Distribution of respiratory viruses: Evaluation of multiplex PCR results of 3074 patients

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ABSTRACT

OBJECTIVE: Early and accurate diagnosis of acute respiratory infections is important because these diseases negatively affect public health and can lead to loss of workforce and an increase in health expenditures. In this study, we aimed to determine the respiration panel multiplex polymerase chain reaction (PCR) test results and seasonal distribution in our region.

METHODS: Three thousand and seventy-four patients samples multiplex PCR (Anatolia, Bosphore® Respiratory Pathogens Panel Kit v1) test results, which were sent to our laboratory, from 13 hospitals in our region between January 2018 and December 2018, were evaluated retrospectively.

RESULTS: A total of 3074 patients samples, 1465 (48%) were positive and 1609 (52%) were negative test results. The most common factors were rhinovirus 30.2%, influenza A 23.1%, and respiratory syncytial virus (RSV) A/B 19.1%, respectively. When the distribution of these three most common viruses by months is examined, the most frequent months were determined as June for rhinovirus, November for influenza A, and February for RSV A/B. In the period between October and February, there was a significant increase in the positivity level of viral factors.

CONCLUSION: The use of molecular methods in the diagnosis of respiratory infections will prevent unnecessary use of antibiotics and ensure correct and rapid treatment.

Keywords: Respiratory tract infection; multiplex polymerase chain reaction; virus.

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Respiratory infections have the highest morbidity among infections seen worldwide, it was more than 75% of acute diseases in developing countries [1]. Although many pathogens play a role in the etiology of respiratory infections, the most common cause is viruses. It is known that more than 20 virus species cause acute respiratory infections [2, 3]. There are seasonal differences in acute respiratory tract infections due to viral factors, as well as changes according to age groups and methods used in diagnosis [4, 5]. The use of traditional cultures, viral cultures, direct immunofluorescence tests, and rapid antigen tests is time consuming and lacking in sensitivity and specificity. In studies using molecular methods, it is possible to detect more factors within 1–6 h depending on the pathogen examined [6, 7]. The most common viral factors responsible for acute respiratory infections are rhinovirus, influenza virus, parainfluenza virus, respiratory syncytial virus (RSV), adenovirus, and enterovirus,

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with the introduction of molecular tests, factors such as influenza A subtypes, human metapneumovirus, coronavirus, and human bocavirus have also been identified [1, 8–10]. In this study, we aimed to retrospectively analyze our respiratory panel multiplex polymerase chain reaction (PCR) test results, which we use in the evaluation of patients who apply to hospitals in our serve area in diagnosis of acute respiratory infections.

MATERIALS AND METHODS

Patient samples which were sent to the Central Laboratory between January 2018 and December 2018 from 13 hospitals (nine Training and Research Hospitals and four Public Hospitals) in the second Presidency Area of Istanbul Public Hospitals Services were included in the study. Totally 3074 nasopharyngeal swab samples with suspected acute respiratory infection patients test results were analyzed retrospectively. Nasopharyngeal swab samples taken from pediatric and adult patients with acute respiratory tract infections with sterile dry swabs were delivered to the laboratory within 2 h and studied with the respiratory panel multiplex PCR kit (Anatolia, Bosphore® Respiratory Pathogens Panel Kit v1). Samples that cannot be studied immediately were kept at + 4°C for 24 h. Multiplex PCR kit was detected; Influenza B, Mycoplasma pneumoniae, Parainfluenza 1, Parainfluenza 2, Parainfluenza 3, Parainfluenza 4, Enterovirus, Metapneumovirus, Influenza A, RSV A/B, Bocavirus, Rhinovirus, Coronavirus, and Pandemic H1N1 Influenza A.

Ethics committee decision number, date: Haydarpasa Numune Training and Research Hospital Ethics Committee (HNEAH-KAEK 2021/KK/68, 15.02.2021).

