



# Bell's Palsy and COVID-19 Infection: A Comparative Analysis with the Pre-pandemic Period

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## Abstract

**Aim:** Bell's palsy is an acute peripheral facial nerve paralysis affecting one side of the face and can be associated with various causes, such as infectious and autoimmune conditions. In line with this, an increase has been observed in the incidence of peripheral facial paralysis during the coronavirus disease-2019 (COVID-19) infection pandemic. We aimed to investigate whether the incidence of Bell's palsy increased before and after the COVID-19 in the pre-vaccine period.

**Methods:** All cases diagnosed with Bell's palsy in a tertiary hospital aged 18 and up in 2020 were analyzed, and to compare these numbers to pre-pandemic numbers, patients' data from 2019 was accessed. Excluding those who had recurrent facial palsy, those whose conditions were due to central causes, and those who were misdiagnosed, the frequency of the disease was calculated by proportioning it to the total number of patients presenting to Neurology, and Ear, Nose, and Throat Diseases Outpatient Clinics and the Green Zone of the Emergency Department at that time; and the Bell's palsy distribution within three-month periods and whether this distribution is correlated with the distribution of COVID-19 infection were examined.

**Results:** Three hundred twenty five cases from 2019 and 291 cases from 2020 were included in the study. No significant difference was detected between those years in terms of age and sex. The frequency of Bell's palsy in 2019 was 0.059% while it was 0.071% in 2020, which suggested a significant difference between the years. The significant difference could be clearly observed in the second and fourth quarters when the cases of COVID-19 infection were at their peak.

**Conclusion:** This study suggests that patients with complaints of peripheral facial paralysis should also be examined for COVID-19 infection.

**Keywords:** COVID-19, facial nerve, peripheral facial paralysis

## Introduction

Bell's palsy is a lower motor neuron disorder that affects the muscles innervated by the facial nerve and is characterized by acute and unilateral peripheral facial weakness. The literature shows that it is more common in men (1). The incidence has been calculated to be 20 to 30 in 100,000 individuals, and the most common cause is thought to be a herpes simplex infection. In Bell's palsy cases, which develop as secondary to infection, the facial nerve becomes swollen while coursing through the temporal bone, causing the nerve to get stuck in the bone (2). Apart from the direct infection, other factors that play a role in the etiology of the disease include immune reaction-stimulating viruses such as cytomegalovirus,

Epstein-Barr virus, human herpesvirus 6 and 7, and adenovirus (3).

Although coronavirus, which was described as novel coronavirus pneumonia in Wuhan, China in December 2019 and caused a pandemic in a short time, manifests as the involvement of the respiratory tract, it also affects several other systems (4). Its neurological effects can include axonal peripheral neuropathy, myopathy, olfactory neuropathy, cerebral infarction, headache, impaired consciousness, seizure, ataxia, and Guillain-Barre syndrome (5).

Considering the facts that Bell's palsy is associated with viral infection etiology and that coronavirus may cause neuropathy, this study reveals the relationship between them by retrospectively scanning the data in

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a single center, which has been serving as a pandemic hospital since March 2020, when the first cases were seen in our country.

## Materials and Methods

### Compliance with Ethical Standards

The study protocol was reviewed and approved by the University of Health Sciences Turkey, Istanbul Haseki Training and Research Hospital Ethics Committee, with approval no: 2020/19. Because of the retrospective design of this study, no informed consent was obtained.

### Study Design

The patients aged 18 and above who were first diagnosed with Bell's palsy in 2020, and cases aged 18 and above who were first diagnosed with Bell's palsy in 2019 were included the study to compare the incidence of Bell's palsy with the pre-pandemic period.

### Patient Evaluation

The patients were documented using the codes in the ICD-10 diagnostic code list: G51.0-Bell's palsy, G51.8-Facial nerve paralysis disorders, and G51.9-Disorder of the facial nerve, unspecified. Facial cases of central nervous system (CNS) origin, recurrent Bell's palsy cases, cases aged under 18, cases identified to have facial paralysis according to ICD-10 codes but not diagnosed as such upon the examination, cases whose underlying cause was demyelinating polyneuropathy, cases that developed it secondarily to trauma, and cases diagnosed before 2019 were excluded from this study. Our study population was determined as the total number of patients who presented to the departments of Neurology, Ear-Nose and Throat, and the Green Zone of the Emergency Department where the diagnosis of Bell's palsy occurs. The total number of patients presenting to those departments was calculated as 545,657 for 2019 and 407,879 for 2020.

