Klebsiella pneumoniae Bacteremia and Capsular Serotypes, Taiwan


Capsular serotypes of 225 Klebsiella pneumoniae isolates in Taiwan were identified by using PCR. Patients infected with K1 serotypes (41 isolates) had increased community-onset bacteremia, more nonfatal diseases and liver abscesses, lower Pittsburgh bacteremia scores and mortality rates, and fewer urinary tract infections than patients infected with non–K1/K2 serotypes (147 isolates).

K. pneumoniae bacteria cause a variety of infections (1,2). Geographic differences in this organism have been recognized, and a high prevalence of liver abscesses has been observed for >20 years in persons in Taiwan infected with K. pneumoniae (3,4). K1 and K2 are the major capsular serotypes that cause liver abscesses and have increased virulence (4–7). In contrast, only limited information is available about serotypes causing K. pneumoniae bacteremia (3,5).

Yu et al. grouped K1 and K2 serotypes and compared clinical characteristics for patients with K. pneumoniae bacteremia with those for patients infected with non–K1/K2 serotypes (3). Recent evidence suggests that K1 is a major cause of primary liver abscesses and has greater potential for causing metastasis, and that K2 is a major cause of secondary liver abscesses (6,8). We examined the distribution and clinical characteristics of serotypes that cause K. pneumoniae bacteremia from 225 patients (9) and performed PCR-based genotyping to identify capsular serotypes (10).

The Study

The study was conducted at Far-Eastern Memorial Hospital in Taipei, Taiwan. Patients with K. pneumoniae bacteremia were identified during January 1–December 31, 2007. Identification of K. pneumoniae was based on colony morphologic features and biochemical reactions (11). Data on time until positive blood culture results were obtained from the automated blood culture system at the hospital. Data for each patient were included only once (at the time of the first detection of bacteremia). Patients <18 years of age and those not admitted to our hospital were excluded. Inactive malignancy was not included as an underlying illness. In-hospital and 14-day mortality rates were assessed. For 225 available bacterial isolates, cps genotyping was performed (10).

A total of 231 patients with K. pneumoniae bacteremia were observed at the hospital during the study; 225 isolates from 225 patients were used. A total of 133 (59%) of these patients had community-onset bacteremia (bacteremia identified in an emergency department). The in-hospital mortality rate was 32.4%. Among 225 isolates, 41 (18.2%) were identified as K1 serotype, 37 (16.4%) as K2, 15 (6.7%) as K57, and 8 (3.6%) as K54. The K1 serotype was found predominantly in community-onset infections (36 [87.8%] of 41 patients compared with 75 [51.0%] of 147 patients infected with non–K1/K2 serotypes; odds ratio [OR] 6.91, 95% confidence interval [CI] 2.57–18.60) (online Appendix Table 1, www.cdc.gov/EID/content/17/6/1113-appT1.htm).

Underlying illness was classified as nonfatal in 75.6% of patients with K1 bacteremia (53.7% of patients with non–K1/K2 bacteremia; OR 2.67, 95% CI 1.22–5.84). A lower percentage of patients with K1 bacteremia had surgery in the previous 3 months (9.8% vs. 30.6%; OR 0.25, 95% CI 0.09–0.73). Patients with K1 bacteremia had lower mean ± SD Pittsburgh bacteremia scores than those with non–K1/K2 bacteremia (2.7 ± 3.1 vs. 4.4 ± 4.7; OR 0.90, 95% CI 0.81–0.99), but the time until a positive blood culture was obtained was not different. K1 serotype was more common in patients with liver abscesses (46.3% vs. 4.1%; OR 20.3, 95% CI 7.31–56.40) and less common in patients with urinary tract infections (UTIs) (4.9% vs. 20.4%; OR 0.20, 95% CI 0.05–0.88). The in-hospital mortality rate for patients with K1 bacteremia was lower than that for patients with non–K1/K2 bacteremia (14.6% vs. 34.7%; OR 0.32, 95% CI 0.13–0.82).

