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2022-02-01

Hafren , L , Saarinen , R & Lundberg , M 2022 , ' Effects of social distancing on the incidence of Bell's palsy and sudden sensorineural hearing loss ' , Acta Oto-Laryngologica , vol. 142 , no. 2 , pp. 220-223 . <https://doi.org/10.1080/00016489.2021.2025425>

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Effects of social distancing on the incidence of Bell's palsy and sudden sensorineural hearing loss

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Short title :

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Abstract

Background

The aetiology of idiopathic facial nerve palsy (Bell's palsy, BP) and sudden sensorineural hearing loss (SSNHL) are not known. It has been proposed that common respiratory tract viruses play a part in the pathophysiology of these diseases.

Objectives

The incidence of many infectious diseases decreased during the lockdown of the society that took place during the COVID-19 pandemic. We investigated a possible change in the incidence of BP and SSNHL during the lock-down.

Material and Methods

We searched the patient records for all BP and SSNHL cases between 1 Jan 2017 – 31 Aug 2020 at the hospital district of Helsinki and Uusimaa that covers a population of about 1.2 million.

Results

The mean monthly incidence on BP decreased during the COVID-19 pandemic lock-down. No change in the SSNHL incidence was discovered.

Conclusions and Significance

There is reason to speculate that one aetiologic reason for BP are transmittable respiratory tract pathogens.

Keywords: Aetiology; Bell's palsy; COVID-19; facial nerve palsy; facial palsy; SARS-CoV-2; sensorineural hearing loss; upper respiratory infection

Introduction

The known causes of facial nerve paralysis (FNP) include Lyme's disease, Ramsay-Hunt syndrome, middle ear infections, and tumours, but in most cases the origin is idiopathic [1], known as Bell's palsy (BP). The annual incidence of BP is reported to be 13-34/100 000 individuals [2]. Various theories of the aetiology have been proposed for BP, but none of them have been proved. One of the prevailing theories suggests that reactivation of dormant viral infection causes the disorder [1]. It is also possible that acute infection other than Herpes zoster or *Borrelia burgdorferi* can inflame the facial nerve. Recent upper respiratory infection is considered a predisposing factor to BP [3].

Sudden sensorineural hearing loss (SSNHL) is another condition without an identifiable cause, in most cases. The annual incidence is 11-77/100 000 [4]. Both BP and SSNHL have tendency for spontaneous recovery. No specific treatments are available, but corticosteroids are commonly used to control inflammation, decrease swelling, and help the body fight the illness.

COVID-19 has been associated with neurologic symptoms such as anosmia, ageusia, encephalitis, seizures, and Guillain-Barré [5]. Suggestions of FNP and SSNHL being associated with COVID-19, or SARS-CoV-2 vaccine exist [6-8], but also reports excluding the association have been published [9,10]. In Finland, a country with a population of 5.5 million, the COVID-19 incidence rapidly increased from 0.16/100 000 in February 2020 to 32/100 000 the following month [11]. Consequently, social distancing rules were implemented to control the pandemic. These rules, and the boosted hand hygiene had a diminishing effect on other respiratory tract infections such as influenza [12-14] and visits to ER decreased [15].

We hypothesized that if viral infections cause SSNHL and BP, there should be fewer cases of these two conditions during social distancing. We designed this study to investigate, if there was an association between social distancing and the incidence of BP or SSNHL. ~~Paragraph: use this for the first paragraph in a section, or to continue after an extract.~~

Material and methods

An institutional study permission was granted (HUS/58/2020). No approval from the research ethics committee was needed because of the retrospective nature of the study. Institutional funding was received (Helsingin ja Uudenmaan Sairaanhoitopiiri, Y1014KN006). Statistics was performed with T-Test Calculator for 2 Independent Means. We considered $p < 0.05$ statistically significant.

