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Surveillance

An outbreak of respiratory tract infection due to Respiratory Syncytial Virus-B in a postpartum center

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ABSTRACT

Background: An outbreak of respiratory tract infection due to Respiratory Syncytial Virus (RSV) type B in a postpartum center was reported on February 1, 2017. Investigation was conducted to identify the magnitude, possible source of infection and risk factors for this outbreak on February 2, 2017.
Methods: A retrospective cohort study was conducted. A case was defined as a neonate having respiratory symptoms with or without fever and stayed at the postpartum center between January 1, 2017 and February 3, 2017. Daily records of neonates were reviewed, and all parents who stayed at the postpartum center were interviewed. Virological testing of real-time polymerase chain reaction was conducted for the neonates having respiratory illness, the parents and all staff members in the facility.
Results: This outbreak occurred between January 17, 2017 and February 7, 2017 in a postpartum center. Thirty-five (58.3%) neonates among 59 neonates were identified as cases and 12 neonates were confirmed to be RSV-B positive. The longer length of stay in the postpartum center is the only risk factor (Relative Risk = 8.10, 95% Confidence Interval:1.84−35.62, $p < 0.01$) in this outbreak. Two nursing staffs and eight parents were confirmed as RSV-B positive.
Conclusions: Longer periods of stay in the postpartum center had an increased chance of becoming infected with RSV during this outbreak. Isolation of cases and temporary closure with environmental cleaning were recommended to the postpartum center.

1. Introduction

Respiratory Syncytial Virus (RSV), a single-stranded RNA virus in the *Paramyxoviridae* family, is one of the major pathogens causing outbreaks of respiratory tract infections among neonates in the hospital setting, and it is associated with increased morbidity and mortality [1,2]. It is well-established that RSV is likely to be spread by contact via direct- or self-inoculation after handling of contaminated environmental surfaces [3]. Thus, the most critical preventive and control measures are strict hand hygiene, rapid isolation of index patients and early detection of transmission sources.

In Korea, three weeks after giving birth has been considered as the most important period of time for having mother's live healthy [4]. Overall 50.2% of total number of newly birth in Korea remain in postpartum centers which current total number is 600 in 2015 [5,6]. The postpartum center in Korea is the non-medical facility which provides full-day nursing care to postpartum women and babies with meals and cleaning services provided for the relaxation of mothers; thus, babies were separated from mothers during their whole stay except for the breast feeding. Nurses feed and wash the babies in a neonatal unit with other babies.

Neonates, immunologically immature, are at risk for health care associated infection. Identifying risk factors and developing evidence-based protocols to control and prevent outbreaks are essential to protecting neonates in postpartum centers. However, to our knowledge, there have been no studies specifically addressing infection control in postpartum centers.

Abbreviation: RSV, Respiratory Syncytial Virus; GA, gestational age.

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On February 1, 2017, a mother of a neonate in a postpartum center reported several neonates having respiratory symptoms to the public health authority. On the following day of notification, outbreak investigation was implemented by a provincial epidemiologist and officers from the local department of public health to evaluate the size of the outbreak, identify the possible source of infection, risk factors for disease development and implement appropriate control measures.

2. Methods

Ethical approval for this study was not required under the *Korean Infectious Disease Control and Prevention Act. No 4* and *Enforcement Rule of Bioethics and Safety Act. No.33*.

2.1. Epidemiological investigation

A case was defined as a neonate staying at the postpartum center between January 1, 2017 (16 days before the first case's symptoms appeared) and February 3, 2017 (the day of the facility closure), having respiratory symptoms, including cough, rhinorrhea, or nasal congestion, with or without fever (oral temperature > 37.4 °C) as well as either laboratory test confirming the presence of RSV-B virus or an epidemiologic link to laboratory-confirmed case. Carriers were defined as the person including mothers and staffs at the center who had test positive on laboratory test for RSV-B virus.

Data on demographic factors was collected using questionnaires included gender, prematurity based on gestational age (GA; in weeks), birth weight (in grams), delivery method, and individual characteristics including feeding method, floors where their parents stayed and the length of stay in the neonatal unit between the day of the admission and the day of the discharge from the postpartum center. Degree of prematurity and birth weight was based on the World Health Organization classification which premature birth is less than 37 weeks of GA and low birth weight is less 2499 g.