RESULTS

Of the 3074 patients samples tested; 1609 (52%) were positive and 1465 (48%) were negative. Of the patients samples tested, 2168 (70.5%) were 0–15 years old and 1344 (62%) had a positive results, 906 (29.5%) were adult patients (15< age) and 217 (24%) had a positive results. The most common microorganisms were 14.4% Rhinovirus, 11% Influenza A, and 9.1% RSV A/B, respectively (Fig. 1). When the distribution of the samples tested in 1 year period is examined; the most samples tested were December and January and the least samples tested were August and September, respectively Table 1). When the distribution of the three most common virus; Rhinovirus had the highest positive rate

Highlight key points

- The distribution of the three most common virus; Rhinovirus had the highest positive rate in June (30.1%), Influenza A in November (33%), and RSV A/B in February (27.8%).
- Of the patients samples tested; 70.5% were 0–15 years old and 62% had a positive results. 29.5% were adult patients (15< age) and 24% had a positive results.
- Viral agent was shown in half of the samples tested.
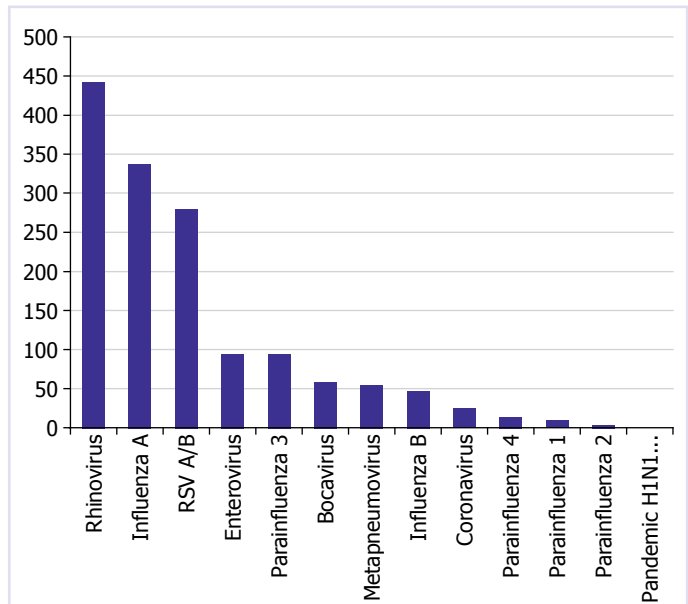

FIGURE 1. Distribution of the total number of positivity of the microorganism in 1 year.

in June (30.1%), Influenza A in November (33%), and RSV A/B in February (27.8%) (Fig. 2).

DISCUSSION

Acute respiratory infections are among the most common infectious diseases in developing countries, and the most common viral agents are RSV, rhinovirus, parainfluenzavirus, adenovirus, and influenzavirus [4, 11]. RSV and influenza are the most common viruses detected in hospitalized children worldwide. Rhinovirus, thought to cause mild upper respiratory infections in adults, can also cause serious infections in children [12, 13]. According to our data in a 1-year period; in our region, the most common viral etiological agents of respiratory tract infections were Rhinovirus, Influenza A virüs, and RSV A/B and increased significantly between October and February. Brittain-Long et al. [14] in their study which included all age

TABLE 1. Distribution of the viruses positivity in the 1-year period by months

Microorganism	Distribution of percentage numbers by month*											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Rhinovirus	9.1	19.3	13.5	4.1	25	30.1	26.7	0	0	20.3	13.5	13
Influenza A	5.8	9.5	3.2	12.2	0.3	0.7	1.3	8.3	8.6	12.3	33	25.6
RSV A/B**	20.4	27.8	2.2	6.6	1.6	0	2.5	3.6	6.7	9.4	6.5	3.4
Enterovirus	0.8	0	6.7	10	3.4	5.3	3.8	0	0	0	4	1.2
Parainfluenza 3	0	0	0	3.8	6.2	21	17.2	1.2	0	0	3.5	0
Bocavirus	1	15	3.8	0	4.1	3	4.4	1.2	0	0	1	0
Metapneumovirus	2.3	0	5.5	0	4.7	0	3.2	0	3.8	0	0	0.6
Influenza B	0	0	0	1.2	13.1	0	1.3	0	0	0	0	0
Coronavirus	1.6	2.1	0	0	0.9	0	0.6	0	0	0	0	1.2
Parainfluenza 4	0	0	0	0	2.2	1.5	1.3	3.6	0	0	0	0
Parainfluenza 1	0	0	0	0	1.2	0.7	0.6	0	2.9	0	0	0
Parainfluenza 2	0.2	0	0	0	0	0	0	1.2	1.9	0	0	0
Pandemic H1N1 Influenza A	0	0	0	0	0	0	0	0	0	0	0	0
Total number	485	327	311	319	320	133	157	84	104	138	200	496
Positive (%)	46	71	37	48	70	79	76	21	27	27	64	47
Negative (%)	54	29	67	52	30	21	24	79	73	554	36	53

