



NEWS RELEASE

U.S. Army Medical Research Institute of
Infectious Diseases
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Vaccination with Anthrax Capsule Protects Against Experimental Infection in Animals

Vaccination with the anthrax capsule, a naturally occurring component of the bacterium that causes the disease, protected mice from lethal anthrax infection, according to scientists at the U.S. Army Medical Research Institute of Infectious Diseases (USAMRIID). In addition, the capsule enhanced the effects of protective antigen (PA), the protective component of the current licensed human vaccine. The work was recently published in the journal *VACCINE*.

According to senior author Arthur M. Friedlander, M.D., *Bacillus anthracis*, the causative agent of anthrax, produces three main components that allow it to do harm—lethal toxin, edema toxin, and the capsule. During anthrax infection, the bacterium invades and grows to high concentrations in the host. The capsule surrounds the bacterium and prevents it from being ingested by host white blood cells that would otherwise destroy it, thus allowing anthrax infection to progress. The toxins are thought to act mainly by damaging defensive cells called phagocytes, causing the immune system to malfunction.

The efficacy of the current licensed anthrax vaccine, Anthrax Vaccine Adsorbed (AVA), is believed to be based on the presence of PA. Though the exact mechanism of protection is not known, antibodies to PA induced by AVA are believed to play a role in neutralizing the anthrax toxins.

USAMRIID scientists have extensively studied protective antigen, demonstrating that PA alone confers protection in animal challenge studies with both rabbits and nonhuman primates. In addition, the recombinant, highly purified version of PA developed and tested by the Institute is the basis for a next generation anthrax vaccine currently in advanced development.

However, because a response against PA is thought to target the toxins only, there is interest in identifying additional potential anthrax vaccine components that target the whole organism. According to Friedlander, scientists have suspected for some time that the anthrax capsule plays a role in conferring protection. This study provides the first definitive proof of that concept.

The research team vaccinated several groups of mice. One month after the second dose, the mice were challenged with lethal doses of spores from a strain of anthrax producing only the

capsule. In the group that had received the capsule vaccine, 7 of 12 mice survived challenge. In the control group, which received injections of a placebo instead of the capsule vaccine, none of the 12 mice survived.

Next, the team evaluated the efficacy of capsule vaccines alone or in combination with PA, using the same dosage schedule as before. In this experiment, using a fully virulent strain producing both capsule and toxins, neither capsule nor PA alone protected while the combination vaccine resulted in survival of 9 of 11 mice.

“We demonstrated that protection was even greater when the capsule was combined with PA, compared to when PA was given alone,” Friedlander said. “A different formulation could make it even better. The next step will be testing in additional animal models.”

Friedlander’s colleagues on the study were Donald J. Chabot, Angelo Scorpio, Steven A. Tobery, Stephen F. Little, and Sarah L. Norris.

“This work shows the importance of developing vaccines that target multiple agent-specific targets,” said George V. Ludwig, Ph.D., interim science director for USAMRIID. “This helps reduce the possibility of technological surprise when dealing with emerging biological threats.”

USAMRIID, located at Fort Detrick, Maryland, is the lead medical research laboratory for the U.S. Biological Defense Research Program, and plays a key role in national defense and in infectious disease research. The Institute’s mission is to conduct basic and applied research on biological threats resulting in medical solutions (such as vaccines, drugs and diagnostics) to protect the warfighter. USAMRIID is a subordinate laboratory of the U.S. Army Medical Research and Materiel Command.

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References:

Donald J. Chabot, Angelo Scorpio, Steven A. Tobery, Stephen F. Little, Sarah L. Norris, Arthur M. Friedlander. Anthrax capsule vaccine protects against experimental infection. *Vaccine* 23. 1:43-47 (2004).

For more information about USAMRIID:

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