

## Coronavirus Pandemic

# Detection of SARS-CoV-2 in Nasal Swabs: comparison with Nasopharyngeal Swabs

Hyun Ah Kim<sup>1</sup>, Miri Hyun<sup>1</sup>, Ji Yeon Lee<sup>1</sup>, Sunggyun Park<sup>2</sup>, Namhee Ryo<sup>2</sup>, Yong Shik Kwon<sup>3</sup>, Jae Seok Park<sup>3</sup>, Jin Young Kim<sup>4</sup>, Jae Cheon Jeon<sup>5</sup>, Kyong Ran Peck<sup>6</sup>

<sup>1</sup> Department of Infectious disease, Keimyung University Dongsan hospital, Keimyung University School of Medicine, Daegu, Korea

<sup>2</sup> Department of Laboratory Medicine, Keimyung University Dongsan hospital, Keimyung University School of Medicine, Daegu, Korea

<sup>3</sup> Department of Pulmonology, Keimyung University Dongsan hospital, Keimyung University School of Medicine, Daegu, Korea

<sup>4</sup> Department of Radiology, Keimyung University Dongsan hospital, Keimyung University School of Medicine, Daegu, Korea

<sup>5</sup> Department of Emergency medicine, Keimyung University Dongsan hospital, Keimyung University School of Medicine, Daegu, Korea

<sup>6</sup> Division of Infectious disease, Samsung Medical Center, Sungkyunkwan University School of Medicine, Seoul, Korea

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Dear Editor,

The World Health Organization declared the outbreak of coronavirus disease (COVID-19) a pandemic [1]. Following Europe and the United States, the outbreaks have started in many developing countries, where healthcare systems are less resilient. The first case in South Korea was reported on 20 January 2020 [2]. Daegu is one of the largest cities in South Korea, with about 2.4 million residents. More than 65 % of South Korea's COVID-19 cases were diagnosed in Daegu [3]. The highest number of new cases in a day in Daegu reached 813 on 29 February 2020. The government established clinics for COVID-19 with the cooperation of private hospitals and the public health center. As a surge of people sought to be tested, screening clinics, soon became overwhelmed. Additionally, there were growing concerns about transmission risk through close contact between patients and healthcare personnel (HCP). Traditionally, nasopharyngeal (NP) swabs have been recommended for the detection of respiratory viruses including severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), owing to their high sensitivity [4]. However,

procedures that involve obtaining NP swabs are considered aerosol-generating procedures, and they require special facilities like airborne infection isolation rooms (AIIR) and should be performed by trained HCP. Because of the very limited number of patients who can undergo NP swab testing in AIIRs, it is difficult to conduct testing on a large scale. It would be beneficial if other specimen types obtained by patients themselves were as effective as NP swabs. This study is aimed to analyze whether nasal swabs are comparable to NP swabs in the detection of SAR-CoV-2.

The diagnosis of COVID-19 was performed by taking nasopharyngeal (NP) swabs and sputum samples concurrently. However, owing to an elevated demand for testing following a rapid surge in cases of COVID-19, tests were conducted on at least one sample per person. We then collected nasal and NP swabs simultaneously from 18 patients diagnosed with COVID-19 at different time intervals from symptom onset and diagnosis. Sputum was obtained from eight patients. COVID-19 testing was performed with real-time reverse transcriptase polymerase chain reaction assay with focus on the *RdRp*, *E*, and *N* genes [5]. A

**Table 1.** SARS-Cov-2 detection results of nasal swab, nasopharyngeal swab and sputum by real-time RT-PCR.

Patient	Days after symptom onset	Days of Admission	Nasal swab				Nasopharyngeal swab				Sputum			
			E gene	RdRp gene	N gene	Result	E gene	RdRp gene	N gene	Result	E gene	RdRp gene	N gene	Result
1	5	1	19.02	20.2	21.52	+	22.38	24.33	25.57	+				
2	6	0	30.49	31.58	33.47	+	.	.	.	-				
3	6	3	.	.	.	-	.	.	36.01	Id				
4	7	2	30.84	32.66	32.04	+	16.8	18.8	21.12	+				
5	7	4	32.23	35.36	33.73	+	28.56	30.93	30.94	+	20.92	24.89	23.26	+
6	8	1	26.11	27.69	28.69	+	.	.	.	-				
7	8	1	24.86	26.59	28.07	+	31.35	34.67	33.99	+	20.01	22.29	21.81	+
8	8	5	.	.	.	-	.	.	36.67	Id	26.27	30.03	28.99	+
9	10	1	.	.	.	-	.	.	39.21	Id				
10	10	4	.	.	.	-	31.82	34.92	34.04	+	22.09	26.08	24.78	+
11	11	0	19.64	21.76	23.88	+	16.2	18.79	20.55	+				
12	12	4	.	.	.	-	.	.	.	-				
13	12	8	.	.	34.69	Id	.	.	37.24	Id	27.7	30.05	29.63	+
14	12	9	.	.	32.5	Id	.	.	36.29	Id				
15	15	2	.	.	.	-	33.58	.	33.09	Id	30.04	30.33	31.25	+
16	15	8	.	.	.	-	.	.	34.16	Id	25.53	28.39	28.5	+
17	15	8	.	.	.	-	.	.	.	-				
18	16	6	.	.	38.85	Id	25.4	29.59	28.94	+	25.92	.	30.06	Id

