SUPER DRUG-RESISTANT GENE DISCOVERY RAISES NEW HEALTH ALARM
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HIR congratulates Associate Professor Dr. Chan Kok Gan and his research team for the discovery of the plasmid mediated colistin resistance gene (mcr-1), making Malaysia one of the first countries in which scientists found the mcr-1 gene. The study is part of the of UM 1,000 Genome Consortium Project on multidrug resistant bacteria. The paper entitled “Emergence of mcr-1-mediated colistin resistance in Escherichia coli in Malaysia” will appear in the Journal of Antimicrobial Agents. (DOI: http://dx.doi.org/10.1016/j.ijantimicag.2016.04.004).

Since the discovery and application of penicillin in 1940s, antibiotics have played unparalleled roles in the prevention, control, and treatment of infectious diseases for humans and animals. It is also proved that the use of antibiotics in animal feeds is an important way to enhance feed efficiency, to promote animal growth, and to improve the quality of the animal products. Therefore, antibiotics are effective tools for ensuring the development of intensive and large-scale farming industry. However, the unreasonable use of antibiotics has given rise to a fear of the development of resistant bacteria that may lead to the transfer of resistant bacteria and its resistant factors from animals to humans. At the Sixty-eight World Health Assembly in May 2015, the Assembly endorsed a global action plan to tackle antimicrobial resistance - including antibiotic resistance, the most urgent drug resistance trend.

Colistin resistance gene (mcr-1) was first discovered in a study conducted in China and five of the E. coli cultures from Malaysia were found to be positive by Dr Chan’s laboratory. Further screening was done on more than 900 bacterial isolates from human, animal and environmental sources collected from different states in Malaysia. Using in silico screening on isolates with draft genomes, and PCR screening, three additional E. coli isolates were found to have mcr-1 gene, one from a human clinical urine specimen and two from non-clinical isolates. All mcr-1 positive isolates were further confirmed by Sanger sequencing.

Clonal relationships for all of the isolates were analyzed by pulsed-field gel electrophoresis (PFGE), which showed the mcr-1-positive isolates to be non-clonal (<85% similarity) except for a few strains that were isolated from different organs of the same chicken. S1 nuclease–PFGE analysis further revealed the presence of multiple plasmids in all isolates. This correlated with the detection of different types of plasmid replicons in the draft genomes. Complete genome sequencing of these mcr-1-positive isolates is currently underway in order to elucidate the gene acquisition mechanisms. With the emergence of the mcr-1 gene, the Enterobacteriaceae could potentially act as a reservoir for colistin resistance that might lead to pandrug resistance among existing MDR bacterial pathogens whereby currently available antibiotics will be rendered ineffective.

An article by columnist Mr. Martin Khor, which appeared in The Star on 9 May 2016, compared the ease of mcr-1 spreading resistance to other species of bacteria through a process known as horizontal gene transfer, resembling a similar scare about the NDM-1, a gene with the ability to jump from one bacterium to other species, making them highly resistant to all known drugs except two, including colistin. He hypothesized that if mcr-1 and NDM-1 were to combine, then bacteria bearing these two genes will be resistant to virtually all drugs.

“We’re losing antibiotics of last resort. Like any other drugs, we have to use the antibiotics responsibly, be it in clinical or in veterinary and livestock industry. Since the publication of our findings, mcr-1 gene has been found in many other Asian and European countries. This is a frightening scenario and the whole world should sit up and take action to prevent the further abuse of antibiotics,” said Dr. Chan.