How Helicobacter pylori identifies and colonizes sites of small injury in the stomach

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Helicobacter pylori infection promotes stomach ulcers and cancer. How *H. pylori* initially interacts with and irritates gastric tissue is not well understood. An article published on July 17th in *PLOS Pathogens* now describes that *H. pylori* rapidly identifies and colonizes sites of minor injuries in the stomach, almost immediately interferes with healing at those injury sites, and so promotes sustained gastric damage.

Smoking, alcohol, excessive salt intake, and non-steroidal anti-inflammatory drugs cause damage to the tissue lining the stomach, and are associated with stomach ulcers. A team of scientists led by Marshall Montrose, from the University of Cincinnati, USA, asked whether *H. pylori* can sense and respond to such damage and so contribute to disease development.

The researchers induced small stomach lesions in anesthetized mice and observed that *H. pylori* bacteria can rapidly detect the injury site and navigate toward it. Within minutes, accumulation of bacteria interferes with repair of the tissue damage—and these results are the earliest indication showing *H. pylori* causing disease.

To examine how the bacteria accomplish this, the researchers also studied mice with larger stomach lesions (ulcers) that were subsequently infected with *H. pylori*. They found that *H. pylori* preferentially colonizes stomach tissue at injured ulcer sites, and there impairs healing of the damaged tissue. Selective colonization requires both bacterial motility and chemotaxis (the ability to change direction of movement in

response to environmental cues), and higher levels of bacterial accumulation cause slower healing. However, when extremely high levels of immotile or chemotaxis-deficient bacteria are added to damaged tissue, they can also slow healing. As the researchers explain, "it's like a tag team race. Chemotactic machinery guides *H. pylori* into the damage site to colonize, and then other virulence factors take over to make sure the site stays just as tasty in the long term by slowing repair of any damage".

While the signals that attract *H. pylori* (but not benign stomach bacteria) toward injured tissue are not yet known, the researchers hope that their ability to rapidly measure *H. pylori* accumulation at the injured site now provides an experimental set-up to determine the factor(s) involved.

"The broader implications of our work", the researchers say, "are that even subclinical insults to the stomach that occur in daily life (damage from grinding of food, ingestion of alcohol, taking an aspirin) can potentially attract *H. pylori* and not only slow repair of any existing damage, but maybe also provide an initiation site that can start the pathogenic sequence of more severe stomach diseases caused by *H. pylori*".

More information: Aihara E, Closson C, Matthis AL, Schumacher MA, Engevik AC, et al. (2014) Motility and Chemotaxis Mediate the Preferential Colonization of Gastric Injury Sites by Helicobacter pylori. *PLoS Pathog* 10(7): e1004275. DOI: 10.1371/journal.ppat.1004275