We examined the demographic characteristics of the patients, such as age and gender, from both years, and to detect if there was any correlation with coronavirus cases, we analyzed the incidence of Bell's palsy between those two years and compared the data belonging to the 4 quarters of 2020 with those of the previous year.

### Statistical Analysis

Descriptive statistics regarding the age variable are presented as "average  $\pm$  standard deviation" whereas descriptive statistics considering categorical variables are presented in numbers and percentages. Parametric independent t-test was used to compare the two independent year groups in terms of the age variable. For this analysis, variance homogeneity was checked by the Levene's test. Concerning the analysis of the relationship between categorical variables, Pearson's chi-squared test

was used while the two-sample t-test was used for the groups that showed a difference. Statistical significance was set to be  $p < 0.05$ .

## Results

Three hundred twenty five cases from 2019 and 291 cases from 2020 meeting all the above-mentioned criteria were examined in the study. The average age of 325 patients from 2019 was calculated as  $44.66 \pm 15.56$  while it was  $43.74 \pm 69$  for 291 patients from 2020. The age distribution of patients was found to be homogeneous ( $p = 0.468$ ).

Regarding the gender distribution, the genders of the patients were reported as follows: 183 men and 142 women in 2019, and 159 men and 132 women in 2020. Similar to the age distribution, no statistically significant difference was found in terms of gender.

When the ratio of the patients diagnosed with Bell's palsy was compared to the total number of patients presenting to the hospital between the years of 2019 and 2020, the frequency of Bell's palsy in 2019 was 0.059% while it was 0.071% in 2020, which revealed a statistically significant difference ( $p = 0.025$ ). While the comparison of the total number of patients presenting to the hospital showed a difference of about one hundred and forty thousand between 2019 and 2020, the numbers of patients who were diagnosed with Bell's palsy in those years were found to be similar (Table 1).

To show the patient distribution throughout the year more clearly, both years (2019 and 2020) were divided into three-month periods as follows: January-February-March, April-May-June, July-August-September, and October-November-December. While there was no significant difference in the numbers of diagnosed patients in the first quarter between the two years, it was observed that this number significantly increased in the second quarter of 2020 ( $p < 0.01$ ). In the second quarter of 2020, even though the number of patients presenting to the hospital decreased by half compared to the second quarter of 2019, the number of patients diagnosed with Bell's palsy was found to be almost the

**Table 1. Difference in the ratios of Bell's palsy cases between 2019 and 2020**

| Years            | 2019            | 2020            | p-value          |
|------------------|-----------------|-----------------|------------------|
| <b>Diagnosis</b> |                 |                 |                  |
| Diagnosed +      | 325 (0.06%)     | 291 (0.07%)     | 0.025            |
| Diagnosed -      | 545,332 (99.9%) | 407,588 (99.9%) | Chi-square=0.002 |

-Pearson's chi squared test was used.  
-Frequency of Bell's palsy in 2019 was 0.06% while it was 0.07% in 2020, which revealed a statistically significant difference.

same. Furthermore, when the numbers collected from the third and fourth quarters were compared, it was found that while there was no significant difference in the third quarter between the years, the fourth quarter showed a significant difference ( $p=0.014$ ) like the second quarter. These significant differences observed in the second and fourth quarters show us a connection between the times when coronavirus disease-2019 (COVID-19) infection made peaks during its spread throughout Turkey (Table 2), (Figure 1).

All patients diagnosed with Bell's palsy in 2020 were scanned in the registers of our hospital to check their COVID-19 polymerase chain reaction test results, and it was found that only 10 patients tested positive for COVID-19. Additionally, only 4 of them were found to have been infected with the coronavirus within the past month.

