Instituts thématiques

Inserm

Institut national
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Press release

Development of two tests for rapid diagnosis of resistance to antibiotics

Two new tests capable of rapidly diagnosing resistance to wide-spectrum antibiotics have just been developed by Inserm Unit 914 "Emerging resistances to antibiotics" (Bicêtre Hospital, Le Kremlin-Bicêtre) under the direction of Professor Patrice Nordmann. Thanks to these tests, it now takes only 2 hours to identify certain bacteria that are resistant to the most used and the most important antibiotics in hospitals. The main targeted bacteria are enterobacteriacae (such as E. Coli), that are responsible for infections. With their excellent sensitivity and specificity, the use of these extremely efficient tests on a world-wide scale would allow us to adapt antibiotic treatments to the individual's needs and to be more successful in controlling antibiotic resistance, particularly in hospitals. These works were published in September in two international reviews:
Emerging Infectious diseases **and** ***The Journal of Clinical Microbiology.***

These diagnostic tests will allow rapid identification of certain bacteria that are resistant to antibiotics and hence:

- Allow us to better adapt the treatment to the infected patients
- Avoid the inappropriate use of certain antibiotics, thus avoiding the over-use of certain wide-spectrum antibiotics
- Isolate patients infected with these resistant bacteria and thus avoid the development of epidemics in hospitals

There is an ever-increasing number of emerging bacteria that cause cross-border epidemics. Researchers all agree on the fact that it is not the number of bacteria that is the problem, but their increasing resistance to antibiotics. The situation is particularly dramatic for certain species of bacteria, Gram-negative bacilli such as enterobacteriacae[1].

A worrying situation both for banal infections and for major treatments.

Whereas certain antibiotics such as wide-spectrum cephalosporins used to be reserved for the most serious cases, now there are cases where they are totally inactive against certain bacterial germs and consequently there is no effective antibiotic treatment for these. And so we are now faced with situations where the treatment of banal infection such as urinary or intra-abdominal infections has no effect. And this puts the life of the patients at risk. Every year, an estimated 25,000 deaths in Europe are due to multi-resistance to antibiotics.

[1] Enterobaceriacae, including *E. coli,* usualy infest the human intestine. Given their proximity to the urinary and digestive tracts, urinary and digestive infections due to these germs are the most frequent.

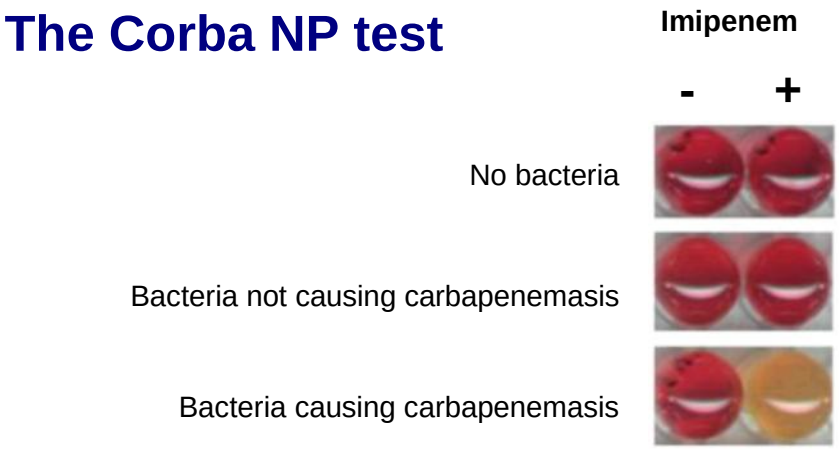
Furthermore, the development of resistance to antibiotics affects an entire aspect of modern medicine that needs efficient antibiotics (grafts, transplants, major surgery, reanimation, etc.).

Undetected importation of multiresistant strains from foreign countries can also considerably accelerate the diffusion of this multiresistance phenomenon.

Two ultra-rapid tests: from Red to Yellow

In an attempt to slow down these increasing resistances, the Inserm researchers have developed a system that can rapidly detect the two enzymes responsible for causing resistance to the bacteria of two classes of common antibiotics: wide-spectrum cephalosprins and carpabenems. In these tests, **the presence of an enzyme indicates the presence of a resistant bacteria.**

These tests (Corba NP test and ESBL NDP test) are based on the acidification properties generated by the activity of the enzymes (ß-lactamases and carbapenemases) when they are in the presence of an antibiotic. If any one of these enzymes is present, the medium becomes acid and the acidity indicator (pH) turns from red to yellow (Figure, Corba NP test).



Note: imipenem belongs to the carbapenemis family.

At present, these tests can be performed using bacteria isolated from urine samples taken during a detected infection, or from bacteria present in stools. The result is obtained in less than 2 hours (compared to 24 to 72 hours using current techniques). These tests are highly sensitive and highly reliable (100%). They are totally inoffensive since they are carried out on bacteria isolated from patients or on biological products such as urine, etc.

Patrice Nordmann, Inserm Research Director and main author of this work, points out that *"These tests are currently being assessed in order to ascertain their sensitivity directly from infected sites such as blood or urine".*

The invention of these tests is an important breakthrough in the fight against the resistance to antibiotics. These tests will provide a simple, inexpensive means of very rapidly detecting the most serious cases of resistance to antibiotics in human medicine and will contribute to limiting international diffusion.

As Patrice Normann states "We can hope, in particular in many Western countries where the situation has not yet reached endemic proportions multi-resistances (France, in particular), to be able to preserve to a certain extent the efficiency of wide-spectrum cephalosporins and carbapenems, antibiotics used as a "last resource".

Used straight at the patient's bedside, these tests will help us to optimise the use of antibiotic treatment, in particular in the developing countries where the levels of resistance are extremely high.

Two international patent applications have been filed with Insert Transfert.

For more information

Rapid detection of carbapenemase-producing Enterobacteriacae.

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Emerging Infectious diseases **http://dx.doi.org/10.3201/eid1809.120355 (September 2012)**

Rapid detection of extended-spectrum ß-lactamase producing Enterobacteriacae.
Nordmann P. Dortet L, Poirel L

Journal of Clinical Microbiology **http://dx.doi.org/10.1128/JCM.00859-12 (September 2012)**

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