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Original Article

High Prevalence of Peroneal Neuropathy Among Children During the COVID-19 Pandemic

Alberto Alemán, Elisa Nigro and Hernán D. Gonorazky
Division of Neurology, The Hospital for Sick Children, University of Toronto, Toronto, ON, Canada

ABSTRACT: ***Objectives:*** We aimed to explore the prevalence of peroneal neuropathy in children during coronavirus disease-19 (COVID-19) pandemic. ***Background:*** Since the COVID-19 outbreak, many children worldwide have experienced a dramatic lifestyle changes, including conducting most daily activities indoors. Peroneal nerve palsy is one of the most common entrapment neuropathies and circumstances as prolonged immobilization or leg crossing predisposes an individual to peroneal neuropathy. ***Methods:*** This is a case–control retrospective study that included patients referred to our neurophysiology clinic with foot drop. We compared the prevalence of spontaneous peroneal neuropathy 1 year before (April 2019/March 2020) and 1 year during the COVID-19 pandemic (April 2020/March 2021); and we also continued collecting data prospectively between April and September 2021 analysis the whole pandemic period. ***Results:*** Totally, 399 patient clinical notes and NCS/EMG reports were reviewed, 220 were evaluated 1 year before and 179 1 year during COVID-19 pandemic. During the COVID-19 pandemic, there was a higher prevalence of peroneal neuropathy (odds ratio 4.74, 95%CI 1.30–17.25, $p = 0.0183$). In the COVID group ($n = 11$), mean age was 14 years and 63.4% were males. Mean age was 15 years and 66.7% were males in the Control group ($n = 3$). There was a significant difference in the time from symptoms onset to the neurophysiology assessment, with a mean time of 14 days in the Control group and 87.5 days in the COVID group. ***Conclusions:*** This study provides evidence that during the COVID-19 pandemic period, there was a higher prevalence of peroneal neuropathy among children. Strategies to prevent peroneal neuropathy should be recommened to this age group.

RÉSUMÉ : Forte prévalence d'une neuropathie du sciatique poplité externe chez les enfants durant la pandémie de COVID-19. ***Objectif :*** L'étude visait à examiner la prévalence d'une neuropathie du sciatique poplité externe (SPE [nerf péronier]) chez les enfants durant la pandémie de la maladie à coronavirus 2019 (COVID-19). ***Contexte :*** Depuis la flambée de COVID-19, un grand nombre d'enfants ont connu partout dans le monde des changements considérables de leur mode de vie, notamment la pratique de la plupart des activités quotidiennes à l'intérieur. La paralysie du SPE est l'une des formes les plus courantes de neuropathie de compression, et des facteurs comme l'immobilisation prolongée ou le croisement des jambes favorisent une neuropathie du SPE. ***Méthode :*** Il s'agit d'une étude rétrospective, cas/témoins, de patients dirigés vers le service de neurophysiologie de l'établissement, pour pied tombant. Ainsi, la prévalence d'une neuropathie spontanée du SPE durant l'année précédant la pandémie (avril 2019-mars 2020) a été comparée avec celle enregistrée durant l'année de la pandémie de COVID-19 (avril 2020-mars 2021), et la collecte de données s'est poursuivie de manière prospective, entre avril et septembre 2021, en vue d'une analyse couvrant toute la période de la pandémie. ***Résultats :*** Ont été examinés 399 observations cliniques et rapports d'analyse de neuroconduction et d'électromyographie : 220 datant de l'année précédente et 179 datant de l'année de la pandémie. Une augmentation de la prévalence d'une neuropathie du SPE (risque relatif approché : 4,74; IC à 95 % : 1,30–17,25; $p = 0{,}0183$) a été observée durant cette dernière année. Dans le groupe COVID (n = 11), l'âge moyen était de 14 ans et il y avait 63,4 % de garçons; dans le groupe témoin (n = 3), l'âge moyen était de 15 ans et il y avait 66,7 % de garçons. Un écart significatif du temps écoulé depuis l'apparition des symptômes jusqu'à l'évaluation en neurophysiologie a été relevé entre le groupe témoin et le groupe COVID, attente qui s'est établie respectivement à 14 jours et à 87,5 jours. ***Conclusion :*** Les résultats de l'étude confirment bien qu'il y a eu une augmentation d'une neuropathie du SPE chez les enfants, durant la pandémie de COVID-19. Il faudrait que soient recommandées des stratégies de prévention d'une neuropathie du SPE aux jeunes de ce groupe d'âge.

