P1741

Impact of SCC*mec* type on Mortality Attributed to Methicillin-Resistant *Staphylococcus aureus* Bacteremia

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Abstract

Background: This study was designed to explore the impact of staphylococcal cassette chromosome *mec* (SCC*mec*) type on mortality attributed to methicillin-resistant *Staphylococcus aureus* (MRSA) bacteremia.

Summary: Among enrolled 198 cases, 47 (23.7%) were MRSA bacteremia-attributed mortality, and the numbers of SCC*mec* types II/III and IV were 140 (70.7%) and 58 (29.3%), respectively. MRSA bacteremia-attributed mortality was higher in SCC*mec* types II/III (29.3%, 41/140) than in type IV (10.3%, 6/58) ($P = 0.003$). In multivariable analysis, SCC*mec* types II/III rather than type IV, higher Charlson's comorbidity score, higher Pitt bacteremia score, and central line associated infection were independently associated with MRSA bacteremia-attributed mortality.

Conclusions: MRSA with SCC*mec* types II/III compared with type IV is independent risk factor for MRSA bacteremia-attributed mortality in this study.

Objectives

Understanding the clinical outcome of MRSA bacteremia according to SCC*mec* type is important when considering the recent epidemiological changes and its gaining importance of community associated-MRSA (CA-MRSA). Although many studies have been conducted to clarify the difference of the clinical outcome between CA-MRSA and healthcare associated-MRSA (HA-MRSA) bacteremia, the results are not always in agreement. The objective of this study was to compare mortality attributed to MRSA bacteremia between SCC*mec* types II/III and type IV.

Methods

Data on all the episodes of MRSA bacteremia between January 2009 and May 2013 were collected from the electronic medical record system at Seoul National University Bundang Hospital (a 1300-bed tertiary-care hospital, Seongnam, Korea). All adult patients (≥15 years) who suffered their first MRSA bacteremia episodes were enrolled. Cases were excluded for polymicrobial infection, suspected contamination, the unavailable bloodstream isolates, and the non-evaluable outcome due to early discharge or transfer without a further follow-up.

MRSA bacteremia-attributed mortality was pre-defined as the presence of at least one of the followings: (1) positive blood culture for MRSA at the time of death; (2) a persistent focus of MRSA infection associated with clinical signs of sepsis; and (3) the death within 14 days of the documentation of bloodstream infection with no other reasonable explanations.

Results

1. Univariable analyses for MRSA bacteremia-attributed mortality.

	Survivor (n=151)	Non-survivor (n=47)	OR (95% CI)	*P*
Female sex	57 (37.7)	12 (25.5)	0.57 (0.27-1.18)	0.128
Age	66.5 (±14.7)	68.4 (±12.0)	1.01 (0.99-1.04)	0.424
Charlson's comorbidity index score	**4.7 (±2.8)**	**6.2 (±2.7)**	**1.20 (1.07-1.35)**	**0.002**
ICU location on culture date	**20 (13.2)**	**14 (29.8)**	**2.78 (1.27-6.08)**	**0.010**
Nosocomial onset	89 (58.9)	31 (66.0)	1.35 (0.68-2.68)	0.391
Pitt bacteremia score	**1.5 (±1.9)**	**4.5 (±4.0)**	**1.45 (1.26-1.66)**	**<0.001**
SOFA score	**4.4 (±3.9)**	**9.3 (±5.8)**	**1.22 (1.14-1.31)**	**<0.001**
Presentation with septic shock	**22 (14.6)**	**20 (42.6)**	**4.34 (2.09-9.05)**	**<0.001**
Steroid use (≥Pd 20mg/day ≥1week)	18 (11.9)	9 (19.1)	1.75 (0.73-4.21)	0.211
Primary bacteremia	**17 (11.3)**	**12 (25.5)**	**2.70 (1.18-6.18)**	**0.019**
Central line associated infection	52 (34.4)	9 (19.1)	0.45 (0.20-1.00)	0.051
Bone & joint infection	**14 (9.3)**	**0 (0.0)**	**NA**	**0.019**
Surgical wound infection	19 (12.6)	6 (12.8)	1.02 (0.38-2.72)	0.974
Skin & soft tissue infection	20 (13.2)	5 (10.6)	0.78 (0.28-2.21)	0.639
Pneumonia	**12 (7.9)**	**10 (21.3)**	**3.13 (1.26-7.81)**	**0.014**
Intra-abdominal infection	6 (4.0)	5 (10.6)	2.88 (0.84-9.90)	0.094
Inappropriate empirical antibiotics	90 (59.6)	24 (51.1)	0.71 (0.37-1.37)	0.302
Persistent MRSA bacteremia	26 (17.2)	11 (23.4)	1.47 (0.66-3.26)	0.344
SCC*mec* types II/III (vs. type IV)	**99 (65.6)**	**41 (87.2)**	**3.59 (1.43-9.01)**	**0.006**
genes for PVL	1 (0.7)	1 (2.1)	3.26 (0.20-53.17)	0.407
Vancomycin MIC ≥ 1.5 μg/mL (E-test)	73 (48.3)	19 (40.4)	0.73 (0.37-1.41)	0.343

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2. Independent factors for MRSA bacteremia-attributed mortality.

	Adjusted OR (95% CI)	*P*
Charlson's comorbidity index score	**1.26 (1.09-1.46)**	**0.001**
Pitt bacteremia score	**1.50 (1.28-1.76)**	**<0.001**
Central line associated infection	**0.33 (0.23-0.85)**	**0.021**
SCC*mec* types II/III (vs. type IV)	**4.50 (1.49-13.59)**	**0.008**

3. Microbiological characteristics of bloodstream isolates in this study.

	SCC*mec* II/III (n=140)	SCC*mec* IV (n=58)
major *spa* types	t2460 (42.1)	t324 (60.3)
	t002 (11.4)	t664 (13.8)
	t9353 (9.3)	t148 (6.9)
	t037 (5.0)	t008 (3.4)
	t264 (3.6)	
	t12701 (3.6)	
genes for PVL	0 (0.0)	2 (3.4)
Vancomycin MIC ≥ 1.5 μg/mL (E-test)	61 (43.6)	31 (53.4)

Conclusions

MRSA with SCC*mec* types II/III, compared with type IV, is independently correlated with higher MRSA bacteremia-attributed mortality in this study. Geographic and accompanying genetic differences should be considered in understanding of MRSA virulence.