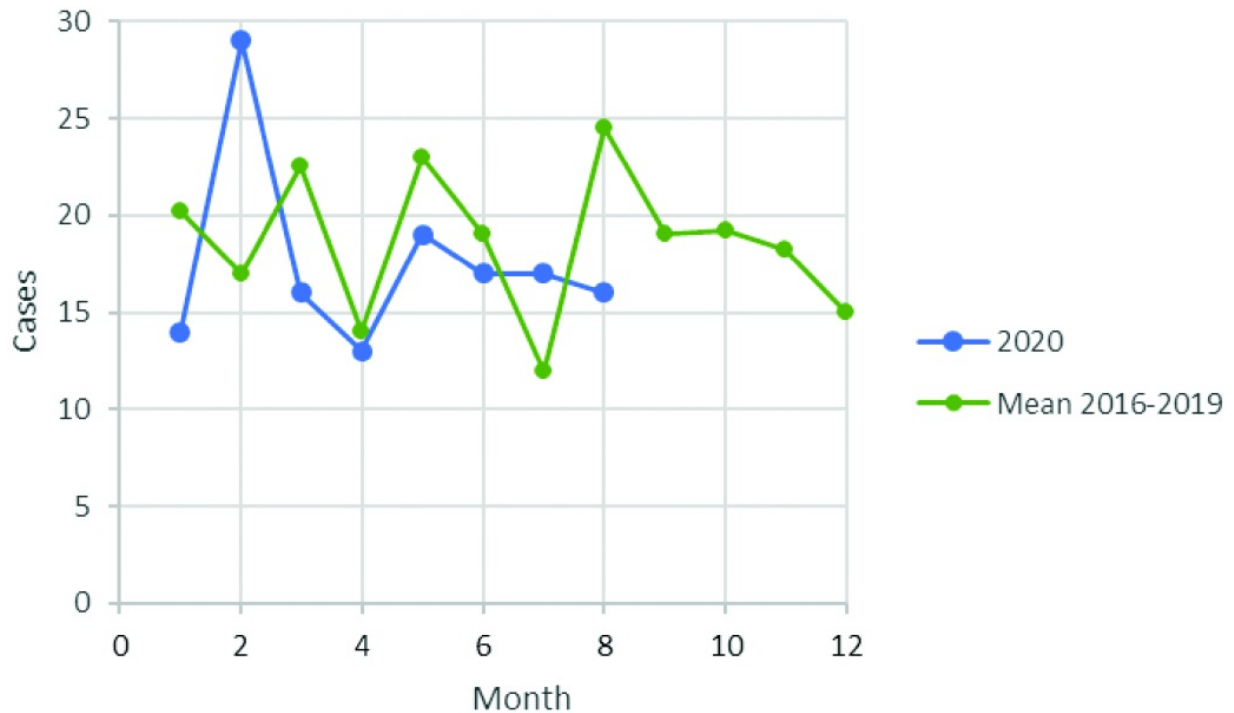
The electronic patient database of Helsinki University Hospital (HUS) was searched for patients with ICD-10 codes for FNP (G51) and SSNHL (H91.2) between January 1st, 2016⁷, and August 31st, 2020. The HUS catchment area includes 1.2 million people and serves both as a secondary

and tertiary hospital for the population. According to the guideline, all patients with FNP or SSNHL should be referred to an ENT-specialist either for primary diagnosis, or for first follow-up. Patient diagnosis is registered in the same manner independent of if the visit is in emergency or outpatient care. If diagnosis is confirmed in primary health care, the first follow-up is within 3 weeks for FNP. For SSNHL it varies from 1 to 3 months, depending on availability of audiometry in the primary facility. From the electronic patient database search, all follow-up visits were excluded, and only the date of the primary ENT-visit (independent of if it was a diagnostic visit or if the diagnosis was set in primary care) was accounted for in the analyses. We then reviewed all patients with FNP diagnosis manually to exclude Lyme's disease (based on laboratory tests, or anamnesis and treatment), Ramsay-Hunt, tumours, trauma, and otologic infections. We also registered positive COVID-19 tests (PCR) and symptoms suggesting COVID-19 for both FNP and SSNHL.

Results

We encountered 800 patients with a novel diagnosis of SSNHL, 401 males and 399 females. The patients' age varied from 9 to 93 years, with a mean age of 55.8 years. The mean monthly incidence of SSNHL at our centre in 2017–2019 was 18.3 (range 10–26). During social distancing in March–May 2020, it was 16.0 (range 13–19). COVID-19 was tested on 9 SSNHL patients during March–August 2020, all were negative. The comparison of mean monthly incidence in 2020 with the mean monthly incidence of the preceding three years is shown in [Figure 1](#). The incidence of SSNHL was low and remained stable from year to year. It showed no correlation with social distancing ($p > 0.05$) or with COVID-19.

