



BRIAN SIMPSON, D.M.D. AND BRIAN BOVINO, D.M.D.

DIPLOMATES OF THE AMERICAN BOARD OF ORAL & MAXILLOFACIAL SURGERY

113 NORTH MIDDLETOWN ROAD NANUET, NY 10954 (845) 623-3497 FAX (845) 623-4039 office@drbriansimpson.com

Antibiotic defences against serious diseases under threat, experts warn

The last line of antibiotic defence against some serious infections is under threat, say experts who have identified a gene that enables resistance to spread between bacteria in China. The gene, called *mcr-1*, allows a range of common bacteria, including *E coli*, to become resistant to the last fully functional class of antibiotics, the polymyxins. This gene, they say, is widespread in bugs called *Enterobacteriaceae* carried by both pigs and people in south China and is likely to spread worldwide. The gene is easily transferred from one strain of bacteria to another. *Enterobacteriaceae* are capable of causing a range of diseases, from pneumonia to serious blood infections. Some of the strains of *Enterobacteriaceae* with the gene have epidemic potential, say experts in the *Lancet Infectious Diseases* journal. "These are extremely worrying results," said Prof Jian-Hua Liu from South China Agricultural University in Guangzhou, author

of the report.

"Our results reveal the emergence of the first polymyxin resistance gene that is readily passed between common bacteria such as *Escherichia coli* and *Klebsiella pneumoniae*, suggesting that the progression from extensive drug resistance to pandrug resistance is inevitable." The polymyxins are an older class of antibiotic, discovered more than 60 years ago but relatively little used because of their toxicity. The spread of antibiotic-resistant bacteria led to renewed interest in them. Polymyxins B and E (known as colistin) are now the last resort for infections caused by multidrug-resistant gram-negative bacteria such as *E coli*.

Experts came across the gene that confers resistance to them by chance during routine testing of animals destined for the food market. Liu and colleagues isolated an

E coli strain (SHP45) from a pig on an intensive pig farm in Shanghai that showed resistance to colistin that could be transferred to another strain. The discovery led them to carry out more widespread testing. They collected bacteria samples from pigs at slaughter across four provinces, and from pork and chicken sold in 30 open markets and 27 supermarkets across Guangzhou between 2011 and 2014. They also analysed bacteria samples from patients with infections who were admitted to two hospitals in Guangdong and Zhejiang provinces. They found the gene in 166 out of 804 animals tested and in 78 of 523 raw meat samples. They also found it in 16 *E coli* and *K pneumoniae* samples taken from 1,322 patients.

The scientists believe the resistance to colistin began in animals. China is one of the world's largest users and producers of colistin for agriculture and veterinary use. Worldwide, the demand for colistin in agriculture

is expected to reach almost 12,000 tonnes a year by the end of 2015, rising to 16,500 tonnes by 2021.

The emergence of *mcr-1* heralds the breach of the last group of antibiotics," say the authors. China's agriculture ministry has already responded to the report by launching a risk assessment on the use of colistin in animal feed additives. But they warn that the gene is likely to spread worldwide. "There are many countries, including in Europe, that use polymyxins in agriculture, and therefore the responsibility to acknowledge and address the use of antibiotics across human and veterinary sectors must be also global," they write. David Paterson and Patrick Harris from the University of Queensland, Brisbane, Australia, writing a commentary in the journal, say the use of colistin in

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(Solensky R *Ann Allergy Asthma Immunol.* 2010;105(4):259-73)

agriculture must be limited or stopped altogether. "This will require substantial political will and we call upon Chinese leaders to act rapidly and decisively. Failure to do so will create a public health problem of major dimensions," they write. Prof Nigel Brown, president of the Microbiology Society, said the discovery that resistance to colistin could be

from one bacteria to another was alarming. "Although resistance to this important and widely used polymyxin group of antibiotics has previously been shown, it was generally caused by mutation in individual organisms," he said. "Now that it has been demonstrated that resistance can be transferred between bacteria and across bacterial species, another

line of defence against infection is in danger of being breached. We need careful surveillance to track the potential global spread of this resistance, and investment in research to discover new drugs with different modes of action."

Sarah Boseley. "Antibiotic Defences against Serious Diseases under Threat, Experts Warn." *The Guardian*. The Guardian, 18 Nov. 2015. Web. 7 Dec. 2015.

Dr. Brian Simpson

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