Inhibitory Effect of Zinc Sulfate on Clinical Isolates of *Pseudomonas aeruginosa* and *Acinetobacter baumannii*

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Abstract

This objective of the study was to determine the inhibitory effect of zinc sulfate against the clinical isolates *of Pseudomonas aeruginosa* and *Acinetobacter baumannii*. The inhibitory effect of zinc sulfate was determined against the 120 clinical isolates (60 isolates of *P. aeruginosa* and 60 isolates *of A. baumannii*) by agar dilution method. The findings indicate that zinc has an inhibitory effect on the clinical isolates of *P. aeruginosa* and *A. baumannii* at a concentration ranging from 0.25to 1mg/ml of zinc sulfate by agar dilution method.

Keywords: Acinetobacter baumannii, inhibitory effect, Pseudomonas aeruginosa, zinc sulfate

Introduction

Zinc, an essential trace element with an estimated total body content of 2–3g, has a proven role in many physiologic enzymatic and structural functions. It is also used as an adjunct in the treatment of diarrheal diseases in the form of supplemental systemic oral administration.[1]Studies have shown the antibacterial action of zinc ions *in vitro* against Gram-positive and Gram-negative bacteria.[2,3] Nosocomial infections are one of the important complications of hospitalization,leading to increased morbidity and mortality, with *Pseudomonas aeruginosa* and *Acinetobacter baumannii* being the most common nosocomial pathogens. The present study was undertaken to determine the inhibitory effect of zinc sulfate on the clinical isolates of *P. aeruginosa* and *A. baumannii*.

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A laboratory-based cross-sectional study was carried out in the Department of Microbiology at Pondicherry Institute of Medical Sciences from May to June 2018. A total of 120 clinical isolates (60 clinical isolates of *P. aeruginosa* and 60 clinical isolates of *A. baumannii*) from exudates, respiratory specimens, urine, and tissues from infected wounds were included in the study. The clinical specimens received in the Department of Microbiology were processed, and the organisms isolated were identified according to the standard guidelines.[4] The minimum inhibitory effect of zinc sulfate was determined against the clinical isolates of *P. aeruginosa* and *A. baumannii* by agar dilution method[5] [Figures 1 and 2]. Zinc sulfate ($ZnSO_4.H_2O$) manufactured by Sigma Aldrich (99.9 trace metal basis purity) was used in the study. The minimum inhibitory concentration of active zinc in $ZnSO_4.H_2O$ ranging from 0.03 to 1mg/ml was tested based on the results of the previous study.[3] ATCC*P. aeruginosa* was included as a control strain. The inhibition concentration was recorded as the lowest concentration of zinc sulfate that completely inhibited growth, disregarding single colony or faint haze caused by the inoculum. All the 120 clinical isolates (60 *P. aeruginosa* and 60 *A. baumannii*) were inhibited at a concentration ranging from 0.25 to 1mg/ml of zinc sulfate [Table 1]. In a study conducted by Faiz*etal*., they found that the enteric bacterial pathogens were inhibited at a concentration of 0.06 to 0.5 mg/ml.[3] In our study, the inhibitory concentration wasslightly higher; this could be because of the multidrug-

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Table 1: Number of Isolates inhibited by different concentrations of zinc sulfate (mg/ml)

Isolates	Number of isolates inhibited by various concentrations of $ZnSO_4.H_2O$ (mg/ml)						Total
	0.03	0.06	0.125	0.25	0.5	1.0	
Pseudomonas aeruginosa	0	0	0	1	6	60	60
Acinetobacter baumannii	0	0	0	0	52	60	60

$ZnSO_4.H_2O$: Zinc sulfate

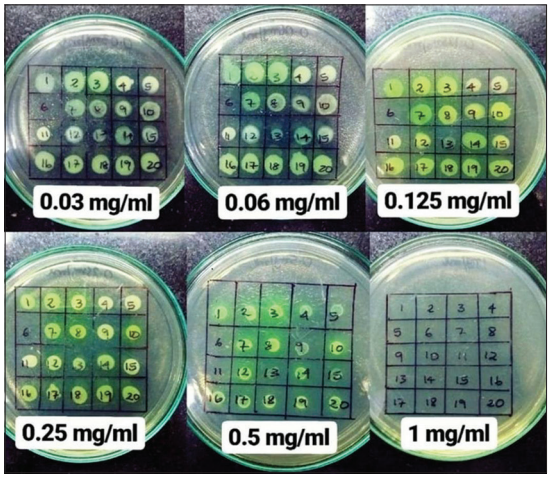

Figure 1: Minimum inhibitory concentration of zinc among clinical isolates of *Pseudomonas aeruginosa*

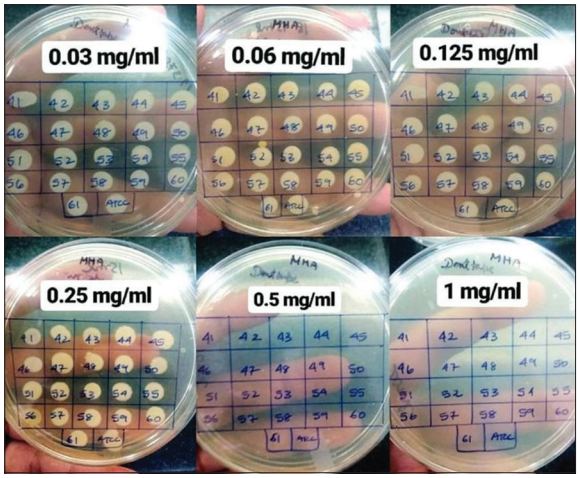

Figure 2: Minimum inhibitory concentration of zinc among clinical isolates of *Acinetobacter baumannii*

resistant clinical isolates of *P. aeruginosa* and *A. baumannii*. We also found that the clinical isolates of *A. baumannii* were all inhibited at 0.5 mg/ml of zinc sulfate when compared to clinical isolates *P. aeruginosa* which were inhibited at 1 mg/ml.

Nosocomial infections caused by multidrug-resistant Gram-negative organisms, especially *A. baumannii* and *P. aeruginosa*, are becoming difficult to treat and have led to longer hospital stay, higher medical costs, and increased mortality. The search for alternate agents having antimicrobial agents is on,and the results of the present study revealed the antibacterial effect of zinc against the bacterial pathogens *P. aeruginosa* and *A. baumannii*.

Conclusion

Use of zinc as an additional agent or addition of zinc to antibiotic formulations could help in controlling infections caused by these organisms.

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Conflicts of interest

There are no conflicts of interest.

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