Giardia loses its hold on intestinal tissue after 'tonic shock'

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Known in America chiefly as the bane of hikers, the single-celled intestinal parasite Giardia lamblia is a major cause of diarrheal illness worldwide with estimates of 100 million infections a year. The parasite colonizes the upper small intestine by fastening to the microvillus brush border of intestinal cells.

But exactly how Giardia attaches itself was unknown until now. At the American Society for Cell Biology annual meeting, University of California, Berkeley researchers present evidence that Giardia uses an osmotic “suction cup” to hang on, a discovery that could make attachment a prime target for new treatments of Giardia infections.

Osmotic pressure is measured in terms of tonicity, the difference in concentration of a substance in solution on opposite sides of a semipermeable membrane. It is a powerful force in the biological world and tightly regulated in the human body. Tonicity, however, fluctuates in the small intestine during fasting and after eating.

Using video microscopy, the researchers challenged Giardia attached to different surfaces with conditions of low and high tonicity. The researchers found that Giardia detached rapidly in response to both lowering and raising the tonicity, yet the parasite was able to adapt to a new tonicity after only a few minutes of exposure.

But experiments with Giardia attached to monolayers of human intestinal epithelial cells revealed that a large percentage of the parasites

could be forced to detach when exposed to a timed pattern of high and low “tonic shock.”

The researchers believe that the susceptibility of attached Giardia to tonicity changes can be traced to an unusual cellular structure on the parasite called the ventral disk. They believe it acts as a suction cup of sorts but with the “suction” created by osmotic pressure from a concentration imbalance between the outside environment and the fluid trapped beneath the ventral disk.

As a potential focus of treatment, Giardia’s osmotic grip may prove to be its Achilles heel.

Source: American Society for Cell Biology

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