Molecular Epidemiology, Serotype Distribution, Antimicrobial Sensitivity and Clinical Findings of Adult Pneumococcal Pneumonia Patients in Japan; Hospital-Based Study

Background

- S.pneumoniae is the leading bacterial cause of morbidity and mortality among adults [1-3].
- In Japan, periodic inoculation of 23-valent pneumococcal polysaccharide vaccine (PPSV23) has started from 2014 for elderly people.
- To our knowledge, there is no study that reported hospital-based pneumococcal serotype, sequence type (ST) of multilocus sequence typing (MLST), and antimicrobial (Ab) sensitivity distribution since 2009 in Japan [4,5].
- We conducted this study to evaluate current molecular epidemiology, serotype and antimicrobial sensitivity distribution, and vaccine type serotypes proportion of pneumococcus from adult pneumonia patients. We also compared clinical findings to the association between antimicrobial sensitivity and clinical findings.

Methods

- This study was conducted as a part of a prospective hospital-based study for adult pneumonias in Japan by the Adult Pneumonia Study Group which consisted of Ehime City Hospital (Hiroshi Chikamori, President), Kameda Medical Center (Chin Y. Peck), Chikuma Hospital (Satoshi Kakiuchi, President), and Naganuma Hospital (Kenichi Morimoto, President). Study period was from September 2013 to September 2014.
- Excluded: developed pneumonia after 48 hours of admission.
- Obtained sputum and blood were cultured by conventional way. We set cutoff value for distinguishing causative agent and colonization.

Results

Patients background and characteristics

- During the study period, a total of 200 pneumococcal patients (205 samples) were enrolled. Blood culture was done in 117 cases (58.5%) and 3 strains were enrolled for pneumonia patients (0.6%).
- In total, 120(60%) participants were male, and 156 (77.5%) patients were classified as having community-acquired pneumonia. 127(63.5%) patients admitted to hospital. Patients with past PPSV23 history were 55 (27.5%), 178 (89.0%) patients had underlying diseases. Use of antibiotics before enrollment was 52 (26.0%), and mortality was 3.5%.

Serotype and antibiotics sensitivity distribution

- Primary serotype was serotype 3 (50 samples) and the primary sequence type (ST) was 180 (most related to serotype 3) (Figure 1).
- The order of the serotype after the second primary serotype was 11A, 6B, 6A/C, 35B, 19A, and 19F.
- PPSV23 serotypes were 1120(58.5%) and PPSV23 type serotypes was 1020(70.5%).
- Most of strains were sensitive for antibiotics (96.1% for PCG, 94.1% for CTRX, and 82.3% for MEPM).

Molecular epidemiology about non-susceptible pneumococcus

- Only 5 CCs occupied approximately 75% of strains that non-susceptible for β-lactams (Figure 2). And 4 out of these CCs belonged to PCRM (Pneumococcal Molecular Epidemiology Network) clades, that means these clones might be a global epidemic clone [6].

Characteristics of pneumonia cases by non-susceptible for β-lactams and others

- There was no important difference for clinical findings and background except respiratory rate (17.6% and 19.7%, p=0.046) between pneumonia patients infected by non-susceptible for β-lactams and susceptible for these antibiotics (Figure 3). Underlying diseases were also not different between those groups, and CTRX and ampicillin/sulbactam were frequently used (data not shown).

Discussion

- Our study revealed serotype 3 is still primary serotype among adult pneumococcal pneumonia. The primary serotype of adult pneumococcal pneumonia did not change from previous study 10 years ago [4]. Sensitivity for PCG (98.1%) maintains at high level although the sensitivity decreased in comparison with the past report (100%, p=0.023).
- Compared with the results of the past research, the isolation rate of the vaccine serotype was decreased in both PCV13 (75.2% and 58.5%, respectively) and PCV10 (70.5% and 30.0%, respectively), probably because of the herd effect of the pediatric PCV13.
- Molecular epidemiology of strains that were not susceptible for β-lactams showed clonality of some specific CCs. 5 CCs accounted for 75% of the strains that were not susceptible for β-lactams. Four out of five are CCs that are acknowledged to be multidrug-resistant. Since those strains were not member of PCRM, it has also been reported in multiple areas in recent years (8,9). And some of β-lactam non-susceptible strains [e.g. serotype 154, 95B] may increase in the future because those serotypes were non-vaccine type.
- The clinical characteristics of pneumonia were not associated with susceptibility of β-lactams, but our sample size was too small to draw conclusion.

- In Japan, adult pneumococcal pneumonia patients’ pneumococcus primary serotype was still serotype 3 and maintained high sensitivity for PCV13, however, since β-lactam non-susceptible strains proliferate clonally and some of these serotypes are non-vaccine type, attention should be paid to the epidemic of these strains.

Reference