Keywords: Peroneal neuropathy; Foot drop; COVID-19; SARS-CoV-2; Pandemic; Pediatric neurology; Neuropathy; Children

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Introduction

A novel coronavirus causing a cluster of severe acute respiratory syndromes was identified on January 2020 in Wuhan, China,[1] and within a few months of the first report, the coronavirus (COVID-19) spread worldwide with the World Health Organization declaring a global pandemic on March 2020. The outbreaks of the COVID-19 have constituted a public health emergency of international concern. The epidemic quickly disseminated

Corresponding author: Alberto Alemán, Division of Neurology, The Hospital for Sick Children, University of Toronto, Toronto, ON, Canada. Email: alberto.aleman@sickkids.ca
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and as at April 25, 2022, 507,501,771 cases were confirmed worldwide, including 6,220,390 deaths.[2] In the province of Ontario, Canada, as of April 24, 2022, 1,244,186 cases and 12,736 deaths have been confirmed.[3]

Intense control measures including the use of facial masks, social distancing, travel restrictions, prompt laboratory testing, hospital or facility-based isolation of cases, and quarantine were implemented to control the outbreak of the COVID-19. In the community, mobility was restricted and social contact was minimized. The first state of emergency was declared on March 17, 2020, and lockdown of the entire province of Ontario was instituted to protect the population. When the emergency state was declared in Ontario, schools were shuttered until the end of the semester in June 2020. Classes resumed in-person in September 2020; nevertheless, children could also be enrolled in a full online learning school program. All educational programs were required to transition to virtual learning in January 2021 after the winter holidays. Schools reopened in-person on February 16, 2021; however, they were closed again on April 7, 2021, and remained closed until the conclusion of the semester with plans to restart in-person the following year.[4]

Since the outbreak of COVID-19, many children worldwide had a dramatic lifestyle change. The pandemic has led many children around the world to carry on the academic year in-virtual classroom and conduct most daily activities indoors during 2020–2021, with reduced frequency of physical activity and increased exposure to television and electronic devices.[5–6] Neurological manifestations during the pandemic were not only directly related to the virus but also to prolonged confinement leading to an increased incidence of tics, functional movement disorders, and neuropsychiatric disorders.[7–9] Sleep disorders, delayed bedtime, and changes in dietary patterns have also been reported.[6,10]

Peroneal nerve palsy is one of the most common entrapment neuropathies. The peroneal nerve is vulnerable to injury as it passes around the fibular neck where the nerve is quite superficial. Different circumstances including prolonged immobilization or leg crossing may repetitively injure the nerve at the fibular neck. This lack of mobility and static postitioning predisposes an individual to peroneal neuropathy. Therefore, the time of exposure to electronic devices or virtual school during pandemic may be associated with an increase risk of peroneal neuropathy as these children were in the same position for long periods of time daily. A higher incidence of sporadic peroneal neuropathy has been reported in adult patients in Spain during the alarm state due to COVID-19 pandemic.[11] The most common clinical presentation is with foot drop due to weakness of the ankle dorsiflexors muscles, and it can range from very mild to severe. It is also accompanied by abnormal sensation over the lateral calf and dorsum of the foot and normal patellar and ankle reflexes.[12–14]

We suspected that during the COVID-19 pandemic year, we were receiving a higher number of referrals than usual due to foot drop, and thereby, we hypothesize that the restrictions implemented and life changes during the pandemic could be associated with this observation. Therefore, we aimed to explore the prevalence of foot drop due to spontaenous peroneal neuropathy in children during COVID-19 pandemic.

Patients and Methods

A retrospective, observational study was conducted via chart and nerve conduction study review. We retrospectively collected data from patients who were referred to our neurophysiology clinic at The Hospital for Sick Children for evaluation of foot drop in two similar periods: 1 year previous to the COVID-19 pandemic (Control group) from April 1, 2019 to March 31, 2020, and 1 year during the COVID-19 pandemic (COVID group) from April 1, 2020 to March 31, 2021.

Once we compared the two periods of time, we continued recruiting prospectively all patients referred with foot drop between April 1, 2021 and September 30, 2021 for an extended period of time for the analysis of the whole pandemic period and eventually confirmed a negative or positive tendency of the first analysis. All patients with diagnosis of spontaneous peroneal neuropathy and without meeting exclusion criteria were included in the analysis.

