

New vaccine protects from widespread, costly infection, mice study shows

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A newly developed experimental vaccine was more than eighty percent effective in protecting mice from succumbing to *Staphylococcus aureus*

infection. *S. aureus* causes more than 30,000 deaths from hospital-acquired infections annually in the US, costing the healthcare system \$10 billion. The research is published this week in *Infection and Immunity*, a journal of the American Society for Microbiology.

S. aureus is associated with a wide range of acute and [chronic diseases](#) such as bacteremia, sepsis, skin and soft tissue infections, pneumonia endocarditis, and osteomyelitis (bone [infection](#)), and has a high rate of mortality, estimated at 20-30 percent in bacteremia (blood infection) patients.

In the study, the investigators tested the vaccine in mouse and [rabbit](#) models of *S. aureus* infection. More than 80 percent of immunized mice survived, and two thirds of them cleared the infection, versus less than 10 percent of controls. On the 21st day post infection, the surviving animals—both those immunized, and controls—showed no signs of ill health, such as ruffled fur, or other abnormalities of appearance, and all had regained pre-infection weight.

In the rabbit experiments, the researchers injected the pathogen into the tibial bone marrow. Twenty-four days post infection, nearly two thirds of the immunized rabbits had cleared the infection; none of the controls had done so. Additionally, while control rabbits had hole-like lesions within the bone, immunized rabbits had smaller lesions or no lesions at all. (Rabbits do not typically succumb to *S. aureus* infection.)

Effective vaccination "would have enormous therapeutic utility in patients undergoing surgery, especially orthopedic and cardiovascular procedures where medical structures or devices are implanted, and in cases of traumatic injury," said Janette M. Harro, Ph.D., Research Assistant Professor, University of Maryland, Baltimore. Surgical site infections represent 20 percent of hospital acquired infections, and *S. aureus* is the major causative agent.

The diversity of disease caused by *S. aureus* results from differential expression of more than 70 [virulence factors](#). Virulence factors initiate colonization and growth, mediate damage to the host, and hinder immune response.

Biofilm formation is a powerful virulence factor. *S. aureus* is difficult to eradicate largely because it so readily forms biofilms.

Biofilms are communities of bacteria that adhere powerfully to surfaces, in the manner of dental plaque. They are notably resistant to host immune response, and to antibiotics, because they are hard to penetrate, and because microbes in biofilms have low metabolism, which further reduces the potential to gain entry into [bacterial cells](#).

Biofilms frequently form on medical implants such as artificial knees, hips, and cardiac devices. They can form anywhere there's a surface, moisture, and a nutrient source.

The vaccine the investigators developed recognizes five different *S. aureus* proteins. Four of these proteins are specific to *S. aureus* biofilms, and one is specific to *S. aureus* in the planktonic state.

"We identified vaccine candidates by screening *S. aureus* proteins with antibodies elicited during chronic *S. aureus* infections in animal models," said Dr. Harro. "This method permitted us to select protein targets for vaccination that were both expressed during an infection and were capable of being recognized by the [immune response](#)."

Provided by American Society for Microbiology

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