

3M™ Skin and Nasal Antiseptic (Povidone-Iodine Solution 5% w/w [0.5% available iodine] USP) Patient Preoperative Skin Preparation and 3M™ DuraPrep™ Surgical Solution (Iodine Povacrylex [0.7% available iodine] and Isopropyl Alcohol, 74% w/w) Patient Preoperative Skin Preparation Bactericidal Activity Against Methicillin-Resistant *Staphylococcus aureus*

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Abstract

Objective: We assessed the *in vitro* activity of 3M™ Skin and Nasal Antiseptic (Povidone-Iodine Solution 5% w/w [0.5% available iodine] USP) Patient Preoperative Skin Preparation against 24 vancomycin-intermediate methicillin-resistant *Staphylococcus aureus* (MRSA) isolates and 20 mupirocin non-susceptible MRSA isolates. We further studied 3M™ DuraPrep™ Surgical Solution (Iodine Povacrylex [0.7% available iodine] and Isopropyl Alcohol, 74% w/w) Patient Preoperative Skin Preparation against the same 24 vancomycin-intermediate MRSA isolates.

Methods: Minimum bactericidal concentrations (MBC) were determined using a microdilution method, modified from the Clinical and Laboratory Standards Institute (M26-A,1999). Previously tested *S. aureus* ATCC isolates 29213 (vancomycin-, methicillin-, and mupirocin-susceptible) and 43300 (methicillin-resistant, vancomycin-and mupirocin-susceptible) were included as controls. Bacteria were diluted to 10⁴ cfu in wells containing 0.06 to 64 µg/ml of 3M Skin and Nasal Antiseptic (0.5% available iodine) or 0.06 to 16 µg/ml of 3M DuraPrep Surgical Solution (0.7% available iodine). After 30 min at 37°C, 5 µl from each well was transferred to a microtiter plate containing cation-adjusted Mueller Hinton Broth. At 24 h, the well with the lowest concentration of antiseptic remaining clear was recorded as the MBC. Results are based on the amount of available iodine in the product required to kill the bacteria. The MBC range, MBC required to kill 50% of organisms (MBC₅₀), and MBC required to kill 90% of organisms (MBC₉₀) were calculated.

Results: The 20 mupirocin non-susceptible MRSA isolates tested against the 3M Skin and Nasal Antiseptic had a MBC range of ≤0.06 to 0.25 µg/ml, and both MBC₅₀ and MBC₉₀ values of 0.25 µg/ml. The control MBCs were 0.25 and 0.125 µg/ml for ATCC 29213 and 43300, respectively. The 24 vancomycin-intermediate MRSA isolates tested against the 3M Skin and Nasal Antiseptic had a MBC range of ≤0.06 to 0.25 µg/ml, and MBC₅₀ and MBC₉₀ values ≤0.06 and 0.25 µg/ml, respectively. The control MBCs were ≤0.06 and 0.125 µg/ml for ATCC 29213 and 43300, respectively. The vancomycin-intermediate MRSA isolates tested against 3M DuraPrep Surgical Solution had a MBC range of 1-4 µg/ml and MBC₅₀ and MBC₉₀ values of 2 µg/ml. The control MBCs were both 2 µg/ml.

Conclusions*: 3M Skin and Nasal Antiseptic had bactericidal activity against vancomycin-intermediate and mupirocin non-susceptible MRSA isolates, and 3M DuraPrep Surgical Solution had bactericidal activity against vancomycin-intermediate MRSA isolates, similar to that found for control isolates.

References

- Clinical and Laboratory Standards Institute: Methods for determining bactericidal activity of antimicrobial agents; Approved guideline. CLSI document M26-A. 1999, 19: 18. Clinical and Laboratory Standards Institute. Wayne, PA.
- Clinical and Laboratory Standards Institute: Methods for dilution antimicrobial susceptibility tests for bacteria that grow aerobically; Approved Standard-Ninth Edition CLSI document M07-A9. 2012, 32: 2. Clinical and Laboratory Standards Institute. Wayne, PA.
- Clinical and Laboratory Standards Institute: Performance standards for antimicrobial susceptibility testing; Twenty-Second Informational Supplement M100-S23. 2013, Clinical and Laboratory Standards Institute. Wayne, PA.

Introduction

With the emergence of drug-resistant pathogens, additional susceptibility testing is needed for antiseptic skin preps. We hypothesized that mupirocin non-susceptible and vancomycin-intermediate MRSA would be susceptible to 3M Nasal and Skin Antiseptic. We also hypothesized that the same vancomycin-intermediate MRSA isolates would be susceptible to 3M DuraPrep Surgical Solution.

