Tomographic Evaluation of Paranasal Sinus findings in COVID-19-Positive Patients

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Abstract

Background: Sinonasal symptoms are important in patients with coronavirus disease 2019 during the diagnostic process. This study aimed to evaluate paranasal sinus findings on computed tomography by comparing patients diagnosed with coronavirus disease 2019 and those who were negative for coronavirus disease 2019.

Methods: This retrospectively planned study included 163 patients (89 males and 74 females) with positive coronavirus disease 2019 polymerase chain reaction results and 104 patients with negative results for coronavirus disease 2019 (56 males and 48 females) who came to the emergency department for related symptoms. Cranial computed tomography scans routinely performed in symptomatic patients were assessed using the Lund–Mackay scoring system. All sinuses, the ostiomeatal unit, and the right-sided and left-sided sinuses were assessed separately. Mucosal opacities of less than 1 mm were scored as 0, partial opacities that did not completely obliterate the sinus were scored as 1, and opacities that completely obliterated the sinus were scored as 2.

Results: In computed tomography scans performed, the mean total Lund–Mackay scores for right-sided sinusitis and left-sided sinusitis in coronavirus disease 2019-positive patients were 1.29 ± 1.9 and 1.26 ± 1.8, respectively. The mean total Lund–Mackay score for right-sided sinusitis in coronavirus disease 2019-negative patients was 1.26 ± 1.7, while it was 1.24 ± 1.7 for left-sided sinusitis. Statistical analysis revealed no significant pathological changes in the paranasal sinuses in the symptomatic coronavirus disease 2019-positive patient group ($P > .05$)

Conclusion: Although coronavirus disease 2019 is a disease with prominent sinonasal symptoms and sampling of the nasal cavity and nasopharynx is essential for diagnosis, no significant difference was determined between the coronavirus disease 2019-positive patient group and the coronavirus disease 2019-negative patient group in terms of paranasal sinus findings.

Keywords: Computed tomography, COVID-19, nasal congestion, nasal obstruction, paranasal sinus, sinusitis

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INTRODUCTION

Upper respiratory symptoms were frequently mentioned in the symptom definitions of coronavirus disease 2019 (COVID-19) disease. Cough, sore throat, and dyspnea were defined as the most common symptoms.[1] In addition, symptoms such as rhinorrhea (4%-6%), nasal congestion (7.7%-41%), dizziness, hyposmia, anosmia, tonsillar edema, and headache were among the frequently mentioned symptoms.[1,2] The most commonly used diagnostic method for COVID-19 is polymerase chain reaction (PCR) with a nasopharyngeal or oropharyngeal swab specimen.[3]

These findings suggest that COVID-19 creates a viral rhinosinusitis-like clinical picture, especially in patients with mild symptoms. Facial pressure, fullness, nasal obstruction, and postnasal drainage are the cardinal symptoms of acute rhinosinusitis.[4]

In this study, COVID-19-positive patients who underwent cranial computed tomography (CT) scan within 1 week of diagnosis for suspected complications were compared with COVID-19-negative patients who had headache, nasal congestion, and facial pressure. Paranasal sinus total Lund–Mackay scores were calculated using the Lund–Mackay scoring system. Based on objective data, sinus involvement was investigated by comparing COVID-19-positive patients with sinusitis-like symptoms and COVID-19-negative patients with sinonasal symptoms. Therefore, the present study

aims to further elucidate the significance of the pathognomonic findings of the COVID-19 disease.

METHODS

A retrospective study was designed. Patients with a diagnosis of COVID-19 who presented to the Ankara City Hospital emergency department or otolaryngology outpatient clinic between July 2020 and July 2021 (COVID-19-positive patient group) and patients without COVID-19 who presented to our outpatient clinic with headache, nasal congestion, and facial pressure during the same period (COVID-19-negative patient group) were included in the study. All procedures contributing to this work comply with the ethical standards of the relevant national and institutional guidelines on human experimentation and with the Helsinki Declaration of 1975, as revised in 2008. The study was approved by the local Institutional Review Board (Ankara City Hospital-E1-21-1078/03/11 /2021). The informed consent was obtained from the subjects.

Cranial CT is performed in patients with suspected neurological complications such as severe headache, blurred vision, and sensory deficits.

Patients between the ages of 18 and 65 participated in the study. Patients diagnosed with COVID-19 included those with a positive PCR test. Patients who had already undergone nasal or sinus surgery, had polyps, etc. in the nasal cavity and patients who did not fit the age range reported in medical records and internet-based data systems were excluded from the study.