Figure 1. Mean monthly incidence of sudden idiopathic deafness at HUS during 2016–2019, and the monthly incidence of sudden idiopathic deafness in 2020 during social distancing. [+](#)



We retrieved 1279 patients with FNP diagnosis but excluded 292 and were left with 987 cases, 511 males and 476 females, with a mean age of 46.5 years (range 2–93 years) (Figure 2). The most common reason for exclusion was Lyme's disease ($N = 129$), followed by Ramsay-Hunt syndrome ($N = 65$). The monthly incidence of BP at our centre from January 2017 to December 2019 was 23 (range, 13–35) and is shown in Figure 3. The incidence of BP per month at our centre was 14.7 (range 14–15) during strict social distancing (March–May 2020). The decrease was statistically significant when comparing with the corresponding mean monthly incidence in 2017-2019 ($p = 0.007$).

Figure 2. Data collection of Bell's palsy patients from HUS databases. +

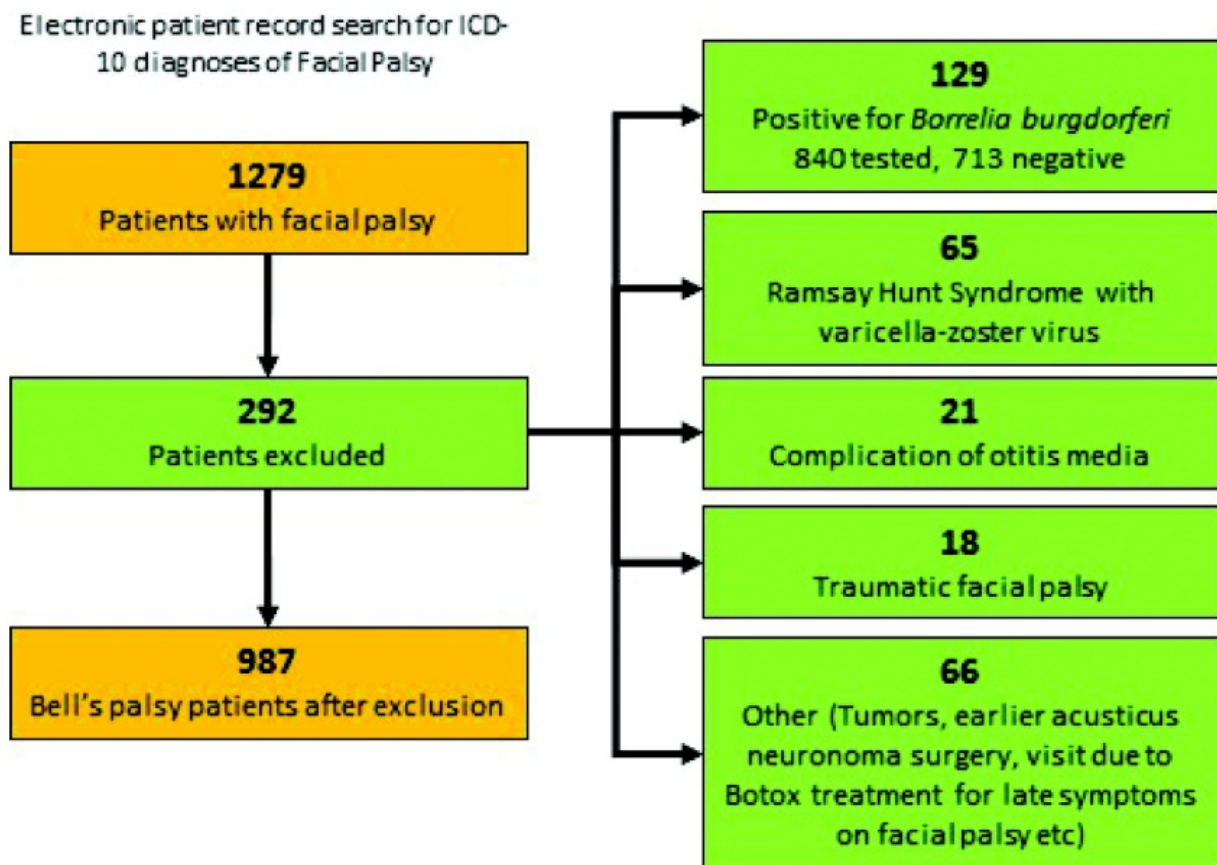
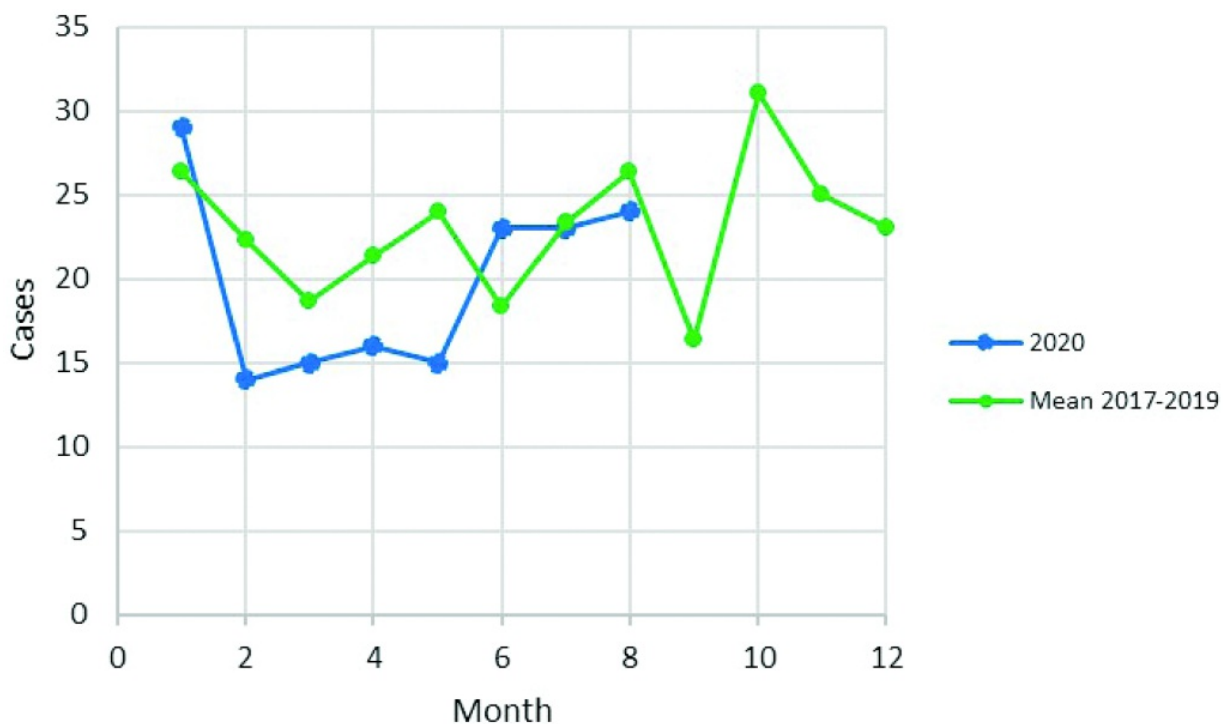


Figure 3. The monthly incidence of facial palsy in 2020 during social distancing, compared to the mean monthly incidence of facial palsy at HUS during 2016–2019. [+](#)



None of the patients with FNP were positive for COVID-19 but only patients with symptoms suggestive of COVID-19 were tested ($N = 9$). SARS-CoV-2 vaccination in Finland started in January 2021; thus, none of the FNP or SSNHL patients were vaccinated against SARS-CoV-2.

