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Evaluation of taste and smell disorders in pediatric COVID-19 Cases

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SUMMARY

OBJECTIVE: Pediatric coronavirus disease 2019 (COVID-19) cases have a high risk of contagiousness, as they usually progress with asymptomatic or mild respiratory symptoms. Disorder in taste and/or smell has rarely been reported in pediatric cases. In our study, early diagnosis and isolation measures were emphasized by evaluating the clinical, laboratory, and radiological imaging findings of pediatric COVID-19 cases presenting with symptoms of taste and/or smell disorder.

METHODS: Seven cases aged 0–18 years were included in the study. The severe acute respiratory syndrome coronavirus-2 polymerase chain reaction test was performed for the seven cases presented with taste and/or smell disorders. Clinical findings, laboratory tests, and radiological imaging of all the cases were evaluated on the day of admission and on the fifth day.

RESULTS: Seven (5.7%) of 122 pediatric COVID-19 cases had disorder in taste and/or smell. In two cases, pneumonia findings were detected in thorax computed tomography imaging. It was observed that all the patients fully recovered at the latest on the 21st day. In the cranial diffusion magnetic resonance imaging of a case, diffusion restriction was detected in the corpus callosum splenium.

CONCLUSION: Although less common than adults, children with COVID-19 may also have taste and smell disorders, and this may be accompanied by central nervous system imaging findings.

KEYWORDS: Child. Coronavirus disease 2019. Smell. Taste.

INTRODUCTION

The new coronavirus disease 2019 (COVID-19) caused by severe acute respiratory syndrome coronavirus-2 (SARS-CoV-2) often presents with fever, weakness, dry cough, muscle pain, respiratory distress, vomiting, and diarrhea symptoms[1-3], as well as taste and smell disorders, although these symptoms are less frequently found in adult COVID-19 cases. However, there is insufficient data on the frequency of taste and smell disorders in pediatric COVID-19 cases[3-6].

Angiotensin-converting enzyme 2 (ACE2) is widely available on the oral and nasal mucosa and has been identified as a cellular receptor for SARS-CoV-2[7,8]. It has been reported that SARS-CoV-2 can adhere to the oral mucosa, tongue, nasal respiratory epithelium, and olfactory epithelial support cells;

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and this is associated with taste and smell disorders in COVID-19 cases[8,9]. It is known that ACE2 in the nasal mucosa participates in inflammatory processes through peptides such as bradykinin[10]. However, significant inflammatory and rhinitis symptoms are generally absent in the nasal mucosa of COVID-19 patients[4,5]. Therefore, it is reported that the disorder in the sense of smell may be related to the virus affecting the olfactory pathways[2,11,12]. SARS-CoV-2 binds to the sialic acid receptors on taste pores[2]. Sialic acid is a protector of glycoproteins against the enzymatic effects of taste molecules in taste pores. The decrease in the sialic acid effect causes an increase in the taste threshold[13].

Pediatric COVID-19 cases with asymptomatic or mild clinical symptoms are an important factor in the spread of the virus. The symptoms of COVID-19 are well known, and the early diagnosis of the disease will contribute significantly to the prevention of virus spread. The aim of this study is to investigate the frequency of taste and smell disorders and clinical laboratory findings in pediatric COVID-19 cases.

MATERIALS AND METHODS

The study was performed retrospectively in pediatric COVID-19 cases who were admitted to the Ministry of Health Sakarya University Training and Research Hospital between March 15, 2020 and June 15, 2020. The study included cases who were positive for COVID-19 polymerase chain reaction (PCR) test and admitted to the hospital with taste and/or smell disorder. One of the criteria for inclusion in the study was that the patients were between the ages of 0–18. However, 7 patients included in the study due to taste and smell disorders were between the ages of 11–17. The vital signs and physical examination findings were recorded at the time of admission. In addition, the following test results, which were taken during the time of admission and on the fifth day, were recorded: complete blood count (CBC), C-reactive protein (CRP), procalcitonin (PCT), creatinine (Cr), aspartate aminotransferase (AST), alanine aminotransferase (ALT), creatinine phosphokinase (CPK), lactic dehydrogenase (LDH), ferritin, troponin I, and D-dimer. Chest X-rays, thoracic computed tomography (CT), cranial magnetic resonance (MR), and diffusion MR images were evaluated by the same radiologist. The results are shown as descriptive tables. An Ethics Committee approval from the Sakarya University Medical Faculty was obtained for this study (Ethics Committee Number: 71522473/050.01.04/288).

