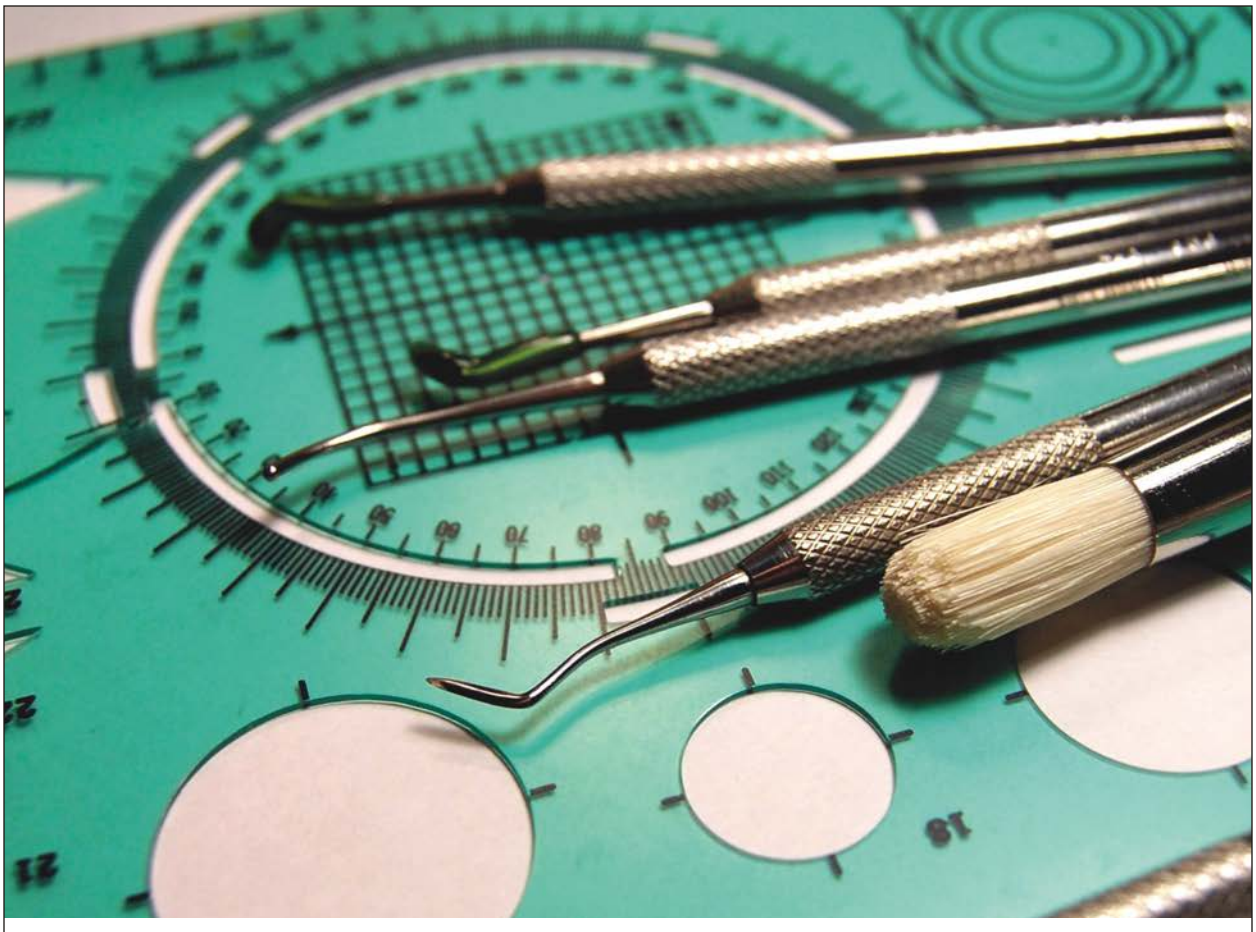

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Antimicrobial Activity of Savlon®, Izal® and Z-germicide® Against Clinical Isolates of *Pseudomonas aeruginosa* from Hospital Wards

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ABSTRACT

The antimicrobial activities of Savlon®, Izal® and Z-Germicide® disinfectants against 23 clinical isolates of *Pseudomonas aeruginosa* were evaluated. The agar well diffusion technique and broth dilution technique for determining Minimum Inhibitory Concentration (MIC μg mL^{-1}) were employed. The overall result of the study showed that Savlon® and Izal® have appreciable antimicrobial activity against the *P. aeruginosa* isolates, while Z-Germicide® produced low activity. The use of Savlon® and Izal® disinfectants in hospitals and clinics in Nigeria, is hereby suggested.

