Journal of Hospital Infection 96 (2017) 360–365

Available online at www.sciencedirect.com

Journal of Hospital Infection

journal homepage: www.elsevierhealth.com/journals/jhin

Respiratory-syncytial-virus- and rhinovirus-related bronchiolitis in children aged <2 years in an English district general hospital

S.P. Paul [a,*], A. Mukherjee [a], T. McAllister [b,c], M.J. Harvey [b,c], B.A. Clayton [b,c], P.C. Turner [d]

[a] Department of Paediatrics, Torbay Hospital, Torquay, UK
[b] Peninsula College of Medicine and Dentistry, University of Exeter, UK
[c] Peninsula College of Medicine and Dentistry, University of Plymouth, UK
[d] Department of Medical Microbiology, Torbay Hospital, Torquay, UK

ARTICLE INFO

Article history:
Received 2 April 2017
Accepted 26 April 2017
Available online 3 May 2017

Keywords:
Rhinovirus
Respiratory syncytial virus
Nasopharyngeal aspirate
Bronchiolitis
Respiratory PCR

SUMMARY

Background: Bronchiolitis is the most common reason for hospitalization in young children. In addition to respiratory syncytial virus (RSV), other viruses have been increasingly implicated. Guidance on testing has also changed.

Aims: To compare clinicopathological outcomes in young children admitted with bronchiolitis due to RSV in comparison with rhinovirus (RV), and identify associated risk/epidemiological factors.

Methods: Children aged less than two years admitted to hospital with a clinical diagnosis of bronchiolitis with positive results for either RSV or RV were included in this study. Polymerase-chain-reaction-negative cases using an extended respiratory virus panel served as a control group. Retrospective data were collected on sex, risk factors, respiratory support, intravenous fluids and antibiotics. Outcomes such as length of stay (LOS) and need for transfer to the high-dependency unit/paediatric intensive care unit were included.

Findings: Two hundred and twenty-seven out of 437 nasopharyngeal aspirate samples were positive for either RSV ($N = 162$) or RV ($N = 65$). The median age of cases was three months and 75% had at least one risk factor. Risk factors were higher in the RV group ($P = 0.004$). RV accounted for the majority of cases outside the RSV season ($P < 0.01$). RV-associated bronchiolitis had a longer LOS (more than seven days) ($P < 0.05$) and increased need for chest X-rays and/or antibiotics ($P < 0.05$). Use of intravenous fluids and respiratory support were higher in the RV group, but the difference was not significant.

Conclusions: RV is the second most common pathogen associated with bronchiolitis and is isolated all year round. This may be important in those with risk factors resulting in prolonged LOS. Further research is necessary to establish the exact role of RV in this common condition, particularly outside the traditional RSV season.

* Corresponding author. Address: Department of Paediatrics, Torbay Hospital, Vowden Hall, Lowes Bridge, Torquay TQ2 7AA, UK.
E-mail address: siba.paul@nhs.net (S.P. Paul).

http://dx.doi.org/10.1016/j.jhin.2017.04.023

Introduction

Acute viral bronchiolitis is common in children aged less than two years. It is a major reason for admission to hospital, and secondary spread can lead to hospital-associated infections and outbreaks. It usually presents with cough and increased work of breathing, and often affects a child's ability to feed [1]. Respiratory syncytial virus (RSV) is the most common pathogen detected in hospitalized children, particularly during the winter months in temperate climates. A nasopharyngeal aspirate (NPA) has traditionally been used to inform cohorting of infectious patients (i.e. to minimize secondary spread) and to aid clinical decision making (e.g. avoiding unnecessary antibiotics). However, bronchiolitis remains primarily a clinical diagnosis, and recent studies have highlighted a large number of other viral pathogens such as adenovirus, influenza virus, parechovirus, bocavirus, human metapneumovirus and rhinovirus (RV) as pathogens associated with this clinical condition [2]. Neither the American Academy of Pediatrics (AAP, 2014) nor the National Institute for Health and Care Excellence (NICE, 2015) guidelines recommend routine use of NPA testing for RSV in the diagnosis of infants with bronchiolitis [1,3].

Extended polymerase chain reaction (PCR) testing for viral respiratory tract pathogens, including those associated with bronchiolitis, is now available for routine use in most diagnostic microbiology laboratories. As part of a review of the use of this technology, the role of RV as a cause of non-RSV-associated cases, particularly those occurring outside the traditional RSV season (October–February in the Northern hemisphere), was examined. As RV is a common virus in both children and adults, there is also a risk of nosocomial spread involving healthcare workers and visitors, adding to the challenge of controlling these infections in hospitals.