After establishing inclusion and exclusion criteria, 163 COVID-19-positive patients and 104 COVID-19-negative patients were examined. Of the COVID-19-positive patients, 89 were male and 74 were female. In the COVID-19-negative patient group, there were 56 males and 48 females.

The images of patients who underwent cranial CT scan for non-traumatic reasons in the emergency department were reviewed retrospectively. No additional CT scans were performed on the patients. Additional symptoms and complaints of the patients were collected through their patient files. All scans were carried out using 3 mm thickness in axial and coronal planes with sagittal reconstruction. The evaluation (scoring) was performed by the same ear–nose–throat physician. The maxillary sinuses, anterior ethmoid sinuses, posterior ethmoid sinuses, sphenoid sinuses, and frontal paranasal sinuses were evaluated for opacities using the Lund–Mackay measurement system. Sinuses with mucosal thickening of <1 mm were considered normal. Mucosal opacities (thickenings) of less than 1 mm were scored as 0, partial opacities that did not completely obliterate the sinus were scored as 1, and opacities that completely obliterated the sinus were scored as 2.

Statistical Analysis

Data were analyzed with the programs International Business Machines Statistical Package for the Social Sciences software Statistics 25 (IBM Corp.; Armonk, NY, USA). Student's *t*-test was used for comparisons between groups. The conformity of the groups to the normal distribution was tested using the Shapiro–Wilk test. A $P < .05$ value was accepted as a significant statistical value.

RESULTS

The age range of the study participants was 18-65 years (Table 1). The mean age was found to be 46.7 years. The minimum age was 18 years, and the maximum age was 65 years. Of the patients in the study, 145 were male and 122 were female. One hundred sixty-three COVID-19-positive patients and 104 COVID-19-negative patients who underwent cranial CT for other reasons were examined. The COVID-19-positive group included 71 patients who were hospitalized and 14 patients who required intensive care. Of these COVID-19-positive patients, 52 (31.9%) had nasal obstruction and 83 (50.9%) had headache. Conditions such as general condition impairment and sensory and motor dysfunction were other reasons for CT scan in the COVID-19-positive patient group. In the COVID-19-negative patient group, headache, facial pressure, and fullness were the most common reasons for CT scans.

Table 1. Descriptive Statistics: Age

	N	Minimum	Maximum	Mean	Standard Deviation
Age	267	18	65	46.78	13.453
Female	122	24	65	46.77	12.671
Male	145	18	65	46.77	14.122
COVID+ male	89	20	65	48.2	14.046
COVID– male	56	18	65	44.5	14.070
COVID+ female	74	24	65	48.6	12.757
COVID– female	48	24	64	43.9	12.118

In Table 2, the mean total Lund–Mackay scores for the right and left paranasal sinuses were compared separately between the COVID-19-positive and COVID-19-negative patient groups. The comparison performed with the independent samples *t*-test showed no statistically significant difference between the groups ($P = .9$ for the right side and $P = .812$ for the left side).

Table 3 compares maxillary sinuses, anterior ethmoid sinuses, posterior ethmoid sinuses, frontal sinuses, sphenoid sinuses, and ostiomeatal unit (omu) on the right and left sides. There was no statistically significant difference between COVID-19-positive and COVID-19-negative patient groups when the results were evaluated using the independent samples *t*-test ($P > .001$).

According to the Lund–Mackay staging, the mean total Lund–Mackay score for right-sided sinusitis in COVID-19-positive patients was 1.29 ± 1.9 and the mean total Lund–Mackay score for left-sided sinusitis in COVID-19-positive patients was 1.26 ± 1.8. The mean total Lund–Mackay score for right-sided sinusitis in COVID-19-negative patients was 1.26 ± 1.7 and the mean total Lund–Mackay score for left-sided sinusitis in COVID-19-negative patients was 1.21 ± 1.5. In addition, the mean total Lund–Mackay scores for right-sided sinusitis and left-sided sinusitis in COVID-19-negative patients were 1.26 ± 1.7 and 1.24 ± 1.7, respectively.

