The Population Dynamics of Antibiotic Resistance in Staphylococcus aureus in Boston: A Return to Antibiotic Susceptibility

2167. Relatedness of MRSA and VRE Strains Isolated from Post-acute Care Patients and Their Environment: a Longitudinal Assessment

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Session: 242. HAI: MRSA, MSSA, and Other Gram-positives
Saturday, October 7, 2017: 12:30 PM

Background. Methicillin-resistant *S. aureus* (MRSA) and Vancomycin-resistant enterococci (VRE) are endemic in post-acute care (PAC) settings. We characterize their transmission between patients and environment in 6 PAC facilities in SE Michigan.

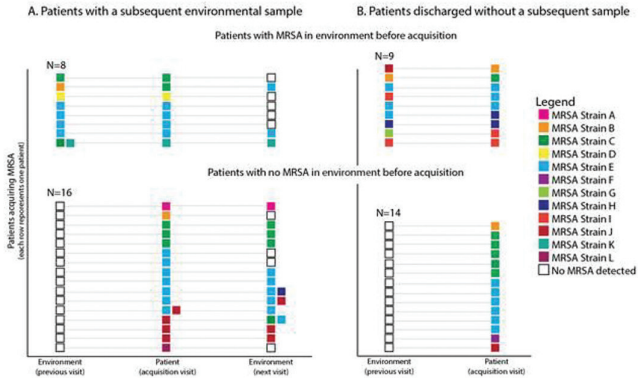
Methods. In a multicenter prospective observational cohort study we collected surveillance cultures of nares, oropharynx, groin, perianal area, wounds, device site(s) and 10 environmental sites collected at enrollment, day 14, and every 30 days thereafter from 651 newly admitted patients. Pulsed-field gel electrophoresis (PFGE) and PCR for *SCCmec, agr*, and Panton–Valentine leukocidin (*pvl*) were performed for MRSA. PFGE, and *vanA/vanB* genotyping were performed for VRE.

Results. 386/651 (59%) participants were not colonized with MRSA at baseline, had more than 1 follow-up visit and were observed for 15,683 patient-days, over which 5,558 patient and 11,108 environmental swabs were collected. Of these 386 patients, 47 (12%) newly acquired MRSA and had complete strain typing available. 42% of strains were USA 100 HA-MRSA, and 31% were USA 300 CA-MRSA. 14% of strains were non USA 100–1100 strains. For 11/47 (23%), a related MRSA strain was isolated from the environment during the previous visit (Figure 1). 24/47 had a subsequent follow-up visit. In 13/24 (54%) a related MRSA strain was found in the environment on the next visit, suggesting transmission from the patient to the environment (Figure 1).

For VRE, PFGE profiles showed high heterogeneity. Among 76 of 296 patients (followed for 11,580 days) who newly acquired VRE, a related VRE was found in the previous visit in 12% of patients, no VRE was found in the previous visit for 42 (55%), and an unrelated strain was present for 33%. In 37 patients for whom a follow-up visit was available, 22% had a related VRE strain in the environment on the subsequent visit and 27% had a new VRE strain.

Conclusion. New acquisition of VRE was more common than MRSA in this PAC population. Using molecular epidemiologic methods in this large prospective cohort, we show active, frequent and immediate bi-directional transmission between patients and environment. Diminishing environmental contamination has the potential to reduce MDRO transmission to patients in a setting where MRSA and VRE are endemic.

Figure 1. New Acquisition of MRSA



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2168. The Population Dynamics of Antibiotic Resistance in *Staphylococcus aureus* in Boston: A Return to Antibiotic Susceptibility

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Background. Methicillin resistant *Staphylococcus aureus* (MRSA) has been declining over the past decade, but changes in *S. aureus* overall and the implications for trends in antibiotic resistance remain unclear. We determine whether the decline in rates of infection by MRSA has been accompanied by changes in rates of infection by methicillin susceptible, penicillin resistant *S. aureus* (MSSA) and penicillin susceptible *S. aureus* (PSSA). We test if these dynamics are associated with specific genetic lineages and evaluate gains and losses of resistance at the strain level.