*: Percentage ratios were calculated with all patients; **: RSV A/B: Respiratory syncytial virus A/B; Jan: January; Feb: February; Mar: March; Apr: April; Jun: June; Jul: July; Aug: August; Sep: September; Oct: October; Nov: November; Dec: December.
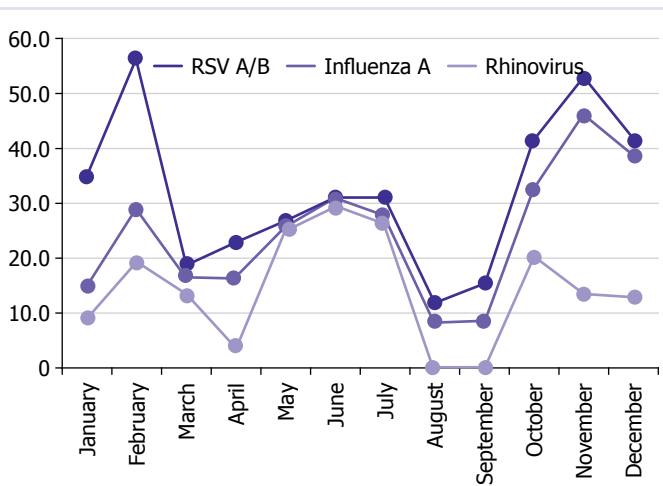
FIGURE 2. Distribution of the three most common factors by months.

group patients, the total detection rate of respiratory virus was found to be 48%. Kaida et al. and Mengelle et al. [15, 16] were reported, in pediatric patients studies the rate of viral detection as 85.3% and 88.7%, respectively. Various studies conducted in our country found that at least one viral respiratory pathogen detection rate ranged from 41.8% to 78.6%. Distribution and frequency of respiratory viruses may vary depending on factors such as age, season, socioeconomic status, underlying disease, and diagnostic test used [17]. In this study, total of 3074 patient samples tested was detected 48% positivity. Arslan et al. [18] were detected 47.4% positivity rate and Ecemiş et al. [19] were detected 34.4% positivity. In the pediatric group patients with acute respiratory infection, the rate of detection of respiratory viruses varies between 30 and 96% [20, 21]. Çiçek et al. [5] were detected the positivity rate as 35.4% in pediatric patients with acute respiratory infection and 27.3% in adult patients. Akçalı et al. [22] reported 41.8%, Ünüvar et al. [23] reported 29.8% viral agent positivity that could cause infection in a pediatric patient. Avcu et al. [17] reported that viral agents were detected in 83.3% of patients by molecular methods and RSV has been reported as the most common agent. In our study, the most frequent microorganism was Rhinovirus 30.2%, Influenza A 23.1%, and RSV A/B 19.1%. A total of 3074 patients, 2168 (70.5%) were detected to pediatric patients and 906 (29.5%) were belong to adult patients. One thousand two hundred and forty-eight (57.5%) samples was detected positivity in pediatric patients. Masoud et al. [24] reported that 52.5% was positive in a similar study for children and

the most common factor was 69.8% Rhinovirus. In conclusion, it is an expected situation that unnecessary use of antibiotics can be prevented in patients with acute respiratory infections by the detection of viral pathogens. Antibiotic resistance can be under the control, hospital stay is shortened, and treatment costs are reduced with early diagnosis and appropriate treatment. Viruses are most common etiological agents causing respiratory infections. While viral respiratory infections may result in severe morbidity and mortality in the elderly, immuncompromised patients, and children [25]. In this study, a viral agent was shown in half of the samples tested. The use of molecular methods in the diagnosis of respiratory tract infections will be increased and treatment will be directed rapidly and the use of antibiotics will be reduced with the idea of bacterial infection.

Conclusion

Multiplex PCR method based on the principle of nucleic acid detection, which can detect respiratory viruses at the same time with a single sample and a single test, is a convenient and effective practice in terms of directing the clinician to timely and effective treatment.

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