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'Superbugs' That Strike the Sickest Patients

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In hospitals' war against drug-resistant superbugs, a class of bacteria once thought to be fairly benign is emerging as a deadly threat to the sickest and most vulnerable patients. The scourge -- known as gram-negative bacteria -- is throwing a new wrench into efforts to contain the spread of deadly infections.

Amid more than 1.7 million infections annually in hospitals, prevention efforts have been aimed at the most widespread organisms, like the staph infection MRSA and others in the so-called gram-positive category. These can still be thwarted by antibiotics such as vancomycin.

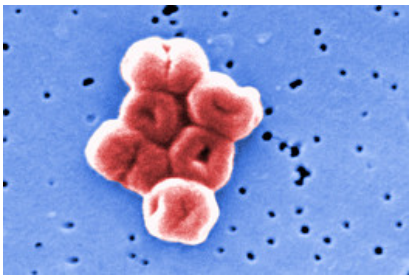

Photo Researchers

Acinetobacter is becoming resistant to all antibiotics.

But some of these bugs' wily cousins -- which don't pick up the purplish dye used in the test to distinguish them from gram-positive bacteria -- are becoming ultra-resistant. The extra outer membrane that rejects the stain also gives them additional armor against antibiotics. Some also produce an enzyme, known as ESBL, that enables them to break down antibiotics and develop even more resistance.

While they don't cause disease in healthy people, infections by gram-negative bacteria can be devastating for those with weak immune systems: wounded soldiers, burn victims, cancer and AIDS patients, the elderly, premature infants and those with severe injuries or illnesses. The gram-negative bugs that pose the biggest threat include *acinetobacter baumannii*, *enterobacter aerogenes*, and *pseudomonas aeruginosa*, which can attack through wounds, surgical incisions, central lines, respirators and catheters.

Most worrisome, says Centers for Disease Control and Prevention epidemiologist Arjun Srinivasan, is that bacteria like acinetobacter are becoming resistant to the class of drugs known as carbapenems, considered a last line of defense for gram-negative organisms.

Hospitals are now scrambling to come up with strategies to fight both gram-positive and gram-negative classes of bacteria, without increasing the chances that preventing one will lead to the rise of the other. "The gram-negative bacteria are catapulting past MRSA and now getting resistant to almost every antibiotic, which can mean a death sentence" for the sickest patients says Peter Pronovost, a professor at Johns Hopkins University School of Medicine. With no new antibiotics immediately on the horizon for either class, preventing infections "comes down to blocking and tackling," Dr. Pronovost says -- quickly diagnosing infections, using appropriate antibiotics and "going back to basics" such as getting health-care workers to wash hands.

In partnership with the Michigan Hospital Association, Dr. Pronovost developed a program to

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prevent bloodstream infections, which can be caused by both gram-negative and gram-positive bacteria and often strike patients in ICUs with large catheters inserted into their veins. With five practices -- handwashing, draping patients before inserting the lines, cleaning the skin properly, avoiding catheters in the groin and removing them as soon as possible -- the consortium reported that the rate of infections in Michigan ICUs dropped by 66% over an 18-month period. The process saved more than 1,729 lives and $246 million.

Dr. Pronovost says that while the steps are well-established, his research shows doctors skip steps more than a third of the time. Today, the Agency for Healthcare Research and Quality, part of the federal Department of Health and Human Services, plans to announce that it will provide funding to expand Dr. Pronovost's program to 10 other states.

Hospitals are struggling to determine how best to detect the presence of different types of bacteria and identify patients on admission who might carry them on their skin or in their intestinal tract. Such screening programs can be costly, and it isn't clear who will pay for them. "You can't culture every patient in every bed for every possible resistant organism," says Gina Pugliese, vice president of the safety institute at Premier Inc., a large hospital purchasing cooperative.

Hospitals are launching myriad new efforts to combat the bugs: They are sterilizing equipment with techniques including vaporized hydrogen peroxide that can decontaminate equipment without harm, discarding contaminated devices, bathing ICU patients with a chemical antiseptic and closing down units for decontamination. They are also requiring hospital workers to wear protective equipment when caring for infected patients or those considered at risk for infection, draping patients from head to toe during procedures and isolating infected patients.

