'Search-and-destroy' strategy versus standard precautions for control of methicillin-resistant Staphylococcus aureus (MRSA) in nursing homes (NH): a randomized controlled study

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Objectives: Prevalence of MRSA carriage increased from 4.5% in 2003 to 12% in 2008 among NH residents in Canton Vaud, Switzerland. As MRSA control strategy has not been clearly defined in this setting, the aim of our study was to compare the one-year impact of standard precautions either alone (control) or with universal screening followed by decolonization of carriers (intervention) on the prevalence of MRSA carriage at NH level.

Methods: All 157 NH of canton Vaud were invited to participate to this randomized controlled study. In all participating NH, Standard Precautions were enforced and residents underwent MRSA screening at study entry and 12 months thereafter, except if they had documented ongoing MRSA infection or bacteriuria, or stage IV skin ulcers. In the intervention group, residents admitted during the 12 study months were also screened, and all MRSA carriers underwent a 5-day topical decolonization (nasal mupirocine and chlorhexidine disinfection of skin and pharynx) combined with environmental disinfection. Decolonization was repeated once in case of failure.

Results: 104/157 NH (67%) were included and randomly allocated to control (51%) or intervention (49%). Characteristics of NH (size, proportion of single rooms, healthcare workers/resident ratio), and of residents (age, gender, diabetes, ulcers, medicals devices, performance score, previous admission in acute care hospital, previous antibiotic therapy) were similar in both groups. A total of 6,036 residents were screened at baseline, which represented 86% (range: 27-100%) of the NH population in the control group and 87% (20-100%) in the intervention group. 60% of carriers in the intervention group were successfully decolonized, and 47% remained negative at study end. Mean MRSA prevalence at baseline was 8.9% in both groups (range 0-44%). After 12 months, it significantly declines to 6.6% in the control group and to 5.8% in the intervention group (difference: -0.8%, p=0.3). The impact of the intervention did not reach significance in multivariate analysis, even if restricted to NH with screening rates > 95% (-2.5%, p=0.33).

Conclusion: Topical MRSA decolonization was successful in 60% of NH residents. Nevertheless, universal screening followed by decolonization of carriers had no significant additional impact in reducing prevalence of MRSA carriage rate at one year compared to Standards Precautions alone.
Chlorhexidine as a Driver of Antimicrobial Resistance

Discussion:

“....The clinical implications of this are that antibiotic resistance does not necessarily encode biocide resistance; in contrast, reduced susceptibility to biocide is more likely to encode for antibiotic resistance. There was a low efficacy of chlorhexidine against either standard strains or clinical isolates after 2 h of bacterial drying time. The efficacy was much increased against the standard strains after 24 h of bacterial drying time and increased to a lesser extent against the clinical isolates. It should be noted that drying has an effect on bacterial cell counts even without the presence of chlorhexidine, and attempts were made to take this into account. The effectiveness of chlorhexidine residues upon bacterial suspensions decreased with longer drying times. However, even after 48 h, the residues still exerted an effect on most isolates. Because this effect was minimal, it therefore may act as a selective pressure and allow the less susceptible strains to persist in the clinical environment by incomplete eradication. Such a situation may occur in the hospital environment where exposure to low or residual concentrations of biocides may persist on surfaces leading to reduced efficacy. Although biocides when used at concentrations instructed by the manufacturers are bactericidal, concentrations that might remain on surfaces after cleaning might provide a selective pressure on microorganisms. In theory, sublethal concentrations of biocide for any given cellular target may occur at some point along this concentration gradient, providing a selective pressure for mutations in a range of cellular targets. The varying effect of chlorhexidine upon clinical isolates, as observed in both the surface disinfectant and biocide residue tests, is of importance as it may mean that certain isolates will have an ability to survive chlorhexidine treatment and that the use of biocides could act as a selective pressure to allow these isolates to predominate. The increases in the MICs of all tested antibiotics for the susceptible control S. aureus strain following exposure to surface dried chlorhexidine residues is of interest as it suggests that the use of chlorhexidine in the hospital environment may be linked to increased resistance to antibiotics in previously susceptible strains. The exposure to subinhibitory doses of biocides selects for up-regulation of efflux pumps capable of transporting these compounds as well as some antibiotics out of the cell and contributes to reduced biocide susceptibility. It may be that the long period of surface drying of chlorhexidine leads to reduced efficacy of the biocide, thus allowing the persistence of isolates when the biocide is left as a residue. Biocides are critical components of intervention strategies used in clinical medicine for preventing the dissemination of nosocomial infections. Reduced susceptibility to biocides and the threat this represents is a serious concern. It is important to determine the susceptibility of clinical MRSA to various biocides to assess the control and preventive measures currently implemented in hospitals”.

Reference:

Frequency of biocide resistance genes, antibiotic resistance and the effect of chlorhexidine exposure on clinical methicillin-resistant Staphylococcus aureus isolates
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