Significance of invasive infections due to methicillin sensitive *S. aureus* in the neonatal population

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Background

- *Staphylococcus aureus* (SA) is a common bacterial pathogen in the inpatient setting that colonizes skin and mucous membranes.
  - It is one of the most common causes of late onset sepsis in patients admitted to the NICU[1], which results in many serious implications in the morbidity and mortality of this fragile population.
- Methicillin resistant *S. aureus* (MRSA) has been the focus for infection control, but there is new emergent evidence about methicillin sensitive *S. aureus* (MSSA) burden of disease in neonatal population.[2]
  - There is need for more studies to better understand the relationship between MSSA colonization and invasive disease
- On November 2018, a new MRSA index case was identified in a single center NICU. Active surveillance was started, and a total of 47 cases of SA colonization were identified until the end of January 2019.
- Our objective was to identify and stratify the clinical characteristics, risk factors, and hospital course, between MRSA and MSSA colonized patients.

Results

Figure 1: Breakdown of *S. aureus* colonization (Total N=47) X% (N)

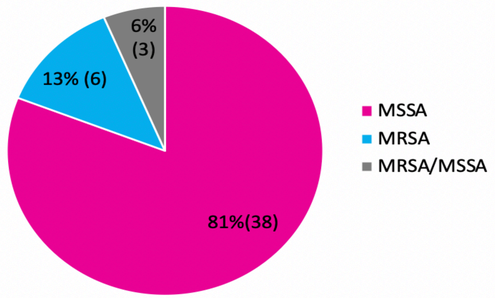

Table 1. Demographics and Clinical Characteristics

Variables	MSSA (n=38) N (%) or Median (IQR)	MRSA or MRSA/MSSA (n=9) N (%) or Median (IQR)	p-value
Race			0.73
White	17 (44.7)	4 (44.4)	
Black	9 (23.7)	1 (11.1)	
Other (Hispanic, Asian, not identified)	12 (31.6)	4 (44.4)	
Sex			0.72
Male	22 (57.9)	6 (66.7)	
Female	16 (42.1)	3 (33.3)	
Birthweight (Kg)	1.36 (1.04, 2.07)	1.40 (1.08, 1.73)	0.86
Apgar			0.70
9	24 (63.2)	7 (77.8)	
< 9	14 (36.8)	2 (22.2)	
Type of Delivery			>0.99
C-Section	25 (65.8)	6 (66.7)	
Vaginal	13 (34.2)	3 (33.3)	
Gestational Age (weeks)	31 (27.4, 34)	31.4 (30, 31.9)	0.71
Transfer			0.07
No	35 (92.1)	6 (66.7)	
Yes	3 (7.9)	3 (33.3)	
Multiple Gestation			0.69
No	28 (73.7)	6 (66.7)	
Yes	10 (26.3)	3 (33.3)	
Breastfeeding			0.09*
No Breast Feeding	1 (2.6)	2 (22.2)	
Expressed Breast Milk	20 (52.6)	1 (11.1)	
Donor Breast Milk	7 (18.4)	3 (33.3)	
Both Types of Breast Milk	10 (26.3)	3 (33.3)	
MV			>0.99
No	5 (13.2)	1 (11.1)	
Yes	33 (86.8)	8 (88.9)	
Shared Equipment			0.52
1 Shared	1 (2.6)	1 (11.1)	
2 Shared	16 (42.1)	4 (44.4)	
More than 2 Shared	21 (55.3)	4 (44.4)	
Invasive Infection			0.17
No	33 (86.8)	6 (66.7)	
Yes	5 (13.2)	3 (33.3)	
Time of Sepsis (days)			0.23
No Sepsis	34 (89.5)	7 (77.8)	
EOS	0 (0)	0 (0)	
LOS	4 (10.5)	1 (11.1)	
VLOS	0 (0)	1 (11.1)	
Difficult IV Access			>0.99
No	34 (89.5)	8 (88.9)	
Yes	4 (10.5)	1 (11.1)	
Colonization Status upon Discharge			0.0001
None	8 (21.1)	3 (33.3)	
MSSA	30 (78.9)	2 (22.2)	
MRSA	0 (0)	4 (44.4)	
Alive upon Discharge			0.09
No	1 (2.6)	2 (22.2)	
Yes	37 (97.4)	7 (77.8)	
TPN Days	7 (3, 14)	7 (6, 15)	0.60
LOS (days)**	54.5 (25, 107)	65 (50, 78)	0.72
Time Since Index Case Identified (days)	22 (8, 58)	15 (2, 57)	0.39
Exposure of Antibiotics before colonization (days)	2 (2, 2)	4 (2, 7)	0.04

*p-value is computed comparing breastfeeding (e.g. expressed, donor, or both) vs. no Breastfeeding. Abbreviations: MV: mechanical ventilation, EOS: Early onset sepsis, LOS: Late onset sepsis, VLOS: Very late onset sepsis, IV: Intravenous, TPN: Total parenteral nutrition, LOS**: Length of stay.

Methods

- Retrospective chart review of 47 NICU patients with SA colonization identified during MRSA transmission events investigation in a single center in November 2018 - January 2019.
- The demographic and clinical characteristics of patients colonized with MRSA and MSSA were stratified (Table 1). Patients with concomitant colonization of MRSA and MSSA were considered MRSA colonized. Shared equipment included: x rays, echocardiogram, and ultrasound machines.
- Categorical variables are reported as frequencies and proportions.
- Continuous variables are reported as median and interquartile range (IQR).
- Comparisons between groups were performed using Fisher's exact tests and Wilcoxon rank-sum tests, as appropriate. (Figure 1 and Table 1).

Conclusions

- MRSA colonized infants had more days of antibiotic exposure before colonization was identified (p value < 0.05).
- More MSSA colonized infants were still colonized at time of discharge (p value <0.05).
- This data provides support to suggest that there is no difference between the proportion of invasive infection, clinical characteristics, risk factors, and hospital course between MRSA and MSSA colonized infants.
- The type of invasive infections identified were SSTI, bacteremia, and osteomyelitis.
- The statistical significance of these results is affected by the small power of the study and skewed distribution towards MSSA colonization. However it does provide insight about the need for increase awareness of real MSSA prevalence and risk for invasive infection among NICU patients.
- There is conflicting data recognizing clinical significance of MSSA colonization. More supportive material for future recommendations of infection control measures to address MSSA colonized patients is needed.

References

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2.Ericson JE, Popoola VO, Smith PB, et al. Burden of Invasive *Staphylococcus aureus* Infections in Hospitalized Infants. JAMA Pediatrics. 2015;169(12):1105-1111.