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Nature Medicine: New imaging probe may ID heart valve infection

Massachusetts General Hospital (MGH) researchers have developed an imaging probe that may accurately diagnose *Staphylococcus aureus* infection in the heart valves, according to findings published in advance in *Nature Medicine* online Aug. 21.

Peter Panizzi, PhD, Harrison School of Pharmacy at Auburn University in Auburn, Ala., and colleagues demonstrated how the presence of *S. aureus*-associated endocarditis was identified in PET/CT imaging of a mouse, using a radiolabeled version of prothrombin—a protein involved in bacterial vegetation growth.

Tissue infections in heart valves involve vegetations of clotting components such as platelets, fibrin and infecting microorganisms, according to the researchers. *S. aureus* bacterial vegetation grows by secreting a clotting enzyme—staphylocoagulase—which utilizes prothrombin in the process, enhancing growth and anchoring vegetations to the heart valve.

Endocarditis caused by *S. aureus* is particularly dangerous, with a reported mortality rate of 25 percent to 47 percent, the researchers noted.

“Our probe was to sense whether *S. aureus* was present in abnormal growths that hinder the normal function of heart valves,” co-author Matthias Nahrendorf, MD, PhD, of MGH's Center for Systems Biology in Boston, said in a statement. “It’s been very difficult to identify the bacteria involved in endocarditis, but a precise diagnosis is important to steering well-adjusted antibiotic therapy.”

The researchers’ approach exploits the process by using prothrombin analogs engineered with fluorescent beacons, which allows researchers to specifically detect the bacterial vegetations. The approach may be a large advance in guiding antibiotic and surgical therapies, according to the authors.

“Previously proposed techniques for imaging endocarditis have generally lacked specificity for bacterial infection. The approach reported here focuses on detection of coagulase-positive *S. aureus*, the deadliest pathogen responsible for the majority of acute endocarditis cases,” the researchers wrote.

Further studies are needed to explore the use of the process in large animals and humans, according to the researchers, who added that the PET-tracer may inform on the site, bacterial load and activity of infections.

“An approach like this could help clinicians detect the presence of endocarditis, determine its severity and whether it is caused by *S. aureus*, and track the effectiveness of antibiotics or other treatments,” said Nahrendorf. “We are working to improve the PET reporter probe with streamlined chemistry and a more mainstream PET isotope to make it a better candidate for eventual testing in patients.”

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