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Sensitivity of MRSA & MSSA to Different Antiseptics & Disinfectants

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Abstract: *It has been a common practice to use various antiseptics, disinfectants and sterilizing agents in clinical and household practices. Antiseptic draping and dressings are prerequisites before every surgical procedure barring a very selected few. However the important question is what is the sensitivity of one of the most common pathogen staphylococcus aureus to the commonly used antiseptics. Fact observed is that most bacteria and specially MRSA and MSSA are commonly insensitive to usual concentrations of household and clinical antiseptics. Improved hand hygiene practices and use of antiseptics in adequate concentration will help in further arrest of staphylococcus infections.*

Keywords: *Antiseptics, Disinfectants, MRSA, MSSA, Sensitivity*

I. Introduction

Disinfectants are chemical agents which may kill vegetative bacteria,fungi,viruses & occasionally spores by the destruction of proteins, lipids or nucleic acids in the cell or its cytoplasmic membrane. Disinfection does not necessarily kill all microorganisms but reduces them to a level acceptable for a defined purpose. Disinfectants are used to decontaminate surfaces that have been in contact with body fluids,tissues or mucosa,pathological specimens or microbiological cultures.They may be used for medical devices where sterility is not required i.e. when there is no risk of implanting spores onto sterile tissues.[1]

In a study it was confirmed the high degree of effectiveness of PVP-I solution (10%) and cream (5%), compared to chlorhexidine, against MRSA in vitro.[2]

MCLURE had the same results on 33 clinical isolates of MRSA, against which chlorhexidine never achieved a total kill, and only killed three out of 33 strains (9% success), while PVP-I achieved full efficacyagainst all of them (100% success) .[3]

In a study it was found that various commonly used antiseptics were tested against three strains of methicillin-resistant Staphylococcus aureus (MRSA) at stock strength and in serial 10-fold dilutions. The stock solutions of 4% chlorhexidine gluconate-alcohol ,1% p-chloro-m-xylenol and 3% hexachlorophene produced 2-log reductions of MRSA after a 15-s exposure, but even after 240 s, these solutions failed to kill all the MRSA. Povidone-iodine (Betadine) solution was maximally effective at the 1:100 dilution, killing all the MRSA within 15 s; other dilutions were less effective, though each killed the MRSA within 120 s. Similar results were obtained with three different strains of methicillin-susceptible S. aureus. Thus, of the four most commonly used antiseptics, povidone-iodine, when diluted 1:100, was the most rapidly bactericidal against both MRSA and methicillin-susceptible S. aureus.[4]

In a study using a modified version of the phenol coefficient method as part of an effort to investigate the antiseptic resistance of S. aureus showed that Chlorhexidine digluconate killed an antiseptic-sensitive strain within 1.5 min at 22 degrees C at a standard concentration (0.1%), whereas resistant strains still survived after 1.5 min. Povidone-iodine killed the sensitive strain within 1.5 min at a concentration of 0.1%, whereas it took this agent 3.0 and 4.5 min to kill low- and high-level resistant strains, respectively, at a concentration of 0.8%.[5]

The present study is done To find out and compare recent sensitivity pattern to different antiseptics and disinfectant of Staphylococcus Aureus and Effectivity of common disinfectants in controlling Methicillin Resistant Staphylococcus Aureus and Methicillin Sensitive Staphylococcus Aureus.

II. Materials And Methods

Sample Design-Patients(swabs and urine sample) selected from different indoor wards of a tertiary medical college and Hospital Swabs from fomites(blood pressure cuff, floor,tray, door handle,gowns of patients and doctors, stethoscopes) , from indoor and outdoor wards of a tertiary medical college

Sample size- urine and different swabs from 200 patients, swabs from 100 fomites. Total 300 samples.

Study Period- March 2010 to February 2011

Disinfectants like Betadine, Chlorhexidine, Phenol, Hypochlorite, Dettol were prepared in dilutions like 1:10, 1:20,1:30, 1:40,1:50 & 1:100.

1. With a sterile pipette, transfer 1 ml of the prepared disinfectant into 9ml sterile nutrient broth.
2. Also mix 1ml of fresh disinfectant with 9ml of E.coli culture.
3. Inoculate this mixture onto 10 different areas of two well dried nutrient agar plates each.
4. Incubate one plate for 3days at 37^0C & the other for 7days at room temperature.
5. Examine the plates to see on how many areas growth have appeared.