Hypothesis

Our first hypothesis was that during the pandemic period, there would be a higher prevalence of foot drop since many patients and families reported spending more time during indoor activities and increased the exposure time to electronic devices, which would lead to postures that may compress the peroneal nerve at the fibula head. Our second hypothesis was that the risk would be probably higher during the coldest seasons of the year.

Patient Demographics

Patient charts and nerve conduction study reports were reviewed to collect information regarding age, sex, weight, length, body mass index, others symptoms besides foot drop (e.g., sensory), duration of symptoms onset, comorbidities, recent history of weight loss, and physical exam.

Clinical Evaluation and Electrodiagnostic Test

All patients underwent a first neurological examination that include motor, sensory, and deep tendon reflexes testing. This included Medical Research Council grading of ankle dorsiflexion, eversion and plantar flexion, and then sensory evaluation of different dermatomes. During the visit to the neurophysiological clinic, patients had a new physical exam and complete test with nerve conduction study (NCS) and electromyography (EMG) if the patient and family agreed.

Definitions

Inclusion criteria were patients who were referred to our neurophysiology clinic at The Hospital for Sick Children for the evaluation for unilateral foot drop due to spontaneous peroneal neuropathy, with clinical evaluation and onset of symptoms during the prespecified periods of time. All patients included in the COVID period did not experience recent symptoms of coronavirus infection, and they were not routinely screened for COVID infection due to foot drop.

Foot drop is a general term for difficulty lifting the ankle and extending toes due to weakness or paralyses of the anterior muscles of the leg, which are involved in the extension of the foot and toes.

Spontaneous peroneal neuropathy: nontraumatic injury of the common or deep peroneal nerve in the leg confirmed with medical history, complete physical examination with or without NCS/EMG. The typical clinical presentation was consistent with the diagnosis if the patient presented toe and/or ankle dorsiflexion weakness and sensory disturbances in the space between the first and second toes (only deep peroneal nerve), and/or foot eversion

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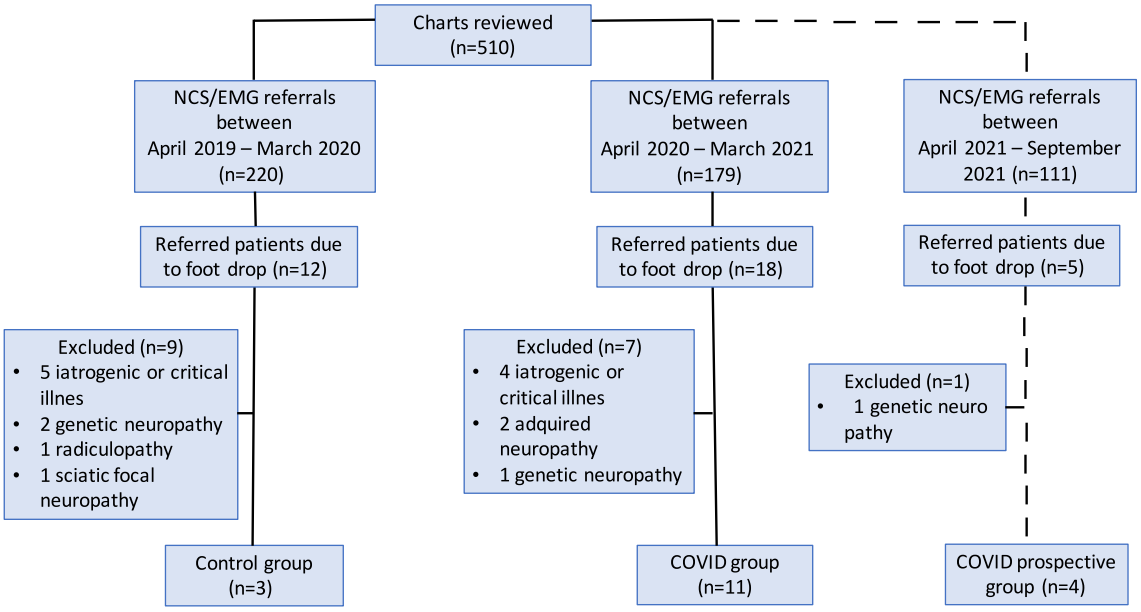

