EV0239

Comparative analysis of different antibiotic susceptibility tests among 670 *mecA*+ MRSA isolates from sterile sites (TIST study, 2006-2010)

Wei-Yao Wang*, Tzong-Shi Chiueh, Yuan-Ti Lee, Shi-Ming Tsao. Feng-Yuan Hospital, Taichung, Taiwan

Introduction

Methicillin-resistant *Staphylococcus aureus* (MRSA) causes severe infections with considerable morbidity and mortality. Antimicrobial susceptibility test (AST) help physicians to choose appropriate antibiotics to treat infections caused by MRSA and to save lives. The goal is to compare various AST results of commonly used antibiotics against MRSA isolated from sterile sites in Taiwan.

Materials and Methods

MRSA from sterile sites were collected from 22 hospitals (Tigecycline *In-vitro* Surveillance in Taiwan – TIST 2006-2010) and tested of MIC against antibiotics with variable AST: agar dilution for oxacillin (OX) and vancomycin (VA); Etest for VA and daptomycin (DAP), and Vitek-II automated system for OX, VA, and DAP according to CLSI [1] and manufacturer's guides . Molecular types including SCC*mec* [2], *spa* [3], and *dru* [4] were determined by PCR and nucleotide sequencing. The differences of MICs by various AST and correlation of MICs with molecular types were analyzed with appropriate statistic methods.

Results

Totally, 670 *mecA*+ MRSA were collected and their origins and year distribution were listed in Table 1 . As in Table 2, MIC_{50}/MIC_{90} against VA by agar dilution, Etest, and Vitek-II were 1.5/2, 2/2 and 1/1 mg/L, respectively. DAP MIC_{50}/ MIC_{90} by Etest and Vitek-II were 0.25/0.38 and 1/1 mg/L, respectively. OX MIC_{50}/ MIC_{90} by agar dilution and Vitek-II were 256/ >256 and ≧4/≧4 mg/L, respectively. The distribution of VA and DAP MICs were shown as Fig. 1 & 2. VA arithmetic/ geometric mean MICs by Etest (1.87/1.81 mg/L) were higher than agar dilution (1.42/1.36 mg/L) and Vitek-II (0.94/0.87 mg/L) ($p < 0.001$). In contrast, the DAP arithmetic /geometric mean MICs by Etest (0.28/0.24 mg/L) were lower than Vitek-II (0.79/0.67 mg/L) ($p < 0.001$). The number of isolates with OX MIC ≧4 mg/L (i.e., resistant phenotype) by agar dilution was significantly higher than those by Vitek-II ($p < 0.001$). Higher VA MICs were noted in molecularly-defined HA-MRSA (SCC*mec*II & III; *spa* t002 & t037; *dru*4, 13, and 14) than CA-MRSA (SCC*mec*IV, V, and V_T; *spa* t437 & t1081; *dru*9 &11) ($p < 0.05$).

Results

Table 1. Origins and year distribution of 670 *mecA*+ MRSA from sterile sites (TIST, 2006-2010).

Isolates origin/year	No. of isolates (%)					
	2006	2007	2008	2009	2010	Total
Blood	149	146	148	92	92	627 (93.6)
Pleural effusion	5	7	4	1	2	19 (2.8)
Ascites	5	0	3	1	1	10 (1.5)
Biopsied tissue	0	0	3	2	2	7 (1.0)
Synovial fluid	1	0	0	1	2	4 (0.6)
Others	0	0	1[a]	1[b]	1[c]	3 (0.4)
Total	160	153	159	98	100	670 (100)

[a]: lymph node; [b]: bronchoalveolar lavage; [c]: cerebrospinal fluid.

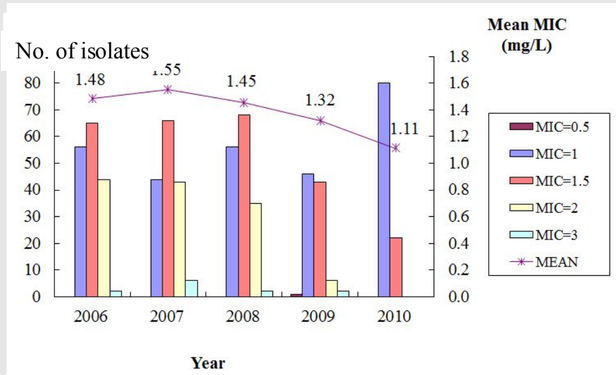

Figure 1. Distribution and mean of vancomycin MIC by agar dilution among 670 *mecA*+ MRSA isolates.

Table 2. Comparative susceptibility results by agar dilution, Etest, and Vitek-II among 670 *mecA*+ MRSA (TIST, 2006-2010).

methods/drugs	vancomycin (VA)			daptomycin (DPC)		oxacillin (OX)	
	agar dilution	E-test	Vitek II	E-test	Vitek II	agar dilution*	Vitek II**
MIC_{50} (mg/L)	1.5	2	1	0.25	1	256	≧4
MIC_{90} (mg/L)	2	2	1	0.38	1	>256	≧4
arithmetic means (mg/L)	1.42	1.87	0.94	0.28	0.79		
geographic means (mg/L)	1.36	1.81	0.87	0.24	0.67		
p value	<0.001[1, 2]	<0.001[3]		<0.001[3]		<0.001[4]	

*: MICs by agar dilution ranged from 0.25 mg/L to > 256 mg/L; **: MICs by Vitek II ranged from ≦0.25 mg/L to ≧4 mg/L.
[1]: arithmetic means of MIC by agar dilution vs by E-test; [2]: arithmetic means of MIC by agar dilution vs by Vitek II; [3]: arithmetic means of MIC by E-test vs by Vitek II; [4]: number of oxacillin MIC ≧4 mg/L (i.e. resistant phenotype) by agar dilution (653 isolates) vs by Vitek II (663 isolates).

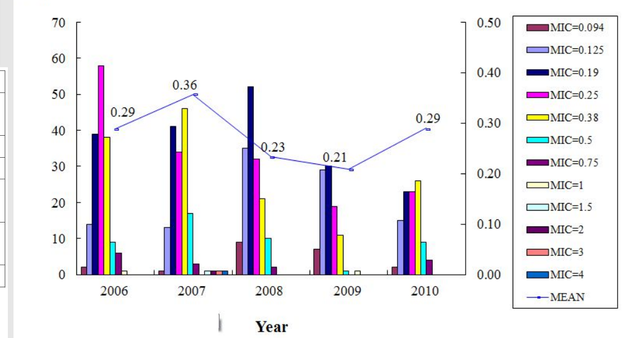

Figure 2. Distribution and mean of daptomycin MIC by Etest among 670 *mecA*+ MRSA isolates.

Conclusions

Significant differences between antibiotic susceptibility against VA, DAP, and OX were found among MRSA from invasive infections in Taiwan during 5-year study. Increase in VA MIC may predict treatment failure in patients infected with HA-MRSA.

References

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