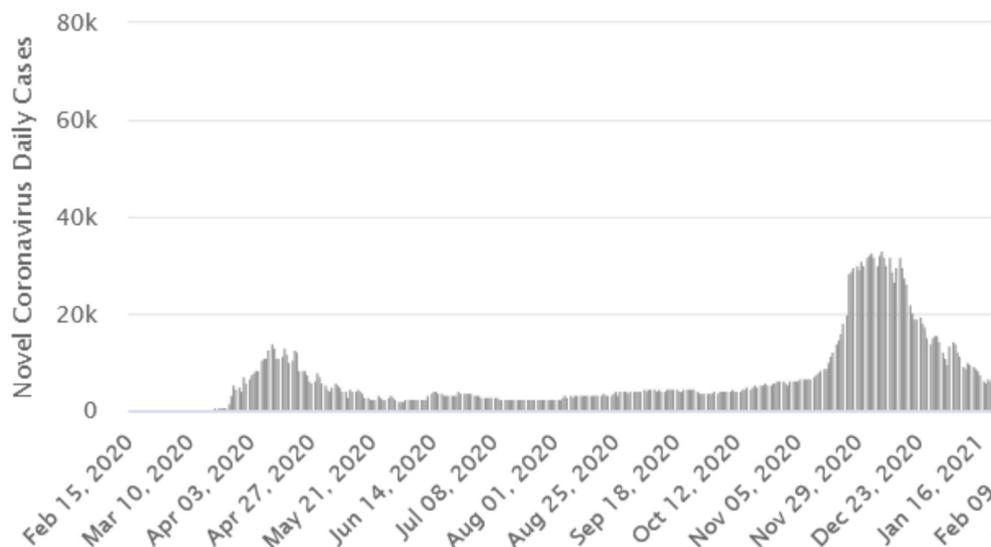
### Discussion

In a study conducted in Wuhan, the first epicenter of the pandemic, 36.4% of the COVID-19-infected patients showed neurological symptoms (6). Observed neurological symptoms included CNS involvement such as headache, seizure, confusion, viral encephalitis, toxic encephalopathy, and cerebrovascular disease, along with peripheral nervous system involvement like anosmia, olfactory nerve involvement in the form of hyposmia, peripheral facial paralysis, and Guillain-Barre syndrome (6,7). Based on the data collected from those studies, COVID-19 has been thought to cause neurological symptoms by using direct and indirect mechanisms (8). There is evidence implying

the direct involvement of the CNS in the pathological mechanism of the virus (9).

Respiratory tract viruses may invade the CNS by using blood circulation or neuronal retrograde routes. In terms of retrograde axonal transport, the virus is assumed to reach the CNS through some cranial nerves (such as the olfactory nerve, trigeminal nerve, glossopharyngeal nerve, and the vagus nerve) or peripheral nerves (10).

Even though cases are reported to have developed Bell's palsy following infection or vaccination, a relationship between them has not been clearly proven; the most commonly accepted hypothesis is the autoimmune mechanism through the mimicry of antigens of the vaccines (11-13). In contrast, the incidence of Bell's palsy during the third phase studies of BNT162b2 (Pfizer-BioNTech) and mRNA-1273 (Moderna) vaccines was reported to be no more common than the ordinary frequency observed in the general public (12). A small case-control study in Israel matched 37 patients with Bell's palsy to 74 controls and found no association with mRNA-based severe acute respiratory syndrome coronavirus-2 (SARS-CoV-2) vaccination (14). Unfortunately, the inactivated vaccine started to be used in January 2021; thus, it is impossible to mention the effects of the vaccine in our study. A review study consisting of the studies conducted between March 2020 and December 2020, documented 20 cases of Bell's palsy and suggested that Bell's palsy could be an important clinical finding for COVID-19 infection. However, it reported that further studies were needed to demonstrate their possible relationship and to identify the underlying mechanism (15).



**Figure 1.** Distribution of novel coronavirus cases in Turkey over time

|  | Year               | 2019             | 2020             | p-value                     |
|--|--------------------|------------------|------------------|-----------------------------|
| <b>January<br/>February<br/>March</b>    | <b>Diagnosed +</b> | 67 (0.1%)        | 96 (0.1%)        | 0.390<br>Chi-square=0.738   |
|  | <b>Diagnosed -</b> | 95,917 (99.9%)   | 157,562 (99.9%)  |                             |
|  | Total              | 95,984           | 157,749          |                             |
| <b>April<br/>May<br/>June</b>            | <b>Diagnosed +</b> | 78 (0.1%)        | 71 (0.1%)        | <0.001<br>Chi-square=22,375 |
|  | <b>Diagnosed -</b> | 142,594 (99.9%)  | 60,824 (99.9%)   |                             |
|  | Total              | 142,672          | 60,895           |                             |
| <b>July<br/>August<br/>September</b>     | <b>Diagnosed +</b> | 75 (0.05%)       | 60 (0.05%)       | 0.716<br>Chi-square=0.133   |
|  | <b>Diagnosed -</b> | 141,745 (99.95%) | 120,786 (99.95%) |                             |
|  | Total              | 141,820          | 120,846          |                             |
| <b>October<br/>November<br/>December</b> | <b>Diagnosed +</b> | 105 (0.1%)       | 64 (0.1%)        | 0.014<br>Chi-square=6,027   |
|  | <b>Diagnosed -</b> | 165,076 (99.9%)  | 68,325 (99.9%)   |                             |
|  | Total              | 165,181          | 68,389           |                             |

