

Abstract

Analysis of national surveillance of respiratory pathogens for children and adolescents' community acquired pneumonia in Korea, 2018-2019

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Worldwide, respiratory infection in children ranks high in outpatient and inpatient cases. One type of respiratory infection, community acquired pneumonia (CAP), is one of the most infectious diseases worldwide. The causes of CAP vary depending on individual susceptibility and the epidemiological characteristics of the season and the community within which it occurs. Among the many challenges that CAP confers, it is difficult to obtain samples for microbiological diagnosis. The aim of this surveillance was to identify the pathogens that cause respiratory infections and analyze the current status of antibiotic resistance to provide scientific evidence for management policies of domestic respiratory infection. To accomplish this aim, this study conducted a 24-month prospective study of CAP.

The monitoring network of this study was composed of 28 secondary and tertiary medical institutions based on the national community, and the study operated a community monitoring network for CAP in children, August 2018 to June 2020.

A total of 1,023 cases were registered for nasopharyngeal aspirate or sputum in patients with CAP, and 264 cases (25.8%) were isolated by culture, *S. aureus* 131 cases (12.8%), *S. pneumoniae* 92 cases (9%), and *H. influenzae* 20 cases (2%). The polymerase chain reaction (PCR) of atypical pneumonia pathogens revealed 422 cases of *M. pneumoniae* (41.3%), 5 cases of *C. pneumoniae* (0.5%), and 5 cases (0.5%) of *B. pertussis*. 14.1%. Furthermore, of the *S. pneumoniae* cases, 92 cases were resistant to penicillin and 8.7% were resistant to cefotaxime and ceftriaxone. 97.8% of the pathogens were resistant to cefaclor, and 93.5% were resistant to erythromycin. Of the 21 cases of *H. influenzae*, 71.4% were resistant to ampicillin and 38.1% were resistant to amoxicillin/K clavulanate, and 28.4% were resistant to trimethoprim/sulfamethoxazole. Of the 131 *S. aureus* cases, 53.4% were resistant to oxacillin, 48.1% were resistant to erythromycin, and 43.5% were resistant to clindamycin; no strains were resistant to trimethoprim/sulfamethoxazole, teicoplanin, linezolid and vancomycin. All 8 cases of *K. pneumoniae* showed resistance to ampicillin and cefazolin. Of the 13 cases of *P. aeruginosa*, 7.7% were resistant to amikacin, cefepime, piperacillin and ceftazidime.

This study concluded that, in preparation for potential new epidemics and pandemics, including COVID-19, the monitoring of respiratory infections in children and adolescents has become more important and additional research should be conducted.

Keywords : Children, Community acquired Pneumonia, Pathogen surveillance, Respiratory bacteria

Table 1. General characteristics of patients with community acquired pneumonia

| Categories | | Frequency N (%) |
|------------------|--------------------------|-----------------|
| Gender | Male | 535 (52.3%) |
| | Female | 483 (47.2%) |
| Age* | <12 month | 147 (14.4) |
| | 1-3 years | 309 (30.2) |
| | 4-6 years | 215 (21.0) |
| | 7-11 years | 270 (26.5) |
| | 12-18 years | 72 (7.0) |
| | Total | 1,014 (100) |
| Geometric region | Gyeongsang | 360 (35.2) |
| | Chungchong | 219 (21.4) |
| | Gyeonggi | 215 (21.0) |
| | Seoul | 114 (11.1) |
| | Jeolla | 101 (9.9) |
| | Gangwon | 14 (1.4) |
| Treatment place | Hospitalized | 973 (95.1%) |
| | Outpatient clinic | 45 (4.3%) |
| Sample | Nasal swab | 73 (7.1%) |
| | Throat swab | 8 (0.8%) |
| | Sputum | 195 (19.1%) |
| | Nasopharyngeal aspirates | 727 (71.1%) |
| | Bronchoalveolar lavage | 12 (1.2%) |
| | Transtracheal aspirate | 2 (0.2%) |

*Age range (min-max): 1 month-18 years, Mean Age (mean±SD): 4.9±3.4

Table 2. Clinical characteristics of study patients

| Clinical finding N (%) | Physical examination N (%) | Chest X-ray findings N (%) |
|-----------------------------|-------------------------------|---------------------------------------|
| Cough 992 (93.8) | Rale 688 (65.0) | Peribronchial infiltration 470 (44.4) |
| Fever 911 (86.1) | Wheezing 206 (19.5) | Lobar infiltration 453 (42.8) |
| Sputum 825 (78.0) | Decreased aeration 111 (10.5) | Interstitial infiltration 117 (11.1) |
| Rhinorrhea 541 (51.1) | Hypoxia <95% 55 (5.2) | Pleural effusion 40 (3.8) |
| Poor oral intake 137 (12.9) | Chest retraction 50 (4.7) | |
| Chill 86 (8.1) | | |
| Sore throat 86 (8.1) | | |
| Dyspnea 58 (5.5) | | |
| GI symptom | | |
| Abdominal pain 34 (3.2) | | |
| Vomiting 70 (6.6) | | |
| Diarrhea 37 (3.5) | | |
| Myalgia 36 (3.4) | | |
| Chest pain 21 (2.0) | | |
| Hoarseness 17 (1.6) | | |
| Rash 11 (1.0) | | |
| Hemoptysis 5 (0.5) | | |