Methods

- 20 mupirocin non-susceptible MRSA isolates (Mayo Clinic and NARSA)
- 24 vancomycin-intermediate MRSA isolates (Mayo Clinic and NARSA)
- ATCC 29213 vancomycin-, methicillin-, mupirocin-susceptible *S. aureus* isolate
- ATCC 43300 vancomycin-, mupirocin-susceptible MRSA isolate
- Modified broth microdilution susceptibilities, adapted from the Clinical Laboratory Standards Institute guidelines [1-3]
- 96-well round bottom microtiter plate
- 3M Skin and Nasal Antiseptic (5350 µg/ml available iodine) was diluted in water for irrigation (wfi) to test concentrations 64 to 0.06 µg/ml
- 3M DuraPrep Surgical Solution (6020 µg/ml available iodine) was diluted in isopropyl alcohol, then wfi to test concentrations 16 to 0.03 µg/ml of available iodine
- A control for each isolate contained wfi with no antiseptic
- ~10⁶ cfu/ml bacteria were inoculated into Butterfield's phosphate buffered water and 100 µl was added to each well
- Microtiter plates were incubated stationary for 30 minutes at 37°C
- 5 µl from each well was transferred to a new microtiter plate containing 200 µl of CaMHB
- CaMHB microtiter plates were incubated stationary for 24 hours at 37°C
- The lowest concentration well that remained clear was the minimum bacterial concentration (MBC)
- Results were based on the amount of available iodine in the products and reported as MBC range, MBC required to kill 50% of organisms (MBC₅₀), and MBC required to kill 90% of organisms (MBC₉₀)

- 20 mupirocin non-susceptible MRSA isolates tested with the 3M Skin and Nasal Antiseptic had a MBC range of ≤0.06 to 0.25; the MBC₅₀ and MBC₉₀ were both 0.25 µg/ml of available iodine (Table 1)
- 24 vancomycin-intermediate MRSA isolates tested with the 3M Skin and Nasal Antiseptic had a MBC range of ≤0.06 to 0.25; the MBC₅₀ and MBC₉₀ were ≤0.06 and 0.25 µg/ml, respectively (Table 2)
- 24 vancomycin-intermediate MRSA isolates tested using 3M DuraPrep Surgical Solution had a MBC range of 1-4 µg/ml; the MBC₅₀ and MBC₉₀ were 2 µg/ml (Table 2)



3M™ DuraPrep™ Surgical Solution (Iodine Povacrylex [0.7% available iodine] and Isopropyl Alcohol, 74% w/w) Patient Preoperative Skin Preparation



3M™ Skin and Nasal Antiseptic (Povidone-Iodine Solution 5% w/w [0.5% available iodine] USP) Patient Preoperative Skin Preparation

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Results

Table 1. Mupirocin non-susceptible MRSA minimum bactericidal concentration (MBC) of 3M Skin and Nasal Antiseptic

Isolate	3M Skin and Nasal Antiseptic MBC (µg/ml)
IDRL 9680	≤0.06
IDRL 9681	0.125
IDRL 9682	0.25
IDRL 9683	0.25
IDRL 9684	0.25
IDRL 9685	0.25
IDRL 9686	0.25
IDRL 9687	0.25
IDRL 9688	0.125
IDRL 9689	0.25
IDRL 9690	0.25
IDRL 9691	0.25
IDRL 6092	0.25
IDRL 6117	0.25
IDRL 5964	0.125
IDRL 6169	0.125
IDRL 9665	0.125
IDRL 9667	0.125
IDRL 9671	0.25
NRS107	0.125
ATCC 43300	0.25
ATCC 29213	0.125
n=20	
Range ≤0.06-0.25	
MBC ₅₀ 0.25	
MBC ₉₀ 0.25	

Table 2. Vancomycin-intermediate MRSA minimum bactericidal concentration (MBC) of 3M Skin and Nasal Antiseptic and 3M DuraPrep Surgical Solution

Isolate	3M Skin and Nasal Antiseptic MBC (µg/ml)	3M DuraPrep Surgical Solution MBC (µg/ml)
IDRL 5976	0.25	2
IDRL 5977	0.25	2
IDRL 6373	0.25	2
IDRL 6707	0.25	2
IDRL 8686	0.25	2
IDRL 8768	0.25	1
IDRL 9006	0.25	4
IDRL 9007	0.25	4
IDRL 9008	0.125	2
IDRL 9010	0.125	2
IDRL 9011	≤0.06	2
IDRL 9692	≤0.06	2
IDRL 9705	≤0.06	1
IDRL 9706	≤0.06	2
IDRL 9707	0.125	2
IDRL 9708	≤0.06	2
IDRL 9709	≤0.06	1
IDRL 8609	≤0.06	1
NRS1	≤0.06	1
NRS56	≤0.06	1
NRS403	≤0.06	1
NRS404	≤0.06	1
NRS 402	≤0.06	1
NRS118	≤0.06	1
ATCC 43300	≤0.06	2
ATCC 29213	0.125	2
n=24		n=24
Range ≤0.06-0.25		Range 1-4
MBC ₅₀ ≤0.06		MBC ₅₀ 2
MBC ₉₀ 0.25		MBC ₉₀ 2

Conclusions*

- 3M Skin and Nasal Antiseptic is effective in killing mupirocin non-susceptible MRSA and vancomycin-intermediate MRSA
- 3M DuraPrep Surgical Solution is effective in killing vancomycin-intermediate MRSA

*The clinical relevance of *in vitro* data is unknown.

