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Germ-Fighting Inhaler Could Fend Off Bioterror Agents

Makers say it may protect first responders, or people with weak immune systems

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MONDAY, Dec. 3 (HealthDay News) -- Mention inhalers and most people think of asthma, but new research shows that inhalers could become infection-fighting, lifesaving gear for firemen, emergency workers and other first responders.

They could also help protect people whose immune systems are weakened by chemotherapy or HIV, according to scientists who've tested the new inhaler in mice.

"We showed we can protect mice against all four major classes of pathogens: Gram positive bacteria, Gram negative bacteria, fungus and virus. So, it has protected against everything we tried," said study author Brenton Scott, a post-doctoral fellow in the pulmonary medicine department of the University of Texas M.D. Anderson Cancer Center.

His team was slated to present its findings Monday at the American Society for Cell Biology's annual meeting in Washington, D.C.

Pneumonia, especially, is a significant cause of death for chemotherapy patients, so the researchers decided to see if they could protect patients against the disease by boosting immune activity in the lungs beforehand.

The team exposed mice to an aerosolized formulation called Aerosolized Lung Innate Immune Stimulant (ALIIS), a soluble bacterial extract.

They then challenged the mice with inhaled *Streptococcus pneumoniae*, the pathogen that causes pneumonia.

The untreated mice all died of the infection, but 83 percent of the mice that were exposed two hours following treatment survived, as did 100 percent of mice exposed between four and 24 hours later. Protection lasted as long as five days, the team said, and was also effective against a broad range of pathogens, including the bacteria responsible for anthrax, plague, tularemia, the fungus *Aspergillus* and influenza virus.

According to Scott, this broad-spectrum protection means ALIIS could potentially be used by first responders in the event of a bioterror attack.

"First responders could potentially take a dose of ALIIS and be protected without knowing what the bugs are, and buy a window of opportunity to see what bacteria are out there," said Scott, who envisions a delivery system akin to an asthma inhaler.

But Steven Mizel, a professor of microbiology and immunology at Wake Forest University Health Sciences in Winston-Salem, NC, was skeptical.

"If first responders get a cut on their finger, they are still dead," he said.

That's because the protection afforded by ALIIS is limited to inhaled pathogens; challenge with injected bacteria still resulted in death, Scott noted. But Scott believes this finding is also a benefit, as it suggests the drug induces only a localized immune response, rather than a potentially damaging, whole-body one.

Scott also noted that ALIIS neither induced mucus formation not exacerbated asthma, and that repeated exposure of mice to the treatment appeared to cause little long-term damage beyond fibrosis, a thickening of the airways.

ALIIS induces massive stimulation of the so-called innate immune response, a hodge-podge of antimicrobial peptides (proteins), growth factors, and white blood cells that collectively, though non-specifically, deal with potential pathogens. Indeed, it does this so well, Scott said, that microbes died virtually on contact with the lining of the airway.

But ALIIS has no effect on the other arm of immunity, the adaptive response of B and T lymphocytes that are responsible for protective antibodies and long-term immunological memory. As a result, Mizel said, its potential real-world efficacy could be limited.

"I think this research supports the contention that the innate immune response is being triggered, and that is a good holding action," Mizel said. But he added that, "you need adaptive immunity to kick in eventually," especially if the body is exposed to large doses of pathogen, as is likely during a bioterror incident.

"If you are at the epicenter of the attack, and there are high concentrations of bacteria around, I would be shocked if the innate immune system could handle that," he said.

Study senior author Dr. Burton Dickey and Scott have formed a company called Pulmotect to commercialize ALIIS. Clinical trials are in the planning stages, Scott said, but will have to wait at least

until safety and efficacy studies in other animal models can be completed.

More information

For more information on infectious disease, visit the U.S. Centers for Disease Control and Prevention.