Clinical characteristics and distribution of capsular types of community-acquired, healthcare-associated and nosocomial *Klebsiella pneumoniae* bacteraemia in Taiwan

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Introduction

Klebsiella pneumoniae bacteraemia is a major cause of morbidity and mortality worldwide. Capsular polysaccharide is an important virulent factor of *K. pneumoniae* infections, and strains with capsular type K1, K2, K5, K20, K54, and K57 are virulent and prevalent in community-onset pyogenic infections in Asian countries. Healthcare-associated (HCA) bacteraemia was proposed as a new epidemiological category in community-onset infections that was similar to nosocomial infections in terms of clinical features and antimicrobial resistance. Studies regarding the different clinical characteristics and distribution of capsular types among community-acquired (CA), HCA, and nosocomial *K. pneumoniae* bacteraemia were limited..

Aims

We conducted this study to compare clinical characteristics, antimicrobial resistance, and capsular types of *K. pneumoniae* bacteraemia among CA, HCA, and nosocomial infections.

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Methods

A retrospective study of patients with *K. pneumoniae* bacteraemia was conducted in a medical centre in Taiwan from August to December, 2015. Community-onset bacteraemia included CA and HCA infections. HCA *K. pneumoniae* bacteraemia was defined as bacteraemia occurred within 48 hours of admission meeting the defined criteria of healthcare exposure. The virulent capsular types (K1, K2, K5, K20, K54, and K57) were detected by the polymerase chain reaction. Clinical features, antimicrobial resistance, and distribution of capsular types were compared among CA, HCA, and nosocomial bacteraemia.

Results

A total of 149 patients with *K. pneumoniae* bacteraemia were identified. Twenty-five patients (16.7%) were CA infection, 47 patients (31.5%) were HCA infection, and the remaining 77 patients (51.8%) were nosocomial infection. The 28-day mortality was highest in nosocomial infection (36.4%), followed by HCA infection (23.4%), and CA infection (16.0%) (Table 1). Wild-type antibiotic susceptibility (only resistant to ampicillin) was significantly more common in strains from CA infection than that from nosocomial infection (76.0% versus 45.5%, $p = 0.008$), and was higher than that from HCA infection with borderline statistical significance (76.0% versus 55.3%, $p = 0.084$) (Table 2). Multidrug resistance phenotype was more common in strains from nosocomial and HCA infection than that from CA infection (39.0% versus 4.0%, $p = 0.001$; 36.2% versus 4.0%, $p = 0.003$, respectively). Notably, the proportion of the strains with virulent capsular types was similar between CA and HCA infection (48.0% versus 34.0%, $p = 0.247$), and the proportion of them was significantly higher than that in nosocomial infection (48.0% versus 16.9%, $p = 0.002$; 34.0% versus 16.9%, $p = 0.029$, respectively) (Table 2).

Conclusions

Strains from HCA bacteraemia have similar resistance phenotype to that from nosocomial bacteraemia. However, the proportion of strains with virulent capsular types in HCA bacteraemia was more close to that in CA bacteraemia. We suggested that HCA bacteraemia is a distinct category in terms of the microbiological features.

Table 1. Clinical outcomes of patients with community-acquired (CA), healthcare-associated (HCA), and nosocomial *K. pneumoniae* bacteraemia

Variable	CA (n = 25)	HCA (n = 47)	Nosocomial (n = 77)	*p* value		
				CA vs. HCA	HCA vs. Nosocomial	CA vs. Nosocomial
Appropriate empirical antimicrobial therapy	23 (92.0)	39 (83.0)	65 (84.4)	0.477	0.833	0.508
Appropriate definite antimicrobial therapy	21 (84.0)	44 (93.6)	62 (80.5)	0.227	0.064	1.000
Length of stay after bacteremia, median (IQR), days	13.0 (5.5-20.5)	17.0 (10.0-31.0)	17.0 (4.5-26.5)	0.048	0.199	0.425
Septic shock when bacteraemia	5 (20.0)	21 (44.7)	34 (44.2)	0.038	0.954	0.031
Mortality						
In-hospital mortality	4 (16.0)	13 (27.7)	28 (36.4)	0.384	0.318	0.082
14-day mortality	3 (12.0)	6 (12.8)	20 (26.0)	1.000	0.080	0.178
28-day mortality	4 (16.0)	11 (23.4)	28 (36.4)	0.553	0.132	0.082

Table 2. Comparison of microbiological characteristic among clinical isolates of community-acquired (CA), healthcare-associated (HCA), and nosocomial *K. pneumoniae* bacteraemia

Capsular types	CA (n = 25)	HCA (n = 47)	Nosocomial (n = 77)	*p* value		
				CA vs. HCA	HCA vs. Nosocomial	CA vs. Nosocomial
K1	5 (20.0)	4 (8.5)	2 (2.6)	0.160	0.199	0.009
K2	4 (16.0)	7 (14.9)	3 (3.9)	1.000	0.041	0.059
K1 and K2	9 (36.0)	11 (23.4)	5 (6.5)	0.256	0.006	<0.001
K1, K2, K5, K20, K54, and K57	12 (48.0)	16 (34.0)	13 (16.9)	0.247	0.029	0.002
Wild-type antibiotic susceptibility	19 (76.0)	26 (55.3)	35 (45.5)	0.084	0.286	0.008
Antimicrobial resistance with capsular type K1, K2, K5, K20, K54, and K57	1 (4.0)	5 (10.6)	6 (7.8)	0.658	0.589	1.000
Multidrug resistance with capsular type K1, K2, K5, K20, K54, and K57	1 (4.0)	3 (6.4)	4 (5.2)	1.000	1.000	1.000

*Competing interests: The authors declare that they have no conflicts of interest.