Id: indeterminate.

diagnosis was confirmed if all three genes showed cycle threshold (Ct) values below the reference value. If just one or two of the three were below the reference value, the case was defined as indeterminate. The study was approved and the requirement for informed consent was waived by the Institutional Review Board (2020-03-027).

Among the 18 patients enrolled, nine patients tested positive from nasal or NP swabs, results were concordantly positive for both tests in five patients (Table 1). From the seven patients with positive nasal swabs, specimens were obtained from four patients within a week of symptom onset. Sputum showed positive results in seven out of eight patients. Results were positive in 12 patients for either nasal swab or sputum test and 11 patients out of 18 patients for either NP swab or sputum test. The positivity was evaluated after the classification of patients by symptoms duration. Among 5 patients from whom specimens were taken within a week of symptom onset, nasal swabs were positive in four patients (80 %, 4/5) and NP swabs in 3 (60 %, 3/5) (Table 2). Among 13 specimens taken later than a week after symptom onset, nasal swabs were positive in three patients and NP swabs in four.

In this study, SARS-CoV-2 was detected in nasal swabs, even from patients without a coryza. The detection of SARS-CoV-2 in nasal swabs (63 %, 5/8) has also been reported in another study [6]. However, the positivity rates of nasal and NP swabs were not compared in that study. Having compared them in this study, we found that the positivity rates of nasal swabs were comparable to those of NP swabs. When specimens were obtained within 7 days of symptom onset, the positivity rates of nasal swabs were high (80 %, 4/5) as those of NP swabs. Overall, sputum showed higher positivity rates than NP or nasal swabs in this study. Although sputum is difficult to obtain in the early phase of diseases, it remains PCR positive for a longer time from symptom onset in patients with COVID-19 [7]. Therefore, sputum is a superior specimen if it is obtainable, especially in the later stages of the disease.

One study reported the generation of false-negative NP swab test results by unskilled HCP in a case of nasal obstruction [8]. As such, had the screening tests been performed by skilled HCP, the sensitivity of the samples would have definitely improved. However, owing to the overwhelming spread of the current

**Table 2.** Difference in positivity rate by sample type according to symptom onset.

Sample type	Days after onset of symptom	
	≤ 7 days	> 7days
Nasal swab	4/5 (80%)	3/13 (23%)
Nasopharyngeal swab	3/5 (60%)	4/13 (30%)

pandemic, it is impractical for experienced HCP to perform all screening tests.

Prior studies reported that nasal swabs were as sensitive as NP swabs in detecting respiratory viruses [9,10], and the lower sensitivity of a specimen type could be overcome by the use of molecular methods, which are standard methods of detecting SARS-CoV-2 at this point [11]. One study revealed that some level of reduced sensitivity of nasal swabs in the detection of respiratory syncytial virus could be acceptable if it were outweighed by facility, lower cost, and better acceptability among patients in developing countries [12]. Nasal swabs can be obtained by patients themselves, and this is an important advantage. This can be applied to the development of self-test kits usable at home.

Our study finding suggest that nasal swabs could be considered as an alternative methods of specimen collection to NP swabs in the detection of SARS-CoV-2. In particular, they are advantageous where there is a shortage of healthcare personnel and facilities, especially if they are obtained an early stage of infection. Nasal swabs could be useful in screening larger populations as specimens can be collected more rapidly and efficiently. Considering the relatively low sensitivity of nasal swabs at later stages of infection and the difficulty of collecting sputum, combining tests for both specimens would be more effective in the detection of SARS-CoV-2. Notwithstanding, the effectiveness of nasal swabs should be evaluated further in future studies.

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## Corresponding author

Kyong Ran Peck, MD, PhD  
 Division of Infectious Diseases, Samsung Medical Center,  
 Sungkyunkwan University School of Medicine, Seoul, Republic of Korea  
 Tel: 82-2-3410-0329  
 Fax: 82-3-3410-0064  
 Email: krpeck@skku.edu

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