Management of *Staphylococcus aureus* Bacteremia: Room for Improvement

Rossana Rosa, M.D.[1]; Andrew Wawrzyniak, Ph.D[2]; Maroun Sfeir, M.D.[1]; Laura Smith, Pharm.D[3]; Lilian Abbo, M.D.[4]

1. Jackson Memorial Hospital-Department of Medicine, Miami, FL; 2. School of Nursing & Health Studies and Departments of University of Miami, Miller School of Medicine, Miami, FL; 3. Department of Pharmacy, Jackson Memorial Hospital Miami, FL; 4. Department of Medicine Division of Infectious Diseases, University of Miami Miller School of Medicine, Miami, FL

Background

Staphylococcus aureus (SA) bloodstream infections (BSIs) are an important cause of morbidity and mortality worldwide. The Infectious Disease Society of America (IDSA) has published guidelines for the diagnosis and management of SA BSIs. Compliance with optimal antimicrobial therapy and recommended strategies could be suboptimal in clinical practice.

Obejctives

To determine the incidence and risk factors for clinical failure of SA BSI at Jackson Memorial Hospital.

To evaluate the diagnosis and antimicrobial management of patients with SA BSI at our institution, in order to identify quality improvement opportunities.

Methods

- Retrospective cohort study with review of electronic medical records of hospitalized patients ≥18 years old who had at least one positive blood culture with SA (methicillin resistant [MRSA] and methicillin susceptible [MSSA]) BSIs, at Jackson Memorial Hospital (1550 beds, Miami, FL) from December 01, 2011 to April 30th 2013.
- Data were collected for: patient demographics, comorbidities, date of onset of the bacteremia, date of follow up blood cultures, source of infection, antibiotics used (drug, duration and dosing), length of treatment, vancomycin trough levels, length of hospital stay, costs, and if an infectious diseases specialist was consulted.
- **Clinical failure** was the main outcome analyzed; it was defined as a composite endpoint of in-hospital mortality and persistent bacteremia. Persistent bacteremia was defined as a positive blood culture (BC) for 7 or more days. Relapse and length of stay were secondary outcomes.
- Analyses controlled for age and gender were performed using SPSS Version 21.0.

Results

- A total of 250 consecutive SA BSI episodes (130 [52%] MRSA vs.120 [48%] MSSA) identified in 241 unique patients
- **Overall clinical failure occurred in 61(24.4%) patients**
- **In-hospital mortality was 20% (12.5% MRSA BSI vs. 8.1% for MSSA BSI)**
- 95(38%) of the BSI episodes were cared by Internal Medicine teaching teams, 92 (37%) by non-teaching medical teams and 25% by others.
- Average **time form admission to the first positive blood culture was 8.45 days (±1.2)**
- Average time from admission to first follow-up BC was 3.8 (± 2.3) days.
- Average time from first positive BC to first dose of antibiotics was 1.8 days (±0.18).
- Mean time from the first dose of vancomycin, to the first trough level was 4.7 days (± 0.6)
- **Only 15/241(6.2%) patients reported a penicillin allergy in the electronic medical record**
- **Infectious diseases (ID) consults were performed in 97 (39%) of the BSI episodes**
- **An average of 5.98 days (± 0.51) elapsed from first positive BC to ID consult**

- **Variables significantly associated with clinical failure were a greater elapsed time between the first positive BC and the first follow up blood culture (p<0.001), and to consulting ID (p=0.008).**

Table 1. Comparison of average number of days to the performance of processes of care based on clinical failure

