Relationship between Smell and Taste Impairment Function among COVID-19 Patient in General Hospital of Adam Malik Medan

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Abstract

BACKGROUND: Decrease of smell-taste has become a cardinal symptom of COVID-19. Some previous studies have reported that most of the COVID-19 patients complained of early smell-taste impairment.

AIM: Hence, this study was aimed to investigate the relationship between smell and taste impairment against PCR test results.

METHODS: This study was an observational study with a cross-sectional study among 193 patients who were diagnosed as COVID-19 that had smell-taste impairment between March and August 2020. Parameters were evaluated in this study included age, sex, ethic, occupation, smell-taste impairment, coagulation state, comorbid condition, obesity, and the result of the swab PCR test. The relationship between smell and taste impairment and the PCR test result was analyzed by Chi-square and regression logistic.

RESULTS: This study showed that most COVID-19 patients were female (32.1%) aged 18−40 years old (25.9%). Meanwhile, the most comorbid condition owned by the COVID-19 patient in the General Hospital of Adam Malik Medan was diabetes, followed by hypertension, cardiovascular disease, and stroke. Moreover, this study also revealed that the smell (adjusted OR: 3.92; 95% CI: 1.30−11.87) and taste (adjusted OR: 3.64; 95% CI: 1.30−10.22) impairment significantly associated with COVID-19 (p < 0.05)

CONCLUSION: Overall, it can be concluded that the smell-taste impairment can be used to early symptoms to predict the COVID-19 with the positive PCR test result.

Introduction

Recently, the world was surprised by a new type of coronavirus known as COVID-19 in Wuhan, China, in the past month of 2019, when Huanan Seafood Market acted as the origin. This virus has a similar genome with other coronaviridae viruses such as middle east respiratory syndrome (MERS-CoV) or severe acute respiratory syndrome (SARS-CoV). COVID-19 virus was a RNA virus from genus of betacoronavirus in coronaviridae family. The virus is a spherical or pleomorphic enveloped particle containing the genome associated with a nucleoprotein within a capsid comprised matrix protein. The diameter of this virus is 80−160 nm and contains the largest genome, namely, 26.4−31.7 kb [1], [2].

The World Health Organization (WHO) declared this COVID-19 as a pandemic on March 12, 2020, and it had been reported 32.7 million cases in September 2020 and around 1 million deaths worldwide at the same time [3]. On the other hand, COVID-19 infection also occurred in Indonesia. On March 3, 2020, two people reported the first case of COVID-19 in Indonesia while the president was officially announcing its condition. Based on the data in April 2020, the total number of COVID-19 cases in Indonesia was 8211. From these infected patients, 1002 patients were cured, and 689 patients died [4]. The Government of the Republic of Indonesia has reported 3,532,567 persons with confirmed COVID-19. There have been 100,636 deaths related to COVID-19 reported, and 2,907,920 patients have recovered from the disease [5].

Severe acute respiratory syndrome (SARS) coronavirus (SARS-CoV-2) shows broad clinical presentation. However, the clinical presentation of the infection is similar to other respiratory infections, such as influenza, bronchitis, and upper respiratory infection. Fever and cough are the prominent signs of mild clinical presentation. Furthermore, the moderate-severe infection will show acute respiratory failure, acute respiratory distress syndrome, metabolic acidosis, coagulopathy, and septic shock. [6], [7].

Recently, a decrease in smell taste has become the cardinal symptom of COVID-19 among some patients. Pissurno *et al*. (2020) reported that a male aged 29 years old diagnosed with COVID-19 complaint of a sudden onset of anosmia. Moreover, the patient also had fever and odynophagia – no abnormalities in the nasopharyngeal mucosa when the physical examination was performed. At the pandemic's beginning, China reported that about 5% of

COVID-19 patients showed anosmia and hypogeusia. Meanwhile, Butowt and Bartheld (2020) reported that the prevalence of smell, taste, and smell and taste impairment in East Asia was 22.4%, 16.2%, and 23.4%, respectively. There are several possible mechanisms of decreasing smell-taste, namely, nasal obstruction/congestion and rhinorrhea, loss of olfactory receptor neurons, brain infiltration affecting olfactory centers, and damage of support cells in the olfactory epithelium [8], [9]. Therefore, some patients may also complain of prolonged olfactory dysfunction caused by olfactory epithelial damage or olfactory pathway disruption [10].

