ANTIBACTERIAL ACTIVITY OF CEROUS NITRATE

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Cerous nitrate ($Ce(NO_3)_3$) has been included in cream formulations to combat wound infections in severely burned patients (Monafo, Tandon, Ayvazian, Tuchschmidt, Skinner and Deitz 1976). Information of the in vitro antibacterial activity of this chemical, however, is very limited. Therefore investigations were undertaken to evaluate the in vitro antibacterial activity of $Ce(NO_3)_3$ including the effect of temperature, pH and the presence of other chemicals on that activity.

Staphylococcus aureus NCTC 6571, Escherichia coli NCTC 8196 and Pseudomonas aeruginosa NCTC 6750 were the test organisms and an overdried agar plate viable counting technique was used to determine the number of organisms surviving and thus the number of organisms killed by a given treatment. Various media were investigated for their ability to recover the $Ce(NO_3)_3$ treated cells. Oxoid Nutrient Agar was found to give the highest recovery and so was used for the surface counts throughout the investigation.

Using 0.1% $Ce(NO_3)_3$ the initial rate of kill for E. coli was greater than 5 log. cycles in 30 min and for P. aeruginosa almost 4 log. cycles in 60 min but for S. aureus only 1 log. cycle in 60 min. Higher concentrations of $Ce(NO_3)_3$ showed little or no increase in effect. 240 min contact between 0.1% $Ce(NO_3)_3$ and P. aeruginosa took the kill through 5 log. cycles. The count for S. aureus remained constant during 60 to 360 min contact with 0.1% $Ce(NO_3)_3$.

The activity of 0.05% $Ce(NO_3)_3$ against all three organisms was assessed at 10°C, 20°C and 30°C. The rate of kill increased only slightly with each 10° rise in temperature and for S. aureus, which showed the greatest temperature effect, the kill after 300 min was only 55%, 86% and 99.7% respectively.

Altering the pH of the reaction indicated that the activity of $Ce(NO_3)_3$ is slightly greater at pH 3.4 or pH 7.6 than at pH 5.6.

The possibility of increasing the activity of $Ce(NO_3)_3$ against S. aureus is of particular interest as the inherent activity of $Ce(NO_3)_3$ against this organism is slight and much less than its activity against the Gram negative organisms. Of many chemicals tested silver sulphadiazine and the surface active agent Triton X45 both showed synergism with $Ce(NO_3)_3$ against S. aureus. However, chlorhexidine gluconate in combination with $Ce(NO_3)_3$ had its activity against S. aureus reduced.

Neither disodium edetate nor phenylethanol in combination with $Ce(NO_3)_3$ showed increased activity against any of the three test organisms. This indicates that the $Ce(NO_3)_3$ readily penetrates the Gram negative cells to reach its site(s) of action and/or is active on the external layer of the cell.

$Ce(NO_3)_3$ does not itself cause cell lysis or facilitate the lysis of the Gram negative cells by lysozyme. It therefore appears that the action of $Ce(NO_3)_3$ is at an internal cell site or sites.

Monafo, W.W., Tandon, S.N., Ayvazian, V.H., Tuchshmidt, J., Skinner, A.M. and Deitz, F. (1976) Surgery, 80, 465