Effect of chlorhexidine upon bacterial isolates from colonized intravenous catheters from companion animals

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Bacterial colonization of intravenous catheters may cause nosocomial infections and septicaemia in critical and hospitalized patients. These bacteria may produce biofilms, a known virulence factor involved in microbial evasion to the action of antimicrobial and disinfectant compounds. This situation represents the ultimate example where “prevention is better than cure”. The aim of this study was to compare chlorhexidine to other commonly used disinfectants (alcohol and iodopovidone) in terms of their ability to inhibit in vitro growth of bacteria isolated from intravenous catheters, relating these data with the isolates’ biofilm forming ability.

The study population comprised a group of 40 animals (28 dogs and 12 cats) hospitalized in the teaching hospital of the Faculty of Veterinary Medicine, Technical University of Lisbon, Portugal. Venopunction sites were disinfected with 4% chlorhexidine and allowed to dry for 10 minutes; all animals under study had been subjected to peripheral intravenous catheterization for a minimum of 6 hours. Catheters’ tips were processed immediately after aseptic removal, using standard microbiological techniques for aerobic bacteria identification. Bacteria susceptibility to the different disinfectants tested was assessed by a modified agar diffusion protocol, using chlorhexidine (4% and 2% v/v), iodopovidone (10% and 5% v/v) and alcohol (70% and 90% v/v). Biofilm formation ability was evaluated using a Fluorescent In Situ Hybridization (FISH) protocol.

It was possible to isolate bacteria from 9 catheters (22%), 2 of which bore a mixed population of 2 isolates and the remaining 7 yielded just one bacterial species. Staphylococcus was the most frequently isolated species. Bacterial susceptibility to chlorhexidine was higher than to iodopovidone and alcohol, regardless of the concentrations tested, for all isolates. Eight isolates (73%) produced biofilm in a time dependent kinetic: 2 isolates were able to produce biofilm at 24h, 6 at 48h and 8 at 72h.

Prevention of intravenous catheter colonization, particularly due to biofilm producing bacteria, is of major importance in critical patients. Our results show a higher antimicrobial susceptibility to chlorhexidine than the other disinfectants used in this trial, both in isolates with and without the ability of in vitro expressing biofilm. Further studies are required, performed with a higher number of bacterial isolates and evaluating the influence of time of disinfectant exposure upon its performance.

Keywords: biofilms; companion animals; catheters; chlorhexidine

Effect of essential oils on the planktonic of S. aureus and E. coli cells

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The essential oils of aromatic plants and their components have a wide range of applications in ethno-medicine, preservation, food flavoring and fragrances and in the perfume industries. Some essential oils derived from plants have revealed promising antimicrobial activity against a wide range of bacteria, including antibiotic resistant species.

The aim of this study was to examine the antimicrobial effect of essential oils of Cinnamomum zeylanicum and Cymbopogon martini against planktonic Staphylococcus aureus and Escherichia coli growth.

The antimicrobial activity of the essential oils was checked by bacterial growth, at 37 °C and 120 rpm, in the presence of increasing concentrations of each essential oil for 24 h. Essential oils were dissolved in DMSO (2.0 %) and saline water (0.85 %) with tween 80 (0.5 %) in order to obtain final concentrations of 0.06 %, 0.09 % and 0.12%, for E. coli, and 0.09 %, 0.12 %, 0.36 % and 0.48 %, for S. aureus. Bacterial planktonic growth over time was followed by the quantification of the number of viable through cultivation of aliquots in TSA.

Data showed that E. coli was more sensitive to the action of both essential oils, since complete planktonic growth inhibition was attained with a concentration of 0.09 % of the essential oil of C. zeylanicum and 0.06 % of the essential oil of C. martini. Conversely, S. aureus was less sensitive to the antimicrobial action of the essential oils. C. zeylanicum essential oil inhibited S. aureus growth only at concentrations of 0.36 % and 0.48 %, after 4 and 2 hours of growth. However, unexpectedly after 24 hours those S. aureus cells recovered gradually their planktonic growth.

The data pointed out that it is crucial to check the bacterial behavior in the presence of antimicrobial products in different concentrations and over time due to the possible development of bacterial tolerance towards the mechanisms of action of those products. In fact, antimicrobials may have a positive effect in the early hours of application, as demonstrated by some results of this experiment. However, for longer times, the inhibitory effect of antimicrobials can be reverted by bacteria making ineffective their use as disinfectants in food industries. Additionally, the continuous exposure of bacteria to antimicrobials can influence the process of microbial resistance development and increase. These preliminary results demonstrated the possibility of using essential oils of C. zeylanicum and C. martini against two bacteria that are responsible for foodborne illnesses at low concentrations but only for slightly prolonged periods of exposure.

Keywords: natural antimicrobial agents, planktonic growth, S.aureus, E.coli, essential oils