Based on the information above, it becomes important to identify the COVID-19 as early as possible while the incidence rate of COVID-19 was high and prevent prolonged smell-taste impairments. Thus, the researcher is interested in investigating the possibility of COVID-19 among the patients with smell-taste impairment while most of the patients reported have a smell-taste impairment. Hence, this study was designed to evaluate the patient's risk of suffering from COVID-19 when the patient has smell-taste impairment.

Methods

This study was an observational study with a cross-sectional design performed in the General Hospital of Adam Malik Medan. This study has been approved by the Health Research Ethics Committee from Universitas Sumatera Utara (Letter No. 663/KEP/USU/2020).

The sample of this study was the patient diagnosed as COVID-19 with a history of smell-taste impairment between March and August 2020. The sample of this study also acted as a population. Hence, this study obtained 193 patients as the sample.

Parameters were evaluated in this study included age, sex, ethic, occupation, smell-taste impairment, coagulation state, comorbid condition, obesity, and the result of the swab PCR test.

Impairment of smell-taste and coagulation state was act as the independent variable. Meanwhile, the result of swab PCR acted as the dependent variable. The PCR test result was chosen to diagnose the confirmed COVID-19 case based on the World Health Organization (WHO) or the Indonesia Health Ministry criteria.

The descriptive statistics analyzed all data. After that, the analysis was continued to Chi-square to look for the relationship between coagulation state and smell-taste impairment function against the PCR test result. Finally, the analysis was ended by regression logistic as multivariate analysis to look for coagulation state and smell-taste impairment function against the PCR test result considering the other confounding factors (age, sex, and comorbid condition) in the analysis model.

Results

In the beginning, this study identified the characteristic of patients described in the following table.

Based on the Table 1, some characteristics included age, sex, obesity, and comorbid conditions grouped in two different groups based on the PCR test result.

Table 1: Characteristic of COVID-19 patients in the General Hospital of Adam Malik Medan between March and August 2020

| Characteristic | PCR test result | | | | Total | p-value |
| | Positive (N=102) | | Negative (N=91) | | [n (%)] | |
	N	%	N	%		
Age						
18−40	50	25.9	48	24.9	98 (50.8)	0.286
41−63	45	23.3	32	16.6	77 (39.9)	
64−86	7	3.6	11	5.7	18 (9.3)	
Sex						
Male	40	20.7	46	23.8	86 (44.6)	0.114
Female	62	32.1	45	23.3	107 (55.4)	
Obesity						
Obese	49	25.4	6	3.1	55 (28.5)	< 0.05
Non-obese	53	27.5	85	44.0	138 (71.5)	
Comorbid conditions						
Hypertension	33	17.1	21	10.9	54 (28.0)	0.152
Diabetes	45	23.3	17	8.8	62 (32.1)	< 0.05
Cardiovascular disease	30	15.5	11	5.7	41 (21.2)	0.003
Stroke	8	4.1	2	1.0	10 (5.2)	0.077

Age

The most of positive PCR patients were aged between 18 and 40 years old, who were 50 patients (25.9%), followed by 41−63 years old (23.3%) and 64−86 years old (3.6%). Meanwhile, the most of negative PCR test was aged between 18 and 40 years old that was 40 patients (24.9%) followed by 41−63 years old (16.6%) and 64−86 years old (5.7%). Moreover, age as the characteristic did not significantly affect the PCR test result, and it was showed by p > 0.05 (p = 0.286).

Sex

The most positive PCR patients were female, 62 patients (32.1%), and the remaining were male, which were 40 patients (20.7%). Meanwhile, the negative PCR test group showed a different pattern; the number of male patients was greater than that of female patients. The number of female and male patients with negative PCR test results was 45 (23.3%) and 46 (23.8%), respectively. However, sex did not significantly affect the PCR test result, and it was showed by p > 0.05 (p = 0.114).

Obesity

The most positive PCR patients were non-obese, 53 patients (27.5%) and the remaining was obese that was 49 patients (25.4%). The number of non-obese and obese patients with negative PCR test results was 85 (44%) and 6 (3.1%) patients, respectively. Meanwhile, the negative PCR test group showed a similar pattern; there were more patients without obesity than with obesity. Moreover, obesity significantly affected the PCR test result, and it was showed by $p < 0.05$.

Comorbid conditions

Some comorbid conditions occupied the positive PCR test result included diabetes (23.3%), hypertension (17.1%), cardiovascular disease (15.5%), and stroke (4.1%). Moreover, almost all comorbid conditions significantly affect the PCR test result, except hypertension with $p > 0.05$ ($p = 0.152$).

