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ORIGINAL ARTICLE

Comparisons of etiology and diagnostic tools of lower respiratory tract infections in hospitalized young children in Southern Taiwan in two seasons

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Background: Lower respiratory tract infections (LRTIs) play an important role in pediatric diseases; however, there are limited data about LRTIs in Southern Taiwan. This study aimed to investigate the clinical and epidemiological data of LRTIs in this area.
Methods: Children aged under 5 years who were hospitalized at a medical center in Southern Taiwan with acute LRTIs from July 2010 to October 2010 (summer) and from March 2011 to May 2011 (spring) were prospectively enrolled. Nasopharyngeal aspirates were obtained and sent for viral cultures, multiplex polymerase chain reaction (PCR), and traditional quick tests. The clinical features, laboratory data, and imaging findings were recorded and analyzed.
Results: A total of 90 children were enrolled, 70 of whom had detectable pathogens. The positive rate of conventional viral and bacterial cultures was 25.6%, which increased to 77.77% after combining with the two multiplex PCR methods. Adenovirus and enterovirus were the most common viral etiologies identified (26.5% of cases) and *Streptococcus pneumoniae* was the

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leading bacterial etiology (46.4%). The seasonal trend of viral infections in Southern Taiwan was different from Northern Taiwan. There were no differences in demographic data, severity of disease, or hospital stay between single and mixed infections. A similar result was found between nonpneumococcal and pneumococcal infections.
Conclusion: Viral infections were the main etiologies of LRTIs in young children. Multiplex PCR methods are rapid assays that can increase the diagnostic yield rate. Mixed infections do not seem to affect the severity of disease. Early detection may aid clinicians in appropriate decision-making and treatment.

Introduction

Lower respiratory tract infections (LRTIs) play an important role in childhood diseases, and are the leading cause of child mortality and morbidity worldwide.[1,2] Adult LRTIs are usually caused by bacteria, however the etiology in young children is mostly viral or mixed infections with bacteria.[3,4] Taking qualified samples from the infection sites of these children is challenging, and the yield rate of conventional diagnostic tools such as viral, blood, or sputum cultures is low.[5,6] A quick and reliable diagnostic tool would help to identify the pathogens earlier and aid in making the decision of whether or not to treat with antibiotics.

Our previous study in the summer of 2010 revealed that multiplex polymerase chain reaction (PCR) had better detection rates than conventional viral cultures for adenovirus.[7] In this study, we added another 45 patients who were enrolled during spring 2011, and compared the detection rates between traditional examinations and multiplex PCR.

Several studies have reported that viral activity varies with seasonal changes, and called this a seasonal trend.[8–10] In Southern Taiwan, spring and summer are the two highest seasons for viral activity, including influenza virus, respiratory syncytial virus (RSV), and human metapneumovirus (hMPV) in spring, and enterovirus in summer.[11] We therefore collected samples during these two seasons and attempted to identify whether there was an obvious seasonal variation, and then compared this with data from Northern Taiwan. With regards to mixed infections, the severity of patients with or without pneumococcal infections was also investigated.

Methods

Patients

In total, 90 patients aged under 5 years who were admitted to the pediatric ward of Kaohsiung Veterans General Hospital, Kaohsiung, Taiwan during two periods, July–October 2010, and March–May 2011 (the periods included the start of new semesters), for an acute LRTI with fever and cough were enrolled into this prospective study. The LRTIs included pneumonia, bronchopneumonia, and bronchiolitis. Children with fever (>38°C), chest X-ray change (focal/segmental consolidation or alveolar process), and other signs (dyspnea and/or tachypnea and/or crackles on auscultation) were diagnosed having pneumonia or bronchopneumonia. The diagnosis of acute bronchiolitis was made by an acute onset of respiratory distress with cough, tachypnea, retraction, and expiratory wheezing in patients younger than 2 years of age. Children with laryngotracheitis were excluded.

Samples

After taking a detailed history, blood samples, and plain chest X-rays, nasopharyngeal aspirates were obtained from each patient within 48 hours. All samples were sent for conventional viral cultures and two kinds of multiplex PCRs. Most samples underwent additional laboratory examinations including the RSV antigen test, pneumococcal antigen test, mycoplasma antibody titer, or influenza A + B quick test, according to the condition of the patient. Patients who did not meet the definition of pneumonia or bronchopneumonia of this study or who did not receive antibiotics treatment would not undergo the pneumococcal antigen test in order to avoid the detection of colonization.

Ethical approval was granted by the Ethics Committee of the Kaohsiung Veterans General Hospital (VGHKS 99-CT-7-13). All of the parents of the patients received clear explanations and signed informed consent forms.

Pathogen identification

The molecular methods included two multiplex PCR methods: the Respiratory Viral Panel (Luminex Molecular Diagnostics, Toronto, Canada) targeting seven respiratory viruses (adenovirus, enterovirus, influenza A virus, influenza B virus, parainfluenza virus, RSV, and hMPV); and the ResPlex I panel (Qiagen, Hilden, Germany) for adenovirus and six bacteria (*Streptococcus pneumoniae*, *Chlamydia pneumoniae*, *Mycoplasma pneumoniae*, *Legionella pneumophila*, *Neisseria meningitides*, and *Haemophilus influenzae*). All procedures followed the manufacturers' recommendations.

The nasopharyngeal specimens were prepared for conventional viral cultures and inoculated on six cell lines (MRC-8, Hep-2, Vero, MDCK, RD, and A549). An inverted microscope was used to observe the cytopathic effects caused by the viruses every 2 days. An immunofluorescent assay was used to confirm the viral type of the samples positive for cytopathic effect.

A BacT/Alert 3D system (Organon Teknika, Boxtel, The Netherlands) was used for blood cultures. Positive sample