563. Association Between Chlorhexidine Gluconate Concentrations and Resistant Bacterial Bioburden on Skin

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Session: 62. HAI: MRSA Prevention
Thursday, October 3, 2019: 12:15 PM

Background. Little research exists to guide optimal Chlorhexidine gluconate (CHG) bathing practices. We examined the association between CHG concentrations and methicillin-resistant *Staphylococcus aureus* (MRSA), carbapenem-resistant *Enterobacteriaceae* (CRE), and vancomycin-resistant *Enterococcus* (VRE) on the skin. Also, we studied whether bioburden is affected by bathing method (2% CHG cloth vs. 4% liquid CHG soap) and time since last CHG bath.

Methods. Patients with MRSA, CRE and VRE at 4 US hospitals were enrolled. Skin swabs (arm, chest) were collected to quantify bioburden and CHG concentrations. Information on bathing method and time since last CHG bath was collected. χ^2 test, Spearman's correlation, and linear regression were performed.

Results. 253 patients were enrolled. On arm skin, MRSA was detected in 17 (19%), CRE on 16 (12%), and VRE on 12 (21%) patients. Detectable CHG levels were observed in 82 (93%) MRSA, 81 (79%) CRE, and 44 (79%) VRE patients. A negative correlation was observed between bioburden and CHG concentration for MRSA ($r_s = -0.11$, $P = 0.28$) and CRE ($r_s = -0.02$, $P = 0.82$) while a positive correlation was observed for VRE ($r_s = 0.15$, $P = 0.28$). On chest skin, MRSA was detected in 25 (28%), CRE on 18 (12%), and VRE on 7 (13%) patients. Detectable CHG levels were observed in 83 (95.4%) MRSA, 78 (72%) CRE, and 43 (77%) VRE patients. MRSA bioburden was negatively correlated with CHG concentration ($r_s = -0.16$, $P = 0.12$), while a positive correlation was noted for CRE ($r_s = 0.18$, $P = 0.06$) and VRE ($r_s = 0.24$, $P = 0.06$). There was no significant difference in bacterial bioburden between CHG concentrations (>20 ppm vs. ≤20 ppm) at both skin sites (Table 1). The bioburden did not differ by method of CHG bath. The mean estimates of bacterial bioburden on both skin sites did not show a significant decrease with increase in CHG concentrations and were not affected by time since last bath (Table 2).

Conclusion. Detection of MRSA, CRE and VRE was infrequent irrespective of CHG bathing method and time since last bath. We found inconsistent associations between increasing CHG concentrations and bacterial bioburden. CHG bathing frequency may be optimized for individual patient populations to augment the reduction of bacteria. Additional research to understand the association of CHG skin concentrations and resistant bacterial burden is required.

Table1: Selected characteristics of patients at each skin site by bacterial bioburden detected for MRSA, CRE and VRE

	MRSA (n= 89)			CRE (n=108)			VRE (n=56)		
	Detected n (%)	Undetected n (%)	p-value[a]	Detected n (%)	Undetected n (%)	p-value[a]	Detected n (%)	Undetected n (%)	p-value[a]
ARM SITES									
CHG ≤20ppm	4(22.2)	14(77.8)	0.70	10(18.5)	44 (81.5)	0.27	6(16.7)	30(83.3)	0.24
CHG >20ppm	13(18.3)	58(81.7)		6(11.1)	48 (88.9)		6(30.0)	14(70.0)	
4%CHGliquid soap	8(20.5)	31(71.5)	0.76	12(15.2)	67(84.8)	0.98	12(21.4)	44(78.6)	
2% CHG impregnated cloth	9(18.0)	41(82.0)		4(15.4)	22 (84.6)		.....[b]	.....[b]	
CHEST SITES									
CHG ≤20ppm	9(42.9)	12(57.1)	0.08	8(14.3)	48(85.7)		2(5.9)	32(94.1)	0.06
CHG >20ppm	16(23.5)	52(76.5)		10(19.2)	42(80.8)		5(22.7)	17(77.2)	
4%CHGliquid soap	12(30.7)	27(69.2)	0.62	13(16.5)	66(83.5)		7(12.5)	49(87.5)	
2% CHG impregnated cloth	13(26.0)	37(74.0)		5(19.2)	21(80.8)		.....[b]	.....[b]	

Abbreviations: MRSA, methicillin-resistant *Staphylococcus aureus*; CRE, carbapenem-resistant *Enterobacteriaceae; VRE*, vancomycin resistant *Enterococcus;* CHG, chlorhexidine gluconate

[a] p-value is for Chi-square test for categorical variable
[b] no observations recorded

Table2: Univariate regression for log transformed detectable skin bioburden for MRSA, CRE and VRE calculated separately for each skin site