Figure 1: Study flowchart. Charts reviewed and identified referrals of patients with foot drop and confirmed peroneal neuropathy. Totally, 399 charts were retrospectively reviewed (continuous line) and 111 charts were prospectively reviewed (dashed line).

weakness and sensory abnormalities in the lateral leg and the dorsum of the foot and toes, sparing the small space mentioned before between the first two toes (common peroneal nerve with also superficial peroneal nerve involvement). Deep tendon reflexes should be normal. Ordinary circumstances recorded in clinical notes as habitual leg crossing, sitting in positions that apply some weight or pressure over the knee, prolonged immbolization, prolonged squatting, or repetitive streching from squatting were considered as risk factors for the compression of the peroneal nerve at the fibula head.

Exclusion criteria were 1) secondary causes of peroneal neuropathy (iatrogenic, surgery, critical care patients with prolonged hospital admissions, closed injuries or direct trauma over the knee, and acquired or hereditary neuropathy), and 2) foot drop due to non-peroneal neuropathy (L5 radiculopathy, lumbosacral plexopathy, or sciatic nerve lesion).

Statistical Analysis

Descriptive statistics was used to compare patient demographics, clinical presentation, and electrodiagnostic variables of the Control group and the COVID group. Descriptive analysis includes median, quartiles, limits lower and upper interval, and percentage scales of dichotomous categorical variables. Bivariate analysis includes Chi square with Yates correction in 2 × 2 table to test the null hypothesis of independence in the frequency distribution of the independent variables categorical.

The prevalence of presenting foot drop due to peroneal neuropathy was compared with the use of odds ratios with the 95% confidence interval. Fisher's exact test with value of $p < 0.05$ was considered statistically significant.

Results

Demographic and Clinical Characteristics

A total of 399 charts from patients referred to our neurophysiologic clinic were retrospectively reviewed. Two hundred and twenty patients were referred between April 1, 2019 and March 31, 2020 (Control group), and 179 were referred during the COVID-19 pandemic period (COVID group). Then, we continue collecting data prospectively from April 1, 2021 to September 30, 2021 (COVID prospectively group) from 111 patients and compared the risk during the whole pandemic period.

After comprehensive evaluation of the medical records, we identified 12 patients who were referred due to foot drop in the control group period and nine were excluded. In the COVID group, we identified 18 patients referred with foot drop and excluded seven patients. We also identified prospectively, five patients referred to our clinic with foot drop between April 1, 2021 and September 30, 2021, and within this group, one was excluded. Patients and reasons for exclusion from the analysis are detailed in Figure 1 (flowchart) and Supplementary Appendix.

The demographic and clinical characteristics are shown in Table 1. The mean age was 15 years, and there were two males (66.7%) in the Control group ($n = 3$). In the COVID group ($n = 11$), the mean age (quartiles) was 14 (12×15) years and 7 were males (63.4%). There was no statistically significant difference in weight, length, and body mass index between both groups. There were also similar proportion of patients who recalled having previous compression over the knee before symptoms onset (66.7% and 63.4% in the Control group and COVID group, respectively), but there was a significant difference between both groups in the percentage of patients who reported recent weight loss (66.7% in the Control group and 18.2% in the COVID group).

The right foot was the side most commonly affected in both groups (100% and 63.4% in the Control group and COVID group, respectively). There was a significant difference in the time from symtoms onset to the neurophysiology clinic appointment between both groups, with a mean time (quartiles) of 14 days in the Control group and 87.5 days (12.5–160.8) in the COVID group. One patient (33.3%) in the Control group and five patients (45.5%) in the COVID group had a full clinical recovery at the time of the appointment in our clinic. The NCS/EMG was declined by two of the five patients in the COVID group who had fully recovered. In

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Table 1: Demographic and clinical characteristics.

