

Cross – resistance between antiseptic agents and antimicrobial agents

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Introduction

Antimicrobial resistance is evolving into a huge public health challenge. The increasing burden of infectious diseases necessitated the increased use of antibiotics which in turn contributed to the growing burden of antimicrobial resistance.¹ The global report on antimicrobial surveillance by WHO in 2014 identified major gaps in the knowledge along with paucity of evidence for quantification of the burden of antimicrobial resistance accurately.² It highlighted the complex interaction between antimicrobial resistance and various environmental and human health factors. One of these factors is interaction between the use of antiseptics and antibiotics. One of the results of such interaction is the development of resistance to antibiotic agents.

Commonly, antiseptic agents are used as preventive agents while antimicrobial agents are used for therapeutic purposes. Cross-resistance of antiseptic agents and antimicrobial agents is not thoroughly studied. Theoretically, it is possible since antiseptic agents sometimes act at the same receptors or pathways as the antimicrobial agents to curtail the infections. Due to this, exposure to antiseptic agents can trigger mutations in the receptors or the pathways which can result in the development of antimicrobial resistance. The term “cross-resistance” in the field of antimicrobial resistance is poorly defined. Many authors use the term “cross-resistance” to indicate the development of resistance to different classes of antimicrobials such as β -lactams, aminoglycosides, polymyxins etc.³⁻⁵ It is often used in the same context as multi-drug resistance. For this paper, cross-resistance specifically refers to the development of resistance to both antiseptic agents and antimicrobial agents. Very few studies are available on the cross-resistance between antiseptic agents and antimicrobial agents. Wand et al found that invitro exposure of *Klebsiella pneumoniae* cultures to chlorhexidine resulted in the development of colistin resistance.⁶ They detected specific mutations in the *PhoP/Q* following the exposure to chlorhexidine that resulted in the development of resistance to both chlorhexidine and colistin.

Several studies investigated the development of resistance to various antimicrobials following exposure to triclosan. Cary et al.,⁷ found that chronic exposure to triclosan is associated with increased resistance to various antibiotics such as rifampicin, ciprofloxacin, gentamycin etc. Werckenthin⁴ studied the resistance genes to various antimicrobial chemicals which include antiseptics and antibiotics in indoor dust microbiome.⁸ They found that there is significant correlation between antimicrobial resistance genes such as β -lactamases, aminoglycoside acetyl transferases and antiseptic resistance genes for several antibiotics like triclosan, triclocarban and butylparaben. Another significant point to consider is the environmental contamination with antiseptics. Studies report that antiseptics such as chlorhexidine and benzalkonium chloride are frequently detected in the sewage sludge

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Lavanya Gudapuri

Division of Clinical Microbiology, Rush University Medical Center, USA

Correspondence: Lavanya Gudapuri, Division of Clinical Microbiology, Rush University Medical Center, 100 S Buffalo Grove Road Apt 113, USA, Tel 2243180076, Email lavanya.gudapuri@gmail.com

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and wastewater at high levels (up to 19 μ g/ml).⁹ The global market for antiseptics and disinfectants accounted for USD 5.55 billion in 2015 and estimated to reach USD 8.1 billion by 2021.¹⁰ This shows the increase in the use of antiseptics worldwide which ultimately end up in the sewage and waste water contaminating the environment. Presence of high level antiseptics can trigger mutations in the bacteria facilitating the development of multidrug resistant strains.

Gradea et al. studied the effect of exposure to quaternary ammonium compounds (commonly used antiseptic agents) on several strains of bacteria.¹¹ They reported that 88% of the isolates developed decreased susceptibility to other antiseptic agents such as chlorhexidine, triclosan, hexachlorophene etc. They also found resistance to ampicillin, sulfamethoxazole, cefotaxime etc. in the same isolates. However, further research is needed to determine if there is an association between the presence of antiseptic agents and development of antimicrobial resistance. Since the is predicted increase in the antiseptic usage in the recent future, the implications of such usage should be identified. Measures to curtail any health challenges posed by the increased usage of the antiseptics should be designed. A step towards such progress would be the ban of triclosan by the FDA.¹² The FDA banned the use of triclosan in the US stating that it could cause health risks such as antimicrobial resistance. While banning of antiseptics would be hazardous, regulating the antiseptic consumption can be an achievable goal considering the environmental contamination by the antiseptics.

Conclusion

Further evidence is needed to support the theory of cross-resistance between the antiseptics and antimicrobials. The interaction between the development of resistance and exposure to antiseptic agents should be evaluated in depth for any contributing factors. Such knowledge will help in designing public health interventions that are effective in preventing future challenges of cross resistance.

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Conflict of interest

Author declares that there is no conflict of interest.

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