Quality Control: Fresh disinfectant should be sterile & should kill a test inoculum of E.coli within 10mins.

III. Results & Discussion

Table 1 and 2shows that all MRSA isolates were sensitive to hypochlorite(1%), Dettol(1:30), Chlorhexidine & Lysol. 71.21% isolates showed no growth in betadine but 28.79% had growth in betadine of dilution 1:100.54.54% isolates were resistant to phenol in 1:110 dilution & 45.46 % in 1:105 dilution which is cooroborating with the study of Payne D.N. et al which showed out of four antiseptic agents (Dettol, Dettol Hospital Concentrate, Savlon and Betadine) which were applied at recommended use dilutions and at a half and a quarter of those concentrations, all but Betadine were effective against the antibiotic resistant bacteria at a half and a quarter of normal concentration. The iodine containing antiseptic, however, failed the test against MRSA at a half normal concentration and showed virtually no activity against MRSA at a quarter normal concentration.[6]

All MSSA isolates were sensitive to Chlorhexidine, Hypochlorite, Dettol, Lysol and 84.75% isolates showed no growth in betadine but 15.25% had growth in betadine of dilution 1:100. 67.8% MSSA isolates are resistant to phenol in 1:110 & 32.2% in 1:105 dilution.

In case of Betadine, Pearson Chi-Square-4.26, P value-0.039

So there is a significant difference in sensitivity to antiseptic & disinfectants between MRSA & MSSA.This study reveals that Betadine is better suited for MSSA than MRSA.

TABLES & FIGURES

Table 1: Sensitivity pattern of MRSA(n=66) in different antiseptics & disinfectants

Disinfectants & antiseptics	Sensitivity	No.of isolates	Percentage
Povidone-iodine	Growth in 1:100	19	28.79
	No Growth	47	71.21
Chlorhexidine	No Growth	66	100
Phenol	Growth in 1:105	30	45.46
	Growth in 1:110	36	54.54
Hypochlorite (1%)	No Growth	66	100
Chloroxylenol (1:30)	No Growth	66	100
Lysol	No Growth	66	100

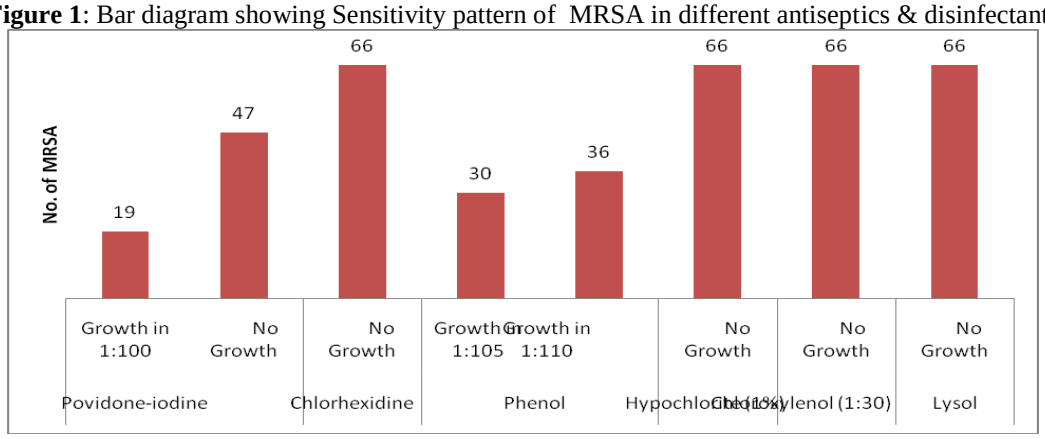
Table 1 shows that all isolates were sensitive to hypochlorite, chloroxylenol, chlorhexidine & Lysol and 47(71.21%) isolates to povidine-iodine. 40(60.61%) isolates were resistant to phenol in 1/110 concentration.

