

The war on bacteria

The emergence of the NDM-1 enzyme is yet another reminder of the growing resistance of bacteria and pathogens to antibiotics, as Derek Butler, Chair of MRSA Action UK, highlights...

Now that the UK has a new Coalition Government, we are hearing much about the need to reduce the public borrowing requirement and balance the books in the long term in the interests of the nation and its people.

Since this government was formed, we have seen improvements in the way that healthcare-associated infections are reported. These include changes from trust level to hospital level, and the decision to release data weekly rather than monthly. Equally important is the news that other pathogens are to be recorded, such as MSSA and *E. coli*. This is a significant step in the right direction, although MRSA Action UK believes it is a step too small, and that more pathogens should be included.

Events during the last few months have shown that if we continue to treat bacteria and pathogens with contempt, we do so at our peril. Once again they have shown that they have the ability to develop a new and sophisticated method of evolving.

‘MRSA Action UK shares the view of leading microbiologists and believes the new government needs to extend further the monitoring and recording of bacteria...’

The emergence of the New Delhi metallo- β -lactamase (NDM-1) gene will, I believe, force a change of approach on how to tackle bacteria in the future. What must be considered is that NDM-1 is not a new superbug, but rather an enzyme produced by certain bacteria that attaches itself to the plasmids in bacteria. Plasmids are DNA molecules that can carry genes that provide resistance to antibiotics. They provide a mechanism for horizontal gene transfer within a population of microbes usually of the same negative or positive family. However there is no reason to suppose that they cannot transfer this resistance to bacteria from different non-related microbiological families. This development of the NDM-1 enzyme allows the bacteria carrying it to neutralise the harmful effects of carbapenems (one of the most powerful

types of antibiotics available to doctors), rendering the antibiotic ineffective.

The NDM-1 gene or enzyme has been discovered in two bacteria – *Escherichia coli* and *Klebsiella pneumoniae*. These are two Gram-negative bacteria, and while there are currently a few antimicrobials being developed to tackle Gram-positive bacteria, the same cannot be said, worryingly, for Gram-negative strains.

We are told that the answer is better hygiene in hospitals to control the bacteria carrying NDM-1. However as these bacteria are being brought into the country, they will have been in the community for some considerable time before they appear on the radar – hence it is just as important to monitor healthcare-associated infections and causative pathogens in the community as in hospitals.

Genetic fingerprinting of bacteria helps to track individual strains and can also be used to flag and identify subtle changes to the DNA profile of the bacteria, as has been discovered with NDM-1.

E. coli in the US food industry provides a good example. This type of bacteria lives in the intestines of humans and



It is just as important to monitor healthcare-associated infections in the community as in hospitals

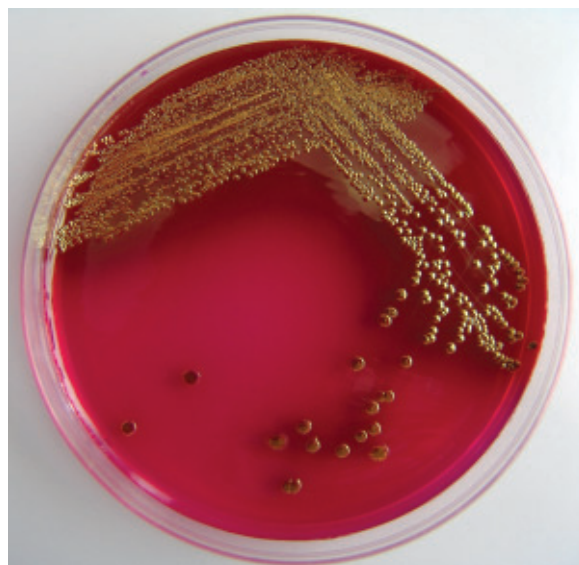
animals alike and in most cases is generally harmless. There are however a few strains that are quite dangerous, such as O157:H7. This produces a powerful toxin that can cause severe illness and even death. It has been shown that with the use of DNA fingerprinting, this particularly harmful strain can be identified easily if it is present in food. After a major outbreak in the US in 1993, the Centers for Disease Control and Prevention (CDC) created PulseNet, a national network of laboratories that performs DNA fingerprinting on food-borne bacteria. PulseNet has been instrumental in stopping outbreaks by quickly identifying the strain in contaminated food after comparing it against known patterns.

It is our belief that the problem of antibiotic resistance needs to be looked at from a different perspective, and whilst still trying to develop newer and more effective antibiotics. It is time to look at alternatives such as vaccines, phage therapy, and to consider genetically re-engineering older antibiotics to counteract microbial resistance, while using technologies and resources to track emerging threats as they evolve, and develop solutions. The one approach that we must improve and maintain is the prevention of healthcare-associated infections, as this does not cost money – in fact it saves money and prevents antibiotic resistance from occurring, preserving our stocks of antibiotics and giving the pharmaceutical industry the time to develop newer and better treatments.

‘...it is just as important to monitor healthcare-associated infections and causative pathogens in the community as in hospitals.’

There has to be far more research into how the bacteria function and their ability to outsmart the best we can develop against them. The irony is that a small- to medium-sized pharmaceutical company probably spends more on research on bacteria than the government gives in grant aid to all of the microbiology research laboratories in the UK combined. There is an urgent need to make this research global because of emerging threats such as NDM-1, which has the potential to spread across the globe just as MRSA did 40 years ago, only this time with greater consequences for public health if the resistant gene easily transfers from one bacterium to another.

At present, there are just 50 cases of this enzyme-affecting bacteria in this country – we still have the chance to keep the situation under control. MRSA Action UK shares the view of leading microbiologists and believes the new government needs to extend further the monitoring and recording of bacteria, as recommended by both the National Audit Office and Public Accounts Committee last



E.coli is one strain of bacteria found to contain the NDM-1 enzyme

year. There is also the need to extend the screening for these potentially lethal pathogens both in hospitals and in the community, especially in care homes, GP practices and primary care.

Burying our heads in the sand will only create massive problems for future generations. Humankind has been in an arms race against bacteria since the development of penicillin. Ignoring this new development could leave the bacteria winning this war. We are doing battle with a formidable opponent – they are adapting, and changing to the environment we create for them. We have to change that environment so that we retain control.

This will not happen until governments face up to the task that is being set by these bacteria, and control more stringently the availability of antimicrobials. Governments around the world need to work in collaboration with each other and with the pharmaceutical industry to find new and better ways to combat the threat from these bacteria.

Alexander Fleming warned 70 years ago of the consequences of misusing antibiotics, and in that time the human race has failed to act on his lesson. The consequence is the development of NDM-1.



Derek Butler
Chair
MRSA Action UK
Tel: +44 (0)7762 741114
derek.butler@mrsaactionuk.net
www.mrsaactionuk.net