Methods. We conducted a 15 year retrospective observational study at two tertiary care institutions in Boston, MA of 31,589 adult inpatients with *S. aureus* infections. Surveillance swabs and duplicate specimens were excluded. We also sequenced a sample of contemporary isolates (n = 180) obtained between January 2016 and July 2016. We determined changes in the annual rates of infection per 1,000 inpatient admissions by *S. aureus* subtype and in the annual mean antibiotic resistance by subtype. We performed phylogenetic analysis to generate a population structure and infer gain and loss of the genetic determinants of resistance.

Results. Of the 43,954 *S. aureus* infections over the study period, 21,779 were MRSA, 17,565 MSSA and 4,610 PSSA. After multivariate adjustment, annual rates of infection by *S. aureus* declined from to 2014 by 2.9% (95% confidence interval (CI), 1.6%–4.3%), attributable to an annual decline in MRSA of 9.1% (95% CI, 6.3%–11.9%) and in MSSA by 2.2% (95% CI, 0.4%–4.0%). PSSA increased over this time period by 4.6% (95% CI, 3.0%–6.3%) annually. Resistance in *S. aureus* decreased from 2000 to 2014 by 0.86 antibiotics (95% CI, 0.81–0.91). By phylogenetic inference, 5/35 MSSA and 2/20 PSSA isolates in the common MRSA lineages ST5/USA100 and ST8/USA300 arose from the loss of genes conferring resistance.

Conclusion. At two large tertiary care centers in Boston, *S. aureus* infections have decreased in rate and have become more susceptible to antibiotics, with a rise in PSSA making penicillin an increasingly viable and important treatment option.

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2169. Predictive Characteristics of Methicillin-Resistant *Staphylococcus aureus* (MRSA) Nasal Swab for MRSA-positive Culture in Hospitalized Veterans

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Background. Providers often must decide whether to empirically treat hospitalized patients for MRSA. The results of routine MRSA nares swabs often are available prior to clinical culture results, so could conceivably help guide antibiotic selection. However, the reported predictive value of nares swabs is mixed. Therefore, we sought to define the predictive characteristics of MRSA nares swabs for the MRSA status of clinical *Staphylococcus aureus*(SA) isolates at the Minneapolis Veterans Affairs Medical Center (MVAMC).

Methods. We retrospectively reviewed electronic health records (EHRs) of 599 MVAMC inpatients with a clinical SA isolate between 2013 and 2016. The SA isolates were from skin/soft tissue (n = 281), blood (n = 99), respiratory (n = 90), urine (n = 62), and bone/joint (n = 27). We recorded each isolate's MRSA vs. MSSA status and the result of the temporally closest MRSA nares swab, then compared swab and culture results in relation to culture site and swab-to-culture interval.

Results. Overall, for identifying MRSA among patients with a clinical SA isolate, the MRSA nares swab's sensitivity was 65.1%, specificity 96.2%, positive predictive value (PPV) 91.4%, and negative predictive value (NPV) 81.9%. The odds ratio (OR) of a positive MRSA nares swab for a MRSA-positive culture was 47.9 (95% confidence interval [CI] 25.7–89.2). Exclusion of the 70 nares swabs that were collected > 14 days before the clinical isolate increased the NPV to 84.0%, with a corresponding sensitivity 68.0%, specificity 83.9%, and PPV 90.3%. Test performance varied significantly by culture site (Table).

Culture Site	OR (95% CI)	Sens. (%)	Spec. (%)	PPV (%)	NPV (%)
All	47.9 (25.7–89.2)	65.1	96.2	91.4	81.9
Skin/soft tissue	59.7 (22.5–158.3)	63.4	97.2	93.0	81.9
Blood	65.9 (13.6–319.9)	95.8	96.9	92.0	85.1
Respiratory	64.1 (13.3–309.5)	73.2	95.9	93.8	81.0
Urine	13.5 (3.7–49.5)	64.3	88.2	81.8	75.0
Bone/joint	N/A	20.0	100.0	100.0	84.6

Conclusion. A positive MRSA nares swab greatly increased the odds that a SA isolate was MRSA. However, sensitivity and NPV were lower than some prior studies. Our findings suggest that, for veterans with a severe infection that might be due to SA, a negative MRSA nares screen provides insufficient NPV to allow confident omission of empiric MRSA-active antibiotics.

Disclosures. **All authors:** No reported disclosures.