	MRSA			CRE			VRE		
	Estimate	95%CI	p-value	Estimate	95%CI	p-value	Estimate	95%CI	p-value
ARM SITES									
CHG concentration ppm[a]	-0.31	(-1.7,1.1)	0.65	-0.74	(-1.80,0.31)	0.16	0.44	(-0.49, 1.4)	0.37
Time since last CHG bath in minutes[b]	-0.01	(-0.03,0.01)	0.08	0.01	(-0.01,0.01)	0.83	-0.05	(-0.01,0.05)	0.33
CHEST SITES									
CHG concentration ppm[a]	-0.81	(-2.3,0.72)	0.3	0.71	(-0.60,2.05)	0.29	0.42	(-0.09,0.92)	0.09
Time since last CHG bath in minutes[b]	-0.01	(-0.03,0.07)	0.21	0.01	(-0.01,0.02)	0.88	-0.04	(-0.01,0.02)	0.22

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564. A Five-Year Evolutionary Study of the Minimum Inhibitory Concentrations of Methicillin-resistant *Staphylococcus aureus* to Mupirocin, Chlorhexidine, and Octenidine in a Singaporean Tertiary Institution

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Session: 62. HAI: MRSA Prevention
Thursday, October 3, 2019: 12:15 PM

Background. Methicillin-resistant *Staphylococcus aureus* (MRSA) is a common cause of healthcare-associated infection. Eradication of MRSA carriage reduces clinical infection and prevents transmission. In Singapore General Hospital, a series of hospital-wide measures were instituted over three years (Figure 1) to reduce mupirocin (MUP) resistance, and to decrease the bioburden of MRSA colonization amongst inpatients using octenidine (OCT)-based products.

Methods. A prevalence study was conducted at three time points (TPs) on consecutive MRSA screening isolates to evaluate for their minimum inhibitory concentrations (MICs) to CHG, OCT and MUP using broth microdilution sensitive plates and the presence of the ileS-2 gene, in 2013 (pre-intervention TP, TP1; $n = 160$), 2016 (early post-intervention TP, TP2; $n = 99$) and 2017 (late post-intervention TP, TP3; $n = 76$). Statistical analyses were performed using the Chi-square test with reference from TP1.

Results. A significant improvement in MUP susceptibility by MIC (256 µg/mL) and ileS-2 testing reduced from 25.0% (TP1) to 12.1% (TP2; $P = 0.014$) to 5.3% (TP3; $P = 0.001$) and 30.0% (TP1) to 18.2% (TP2; $P = 0.036$) to 9.2% (TP3; $P = 0.001$), respectively. OCT MIC range remained stable at 0.5 to 1 across all three TPs. The number of isolates with reduced CHG susceptibility (MIC ≥4 mg/L) increased over the three TPs from 23.1% to 27.2% ($P = 0.45$) to 42.1% ($P = 0.003$), despite decreasing CHG prescription.

Conclusion. A restrictive MUP usage policy can improve MUP susceptibility amongst MRSA isolates over time. Widespread OCT use did not appear to result in a rise of OCT MIC over the intervention period. Although the clinical significance of reduced susceptibility to CHG remains uncertain, this worrying trend in our institution deserves further studies to better understand mechanisms of CHG resistance.

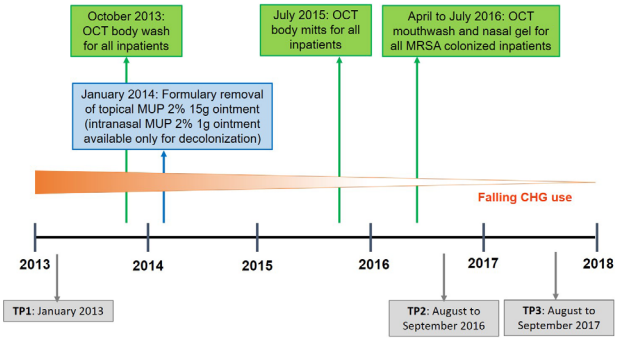

Figure 1: Hospital-wide trends in mupirocin (MUP), octenidine (OCT) and chlorhexidine (CHG) usage over a five-year period with three sampling time points (TPs)

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565. Implementation of a *Staphylococcus aureus* Screening and Decolonization Program in a Multisite Urban Healthcare System

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Background. *Staphylococcus aureus* infection confers high mortality. *S. aureus*-colonized hospitalized patients are more likely to develop invasive infection and can transmit *S. aureus* to other patients in the absence of symptoms. Our health system has a baseline *S. aureus* colonization rate of 21% (MSSA and MRSA combined). To reduce risk of invasive *S. aureus* infection in our patients, we implemented an inpatient *S. aureus* screening and decolonization program.

Methods. Interventions include universal *S. aureus* screening and targeted decolonization for all patients on the Medicine and Pediatrics inpatient services. Adult patients are screened at admission and change in the level of care; pediatric patients are screened weekly. *S. aureus* screening began incrementally by unit between 2016 and 2017, and extended to transplant units in 2018. All cultures are processed in the hospital microbiology lab for identification of MRSA and MSSA. *S. aureus* decolonization (mupirocin ointment in nares twice daily, chlorhexidine 2% wipes below the chin daily for 5 days) began in 2017 for patients with a central venous catheter, in intensive care