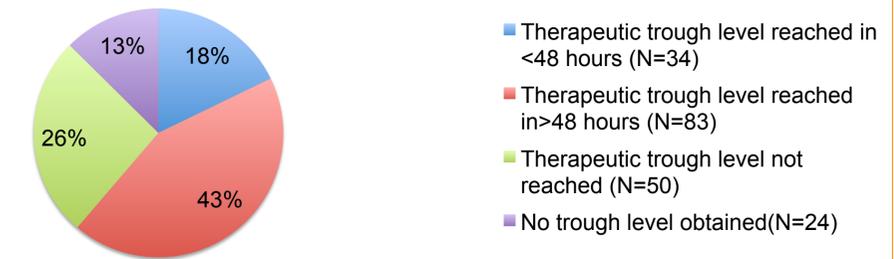| Process of care	No Clinical Failure	Clinical Failure	P value
First follow up blood culture*	3.28 ± 0.95	5.58 ± 0.54	<0.001
ID consult*	5.29 ± 0.54	8.6 ± 1.22	0.008
First antibiotic dose*	1.98 ± 0.29	1.86 ± 0.25	NS
First vancomycin trough**	5.05 ± 0.85	4.09 ± 0.38	NS

*Days since first positive blood culture **Days since first dose of Vancomycin

Figure 1. Mortality based on Antibiotic Selection for the treatment of Methicillin sensitive *Staphylococcus aureus* Bloodstream Infections (n=120)*

	Vancomycin*	Beta-lactam	No treatment
No death	22	74	5
Death	12	7	0

p<0.001
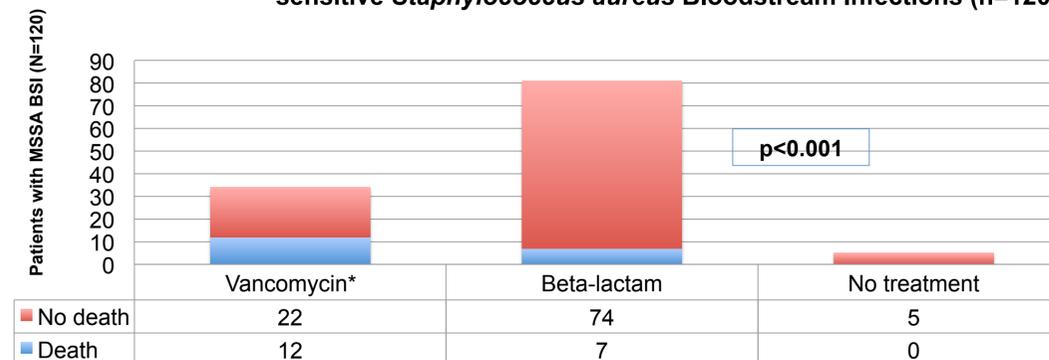
*21/34 (61.76%) of the patients treated with vancomycin had no documented penicillin allergy

Figure 2. Distribution of time to therapeutic vancomycin trough level among all patients with *Staphylococcus aureus* bloodstream infection who received treatment for at least 48 hours

- Therapeutic trough level reached in <48 hours (N=34) — 18%
- Therapeutic trough level reached in >48 hours (N=83) — 43%
- Therapeutic trough level not reached (N=50) — 26%
- No trough level obtained(N=24) — 13%

Table 2. Average length of stay of patients with *Staphylococcus aureus* bloodstream Infection based on clinical outcomes

Outcome		Average time in days*	P value
Persistent Bacteremia	Yes	37.22 ± 38.0	<0.001
	No	19.91 ± 20.6	
In-hospital mortality	Yes	17.84 ± 22.9	NS
	No	20.25 ± 20.21	
Clinical failure	Yes	26.13 ± 35.0	NS
	No	19.91 ± 20.6	

*Days since first positive blood culture up to discharge

Conclusions

- **The majority of SA BSI episodes occurred after an average of 8 days of hospitalization with a significant number of clinical failures (24%) and high mortality (20%).**
- **Processes of care associated with clinical failure were delay in obtaining follow-up blood cultures and in consulting ID specialists**
- **ID specialists were consulted late during the course of bacteremia and in less than 40% of the episodes**
- **There was a significant difference in mortality among patients with MSSA BSI treated with vancomycin compared to those treated with B-lactams**
- **Antimicrobial stewardship efforts with streamlined and standardized hospital protocols for managing patients with SA BSIs are needed, and could improve clinical outcomes.**