RESULTS

In this study, taste and/or smell disorder was detected in 7 (5.7%) of 122 pediatric cases who were positive for the COVID-19 PCR test. Two patients had taste disorder, and five patients had taste and smell disorders. It was determined that taste and/or smell disorder started on the day of admission in four cases, 2 days before admission in two cases, and 3 days before admission in one case. The symptoms of the patients during hospital admission are shown in Table 1. The vital and physical examination findings of all the cases were within normal limits during hospital admission. New symptoms or signs were not detected

Table 1. Demographic data and clinical findings of the study group.

	Case 1	Case 2	Case 3	Case 4	Case 5	Case 6	Case 7
Gender	Female	Male	Female	Male	Female	Male	Male
Age (year)	17	17	15	15	11	15	16
Reason for admission to the hospital	Headache, sore throat, diarrhea, decreased taste and smell	Decreased taste and smell	Decreased taste and smell	Decreased taste and smell	Headache, sore throat, decreased taste	Headache, decreased taste	Headache, decreased taste and smell
Time to start taste or smell disorder	Admission	Admission	Admission	Admission	3 days before admission	2 days before admission	2 days before admission
Respiratory rate (/min)	24	26	24	24	20	22	16
Disease severity	Moderate	Mild	Mild	Moderate	Mild	Mild	Mild
Time to improve symptoms	21st day	5th day	21st day	5th day	5th day	14th day	5th day

during the 5-day clinical follow-up. It was observed that the symptoms of taste and smell disorders recovered completely on the 5th day in four cases, on the 14th day in one case, and on the 21st day in two cases. Five cases with no findings on thorax CT imaging were evaluated as mild disease, and two cases with unilateral or bilateral ground glass images on thorax CT imaging were evaluated as moderate disease. Three cases were treated with hydroxychloroquine sulfate for 5 days, and three cases were treated with hydroxychloroquine sulfate and azithromycin for 5 days. One case was not treated because the family did not allow it. Demographic characteristics and clinical findings of the cases are shown in Table 1. The COVID-19 PCR test was positive in all cases during hospital admission. Control PCR tests taken on the 14th day were negative for five cases. It was found that one of the cases with positive PCR test on the 14th day became negative on the 22nd day and the other on the 32nd day. In two cases, the lymphocyte count was lower than 1,500/mm^3 during admission, and in two cases, the D-dimer was higher than normal limits. However, both values were within normal limits in the follow-up of all cases. Chest X-ray images of all cases included normal findings. Thorax CT imaging revealed a subpleural ground glass opacity in both lungs in one case and only in the left lung in one case. Cranial diffusion MR imaging was performed in all patients. Diffusion restriction was determined in the corpus callosum splenium section in a case of diffusion MR imaging. It was observed that diffusion restriction improved in control diffusion MR imaging after 14 days (Figure 1). Laboratory examinations and radiological imaging findings of our cases are shown in Table 2.

DISCUSSION

In our study, 5 (4.0%) of 122 pediatric COVID-19 cases had taste and smell disorders and 2 (1.6%) had only taste disorder. Lechien et al. found that taste disorder was 88% and smell disorder was 85.6% in 417 mild-to-moderate COVID-19 adult cases, and they reported a significant relationship between taste and smell disorders[5]. In the meta-analysis conducted by Passarelli et al., it was reported that the taste disorder varied between 5.6% and 88%, and the smell disorder ranged between 5.1% and 85.6%. The taste and smell disorder together was 18.6%[14]. In the literature, there is no study investigating the frequency of taste and smell disorders in pediatric COVID-19 cases. In our study, the taste and smell disorders were found to be very low compared with studies involving adults. It was thought that these low rates may be related to the mild clinical course of the disease in children and difficulties in defining the taste and smell disorders of children. Our results have supported this speculation, five cases had mild disease and two cases had moderate disease.

