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ASIA EDITION

New drug formulation for respiratory system infections

September 18, 2014 | News | By BioSpectrum Bureau



Singapore: A team from A*STAR's Institute of Chemical and Engineering Sciences (ICES) and National University Hospital (NUH) has discovered new ways to enhance the efficacy of drugs used to treat respiratory system infections and antibiotic-resistant superbugs.

A team of five researchers and clinicians in Singapore led by Dr Desmond Heng, ICES, has developed a new combination of drugs to effectively combat bacteria in the lungs which lead to common respiratory system infections, or bacteria-linked pulmonary diseases such as pneumonia, bronchiectasis and cystic fibrosis.

Respiratory system infections or bacteria-linked pulmonary diseases are often accompanied by excessive mucus secretion in the airways, which makes treating these diseases extremely challenging and drawn-out.

To tackle these challenges, the researchers pioneered one drug formulation comprising antibiotics and a muco-active agent to kill respiratory bacteria such as Pseudomonas aeruginosa more effectively. The treatment simultaneously clears mucus, disrupts bacterial cell-to-cell communication that is essential for bacteria growth, and directly kills the bacteria.

Tests show that this drug formulation destroyed the bacteria completely, and works twice as fast as today's top-of-the-line antibiotics. Besides halving recovery time, the increased efficacy also minimises the risk of encountering antibiotic resistance.

Antibiotic resistance is a challenge in the treatment of diseases today as bacteria continuously mutate and develop resistance against multiple drugs designed to kill them, turning them into superbugs.

To fight these superbugs, the research team has developed and patented three other drug formulations that are each made up of three different antibiotics. These antibiotics complement each other by fighting bacteria in different ways and they can potentially be used interchangeably to prevent bacteria from developing drug resistance.

The team's findings show that all three mixtures are effective against multi-drug resistant strains which include bacterial pathogens such as Pseudomonas aeruginosa and Klebsiella pneumoniae. These formulations kill more multi-drug resistant bacteria than a single drug, and are up to five times more effective than antibiotics used for treating respiratory system

infections today. This will allow doctors to prescribe smaller, more effective drug doses to treat patients.

In addition, the formulations can be inhaled by the patient directly, thereby allowing a higher concentration of medicine to reach the lungs compared to injections or orally-administered drugs.

Associate Professor Raymond Lin, Head and Senior Consultant, Division of Microbiology, Department of Laboratory Medicine at NUH, said, "Novel ways to deliver antibiotics to kill bacteria in the lungs and airways are important at a time when the population is aging and more people are expected to suffer from different kinds of respiratory infections in future. The global spread of antibiotic resistance in bacteria means that new solutions to tackling them are urgently needed, both to effect better cure and to prevent the rise of multi-drug resistance. The next crucial step will be to translate laboratory findings to clinical application."

Dr Desmond Heng, ICES Principal Investigator, added, "Making the formulation inhalable and portable not only delivers a higher concentration of the drug to the lungs but also gives the added potential to be an effective out-patient treatment alternative. Furthermore, if the disease is well-controlled in an outpatient setting with no further progression, costly hospitalisation could be avoided."