Variable	Control group ($N = 3$)	COVID group ($N = 11$)	COVID prospective group ($N = 4$)
Male sex – *N* (%)	2 (66.7)	7 (63.4)	2 (50.0)
Age – years – mean (quartiles)	15	14 (12–15)	10.5 (9.5–12)
Weight mean – kg (quartiles)	54,6	56.6 (46.4–64.3)	45,6
Length mean – cm (quartiles)	170,5	168,2	143,6
BMI mean – kg/m^2 (quartiles)	17.41	17,57	19,52
Recent history weight loss – *N* (%)	2 (66.7)	2 (18.2)	0 (0)
Recent history of compression at the knee – *N* (%)	2 (66.7)	7 (63.4)	1 (25.0)
Prolonged sitting cross-legged – *N* (%)	2 (66.7)	5 (45.5)	1 (25.0)
Prolonged sitting with the foot under the thigh – *N* (%)	0 (0)	1 (11.1)	0 (0)
Falling asleep for more than 4 hours in a rigid chair – *N* (%)	0 (0)	1 (11.1)	0 (0)
Right side affected (%)	3 (100)	7 (63.4)	1 (25.0)
Time from symptoms onset to EMG study – days (quartiles)	14	87.5 (12.5–160.8)	65 (22.5–92.3)
Full clinical recovery at the EMG appointment – *N* %)	1 (33.3)	5 (45.5)	1 (25.0)
Cancelled NCS/EMG due to full recovery at EMG appointment – *N* (%)	1 (33.3)	2 (18.2)	0 (0)
NCS/EMG performed – *N* %*	2 (66.7)	9 (81.8)	4 (100.0)

N=total number; BMI=body mass index; NCS=nerve conduction study; EMG=electromyography.
*Details of the NCS/EMG are shown in Table 2.

Table 2: Electrophysiologic features found in patients with foot drop.

NCS and EMG findings (on patients tested):	Control group ($N = 2$)	COVID group ($N = 9$)	COVID prospective group ($N = 4$)
Normal NCS/EMG	0 (0)	2 (22.2)	1 (25.0)
Abnormal motor deep peroneal nerve conduction* – *N* (%)	2 (100)	6 (66.7)	3 (75.0)
Abnormal sensory superficial peroneal nerve conduction** – *N* (%)	0 (0)	1 (11.1)	2 (50.0)
Conduction block at fibular head – *N* (%)	2 (100)	6 (66.7)	3 (75.0)
Predominantly demyelinating – *N* (%)	1 (50)	2 (22.2)	1 (25)
Predominantly axonal – *N* (%)	0 (0)	0 (0)	0 (0)
Mixed – *N* (%)	1 (50.0)	4 (44.4)	2 (50.0)
Denervation in the deep peroneal nerve distribution – *N* (%)	1 (50.0)	4 (44.4)	1 (25.0)
Denervation in the superficial peroneal nerve distribution – *N* (%)	0 (0)	2 (22.2)	2 (50.0)

CMAP=compound muscle action potential; EDB=extensor digitorum braves; SNAP=sensory nerve action potential; NCS=nerve conduction study; EMG=electromyography.
*Abnormal findings in deep peroneal nerve include conduction block at fibular head (defined as 50% reduction in the CMPA amplitude or conduction velocity slowing of ≥ 11 m/s between below and above fibular head), and/or low CMAP amplitude at EDB.
**Abnormal findings in superfical peroneal nerve include low SNAP amplitude or no response.

the motor nerve conduction studies, there was confirmation of peroneal nerve demyelination at the fibula head in 100% of the Control group and 66.7% of the COVID-19 group, probably associated with the delay in the appointment and coincident with fully clinical recovery of the patients who had normal nerve conduction study. Others findings from NCS/EMG are also shown in Table 2.

The prevalence of peroneal neuropathy was higher in the COVID group than in the Control group during the same period of time (OR 4.74, 95% CI 1.30–17.25, $p = 0.0183$); however, during the coldest seasons, there was no higher number of cases, and on the contrary to our initial secondary hypothesis, the largest number of cases (72.7%) in the COVID group were seen during the spring and summer 2020 (Figure 2).

When we analyzed the prevalence of peroneal neuropathy during the whole pandemic period, including the prospective and retrospective cohort of patients (patients referred between April 1, 2020 and September 30, 2021) and compared with the Control group, the difference remained statistically significant, with higher risk in the pandemic period (OR 3.95, 95% CI 1.13–13.80, $p = 0.0317$). The total number of cases in the spring and summer 2021 were lower ($n = 4$) than the same seasons during spring and summer 2020 ($n = 8$), but still higher compared with the number of cases during spring and summer 2019 before the outbreak of the pandemic ($n = 1$).