Table 3. Results of respiratory bacterial culture detection

| Respiratory bacteria | Total number of samples 1,023 cases | | 2018.8.-2019.5. (Samples N: 500 cases) | | 2019.8.-2020.5. (Samples N: 523 cases) | |
|---------------------------------|--|------|---|------|---|------|
| | No. of Cultures | % | No. of Cultures | % | No. of Cultures | % |
| <i>Staphylococcus aureus</i> | 131 | 12.8 | 73 | 14.6 | 58 | 11.1 |
| <i>Streptococcus pneumoniae</i> | 92 | 9 | 59 | 11.8 | 33 | 6.3 |
| <i>Moraxella catarrhalis</i> | 33 | 3.2 | 23 | 4.6 | 10 | 1.9 |
| <i>Haemophilus influenzae</i> | 20 | 2 | 13 | 2.6 | 7 | 1.3 |
| <i>Pseudomonas aeruginosa</i> | 13 | 1.3 | 9 | 1.8 | 4 | 0.8 |
| <i>Klebsiella pneumoniae</i> | 8 | 0.8 | 5 | 1.0 | 3 | 0.6 |
| Total | 297 | 100 | 182 | 61.3 | 115 | 38.7 |

Table 4. Results of atypical pneumonia bacterial gene detection

| Atypical pneumonia pathogen | Total number of samples 1,023 cases | | 2018.8.-2019.5. (Samples N: 500 cases) | | 2019.8.-2020.5. (Samples N: 523 cases) | |
|------------------------------|--|------|---|------|---|------|
| | Total No. of gene detection | % | No. of gene detection | % | No. of gene detection | % |
| <i>Mycoplasma pneumoniae</i> | 422 | 41.3 | 93 | 18.6 | 329 | 62.9 |
| <i>Chlamydia pneumoniae</i> | 5 | 0.5 | 3 | 0.6 | 2 | 0.4 |
| <i>Bordetella pertussis</i> | 5 | 0.5 | 4 | 0.8 | 1 | 0.2 |
| Total | 432 | 100 | 100 | 20 | 332 | 63.5 |