Table 2: Sensitivity pattern of MSSA (n=59) to different antiseptics & disinfectants

Disinfectants & antiseptics	Sensitivity	No.of isolates	Percentage
Povidone-iodine	Growth in 1:100	9	15.25
	No Growth	50	84.75
Chlorhexidine	No Growth	59	100
Phenol	Growth in 1:105	19	32.2
	Growth in 1:110	40	67.8
Hypochlorite 1%	No Growth	59	100
Chloroxylenol (1:30)	No Growth	59	100
Lysol	NG	59	100

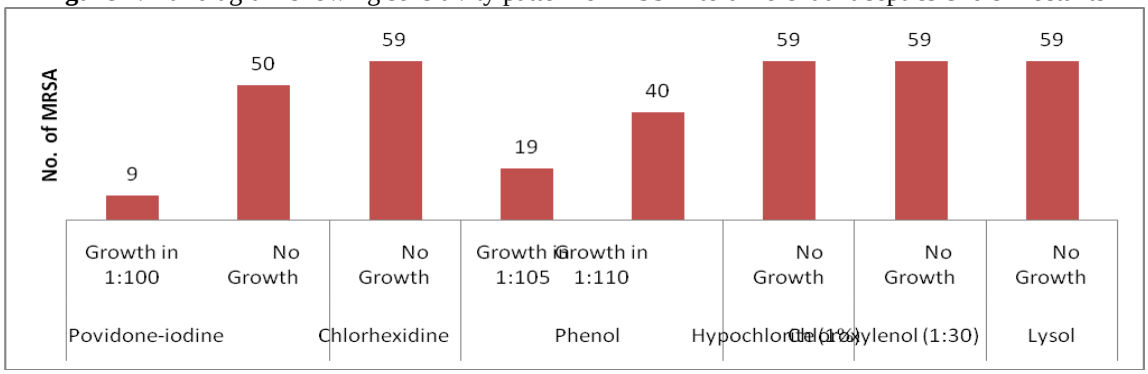
Table 2 shows all MSSA isolates were sensitive to Chlorhexidine,Hypochlorite, chloroxylenol,Lysol and 50(84.75%) isolates to Povidone-iodine. 40(67.8%) MSSA isolates are resistant to phenol in 1/110 concentration

Figure 1: Bar diagram showing Sensitivity pattern of MRSA in different antiseptics & disinfectants



Bar diagram shows all isolates were sensitive to hypochlorite, dettol, chlorhexidine & Lysol and 47 isolates to betadine. 36 isolates were resistant to phenol in 1/110 concentration.

Figure 2: Bar diagram showing sensitivity pattern of MSSA to different antiseptics & disinfectants



Bar diagram showing all MSSA isolates were sensitive to Chlorhexidine, Hypochlorite, Dettol, Lysol and 50 isolates to betadine.40 MSSA isolates were resistant to phenol in 1/110 concentration.

IV. Conclusion

In the present study, terminal cleaning that complied with current NHS guidelines were ineffective in eliminating MRSA: 74% of environmental swabs yielded MRSA before cleaning and 66% after.

Gram-positive organisms show less resistance to the action of biocides, as evidenced by the environmental strain of MRSA and the ATCC strain of S. aureus tested in this study. These gram-positive bacteria showed in vitro inhibition by chlorhexidine at low levels (0.00195%). However, other studies have suggested that chlorhexidine, in actual use, might not always be sufficient to eradicate MRSA from the hands of healthcare workers.[7]

It was found in the study done on the effect of different of antiseptics and disinfectants on growth of MRSA & MSSA that all isolates were sensitive to hypochlorite, dettol, chlorhexidine & Lysol but there is growth in betadine in 1:100 dilution and phenol in 1:105 and 1:110 dilution. So in this study it is found that Betadine which is used for hand and different surgical site scrubbing is diluted before use and it is ineffective in killing MRSA in 1:100 dilution which will have a great contribution to the transmission of MRSA in the hospital settings.

Transmission within health-care facilities has been checked with hand-hygiene and improved cleaning strategies, measures that have helped to reduce the number of infections and deaths. However, reduction in health-care asssociated MRSA has been paralleled by an increased incidence in community-acquired disease particularly associated with transmission in residential homes, prisons, and schools due to injudicious use of antiseptics particularly of betadine and phenol in low and inappropriate concentrations.

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