Antimicrobial resistance: moving forward to the past

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Mankind pinned its hopes on antibiotics in the war against infection. Since the introduction of penicillin in 1945, many other antibiotics have been introduced; unfortunately the subsequent development of bacterial resistance has threatened the contribution of antibiotics to disease control. Dr Margaret Chan, Director-General of the World Health Organization (WHO), said earlier this year[1]:

> *The world is on the brink of losing these miracle cures. In the absence of urgent corrective and protective actions, the world is heading towards a post-antibiotic era, in which many common infections will no longer have a cure.*

Antibiotics have contributed greatly to our ability to treat disease, however we risk losing these gains. While antibiotic resistance becomes increasingly widespread, the research development of new agents to combat evolving bacteria has slowed. It is not commercially viable to develop new drugs if there is a high probability of their becoming ineffective soon after introduction.

Globally emerging antibiotic-resistant bacteria such as methicillin-resistant *Staphylococcus aureus* (MRSA)[2] and extended spectrum beta-lactamase (ESBL)-producing *Escherichia coli*[3] present increasing challenges to community transmission of infection. Recently, New Delhi metallo-beta-lactamase-1 (NDM-1) was identified;[4] this enzyme makes bacteria resistant to most beta-lactam antibiotics which are used to treat antibiotic-resistant bacterial infections.

Causes of resistance

Microbes that cause infectious diseases are complex, dynamic and evolving. They reproduce rapidly, mutate frequently, exchange genetic material freely and adapt to new environments. These processes are further promoted by inappropriate prescription practices and poor drug access control.

Possible solutions in Australia

The NPS (formerly the National Prescribing Service) develops educational material for both practitioners and consumers to influence the culture surrounding antibiotic prescription and use. The NPS has identified specific conditions, such as upper respiratory tract infections, for which antibiotic prescribing may not always comply with best practice guidance (see www.nps.org.au). The Australian Group on Antimicrobial Resistance (AGAR), a collaboration between clinicians and microbiology laboratories, conducts ongoing surveillance to monitor resistance development in pathogens. These data are used to inform clinical processes, policy and research in preventing bacterial resistance.

Future action to reduce resistance includes improving prescription and consumption practices by implementing guidelines on appropriate antibiotic use and education; enhanced surveillance to monitor resistance; developing new vaccines and new antibiotics; and researching other potential treatment modalities such as bacteriophage therapy.[5]

It is apparent that action is needed to prevent a post antibiotic future similar to the pre antibiotic past.

References

1. Dr Margaret Chan. 6 April 2011 World Health Day. Available at: http://www.who.int/dg/speeches/2011/WHD_20110407/en/ (Cited 12 October 2011).
2. Nathwani D, Morgan M, Masterton RG, Dryden M, Cookson BD, French G et al. British Society for Antimicrobial Chemotherapy Working Party on Community-onset MRSA Infections. Guidelines for UK practice for the diagnosis and management of methicillin-resistant *Staphylococcus aureus* (MRSA) infections presenting in the community. *J Antimicrob Chemother* 2008; 61: 976–94. doi:10.1093/jac/dkn096
3. Denholm JT, Huysmans M, Spelman D. Community acquisition of ESBL-producing *Escherichia coli*: a growing concern. *Med J Aust* 2009; 190: 45–6.
4. Kumarasamy KK, Toleman MA, Walsh TR, Bagaria J, Butt F, Balakrishnan R et al. Emergence of a new antibiotic resistance mechanism in India, Pakistan, and the UK: a molecular, biological, and epidemiological study. *Lancet Infect Dis* 2010; 10(9): 597–602. doi:10.1016/S1473-3099(10)70143-2
5. Chhibber S, Kaur S, Kumari S. Therapeutic potential of bacteriophage in treating Klebsiella pneumoniae B5055-mediated lobar pneumonia in mice. *J Med Microbiol* 2008; 57(Pt 12): 1508–13. doi:10.1099/jmm.0.2008/002873-0