Stealth nanocapsules kill Chagas parasites in mouse models

June 20 2016

Lychnopholide, a substance isolated from a Brazilian plant, and formulated as part of "nanocapsules" cured more than half of a group of mice that had been infected experimentally with Chagas disease parasites. "Chagas disease affects millions of people, mainly in poor rural areas of 21 Latin American countries," said Marta de Lana, PhD. The research is published in online ahead of print June 20 in *Antimicrobial Agents and Chemotherapy*, a journal of the American Society for Microbiology.

The new nanocapsules that constitute the delivery system for the lychnopholide in this study are a clever advance over the previous version. The previous—conventional—nanocapsules are recognized as foreign and attacked by host immune cells as they travel through the blood, before entering host cells, where the parasites lodge, said de Lana, who is Professor of Clinical Parasitology, in the School of Pharmacy, the Federal University of Ouro Preto, Minas Gerais, Brazil.

The new "stealth" nanocapsules are designed to go unrecognized by immune cells that patrol the blood. Once they enter host cells, they release the lychnopholide, killing the parasites, *Trypanosome cruzi*.

Another advantage of the stealth nanocapsules is that they can be taken orally, rather than intravenously, as they are impervious to the acidity and enzymes of the stomach. This is far more practical, especially in less developed countries.

Not surprisingly, the stealth nanocapsules are considerably more effective than the conventional nanocapsules. In the study, in the acute (early) phase of the disease, the stealth nanocapsules cured 62.5 percent of the mice, compared to 57.0 percent for the conventional nanocapsules. During the later chronic phase, the stealth and the conventional nanocapsules cured 55.6 percent and 30.0 percent of the mice, respectively.

"Both nanoencapsulated formulations are so simple that they may be produced in a simple laboratory," said de Lana. Additionally, scale-up for commercial production would be simple, she said.

An estimated seven million people, mostly in Latin America, have Chagas disease, according to the World Health Organization. Up to one third develop cardiac abnormalities including enlarged heart, and arrhythmias, which can cause sudden death. As many as ten percent develop neurological and/or digestive problems. The main mechanism of spread is via triatomine insects, vectors that are known colloquially as kissing bugs, assassin bugs, or vampire bugs. Recently, the disease has spread to the United States and to several countries on other continents via other mechanisms.

No vaccines are available for Chagas. Treatment with conventional drugs—benznidazole or nifurtimox—is very effective at eradicating the parasites early in the disease' acute phase. But efficacy falls off sharply with time. This is a problem because symptoms often take time to develop, and by the time they appear, the disease may be too far along to be cured using these drugs. Additionally, both drugs have harmful side effects.

Provided by American Society for Microbiology