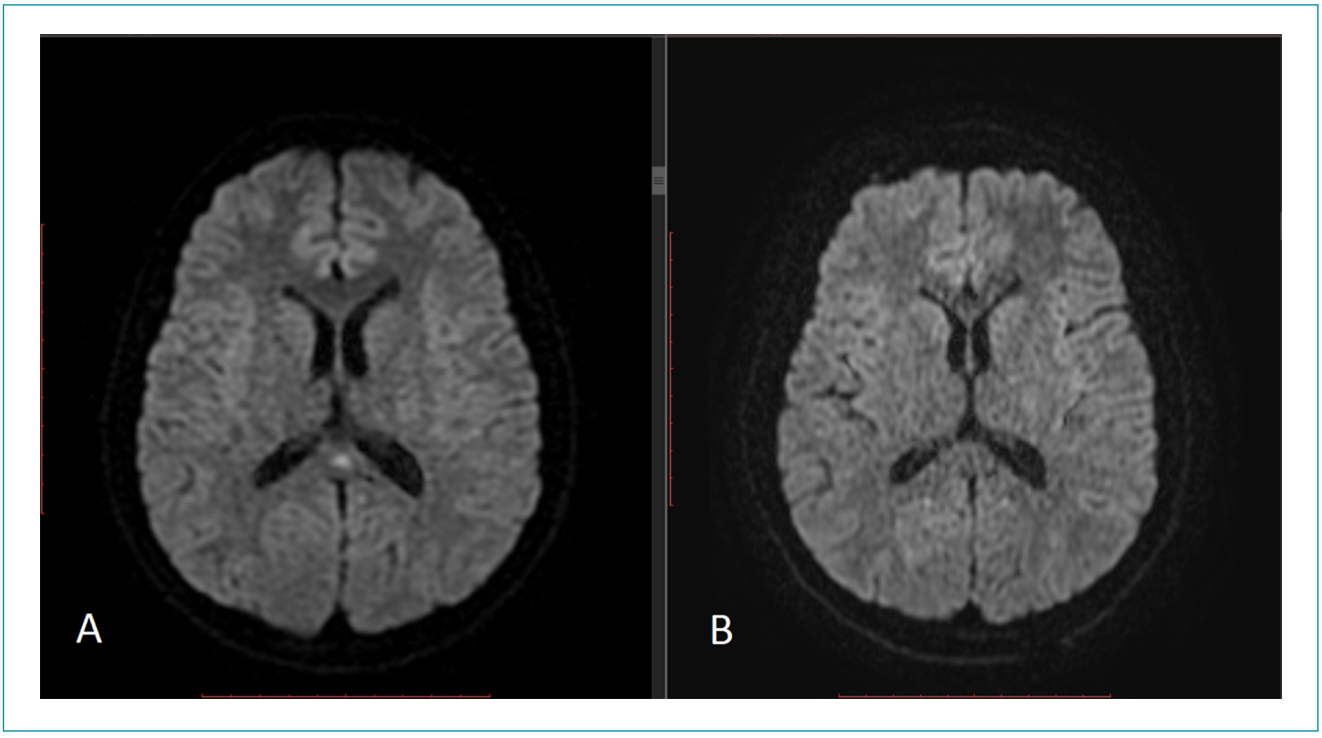

Figure 1. (A) Diffusion restriction in the corpus callosum splenium region (white arrow) in cranial diffusion magnetic resonance imaging of Case 6. (B) Normal findings in control diffusion magnetic resonance imaging of the same case after 14 days.

Table 2. Laboratory examinations and radiological imaging findings of the study group.

	Test time	Case 1	Case 2	Case 3	Case 4	Case 5	Case 6	Case 7
WBC (/ mm^3)	During admission	5,480	4,820	5,520	6,560	8,710	4,780	5,040
	5th day	5,540	6,130	5,300	6,740	5,910	6,740	4,950
LYM (/ mm^3)	During admission	2,510	1,220	1,800	2,010	1,460	1,500	2,080
	5th day	2,620	2,930	1,800	2,750	2,060	2,260	2,080
CRP (mg/L)	During admission	1.23	8.95	0.23	<3.11	<3.11	7.64	5.17
	5th day	<3.11	8.52	0.29	<3.11	<3.11	1.9	1.5
PCT (ng/ mL)	During admission	0.02	0.05		0.03	0.04	0.05	0.02
	5th day	0.02	0.02		0,02	0.03	0.02	0.02
CPK (u/l)	During admission		66	58	91	51	100	111
	5th day	47	42	44	58	28	65	64
LDH (u/l)	During admission	214	203	223	201	228	246	164
	5th day	134	196	175	187	148	227	179
Ferritin (µg/L)	During admission	22.4	16	12.4	70.9	6.5	76.4	88.7
	5th day	15.5	21.5	11.4	75.8	7.3	89	116
Troponin (ng/L)	During admission	0.0	0.0	0.0	0.6	1.1	1.0	0.1
	5th day	0.6	0.8	0.0	1.3	0.3	1.2	76
D-Dimer (FEU µg/L)	During admission	197	669	585	31	85	173	139
	5th day	276	533		115	128	<110	127
SARS-CoV-2 PCR test result	During admission	Positive	Positive	Positive	Positive	Positive	Positive	Positive
	14th day	Positive (22nd negative)	Negative	Negative	Negative	Negative	Positive (32nd negative)	Negative
SARS-CoV-2 Ig G/M test result	14th day	Positive	Positive	Positive	Positive	Positive	Positive	Positive
Cranial diffusion MR imaging	During admission	Normal	Normal	Normal	Normal	Normal	Diffusion restriction in corpus callosum splenium	Normal
Thorax CT imaging	During admission	Subpleural ground glass view in both lungs	Normal	Normal	Subpleural ground glass view in left lungs	Normal	Normal	No screening

WBC: White blood cell count (Normal value: 4.6–10.2 K/µL); LYM: lymphocyte count (Normal value: 0.6–3.4 k/µL); CRP: C-reactive protein (Normal value <3.11 mg/L); PCT: procalcitonin (Normal value <0.5 ng/mL); CPK: creatine phosphokinase (Normal value: 0–145 U/L); LDH: lactate dehydrogenase (Normal value: 180–430 U/L); MR: magnetic resonance; CT: computed tomography.