Discussion

In Finland, COVID-19-related restrictions including strict norms for social distancing were executed as of March until the end of May 2020. Restaurants were closed and schools worked remotely. National and international travel was restricted, adults were recommended to work remotely, and the maximal amount of people that could gather was 10. As of June 2020, gatherings up to 50 people and domestic travelling were allowed, and restaurants opened with restrictions. In July 2020 gathering rules were further increased to 500 people. The Finnish Institute for Health and Welfare reports a marked decrease in upper respiratory infections during the lock-down compared to earlier years [13]. Normally last cases of influenzae are seen around Midsummer, but in 2020, no cases were registered from April onwards. The same phenomenon on diverse upper and lower respiratory infections have been reported elsewhere [14]. It is possible that this decrease is due to people not seeking health care, but lock-down and increased hand hygiene also affect viral spread.

In this study, we used the incidence of influenzae as a descriptive measurement of how social distancing affected viral spread. We could see that the incidence of BP decreased significantly from the previous average of 23 per month to 14.7 cases per month during the strictest restrictions from March to May 2020 at our centre. The incidence started growing again when restrictions were lifted. Our finding supports the theory that BP could be related to respiratory tract infections. In children social distancing has been associated with lower incidence rates in influenza, RSV, and metapneumovirus, but not of rhinovirus or adenovirus [14]. In Finland, no cases of influenza were reported during summer 2020 [13]. In our study the number of BP cases started slowly growing during the summer indicating unlikely correlation with influenzae.

As COVID-19 has been found to affect neurons, it has also been associated with both FNP and SSNHL. Ribeiro *et al.* report a case of FNP associated with COVID-19 and conclude that it is paramount to be aware of the possibility of FNP in this patient group [16]. Lima *et al.* describe eight patients with COVID-19 related FNP and suggest that FNP should be added to the spectrum of neurological manifestations associated with the disease [6]. Case-reports on post-COVID-19 FNP of Guillain-Barré-type have also been published [17]. In northern Italy, the risk ratio for FNP was 1.73 when comparing spring 2020 to the preceding year [7], which is contradictory to our findings. Approximately 20% of the Italian patients had active- or recent COVID-19 or symptoms inclining the disease. However, in an area with high prevalence of COVID-19, paediatric FNP was not more common in 2020 compared to 2015-2019 and none of the children with FNP tested positive for COVID-19 [9]. Mutlu *et al.* reported a low number of COVID-19 positive patients (2%) in their FNP study as well [18]. In a Turkish study, there was no apparent change in the BP incidence during the pandemic [19]. Our findings do not support the theory of COVID-19 being associated with FNP, but not testing the asymptomatic patients for COVID-19 is a weakness of our study. If BP was caused by another transmittable disease than COVID-19, the differences in the reported incidence of BP could be explained by different social restrictions and thus different circumstances for transmission.

The incidence of SSNHL was low during 2017-2019 and remained unchanged during restrictions. Some case-reports have been published on COVID-19 and SSNHL but the relationship has not been scientifically established and could be coincidental [8]. In our material, no SSNHL patients had symptoms suggestive of COVID-19 or tested positive for COVID-19. In addition, we could not see any statistical effect of social distancing on the incidence of SSNHL, a result that is in line with that published by Aslan *et al.* [19]. This suggests that SSNHL is not associated with respiratory tract infections.

This study is retrospective and has limitations. Laboratory tests for COVID-19 and *Borrelia burgdorferi* done in private sector are not recorded in our database, but we believe that information of positive results would have been included in the referrals and identified in the manual search. The pandemic might have decreased patients' willingness to seek medical attention [15] but in our opinion, both BP and SSNHL are conspicuous symptoms that would initiate a contact to health services even during exceptional

circumstances such as pandemic. The stable incidence of SSNHL during the lock-down supports this theory and it seems unlikely that only BP patients would have stayed home. In addition, we believe that the pandemic had no influence on the proportion of patients being treated solely in the private sector, and thus the incidence rates before and during the pandemic at our centre were comparable. There might be alternative explanations for decreased BP numbers during the lockdown, such as reduced air pollution [20], which warrant further studies. The possible association between a transmittable disease and BP warrant further studies as well.

The incidence of BP decreased during strict social distancing in Finland, and we suggest that idiopathic FNP

associates in fact with some transmittable, possibly upper respiratory tract, pathogens. None of the BP or SSNHL cases in this study had a positive COVID-19 test.

Disclosure statement

No potential conflict of interest was reported by the authors.

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