- There were significant differences in the numbers of diagnosed patients in the second and fourth quarters between the years.

In another publication retrospectively analyzing patient records from 41 different health institutions around the world, the incidence of Bell's palsy in patients with COVID-19 infection was calculated as 0.08%. This incidence has demonstrated that Bell's palsy was more common in COVID-19 patients and that it was also higher than the incidence of Bell's palsy reported in those vaccinated for COVID-19 (16). Similarly, our study has shown that the number of Bell's palsy cases in 2020, the year the pandemic began, was significantly higher than the number of cases reported in 2019. Moreover, the numbers of Bell's palsy cases reported during the second and fourth three-month periods of April-May-June and October-November-December, when COVID-19 cases reached their peaks, showed significant differences compared with the numbers of the previous year. However, another study found that the number of admissions for facial nerve palsy during the same period in the preceding years (2015-2020) and 2021 revealed a relatively stable trend (17).

Furthermore, in another study comparing the two-month records of 2020 with those of the previous year, it was detected that Bell's palsy cases were more common in 2020 and that 21% of the 22 Bell's palsy cases were already active COVID-19 patients or had recently had it. The patients were possibly thought to have postponed their hospital visit for fear of catching COVID-19 (18). However, this ratio was found to be much lower in our study: Thirty-one patients out of 291 were tested for COVID-19, and 10 of them were positive, with only 4 detected to have been infected within the past month. The reasons for lower patient numbers could be explained by the fact that the fear of catching COVID-19 deterred people from going to hospitals; that doctors may have refrained from further examinations to limit the time people spent in hospitals;

and that not all doctors may have considered COVID-19 infection as the cause of Bell's palsy, which resulted in lower numbers of tests and, in turn, led to fewer positive cases.

In the only prospective study examining the relationship between Bell's palsy and COVID-19 infection, antibody levels for SARS-CoV-2 IgG + IgM of the 41 patients diagnosed with Bell's palsy were measured twice, and 24.3% of the patients were found to have tested positive for antibodies. The numbers were shown to be higher than those collected in seroprevalence studies conducted in asymptomatic patients (19).

#### Study Limitations

The limitations of our study were that it was a retrospective study and antibody tests for SARS-CoV-2 were not conducted as part of the clinical examinations.

#### Conclusion

Bell's palsy is a commonly observed condition in clinical practice and viral infections play an important role in its etiological factors. Even in cases presenting isolated neurological symptoms without respiratory tract symptoms, it should be considered that COVID-19 infection could be a cause of Bell's palsy.

Although our study supports the cause-effect relationship with the correlation between the change in the frequency of Bell's palsy and the course of the pandemic in our country, it could not reach a definite conclusion because the number of positive cases was much lower than expected. Larger-scale studies are needed to reveal the relationship and mechanism of action between them.

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## Ethics

**Ethics Committee Approval:** This study protocol was reviewed and approved by University of Health Sciences Turkey, Istanbul Haseki Training and Research Hospital Ethics Committee in 28.04.2021, approval number 2020/19.

**Informed Consent:** Because of the retrospective design of this study, informed consent was not obtained.

**Peer-reviewed:** Internally peer-reviewed.

### Authorship Contributions

Concept: G.G., Design: G.G., A.C.O., A.O.C., Data Collection, or Processing: G.G., A.C.O., Analysis, or Interpretation: G.G., A.C.O., A.O.C., Literature Research: G.G., A.C.O., A.O.C., Writing: G.G., A.C.O.

**Conflict of Interest:** No conflict of interest was declared by the authors.

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