No differences were found in clinical characteristics for patients with K2 bacteremia and those with non–K1/K2 bacteremia except for a higher frequency of liver abscesses in patients with K2 bacteremia (13.5% vs. 4.1%; OR 3.67, 95% CI 1.06–12.8). For patients infected with K54 and K57 serotypes, 1 K57 serotype caused liver abscesses; no abscesses were found in patients infected with a K54 serotype. The in-hospital mortality rate was 50% (4/8) for patients with K54 bacteremia and 53.3% (8/15) for patients with K57 bacteremia.

Patients infected with a K1 serotype had lower mean ± SD Pittsburgh bacteremia scores (2.7 ± 3.1 vs. 5.0 ± 5.3;
OR 0.88, 95% CI 0.78–0.98, p = 0.002) and lower 14-day
and in-hospital mortality rates (9.8% vs. 27.0%; OR 0.29,
95% CI 0.89–1.03, p = 0.06; and 14.6% vs. 43.2%; OR
0.23, 95% CI 0.05–0.67, p = 0.007) than patients infected
with K2 serotypes. A higher percentage of patients with
K1 bacteremia had liver abscesses at the site of infection
(46.3% vs. 13.5%; OR 5.53, 95% CI 1.80–17.02, p =
0.003).

Characteristics of patients with community-onset
K. pneumoniae bacteremia were also analyzed (online
Appendix Table 2, www.cdc.gov/EID/content/17/6/1113-
appT2.htm). Patients infected with a K1 serotype were
more likely to have liver abscesses and less likely to have
UTIs or biliary tract infections (OR 11.5, 95% CI 3.99–
33.20; OR 0.20, 95% CI 0.04–0.92; and OR 0.25, 95% CI
0.07–0.91, respectively).

In our patients, K1 and K2 serotypes were found at
similar frequencies (18.2% and 16.4%, respectively),
which differs from results of Fung et al., in which the K1
serotype was more common (K1 30.8% and K2 5.1%)
(12). Despite reported virulence of the K1 serotype, it was
primarily responsible for community-onset bacteremia in
patients with less severe underlying illness and associated
with lower mortality rates. Moreover, the K1 serotype is
associated with liver abscesses and lower mortality rates
(2–7). Liver abscesses were found in 46% of patients with
K1 bacteremia, and a K1 serotype was found in 63.3% of
patients with liver abscesses.

Conclusions

Management of liver abscesses has improved in
Taiwan because of increased physician awareness (13).
Mortality rates for patients with K. pneumoniae bacteremia
were lower in patients with UTIs or biliary tract infections
(5,14), which were less common in patients infected
with a K1 serotype. Thus, patient outcomes depend more
on underlying conditions and severity of sepsis than on
bacterial serotypes (3,9,14).

In our previous study of the interval until a positive
blood culture for K. pneumoniae bacteremia was obtained
(9), we found that higher Pittsburgh bacteremia scores,
a time until a positive blood culture <7 hours, and active
malignancy were associated with death. In this study, we
found no difference in time until a positive blood culture
was obtained for patients infected with different serotypes.
This interval for patients infected with K1 serotypes was
slightly longer than that for patients infected with K2 and
non–K1/K2 serotypes. This finding may have resulted
from a higher percentage of community-onset infections
and liver abscesses and less severe underlying illness in
patients infected with a K1 serotype.

Studies investigating K. pneumoniae bacteremia
have grouped K1 and K2 serotypes (3,7). However, such
grouping may be problematic because evidence suggests
that the K1 serotype is the major cause of primary liver
abscesses (6). Another report showed that the genetic
background of serotype K2 is diversified, and only 1 of the
2 major K2 clones was highly virulent in mice (13). These
findings are consistent with our clinical observations.
Differences in symptoms of patients infected with K2 and
non–K1/K2 serotypes were minimal, despite slightly more
liver abscesses among patients infected with K2 serotypes,
which was lower than for patients infected with K1
serotypes. Because of different serotyping methods used
(3,5,15), caution is required when interpreting data from
various studies.

Despite greater virulence of the K1 serotype, it is
predominant in patients with community-onset infections
and in those with less severe underlying illness. Although
the K1 serotype is the major cause of liver abscesses, it
results in a lower mortality rate, which can be attributed to
host factors.

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References


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