How our last weapon against MRSA could easily fail

MRSA (Methicillin-Resistant Staphylococcus Aureus) is on the rise, with more and more occurrences worldwide.

Today, the antibiotic vancomycin is one of the few remaining weapons available to doctors in their fight against the bacteria.

New research now shows that the treatment of MRSA with vancomycin is not as straightforward as assumed.

If the patient has already been treated with colistin, another antibiotic, the bacteria could’ve become vancomycin-tolerant, in which case treatment could fail.

"Vancomycin isn’t a terribly good antibiotic, but it is the preferred treatment for MRSA because so many other antibiotics fail," says Professor Hanne Ingmer from the Section for Food Safety and Zoonoses at Copenhagen University. “Our research shows that treatment with other antibiotics prior to administering vancomycin can render MRSA vancomycin-tolerant, causing it to fail. This can have fatal consequences.”

The new study was recently published in mBio.

MRSA treatment enhances tolerance

In the new study, which was a collaborative effort between Ingmer’s group and scientists from Stanford University, the researchers looked at what happens when bacteria are exposed to small doses of different antibiotics prior to treatment with vancomycin.

The experiment was to test what happens when a person is first treated for one infection and then for another shortly afterwards. This scenario is often evident in people who are very ill, and remnants from the first treatment can influence how the bacteria in the second infection respond to treatment with vancomycin.

The results showed that colistin enhance staphylococci bacteria’s tolerance to vancomycin to an extent that they are not killed by an otherwise lethal dose of the antibiotic.

By studying the bacteria’s genetics and appearance under a microscope, the scientists could see that colistin made the cell walls of the the bacteria more robust thus enabling them to resist vancomycin.

"It's entirely natural in the natural environment for bacteria to adapt to toxins in their surroundings by changing certain proteins in their cells. They do so without making any genetic changes. But in this case, the adaptations mean that the bacteria also become vancomycin-resistant, which is really bad when we are trying
to treat MRSA," says Ingmer.

**Could explain why treatment can fail**

Ingmer says the new study can help explain why some MRSA patients do not respond as expected to treatment with vancomycin. The experiments also showed that other combinations of antibiotics can give this kind of tolerance and that it is not just colistin's negative effect on vancomycin-tolerance that we have to worry about. According to Ingmer, the findings calls for new test methods to study whether bacteria are not just resistant but also tolerant.

"We need to develop new test methods which enable us to establish whether bacteria have undergone changes in their biochemistry in such a way that they don't respond to the drugs we use to treat them,” she says.

“If the tests show that the bacteria are tolerant to the bacterium, doctors will have to change the dose or the frequency of treatment," says Ingmer.

**May only be relevant in the lab**

Professor Frank Møller Aarestrup, director of research at DTU Food, says the results must first be demonstrated outside the laboratory before the clinical relevance of the results can be verified.

"It's immensely exciting that one antibiotic can cause tolerance of an entirely different antibiotic,” says Aarestrup.

“The next step must be to demonstrate whether it is relevant under natural conditions, for instance in the treatment of humans and the development of resistance, or if it is simply an interesting phenomenon in the lab," he says.

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Research shows that MRSA treatment can fail if a patient has received antibiotics prior to the treatment for MRSA. (Photo: <a href="http://www.shutterstock.com/cat.mhtml?lang=da&language=da&ref_site=photo&search_source=search_form&version=llv1&anyo=1&searchtermx=&photographer_name=&people_gender=&people_age=&people_ethnicity=&people_number=&color=&page=1&inline=128558189" target="_blank">Shutterstock</a>) [10]


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