Natural killer cells could be key to anthrax defense

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One of the things that makes inhalational anthrax so worrisome for biodefense experts is how quickly a relatively small number of inhaled anthrax spores can turn into a lethal infection. By the time an anthrax victim realizes he or she has something worse than the flu and seeks treatment, it's often too late; even the most powerful antibiotics may be no help against the spreading bacteria and the potent toxins they generate.

Now, though, University of Texas Medical Branch at Galveston researchers have found new allies for the fight against anthrax. Known as natural killer cells, they're a part of the immune system normally associated with eliminating tumor cells and cells infected by viruses. But natural killer cells also attack bacteria -- including anthrax, according to the UTMB group.

"People become ill so suddenly from inhalational anthrax that there isn't time for a T cell response, the more traditional cellular immune response," said UTMB assistant professor Janice Endsley, lead author of a paper now online in the journal *Infection and Immunity*. "NK cells can do a lot of the same things, and they can do them immediately."

In test-tube experiments, a collaborative team led by Endsley and Professor Johnny Peterson profiled the NK cell response to anthrax, documenting how NK cells successfully detected and killed cells that had been infected by anthrax, destroying the bacteria inside the cells along with them. Surprisingly, they found that NK cells were also able to

detect and kill anthrax bacteria outside of human cells.

"Somehow these NK cells were able to recognize that there was something hostile there, and they actually caused the death of these bacteria," Endsley said.

In further experiments, the group compared the anthrax infection responses of normal mice and mice that were given a treatment to remove NK cells from the body. All the mice died with equal rapidity when given a large dose of anthrax spores, but the non-treated (NK cell-intact) mice had much lower levels of bacteria in their blood. "This is a significant finding," Endsley said. "Growth of bacteria in the bloodstream is an important part of the disease process."

The next step, according to Endsley, is to apply an existing NK cell-augmentation technique (many have already been developed for cancer research) to mice, in an attempt to see if the more numerous and active NK cells can protect them from anthrax. Even if the augmented NK cells don't provide enough protection by themselves, they could give a crucial boost in combination with antibiotic treatment.

"We may not be able to completely control something just by modulating the immune response," Endsley said. "But if we can complement antibiotic effects and improve the efficiency of antibiotics, that would be of value as well."

Provided by University of Texas Medical Branch at Galveston