Key words: Disinfectants, microorganisms, nosocomial, infection, resistance, opportunistic

INTRODUCTION

Pseudomonas aeruginosa is an opportunistic pathogen that is known to cause infection particularly in immuno-compromised hosts and is responsible for some hospital acquired infection (Lyesak *et al*., 2000). It is a gram-negative bacterium that causes infections that are very difficult to treat because of its virulence, intrinsic and acquired antibiotic resistant nature (Zavaseki *et al*., 2005). This organism is also very resistant to cleaning and hygiene products used in hospital community such as disinfectants, preservatives and antiseptics (White and McDermott, 2001). Disinfectants such as sodium hypochlorite, phenols, quaternary ammonium compounds and chlorhexidene are cationic surfactants that are widely used for the control of bacterial growth in clinical and industrial environment (MacBain *et al*., 2004). The constant use of these products have led to resistance development among some nosocomial microorganism and a cross resistance to antibiotics (Chuanchuen *et al*., 2001).

Laboratory-based studies have shown that bacteria with low susceptibility to some disinfectants/antiseptics can confer cross-resistance to antibiotics (Cohen, 1992) and this can lead to a very serious public health problem. The aim of this study was to evaluate the susceptibility of clinical isolates of *P. aeruginosa* to some disinfectants commonly used in health care settings in Nigeria.

MATERIALS AND METHODS

Bacteria isolates: Twenty three clinical isolates of *Pseudomonas aeruginosa* were obtained from hospital wards environment of Bishop Shanahan Hospital Nsukka (intensive care unit (9), laboratory (6), pediatrics(5) and washing sink (3)) between November 2002-Feburary 2003. The isolates were identified and characterized using standard techniques (Cheesbrough, 2002).

Disinfectant preparation: Fifty fold and two fold dilutions of the test disinfectants were prepared by diluting 1 mL of disinfectant with appropriate quantity of sterile distilled water.

Susceptibility testing: Several plates of Mueller hinton agar plates were prepared using manufacturers specification by dissolving 38 g of Mueller hinton agar in 1000 mL of water in a 1,500 mL conical flask, 20 mL each of the dissolved Mueller Hinton agar was poured into bijou bottles and was autoclaved at 121°C for 15 min. This was allowed to cool to a temperature of 45°C and the test organisms were aseptically inoculated into the Petri dishes together with the MHA. They were allowed for 1 h to solidify and also for the test organism to pre-diffuse. A sterile cork borer was aseptically used to bore 8 mm hole on the agar plates and each of the prepared disinfectant was used to fill up these holes. They were then allowed for 30 min to pre-diffuse before incubating at 37°C for 18-24 h. The radial zones of inhibition were subsequently recorded.

Determination of MIC: The agar dilutions method was employed. A 19 mL of Mueller Hinton agar plate was seeded together with 1 mL each of the five different two folds serial dilutions of each disinfectant. These were dispensed into Petri dishes and allowed for 45 min to solidify and for the test disinfectant to pre-diffuse into the agar plates. A 0.5 McFarland equivalent standard of each of test organisms were used to streak on the surface of each of the petri dish that was seeded with different concentrations of the test disinfectants. The set-up was incubated at 37°C for 18-24 h. They were later observed for growth. The Petri dish with the lowest concentration of the test disinfectant that inhibit the growth of any of the test organisms were taken as the Minimum Inhibitory Concentration (MIC).

RESULTS AND DISCUSION

Resistance of microorganisms to disinfectants within the hospital, Industry and other community settings is an emerging public health concern. The result of the present study showed that 39.1% of the clinical isolates of *Pseudomonas aeruginosa* were resistant to Savlon®, 34.7% to Izal® and 91.3% to Z-Germicide®, respectively (Table 1). The emergence of bacteria resistance to disinfectants, antiseptics and other antimicrobial agents could be attributed to the empirical use adopted in many hospital routines (over-use and under-use) that probably induces selective pressure (Russel, 2004). Some disinfectants/antiseptics are reported to share the same mechanism of action with some antibiotics and this can cause resistance to disinfectants used in cleaning our environments (Heath *et al.*, 2001). Based on this, it is obvious that resistance of organisms to disinfectants especially in the hospital setting could be antibiotic resistance-related as a result of cross-resistance. Earlier studies have suggested a potential molecular link between reduced susceptibility to some disinfectants/antiseptics and antibiotic resistance (Akimitsu *et al.*, 1999; Heir *et al.*, 2004).