Relationship between smell and taste impairment and PCR test result

After descriptive statistics, the analysis was followed by the Chi-squared and regression logistic. The result of these analyses was described in the following table.

Based on the Table 2, most patients with positive PCR tests showed both smell and taste impairments. The number of positive PCR tests patients with smell and taste impairment was 55 (28.5%) and 64 (33.2%). Meanwhile, most patients with negative PCR test results did not complain of any smell or taste impairments. The bivariate analysis showed that smell and taste impairment significantly affects the PCR test result. The odds ratio (OR) for smell and taste impairment was 8.51 and 11.09, respectively. Moreover, the adjusted OR for smell and taste impairment was 3.92 and 3.64, respectively. It means that the patient with smell and taste impairment was 3.92 and 3.64 times more likely to have positive PCR test result than without smell and taste impairment, respectively.

Table 2: Comparison between smell and taste impairment and PCR test result

Smell-taste impairment	PCR test result				Total	p-value	OR (95% CI)	Adjusted OR (95% CI)*
	Positive		Negative					
	n	%	n	%				
Smell impairment								
Yes	55	28.5	11	5.7	66 (34.2)	< 0.05	8.51	3.92
No	47	24.4	80	41.5	127 (65.8)		(4.06–17.85)	(1.30–11.87)
Taste impairment								
Yes	64	33.2	12	6.2	76 (39.4)	< 0.05	11.09	3.64
No	38	19.7	79	40.9	117 (60.6)		(5.35–22.96)	(1.30–10.22)

*Odds ratio (OR) was adjusted for sex, age, obesity, and comorbid conditions.

Discussion

This study's result answered the purpose of this study. Smell-taste impairment can be used to predict the possibility of COVID-19. Some conditions such as obesity, diabetes, and cardiovascular diseases can affect the risk of COVID-19 among patients with smell-taste impairment. Thus, the risk of COVID-19 among the patient with smell and taste impairment was 3.92 and 3.64 after adjusting for sex, age, obesity, and comorbid condition, respectively.

Some studies have been performed as the previous studies. Mao *et al*. (2020) reported that there were 12 patients (5.6%) who suffered from COVID-19 in Wuhan, China, between January and February 2020 that complained of a taste impairment and 11 patients (5.1%) who complained of smell impairment. Moreover, Mao *et al*. (2020) also reported that the onset of smell and taste impairment ranged between 1 and 5 days. The difference in the result of this study was due to the different characteristics of patients. Mao *et al*. (2020) were evaluated the relationship in the Wuhan population that was different sociodemography conditions. Moreover, the recent study was performed after a few months of the pandemic; meanwhile, the previous study performed by Mao *et al*. who was performed at the early pandemic [11].

Another study by Hariyanto *et al*. (2021) also reported that anosmia or hyposmia is significantly associated with positive COVID-19 infections with a risk ratio of 4.56 (95% CI: 3.32−6.24). A recent reported that smell impairment was significantly associated with the COVID-19 infection with an odds ratio range of 1.30−11.87. This odds ratio was ranged within the risk ratio reported by Hariyanto *et al*. (2021). Hence, it can be seen that Hariyanto *et al*. (2021) reported similar results to the recent study result [12].

Some possible mechanisms can cause smell-taste impairment. Butowt and Bartheld (2020) reported several possible mechanisms of decreasing smell-taste dysfunction, namely, nasal obstruction/congestion and rhinorrhea, loss of olfactory receptor neurons, brain infiltration affecting olfactory centers, and damage of support cells in the olfactory epithelium. Kiay *et al*. (2021) reported that the entire virus infected mucosa caused nasal mucosal inflammation and swelling. Moreover, the virus also disturbed olfactory mucosal. Thus, the viral load affects the severity of smell-taste impairment. The smell-taste impairment will express within around 7 days and recovery within 28 days. Junior *et al*. (2021) agreed with Kiay *et al*. reported about the disruption of the olfactory epithelium; furthermore, Junior *et al*. (2021) also stated that the entire virus could ascend to the central nervous system through the cribriform lamina and olfactory bulb and followed the olfactory nerve and

reach the central nervous system structures to cause smell-taste impairment [8], [13], [14].

Conclusion

Overall, it can be concluded that the smell (adjusted OR: 3.92; 95% CI: 1.30−11.87) and taste (adjusted OR: 3.64; 95% CI: 1.30−10.22) impairment can be used to early symptoms to predict the COVID-19 with the positive PCR test result.

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