The daily clinical reports of all neonates admitted since January 1, 2017 were reviewed; these reports included records of any abnormal symptoms in the neonates that were observed by staff members in the postpartum center. Furthermore, parents of neonates were interviewed to verify the respiratory symptoms of neonates with the dates first observed. With consideration of the incubation period of RSV (from 2 to 8 days), active surveillance was conducted for 7 days after the closure of the postpartum center to identify additional cases.

To assess the level of environmental contamination, environmental swabs were taken from the hand grip and number plate of a telephone in the neonatal unit, as well as from kitchen materials in a dining room, including a knife and a shelf.

2.2. Laboratory analysis

Nasopharyngeal swabs were taken from 15 among 35 cases by pediatricians during the study period. To identify the carrier, 18 parents whose neonates exhibited respiratory symptoms and all 27 staff members (16 from the postpartum center and 11 from the delivery room at a maternity hospital) were evaluated using nasopharyngeal swabs. Sixty-four swab-samples from 15 cases, 45 suspected carriers, and 4 environments were transported to the commercial laboratory (Green Cross Lab. Inc, Korea) using virus transport media (Becton Dickinson, USA) and stored at 4 °C. To identify RSV-B, AdvanSure™ real-time RT-PCR kit (AdvanSure; LG Life Sciences, Korea) was used according to the manufacturer's instructions [7].

2.3. Statistical analysis

The overall attack rate was calculated by dividing the total number of confirmed cases by the total number of neonates admitted between January 1, 2017 and February 3, 2017. Fisher's-exact test was used to assess the significant differences in demographic factors between cases and non-cases. Bivariate logistic regression analysis was carried out to identify the risk factor for RSV infection in this outbreak. The variables used in logistic regression analysis were the gender, prematurity, birth weight, delivery method, feeding method, floors where parents stayed, and the length of stay in the neonatal unit.

A p-value ≤ 0.05 was considered statistically significant. The statistical package R version 3.2.4 (R Foundation for Statistical Computing, Vienna, Austria) was used for all statistical analyses.

3. Results

3.1. Description of postpartum center

The postpartum center is located on the fifth and sixth floors of a building and all neonates in the center were born without any comorbidity in the same maternity hospital. The neonatal unit only situated on the sixth floors has 20 beds distributed in a 3x5 m^2 cubicle without a compartmentalization and the distance between bassinets is 0.2 m (Fig. 1). There is a single number of sink where near the formula made and feeding bottles after use washed in the unit and the feeding bottles were stored at a UV sterilizer. The centers only allow the husband or postpartum women's mothers to visit and restrict the mothers go out during their stay. However, there was no written screening procedure of the health status of staff members and visitors. Furthermore, no monitoring of the compliance with hand hygiene practice of staff members, mothers and visitors were conducted in this postpartum center.

3.2. Descriptive epidemiology

A total of 59 neonates were enrolled in this study. Thirty-five neonates were identified as cases and the overall attack rate was 58%. The first case presented cough and rhinorrhea on January 17, 2017 and leave the facility on 4 days after. The epidemic curve comprised of two peaks which the first peak was on January 24, 2017 with four cases and the second peak was on February 3, 2017 with five cases (Fig. 2). No additional case was reported after February 7, 2017.

Reported symptoms of cases were cough (25 cases; 71% of total cases), nasal congestion (15 cases; 43%), increased respiratory secretion (9 cases; 26%), rhinorrhea (8 cases; 23%) and fever (3 cases; 9%). All cases were improved after conservative management through the hospitalization (2 cases; 6% of total cases) and outpatient clinics (33 cases; 94% of total cases).

3.3. Detection of RSV

Among 15 cases conducted for the laboratory test, 12 were confirmed to be RSV-B positive. From environment samples, RSV was not identified. However, RSV-B was detected from the two nurses and eight parents who haven't had experienced with any respiratory symptoms or fever.

3.4. Analytical epidemiology

There were no significant differences on the variables between cases and non-cases by gender, delivery method, gestational age, birth weight, breast-feeding methods, or floors where parents

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