Table 2. Right and Left Total Lund–Mackay Scores Between COVID-19-Positive and COVID-19-Negative Patient Groups

	COVID-19-Positive Patient	COVID-19-Negative Patient	*P**
Lund–Mackay right	1.29 ± 1.9	1.26 ± 1.7	.900
Lund–Mackay left	1.26 ± 1.8	1.21 ± 1.5	.812

**t*-test in dependent groups.
COVID-19, coronavirus disease 2019.

Table 3. Detailed Sinus Examination in COVID-19-Positive and COVID-19-Negative Patient Groups According to Lund–Mackay Staging

	COVID-19-Positive Patient	COVID-19-Negative Patient	*P**
Right maxillary	0.36 ± 0.4	0.39 ± 0.4	.53
Right anterior ethmoid	0.26 ± 0.5	0.25 ± 0.4	.83
Right posterior ethmoid	0.21 ± 0.4	0.21 ± 0.4	.95
Right frontal	0.25 ± .4	0.46 ± 0.3	.59
Right sphenoid	0.18 ± 0.4	.0.16 ± 0.3	0.77
Right omu	0.2 ± 0.2	0.2 ± 0.1	.84
Left maxillary	0.39 ± 0.4	0.43 ± 0.4	.45
Left anterior ethmoid	0.24 ± 0.4	0.23 ± 0.4	.88
Left posterior ethmoid	0.18 ± 0.4	0.16 ± 0.3	.69
Left frontal	0.26 ± 0.4	0.21 ± 0.4	.37
Left sphenoid	0.18 ± 0.4	0.17 ± 0.4	.83
Left omu	0.01 ± 0.1	0.00 ± 0.00	.42

*t-test in dependent groups.
COVID-19, coronavirus disease 2019.

DISCUSSION

Coronavirus disease 2019 is a disease that can present with many sinonasal symptoms such as nasal congestion, rhinorrhea, headache, facial pressure, hyposmia, and anosmia.[1,5] Nasal cavity is very important for the diagnosis of the disease. It is also known that nasal secretions and droplets are crucial for the modes of transmission.[3]

Especially in mild cases, the symptoms resemble acute viral rhinosinusitis.[4,6] In evaluations of the loss of sense of smell, this symptom was considered to occur mainly due to viral cell entry resulting in *deciliation* and widespread edema in the nasal mucosa and olfactory region, which impairs the sense of smell.[5,7] In the paranasal CT study, which was performed in 49 patients with olfactory loss, the Lund–Mackay score was 0 in 83.7% of patients and 1 in 6.1% of patients, and it was observed that there were no significant mucosal findings in the paranasal sinuses of patients with olfactory loss.[5] Cranial or paranasal sinus CT is not part of the COVID-19 diagnostic process. However, CT is performed in cases that indicate complications such as severe headache, sensory defects in the face and extremities, and loss of motor function, which may be indicative of an acute neurologic event.[8,9] Many studies have used the Lund–Mackay scoring system to evaluate sinusitis. Zhou et al[10] reported that the Lund–Mackay scoring system could be more critical than the Sinonasal Outcome test 22 (SNOT-22) and European Position Paper on Rhinosinusitis and Nasal Polyps 2022 (EPOS) diagnostic criteria. Therefore, we used the same scoring system for CT evaluation in this study. In a study in which 28 COVID-19-positive patients and 67 COVID-19-negative patients were examined, symptoms were asked by telephone; the rate of nasal congestion was 41% in the positive patient group and 4.3% in the negative patient group.

No significant difference in Lund–Mackay scores was found between the 2 groups.[2] In our COVID-19-positive patient group, 71 of 163 patients were hospitalized and 14 required intensive care. Although nasal obstruction was noted in 31% of patients and headache in 50%, the mean total Lund–Mackay score in the COVID-19-positive patient group was 1.29 ± 1.9 for the right side and 1.26 ± 1.8 for the left side. In the COVID-19-negative patient group, the mean total Lund–Mackay score was 1.26 ± 1.7 for the right side and 1.24 ± 1.7 for the left side. These findings yielded no statistically significant difference between the COVID-19-positive and -negative patient groups ($P > .05$). Similarly, there was no significant difference between the groups when the sinuses were examined one by one, and an assessment (scoring) of the ostiomeatal unit was performed.

Our study examined more paranasal sinuses than reported in the literature in COVID-19-positive and -negative patient groups. The present study also provided an evaluation in the patient population who described acute viral rhinosinusitis-like symptoms and headache and revealed that COVID-19 did not cause significant mucosal thickening or obstruction in the paranasal sinuses. Although the utility of CT is limited in COVID-19-positive patients, magnetic resonance imaging should be preferred, especially if neurologic complications are suspected.[10]

CONCLUSION

Comparison of COVID-19-positive patients with the normal population revealed no significant difference in paranasal sinus involvement.

Ethics Committee Approval: The study was approved by the local Institutional Review Board (Ankara City Hospital-E 1-21-1078/03/11/2021).

Informed Consent: Written informed consent was obtained from the patients who participated in this study.

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