Discussion

During the COVID-19 pandemic, many children in Canada and worldwide had a dramatic lifestyle change. The outbreak of the pandemic has changed how kids learn and interact, as social distancing restrictions against this virus were applied for reducing its spread, such as isolation, quarantine, social distancing, closing schools, reduced recreational physical activity, and supressing team sports, what have lead to unhealthy lifestyle habits and an increasing exposure time to electronic devices during lockdowns[5–6]. Prolonged confinement has lead to a higher frequency of complications not directly related to the virus but with lifestyle changes in adults and children. Previous studies reported changes in dietary patterns, sleep disorders, delayed bedtime, increased body weight, tics, functional movement disorders, anxiety disorder, depressive disorder, and increased substance use.[6–10,15–16]

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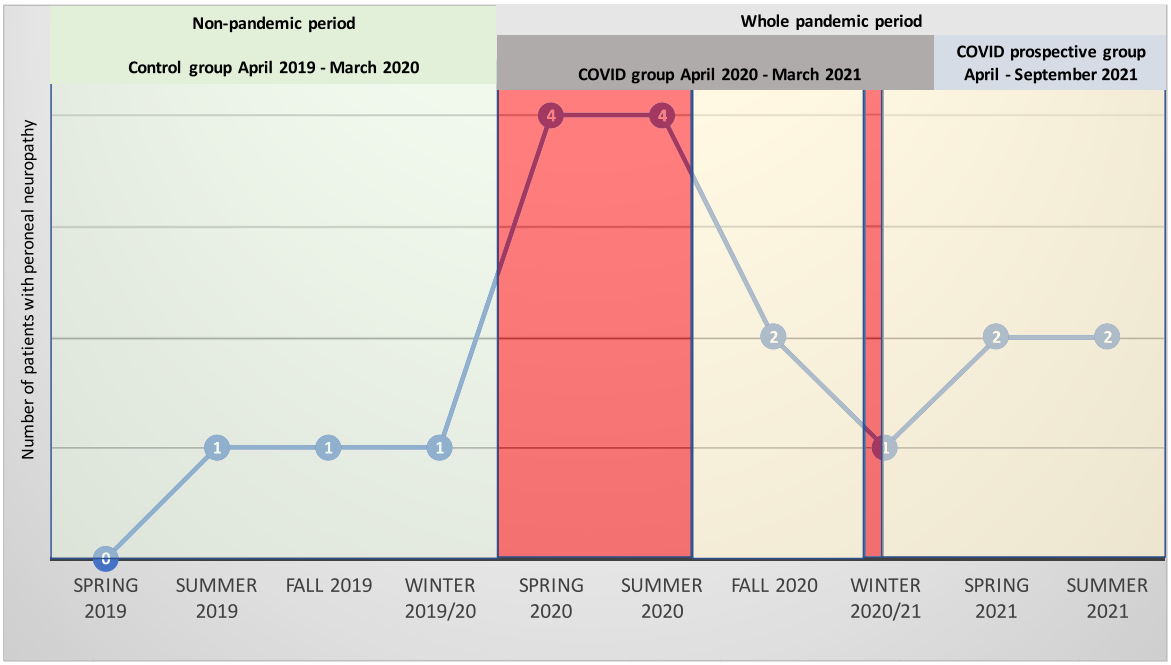

Figure 2: Cases of peroneal neuropathy per season 1 year previous to the outbreak of the COVID-19 pandemic in Ontario (green), during the first year of the pandemic (dark gray) and prospective follow-up until summer 2021 (light blue). The year previous to the pandemic outbreak is shown in light green; the states of emergencies during the pandemic period are shown in red (the first one was declared from March 17 to July 24, 2020; and the second state of emergency was declared from January 12 to February 10, 2021); and the gradual lifting of the government restrictions are shown in yellow. Prevalence of spontaneus peroneal neuropathy in the COVID group versus the Control group: odds ratio 4.74, 95% CI 1.30–17.25, p =c0.0183. Prevalence of spontaneus peroneal neuropathy in the whole pandemic period versus the Control group: odds ratio 3.95, 95% CI 1.13–13.80, p = 0.0317.

This retrospective study analyzed charts of patients referred to our neurophysiology clinic and investigated the potential increment in the number of peroneal neuropathy that may be associated with the increase in time in virtual activities expended during the quarantine implemented to control the outbreak of the COVID-19. Knowledge of how this may impact in children has a great relevance to take preventive decisions and actions. We compared the prevalence during two consecutive years, 1 year previous to the COVID-19 pandemic and 1 year during the COVID-19 pandemic, and we also continued recruiting cases prospectively between April 1, 2021 and September 30, 2021 for an extended analysis during the whole pandemic period.