The aim of this study was to determine the clinicopathological outcomes in a cohort of infants and young children aged less than two years admitted with bronchiolitis, where the presence of either RSV or RV as a single pathogen was detected on analysis of NPA samples. NPA samples that were negative on PCR using an extended panel of respiratory viruses served as a control group.

Methods

An extended panel of respiratory viruses has been available for a number of years from the microbiology laboratory at the study hospital. RV was included as part of the extended panel from April 2012 onwards. Until December 2013, the extended panel was undertaken by the South West Virology (Public Health England) Laboratory in Bristol. From January 2014, the local microbiology laboratory provided the extended PCR panel (Respiratory Pathogens 21, Fast Track Diagnostics, Slierna, Malta). Pathogens detected included influenza A, influenza A (H1N1 pdm09), influenza B, rhinovirus, coronavirus (NL63, 229E, OC43, HKU1), parainfluenza (1, 2, 3 and 4), human metapneumovirus A/B, bocavirus, RSV A/B, adenovirus, enterovirus, parechovirus and *Mycoplasma pneumoniae*. All NPA samples were initially screened by testing for RSV using antigen detection (Binax NOW RSV card), and those that tested negative went on to have extended PCR panel testing (Figure 1). This was in accordance with the hospital policy at the time to support diagnosis while limiting unnecessary tests.

Children aged less than two years admitted to hospital with a clinical diagnosis of bronchiolitis with a positive NPA for RSV or RV were identified from a search of the microbiology department's electronic database. Data were collected over a period of three years and nine months (April 2012–December 2015). Infants who only had a single pathogen (either RSV or RV) were included in the study. NPA samples that identified more than one pathogen were excluded. Respiratory pathogens detected from babies in the neonatal unit ($N = 10$) were also excluded as bronchiolitis is more difficult to diagnose in this group, and they were more likely to have acquired infection nosocomially. NPA samples that were negative on PCR using an extended panel of respiratory viruses served as a control group.

The study was a service evaluation project, and patient consent was not required. Data were collected on median age at presentation, sex, associated risk factors (chronic lung disease, prematurity, congenital heart disease, genetic conditions), therapeutic interventions (intravenous fluids, intravenous antibiotics, chest X-ray), need for respiratory support (high flow oxygen, continuous positive airway pressure, ventilation), management in high-dependency unit (HDU)/paediatric intensive care unit (PICU) and outcome [length of stay (LOS) and any deaths]. LOS of seven days or less was defined as short, and LOS of eight to 21 days was defined as prolonged. Statistical analysis was performed using standard Chi-squared analysis, and $P < 0.05$ was considered to indicate significance.

Results

In total, 437 NPA samples were tested for children aged less than two years. One hundred and eighteen children were excluded from the study, either because they had a single respiratory pathogen other than RSV or RV ($N = 41$) or they had co-infection with two or more viruses ($N = 77$). Of the 41 children who had a single virus detected on extended PCR panel, the three most common viruses were: parainfluenza virus ($N = 14$), human metapneumovirus ($N = 10$) and coronavirus ($N = 7$). There was no single third predominant viral pathogen identified. The three most common viruses in the co-infection group ($N = 77$) were: rhinovirus ($N = 58$), RSV ($N = 19$) and human metapneumovirus ($N = 18$). Sixty-three patients had two pathogens, 13 patients had three pathogens, and one patient was co-infected with four pathogens.

The remaining 319 children were included in the study: 162 had RSV (114 antigen positive; 48 PCR positive), 65 had RV and 92 served as negative controls. The male:female ratio was 1.4:1 for RSV and 1.7:1 for RV. In the PCR-negative control group, the ratio was 1.3:1. The median age at presentation was 87 days (range 12–692 days) for the RSV group, 92 days (range nine to 693 days) for the RV group and 109 days (range 12–674 days) for the PCR-negative control group.

As expected, the occurrence of RSV infections was seasonal, with only 20/162 (12.3%) cases diagnosed between February and October (Figure 2). RV was much more evenly distributed all year round, with a peak in December [21/65 (32%)]. Forty-eight percent of cases ($N = 31$) of RV-associated bronchiolitis occurred outside the non-RSV season (February–October). This difference was significant when comparing the RV group with the RSV group ($P < 0.01$).

Figure 3 Highlights the distribution of risk factors amongst the three different groups. Children with RSV had significantly