It is known that taste and smell disorders are related to viral infections. In particular, smell disorders have been associated with nasal congestion, rhinorrhea, and olfactory epithelial involvement[15]. However, symptoms of inflammation and rhinitis are often absent in the nasal mucosa of COVID-19[4,5,16]. Yan et al. evaluated 1,480 patients with influenza-like symptoms. While 68% of 59 COVID-19-positive patients had anosmia and 71% had ageusia, 17% of 203 COVID-19-negative patients had anosmia and 16% had ageusia. It has been shown that smell loss and taste loss independently have a strong relationship with COVID-19 positivity[6]. In our study, the symptoms of nasal obstruction or rhinorrhea were not detected in any case.

It has been reported that taste and smell disorders in adult COVID-19 can be seen before the expected classic symptoms as well as during and after the disease course[17]. Lechien et al. reported that 11.8% of 417 adult COVID-19 cases had smell disorder earlier than other symptoms[5]. In our study, it was determined that taste and smell disorders started at the time of admission in four cases, 2 days before admission in two cases, and 3 days before admission in one case. Taste and smell disorders were earlier than other symptoms in three cases. It was reported by Yan et al. that COVID-19 smell disorder improved in 74% of cases with the disappearance of other symptoms[6].

Lechien et al. reported that 67.8% of adult COVID-19 cases with taste and smell disorders recovered within the first 8 days, and 4% cases took over 15 days to recover[5]. In the literature, there is no data on when the taste and/or smell disorders may improve in pediatric COVID-19 cases. In our study, it was observed that the symptoms of all cases resolved between 5 and 21 days. In our study, three of the five mild cases recovered on the 5th day, one case recovered on the 14th day, one case recovered on the 21st day, one of the two moderate cases improved on the 5th day and the other improved on the 21st day. Therefore, it is thought that it is not possible to comment on the relationship between the clinical severity of the disease and the recovery time of taste and smell disorders.

In COVID-19 studies, it was reported that smell disorder improved significantly within 1–2 weeks, and the frequency of central nervous system symptoms was observed at a much lower rate than smell disorders[5,6,17,18]. It was emphasized that the target of SARS-CoV-2 is not neurons, but may be other non-neuronal cells expressing ACE2 receptors such as olfactory epithelium support cells, microvillus cells, Bowman's gland cells, horizontal basal cells, and olfactory bulbus pericides[9]. For this reason, it seems that smell disorders in COVID-19 are not associated with a viral damage that directly or indirectly affects neuronal cells[2]. In our study, one of the patients with taste disorder had diffusion restriction in the corpus callosum splenium. Control diffusion MR imaging of this case was normal after 14 days. Unlike other cases, it was found that the COVID-19 PCR test became negative on the 32nd day. Since it was a condition detected in one case, no relation could be made about the relationship between pathological MR finding and taste disorder. In the literature, no data with diffusion restriction in the corpus callosum splenium section were found in the diffusion MR images of the adult and pediatric COVID-19 cases. We evaluated the present MR imaging finding as COVID-19 central nervous system involvement. This result suggests that the relationship between the time the virus is present in the body and the central nervous system involvement may be among the research topics in the future.

The most important limitation of our study is that due to the insufficiency in the number of cases, the necessary statistics could not be made in order to detect differences in age, gender, and groups receiving and not receiving antiviral therapy.

CONCLUSIONS

In conclusion, in our study, it was found that taste and smell disorders can be seen alone or with other symptoms in pediatric COVID-19 cases and their frequency is less than that in adults. Although the longer duration of SARS-CoV-2 in children with taste and smell disorders may be associated with the central nervous system imaging findings, further studies are needed.

AUTHORS' CONTRIBUTIONS

BE, PDÇ, MFO, GA, İC, AT, ÖFA, HT: Conceptualization, Data curation, Investigation, Methodology, Project administration, Resources, Validation, Visualization, Writing – original draft, Writing – review & editing, Formal analysis, Funding acquisition, Software, Supervision of the study.

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