Our analysis revealed a statistically significant difference between patients who developed spontaneous peroneal neuropathy and foot drop during the COVID-19 year compared with a same period of time but 1 year before (OR 4.74, 95% CI 1.30–17.25, $p = 0.0183$). This difference remained significant when we analyzed the first 18 months since the pandemic outbreak in Ontario (OR 3.95, 95% CI 1.13–13.80, $p = 0.0317$). To our knowledge, this is the first report worldwide of an increased prevalence of spontaneous peroneal neuropathy in children during the COVID-19 pandemic. Parra et al. also reported an increment of 50% of the cases of peroneal neuropathy in adult patients in 2020 compared with three previous years, and all of them developed their symptoms during the emergency state period in Spain.[11]

We also hypothesize that the prevalence will be higher during the coldest seasons of the year; however, we observed that the higher risk was actually during the spring and summer 2020 ($n = 8$) and during the spring and summer 2021 ($n = 4$), compared with spring and summer 2019 ($n = 1$). We do not have an explanation for this observation; nevertheless, one hypothesis could be that higher number of cases during the spring and summer season in 2020 was associated with the first state of emergency and the initial wide lockdown declared in the province of Ontario in March 17, 2020, with gradual lifting of the restrictions since July 24, 2020. It is worth clarifying that since the declaration of the first state of emergency, the restrictions in the province of Ontario have never been completely eliminated and are gradually lifted.[4] Due to record occurrences of the Omicron variant, Ontario went back into partial lockdown in January 2022, ordering the closure for 21 days of most nonessential indoor facilities, including indoor dining, gyms, movie theaters, and schools. Schools returned in-person in January and until now, the Ontario government maintains certain recommendations for schools, such as self-screening every day before coming to school, wearing masks inside the school, proper hand hygiene, and keeping greatest possible distance.[17]

Our study has some limitations. First, the number of cases with foot drop in both groups were small, especially in the Control group, but this would be in accordance with the initial hypothesis. Karakis et al. reported in a 10-year NCS/EMG referral analysis that the most common entrapment neuropathies in their pediatric cohort were the peroneal (24%) and ulnar (22%); however, there is no data about the incidence per year, and they do not independently report spontaneous and secondary etiologies of peroneal neuropathy.[12] In our clinic, we received 209 referrals between April 2018 and March 2019, and only two were found to have clinical peroneal neuropathy, both of whom exhibited abnormal NCS/EMG, indicating that our findings are consistent with our hypothesis.

Second, this was a retrospective analysis with risk of bias during the data collection; however, we compared records of both groups in the same way and analyzed independently the retrospective data

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from the whole pandemic period with similar results when we compared 12 months and 18 monts during the pandemic versus 12 months previous to the pandemic.

Third, there were five patients in the COVID group who had full recovery at the time of the clinical examination in the neurophysiology clinic, two2 of them preferred to cancel the study, two others had normal NCS/EMG study, and the last patient with complete recovery had abnormal NCS/EMG study. Only one patient in the Control group refused to complete the NCS/EMG study due to full recovery. It is important to note that there was a significant difference in the time from symtoms onset to the neurophisiology clinic visit, with a mean time (quartiles) of 14 days in the Control group and 87.5 days (12.5–160.8) in the COVID group. This is likely associated with the delay in the schedule and appointments during the pandemic period. Furthermore, most of the patients with normal physical exam or normal NCS/EMG were those with the longest waiting time until the study. Nevertheless, all the cases had a previous physical exam at the referral time that was consistent with the diagnosis of peroneal neuropathy.

Finally, we did not assess the true impact of lockdown on specific children's habits, physical activities, or time per day using electronic devices, though most of the patients or parents reported that the kids were having more indoor activities, less physical activity, and increased exposure time to electronic devices during the pandemic.

Since March 2020, the COVID-19 pandemic has dramatically changed normal lifestyles across Canada and worldwide. A massive COVID-19 vaccination plan is underway, and at this point, the global COVID-19 pandemic perspective is complex since some countries have vaccinated a large portion of their population, but some others countries are far from achieving herd immunity to bring the pandemic under control. In the mean time, many variant viruses including Alpha, Beta, Gamma, