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Images

MSU expert: How malaria affects children

EAST LANSING, Mich. – Terrie Taylor, a doctor of osteopathic medicine and internationally recognized scientist and malaria expert, recently received the 2024 Distinguished Service Award from the American Osteopathic Association. This is the association's highest honor, given in recognition of contributions to the osteopathic profession.

Taylor, a University Distinguished Professor of Tropical Medicine in the College of Osteopathic Medicine and an MSU Research Foundation Professor, is widely recognized for nearly 40 years of research and clinical service for patients with malaria. She spends six months each year in the Paediatric Research Ward at Queen Elizabeth Central Hospital in Malawi, a landlocked country in southeastern Africa. She also coordinates elective rotations in Malawi for MSU osteopathic students to help broaden their global health experience.

According to a report from the World Health Organization, there were 249 million malaria cases worldwide in 2022 and nearly 4.5 million were in Malawi. Following is an in-depth conversation with Taylor about malaria, the "tricky parasite" she greatly respects, vaccinations and lessons learned during decades of caring work.

What's the possible impact of recent malaria vaccine rollout?

We hope they will diminish the number of children who develop severe malaria, but we don't yet know how they will perform outside of the rigorous conditions of clinical trials.

How many types of malaria are there?

There are six species of malaria parasite that infect humans.

We study Plasmodium falciparum, the species responsible for most of the deaths worldwide. We're studying cerebral malaria in Malawi children because that was highlighted as the research priority by the Malawi Ministry of Health when we started in 1986.

What is it like for a person to have malaria?

All falciparum infections can progress to what we call “uncomplicated malaria,” which presents with a fever, headache, vomiting — I had it once. Malawians refer to it as “total body pain.” It’s miserable.

Older children and adults in malaria-endemic areas have acquired enough immunity to survive repeated bouts of uncomplicated malaria, but younger children and visitors to malaria-endemic areas have not acquired enough “anti-disease” immunity, so they are at risk for the various syndromes of severe malaria.

You can have anemia, jaundice, kidney injury — different organ systems can be involved, alone or in combination.

What is cerebral malaria?

The general definition of cerebral malaria is coma in an individual who is infected with malaria and in whom there is no other obvious cause of coma. Our focus has been on cerebral malaria — malaria infections involving the brain — in Malawian children.

Asymptomatic infections are common in parasites, which benefits the parasite because it can be propagated and transmitted. But these asymptomatic — or presymptomatic — malaria infections can create diagnostic dilemmas for clinicians. People with asymptomatic malaria infections can get sick and fall into coma for any number of reasons. The parasite gets blamed but, in fact, it may not be the cause of the coma. So, not everything that looks like cerebral malaria actually is cerebral malaria.

We’ve been able to increase the likelihood that the parasite is the cause of the coma by finding certain features in the retina, in the back of the eye. About two-thirds of the children who meet that definition of cerebral malarial have evidence of malaria in their eyes. It took us a while to figure out why those findings were not found in every case of cerebral malaria.

How did you discover the link between cerebral malaria and the retina?

Fundamentally, we’ve learned that the disease is far more varied than we thought. Each patient has become more nuanced and more complicated.

We noticed that all the deaths didn’t look the same. Approximately two-thirds of the kids would start gasping and then stop breathing. We immediately thought it could be herniation — when the brain swells so much that it pushes out through the bottom of the skull, which puts pressure on the part of the brain that controls breathing.

We continued to care for children in coma on our research ward. If they had a respiratory arrest, we would do our best to resuscitate them. If they died, we would ask the families for permission to perform an autopsy, and we tried to carry out the autopsy within 12 hours of the death.

Once we combined our results from the living eye exams with the autopsies, everything fit together perfectly. The changes in blood vessels of the eyes caused by parasites corresponded to changes we saw in the brains’ blood vessels and to the respiratory arrests we had observed originally.

Among the children who fit the definition of cerebral malaria, those with brain parasites also had eye changes. The children who didn’t have brain parasites also didn’t have eye parasites — and we

always found another cause of death in those patients. They were children who had asymptomatic malaria infections and another, nonmalaria cause for their comas.

However, we still didn't know why the children with cerebral malaria were dying — we saw evidence of parasites in the brains and eyes, but we rarely saw signs of brain swelling at autopsy. We decided that neuroimaging was necessary to help solve the mystery.

How did you gain neuroimaging capabilities in Malawi?

Very fortunately, the then-chair of radiology at MSU was Jim Potchen, who was a visionary and had a very good working relationship with General Electric HealthCare. He persuaded them to donate an MRI, which arrived in April 2008. Almost instantly, we were able to confirm that these kids were herniating. The reason we didn't capture it before was because when we conducted an autopsy, we released the intracranial pressure that was forcing the brain down. We would never have seen it without the MRI.

A very swollen brain dramatically increased the chances of death. Very few patients died without a swollen brain. But a number of patients with swollen brains survived — the swelling would subside on its own over one to two days.

What can be done for cerebral malaria patients who have brain swelling?

Treatments for brain swelling vary, depending on the cause of the increased brain volume.

We've finished a clinical trial comparing immediate ventilation with a saturated salt solution that pulls water from the brain if the cause of the swelling is impaired blood flow. Study results are pending.

We also have started a new collaboration with a brilliant pediatric intensivist, Nicole O'Brien, an associate professor of clinical medicine at Ohio State University and critical care physician at Nationwide Children's Hospital, who looks at blood flow velocities into and out of the brain using transcranial doppler (a specific ultrasound used to measure blood flow).

What else should people understand about malaria?

Malaria is a very tricky parasite. I have a lot of respect for it. It's really clever. It hides in interesting places, and it subverts the immune system and covers its tracks well.

We're still not finished, but we're getting close. I feel like we've got this parasite cornered.

By E. LaClear

Read more about Taylor's work on MSUToday.

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