Scottish Executive Health Department Chief Scientist Office

FOCUS ON RESEARCH

THE EFFECT OF BIOCIDE USAGE ON CLINICAL MRSA

Researchers
Professor S.G.B. Amyes, Dr Leila Vali, Sarah Davies

Aim

The aims of the proposed project were to identify how chlorhexidine, one of the currently used antiseptics, may cause reduced sensitivity or resistance in clinical Methicillin Resistant *Staphlococcus aureus* (MRSA) and to identify the interaction between developing resistance to disinfectants and antibiotics used in hospital environments, especially in areas of high risk such as intensive care units.

Project Outline/Methodology

We still know little about how resistance to antibiotics or disinfectants actually develops, where resistance enters the clinical population or what really drives the spread of resistant bacteria through the hospital population. One of the resistance mechanisms to antiseptic and disinfectant compounds in *Staphylococcus aureus* is achieved by the presence of a pump at the surface of the cell that exports the chemical out of the cells faster that it can enter it. The genes that encode this pump are often closely located to the genes that confer resistance to antibiotics.

Key Results

Our results showed that exposure to surface dried chlorhexidine (a disinfectant) residues in the hospital environment may be linked to increased resistance to antibiotics in antibiotic-susceptible *Staphylococcus aureus*, even leading to the emergence of MRSA. It may be that the long period of surface drying of chlorhexidine leads to reduced effectiveness of the disinfectant, thus allowing the bacteria to persist for long periods of time. Our findings suggest that the acquistion of resistance genes to disinfectants is not specific to any individual *Staphylococcus aureus* strains but may occur in any MRSA strain.

Conclusions

The reduced effectiveness of chlorhexidine on dried MRSA residues and of chlorhexidine residues upon MRSA suspensions highlights the importance of good cleaning practices and management, and proper use of disinfectants in the hospital environment. The use of low concentrations and allowing chlorhexidine residues or bacterial residues to remain on surfaces, may lead to the persistence of bacteria and the selection of variants that are able not only to resist disinfectants but also to resist commonly used antibiotics.

What does this study add to the field?

Although there is a significant body of knowledge about antibiotic resistance, there has been far less information on the direct causes of resistance and there has been very little study of the contribution of disinfectant use to the emergence and spread of antibiotic resistance. It is important to determine the susceptibility of clinical MRSA to various biocides to assess whether the control and preventive measures currently implemented in hospitals are appropriate and whether they may trigger the selection of resistance. This project has addressed this issue.

Implications for Practice or Policy

The project has also highlighted the potential dangers of testing disinfectants with standard laboratory bacteria for quality control after manufacturing, as these bacteria have consistently been found to be more susceptible than the bacteria present in the clinical setting. This means that although the disinfectants or antiseptics may appear effective when initially tested, in fact they may perform less well in the clinical setting with the bacteria currently found in hospitalised patients.

Where to next?

We would like to extend our findings and focus on the other important hospital opportunistic pathogens. It is highly possible that the use of incorrect dosage or the residue on surfaces may contribute to their spread and persistence in hospitals.

Further details from:

Professor S.G.B. Amyes, Centre for Infectious Diseases, The University of Edinburgh,
The Chancellor's Building, Edinburgh
EH16 4SB