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ORIGINAL ARTICLE

Comparison of invasive pneumococcal disease caused by serotype 19A and non-19A pneumococci in children: More empyema in serotype 19A invasive pneumococcal disease

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KEYWORDS
Empyema;
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Objective: To delineate whether serotype 19A invasive pneumococcal disease (IPD) comprised significantly more necrotizing pneumonia and empyema in children, we compared the clinical characteristics between serotype 19A and non-19A IPD.
Methods: Between January 2007 and December 2011, cases of children with IPD who were treated at the National Taiwan University Hospital were reviewed. Patients were assigned to the 19A group or the non-19A group based on the serotype. Their demographic data, clinical course, laboratory results, diagnosis, complications, and sequelae were collected and analyzed.
Results: Overall, 27 patients were included in the 19A group and 29 patients in the non-19A group. Compared with non-19A group, serotype 19A tended to cause IPD in patients without major underlying diseases ($p = 0.015$). Bacteremia without pneumonia or meningitis was found more frequently in the non-19A group (45% vs. 11%, $p = 0.01$), and pneumonia with or without empyema occurred significantly more frequently in the 19A group (89% vs. 52%, $p = 0.006$). Patients in the19A group had longer duration of fever (12 vs. 3 days, $p = 0.01$), and required more intensive care (78% vs. 41%, $p = 0.01$) and more video-assisted thoracoscopic surgery (74% vs. 28%, $p = 0.001$).

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Conclusion: In comparison with the other serotypes, serotype 19A IPD has significantly more empyema which required more video-assisted thoracoscopic surgery and more intensive care.

Introduction

Invasive pneumococcal disease (IPD) is a very important disease in children and may cause significant morbidity and even fatality. Since seven-valent pneumococcal conjugate vaccine (PCV7) was launched, the incidence of IPD dramatically decreased in countries with nationwide immunization programs.[1,2] However, the incidence of certain serotypes which were not covered by PCV7 increased significantly later on. The most common is the serotype 19A *Streptococcus pneumoniae*, which was observed to increase in incidence in United States.[3,4]

In Taiwan, PCV7 was launched in October 2005, and it was self-paid vaccine, not covered by the national immunization program. The coverage rate of PCV7 among Taiwanese children aged $\leq$5 years was 0.7% in 2005, 8.6% in 2006, 15.9% in 2007, and 25.2% in 2008.[5] Although the coverage rate of PCV7 was not high in Taiwan, we also observed the rising incidence of serotype 19A IPD in Taiwan.[6] In addition, we found that the proportion of necrotizing pneumonia and empyema was high in cases with serotype 19A IPD. To delineate whether serotype 19A IPD would cause significantly more necrotizing pneumonia and empyema, we thus compared the clinical characteristics between serotype 19A and non-19A IPD.

Methods

Patient collection

IPD was defined when *S. pneumoniae* were recovered from a normally sterile site such as blood, pleural effusion, cerebrospinal fluid, or ascites by culture or polymerase chain reaction (PCR).[7] Between January2007 and December 2011, data on pediatric patients under 18 years with IPD in National Taiwan University Hospital were collected.

Clinical data collection

Patients were assigned to the 19A group or the non-19A group based on the serotype. Data pertaining to medical records, demographic details, clinical course, laboratory results, diagnosis, and complication of these patients were collected and analyzed. Respiratory failure was defined as the need for positive pressure ventilation. Pneumonia among patients of IPD was further looked up to find the presence of empyema, or necrotizing pneumonia. Empyema was defined as the presence of pus in pleural space diagnosed by pleurocentesis or video-assisted thoracoscopic surgery (VATS),[8] and necrotizing pneumonia was defined as multiple small radiolucency or pneumatocele on a chest radiograph or as cavities of non-enhancement on a contrast-enhanced CT image.[9]

Microbiological study

Antibiotic sensitivity was reported by disk-diffusion method and minimal inhibitory concentration tested using E-test. The interpretation was categorized according to the 2011 Clinical and Laboratory Standards Institute guidelines for breakpoints.[10]

Pneumococcal isolates were identified by the recognition of typical colony morphology on trypticase soy agar supplemented with 5% sheep blood (BBL Microbiology Systems, Cockeyville, MD, USA), Gram stain characteristics, susceptibility to ethylhydrocupreine hydrochloride (Optochin; Difco Laboratories, Detroit, MI, USA), and bile solubility. The isolate's serotype was determined with latex agglutination (Pneumotest-Latex, Statens Serum Instuit, Copenhagen, Denmark).

Using blood and/or pleural effusion, PCR was performed optionally according to the primary care physician's clinical suspicion. Total nucleic acid was extracted from pleural effusion or blood specimens. Real-time PCR targeting the *wzg* gene was first performed to confirm the presence of *S. pneumoniae* DNA as previously reported.[11] Positive samples were included in the serotyping analysis by target gene PCR subsequently. Serotyping of serogroup 6 and serogroup 15 could only be done via latex agglutination but not PCR in our laboratory. Thus, some samples with positive PCR but negative culture only had serogroup recognized.

Statistics

Chi-square test with Yate's correction was used to compare the categorical data between the 19A and non-19A groups. Student's *t*-test was used to compare age and Mann–Whitney test was used for comparison of duration and laboratory data such as peak C-reactive protein level between the 19A and non-19A groups. A p value < 0.05 was considered statistically significant. All analyses were performed with SPSS version 18.0 (SPSS Inc., Chicago, IL, USA).

Results

Cases

Overall, 27 patients were included in the 19A group and 29 patients in the non-19A group. The non-19 A group comprised serotype 3 (4 patients), serogroup 6 (1 patient), serotype 6A (2 patients), serotype 6B (2 patients), serotype 14 (4 patients), serogroup 15 (2 patients), serotype 15B