The measures can be hard on patients and families, especially those placed in isolation, says Pat Rosenbaum, a nurse who is authoring new guidelines from the Association of Professionals in Infection Control and Epidemiology for the prevention of acinetobacter infections, to be released next year. "We don't take lightly putting people into these kind of precautions, but we also don't want to take a risk that they might infect others," she says.

Because overuse of antibiotics is considered a primary culprit in the growing drug-resistance of all bugs, hospitals are forcing physicians to be more judicious in their use of antibiotics, saving the powerful broad-spectrum drugs for the infections known to respond to them. But it can take two or three days to get lab results back that identify bugs, making it harder to determine the right antibiotic to nip infections in the bud before they rage out of control. Hospitals are experimenting with rapid-testing technology that allows them to diagnose lab cultures within hours instead of the one to three days it now takes, but such tests are not yet widely available.

Marin Kollef, a critical-care specialist at Barnes-Jewish Hospital, in St. Louis, Mo., says that if patients come in with a severe infection such as septic shock, he will order three or more antibiotics to cover both gram-negative and gram-positive organisms, then alter treatment once lab cultures come back with a more-specific diagnosis. "The lab may take 24 to 72 hours to get the information back, and if a clinician makes a wrong decision, too much time may go by before the patient gets the right drug," adding to the risk of death, he says.

Infectious-disease experts say the most worrisome of the gram-negative bacteria may be acinetobacter, which is commonly found in soil and water, and may be carried by up to 40% of people on their skin. Over the past several years, a virulent strain has developed increasing resistance to antibiotics. This strain survives in hospitals for long periods and targets severely ill patients through the skin and airways, causing pneumonia and infections in the skin, tissue, central nervous system and bones. There have been a growing number of infections in wounded military personnel returning from Iraq and Afghanistan, where the bacteria thrive in the soil of the hot, humid climates.

Johns Hopkins learned the hard way how quickly acinetobacter can spread. In October 2003, it found that a treatment known as pulsatile lavage -- which uses a spray-like device to irrigate and treat wounds -- was also dispersing acinetobacter from patients who carried the bug into the air via droplets. Johns Hopkins's analysis suggested that the bacteria may have landed on surfaces and then been spread via health-care workers, and was also possibly inhaled by some patients.

Of 11 patients colonized or infected with a drug-resistant form of the bacteria, eight developed wound infections and three had both bloodstream infections and pneumonia; two deaths were linked to the infections. The outbreak was halted by aggressive infection-control measures, including closing and renovating the wound-care treatment unit to add private rooms.

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Trish Perl, a professor of medicine and hospital epidemiologist at Johns Hopkins, says the hospital has not had an outbreak of infection since changing its practices, but still sees patients colonized with acinetobacter coming into the hospital, especially from long-term care facilities; her group is paged every time a new case is identified to make sure that the appropriate precautions are in place.

After the death of their 27-year-old son, Josh, linked to an infection with a gram-negative bacterium, Victoria and Armando Nahum started a nonprofit group to raise awareness of prevention (safecarecampaign.org). Their group promotes steps patients can take in hospitals such as asking about what screening is done to prevent infection, questioning surgeons about the need for pre- and post-operative antibiotics, and insisting staffers wash their hands in the presence of the patient and family.

Josh, a skydiving instructor in Loveland, Colo., fractured his femur and skull on a jump, and after recovering from a bacterial infection in the ICU, later contracted the infection enterobacter aerogenes in his spinal fluid, which damaged his central nervous system and rendered him a quadriplegic and ventilator-dependent. His infection responded to none of the antibiotics administered, his father says.

"We seem to be out of bullets for these multi-drug-resistant organisms, so we have to find ways to control and prevent these infections, because once your family starts down that path it is a black hole," says Mr. Nahum.

An Emerging Threat

Gram-negative bacteria, harmless to the healthy, are fast developing resistance to antibiotics and infecting the sickest patients.

BACTERIA	FOUND IN	INFECTS
Acinetobacter	soil, water; humid climates, skin	lungs (pneumonia), blood, wounds
Enterobacter Aerogenes	soil, dairy products, sewage, intestinal tract	respiratory, tract, skin, soft tissue, urinary tract, bone
Pseudomonas aeruginosa	soil, water, skin, vegetation, fruits	urinary, respiratory, skin, bone, joint, gut, ear, eye, nervous system
Klebsiella	soil, water, vegetables, intestinal tract, skin, throat	lungs (pneumonia), urinary tract, wounds, blood

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