Methicillin resistance, biofilm formation and resistance to benzalkonium chloride in *Staphylococcus aureus* clinical isolates

Carla Raggi, Marco Pataracchia, Monica Monaco, Annalisa Pantosti, Roberta Creti, Lucilla Baldassarri

Dipartimento di Malattie Infettive, Parassitarie ed Immunomediate, Istituto Superiore di Sanità – Rome (Italy)

**Background.** The widespread use of disinfectants in hospital setting may lead to emergence of resistant important nosocomial pathogens such as *S. aureus*. Genetic determinants may be responsible only in part for such resistance and mode of growth/metabolic state may also play a role.

**Aim.** To examine the resistance to benzalkonium chloride (BKC) and the distribution of biocide-resistance genes in *S. aureus* clinical isolates and to determine any correlation with antibiotic resistance pattern and biofilm formation.

**Methods.** MIC/MBC to BKC were determined in a collection of *S. aureus* both in suspension and on biofilm-embedded cells. Characteristic of the isolates (*qac* genes and biofilm formation) were determined by PCR and a plate assay, respectively.

**Findings.** MICs to BKC were higher among MRSA than MSSA, where the CA-MRSA showed MIC levels closer to the MSSA group. However, fold change (MBC/MIC) indicated MSSA as more tolerant to disinfection procedures. *qacA/B* genes were found only among HA-MRSA and conferred higher resistance to the disinfectant while *smr* gene did not. MBC, but not MIC, were higher for biofilm embedded vs. planktonic cells, but no correlation was found with the ability to form biofilm.

**Conclusion.** We confirmed that presence of *qacA/B*, unlike *smr*, confers higher resistance to BKC. Fold-change values indicated MSSA as more tolerant to biocide in both planktonic and biofilm form, suggesting the existence of additional, as yet unidentified, mechanisms of resistance. Although no correlation could be observed between biofilm thickness and biocide resistance, biofilm-embedded cells responded differently to disinfectants underlining how the current practices for efficacy testing of biocides may not provide sufficient information for the evaluation of disinfectant efficacy against biofilm-embedded microorganisms.