Pseudomonas aeruginosa is known to be one of the organisms that are implicated in nosocomial infection outbreaks in our hospitals especially in intensive care units and its susceptibility is known to be limited to only a few antimicrobial agents. The Minimum Inhibitory Concentrations (MIC) recorded in the present study further indicated that the test isolates screened were most resistant to Z-Germicide® (Table 2). Consequently, the high rate of decreased susceptibility to Z-Germicide® is worrisome considering the fact that Z-Germicide® is among the first line disinfectants commonly used in our target hospital in this study.

In conclusion, the reduced susceptibility of *P. aeruginosa* isolates to disinfectants in this study is probably as a result of indiscriminate and constant use and misuse of a particular disinfectant

Table 1: Mean inhibition zone diameter, izad (mm) produced by the disinfectants against *P. aeruginosa* isolates

S. No.	Savlon®	Izal®	Z-germicide®
1	17.0±1.41	15.0±1.140	8.0±0.00
2	27.0±1.14	21.5±2.120	8.0±0.00
3	15.0±1.41	19.0±1.410	8.0±0.00
4	18.0±1.42	28.0±2.830	12.0±0.00
5	22.5±0.17	15.5±0.170	8.0±0.00
6	13.0±1.41	14.0±0.000	8.0±0.00
7	13.5±0.71	12.0±0.000	8.0±0.00
8	20.5±3.54	20.0±0.000	8.0±0.00
9	28.5±0.71	18.0±1.410	12.0±1.41
10	14.0±1.41	8.00±0.00	8.0±0.00
11	25.0±7.07	17.0±2.830	14.0±1.41
12	21.5±0.71	20.0±0.000	11.5±4.95
13	12.5±0.71	22.0±0.000	11.0±4.24
14	22.0±2.83	21.5±2.120	15.5±6.36
15	15.5±10.6	23.5±21.90	11.5±4.95
16	19.0±4.24	13.0±9.900	11.0±4.24
17	25.0±7.07	20.0±0.000	15.0±1.41
18	8.00±0.00	8.00±0.00	8.0±0.00
19	9.00±1.41	10.5±3.540	8.0±0.00
20	14.5±2.12	13.0±0.000	8.0±0.00
21	19.5±0.71	23.0±4.340	12.5±3.54
22	8.00±0.00	8.00±0.00	9.5±0.71
23	25.0±0.00	20.0±0.000	8.0±0.00

Table 2: Minimum inhibitory concentration (mic μg mL^{-1}) produced by the disinfectants against *P. aeruginosa* isolates

S. No.	Savlon®	Izal®	Z-germicide®
1	1.98340	2.4946	11.9670
2	2.24810	12.7858	12.7858
3	8.54870	2.1414	12.7858
4	2.07780	3.8098	13.8524
5	4.00590	1.0116	11.7791
6	4.22180	2.3627	10.6769
7	1.23720	2.2803	11.8662
8	8.90064	9.3504	9.8841
9	5.73320	1.1143	8.7687
10	1.26210	6.3504	8.7467
11	2.40820	5.8871	12.6127
12	1.26560	2.1321	12.6032
13	2.00540	3.7975	12.8946
14	4.27090	6.9823	4.3621
15	1.20420	2.9208	7.4340
16	1.22610	5.4601	7.6710
17	1.22720	2.8920	7.4319
18	1.04210	1.3074	4.6244
19	3.04090	3.3468	6.2158
20	8.83890	9.1664	3.1426
21	1.48630	1.4652	9.2773
22	3.88150	8.1184	5.2747
23	1.02350	1.9925	4.2766

for a long period of time. Therefore, this study emphasizes the need for hospitals and clinics to adhere strictly to standard disinfectant policy, which gives a guide for proper use of disinfectants/antiseptics. Therefore, the correct use of Izal® and Savlon® as first line disinfectants for effective decontamination of hospital environments, particularly in present study hospital, is recommended.

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