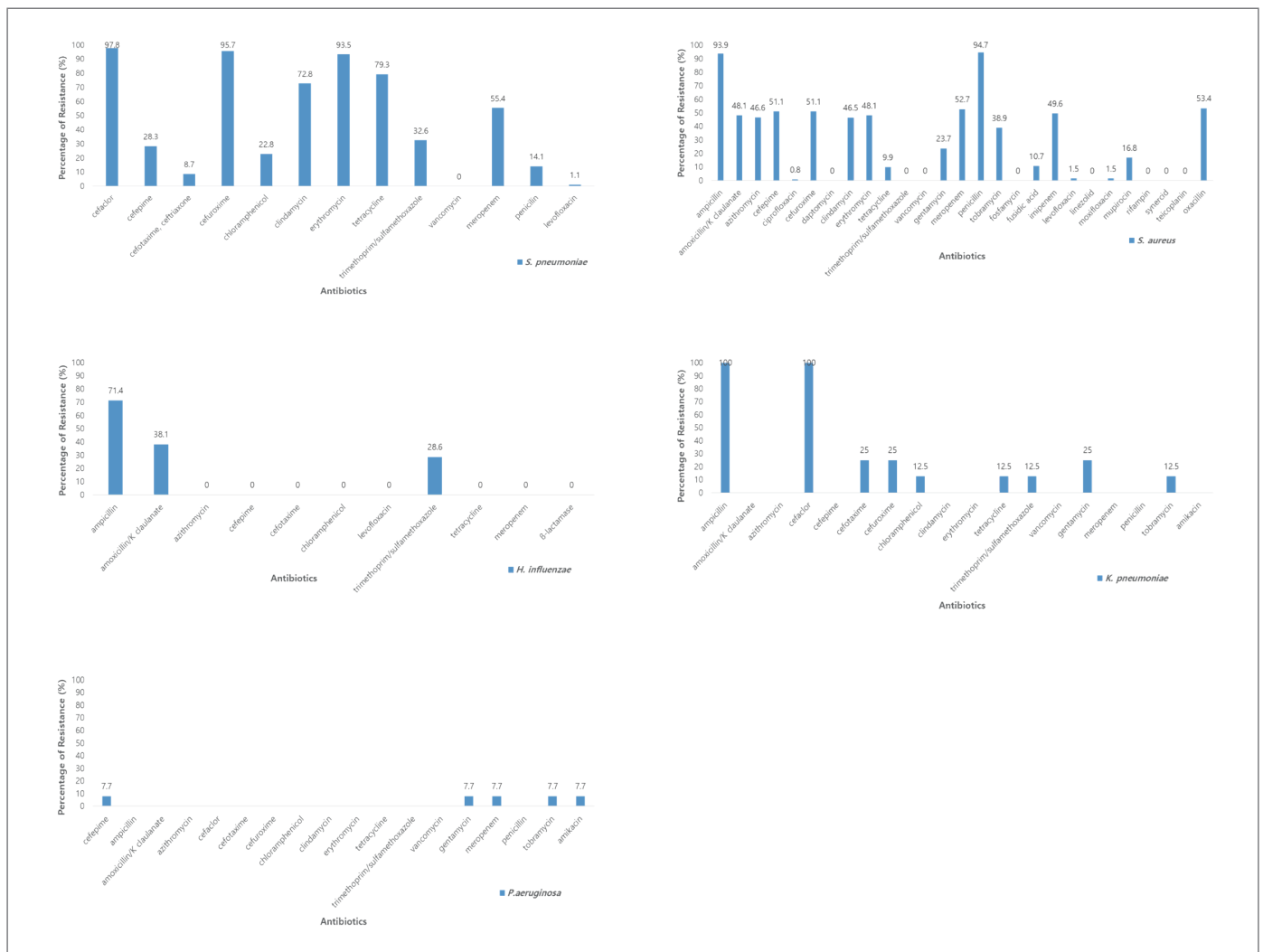


Figure 1. Antibiotic resistance of bacterial pathogens

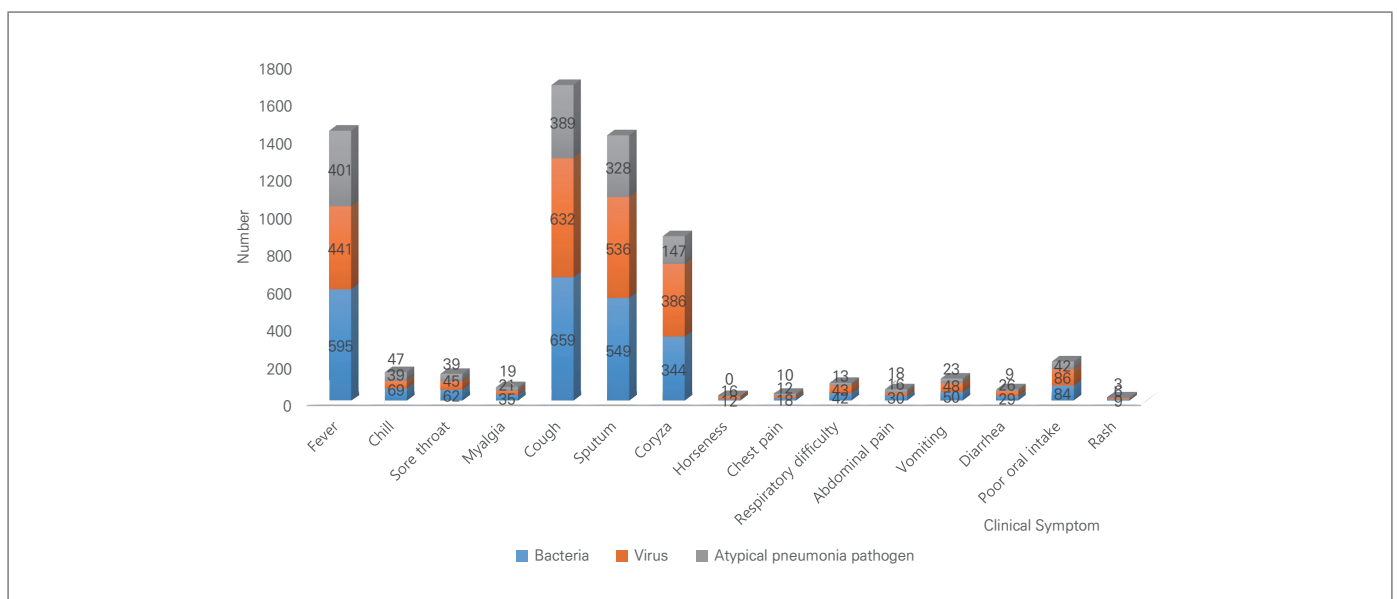


Figure 2. Relationship between clinical signs and causative pathogens