, mostly craniofacial and cleft lip and palate reconstruction, but they were always in a completely sterile environment—the prac-

tioners wore not just gloves, which Nieba's surgical nurse also wore, but masks and gowns. "Surgery" meant a designated operating room in a hospital or clinic, usually with electricity, running water, anesthesia, and surgical equipment. Dr. Anthony Solomon, a medical officer in WHO's Department of Control of Neglected Tropical Diseases, told me that he first saw a TT surgery "on the veranda of a schoolhouse." But, he added, "it makes sense. The eyelid is very vascular. Your risk of having infection is very limited. It's quite a quick procedure. That also limits your risk of infection. Really, you need good lighting and a surgeon who's well trained, with a good steady hand."

Egyptians in the sixteenth century BCE scraped the eyelid to turn the eyelashes away from the eyeball, pulled out the lashes, and/or applied various mixtures of myrrh, urine, lizard dung, and the blood of donkeys, bats, pigs, and goats. In the first century CE, Romans rubbed infected eyelids with red-hot iron needles to cauterize the roots of inward-turning eyelashes. In 2012, Nieba's surgery began with anesthetic drops in her eye, followed by several injections of lidocaine to numb her eyelid.

The nurse placed two hemostats—blood-stanching clamps—onto Nieba's eyelid, a few millimeters in from either end. He cut the skin and muscle just above the edge of the lid, running the incision between the hemostats, careful not to cut all the way through. Then he flipped the eyelid and cut the skin and muscle underneath. Into the incision he inserted a closed pair of scissors, pushing until the scissors emerged through the top of the eyelid. Then he opened the scissors so their blunt sides spread apart any remaining intact muscle. The hemostats were removed and blood flowed profusely, which the nurse dabbed with squares of surgical gauze. Then, with three sutures, he reattached the lower portion of Nieba's eyelid to the upper portion, tying the knots firmly so the

eyelashes pointed well away from the cornea. The nurse cleaned and bandaged Nieba's eye, then sent her home. This surgery, which had been performed without electricity and without even a table in the room, had taken twenty minutes and cost about \$86.

By altering the angle of Nieba's eyelashes, the surgery had altered her life. Not only was she spared excruciating pain, but she could return to her work and family without the fear of going blind. None of her grandchildren would be obliged to drop out of school to care for her or shoulder her household responsibilities. Like many treatments for trachoma—and other NTDs—the TT surgery is simple and inexpensive, with benefits that reach far beyond the patient herself.



In 1999, after studying at the London School of Hygiene & Tropical Medicine, Solomon had joined his professor, the longtime trachoma advocate Dr. Allen Foster, in helping the Ghana Health Service repurpose its successful Guinea worm program for trachoma. (By 2015, Guinea worm—which is on WHO's list of recognized NTDs—was reduced from several million known cases per year to a mere *twenty-five* worldwide.) Ghana was one of five pilot countries receiving the antibiotic azithromycin from the International Trachoma Initiative (ITI), a collaboration between the pharmaceutical company Pfizer and the Edna McConnell Clark Foundation. A single dose of azithromycin—manufactured by Pfizer as Zithromax—could successfully treat active trachoma, a welcome change from the topical tetracycline ointment previously used, which required a six-week course, stung, and caused blurred vision. Azithromycin interferes with the *C. trachomatis* bacterium's ability to synthesize essential proteins, without which it cannot grow and replicate. For a disease that is recorded in Chinese doc-

uments dating from 2600 BCE and that is likely to be much older, azithromycin was the game changer. The drug's safety, stability, and effectiveness—together with Pfizer's commitment to donate the drug—had enabled the World Health Assembly in 1998 to adopt a resolution targeting the worldwide elimination of trachoma as a public health problem.

Solomon was sent to the northern region of Ghana “with a backpack full of money,” he recalled, “about \$5,000 in Ghanaian cedis to pay per diems to people and other expenses, which went across the White Volta River on top of a stack of six bikes in the bow of a dugout canoe, with a guy in the back paddling it with his flip-flops.” Working in collaboration with Ghanaian ophthalmologist Dr. Maria Hagan and ophthalmic nurses Joe Akudibillah and Peter Abugri, Solomon taught volunteers to diagnose trachoma and treat it with Zithromax. The project's tremendous results inspired the Ghana Health Service to scale up the program to nationwide coverage. In 2009, Ghana was able to stop the mass drug administration (MDA) of Zithromax, and the country began WHO's multiyear process of validation that it had eliminated trachoma as a public health problem.

ITI's work changed too, expanding from five countries to forty. In 1999, ITI treated 100,000 people with Zithromax. In 2017, more than 87 million people received the antibiotic, and more than 222,000 underwent TT surgery. “Once you start supplying 120 million doses against a global need of 200 million, the number who need to be treated is going to come down progressively, and it won't be too long before those numbers meet,” said Dr. Solomon. “We're not a million miles away from doing the whole job.”



Besides treatment with azithromycin, cleanliness significantly helps break trachoma's transmission cycle: keeping one's face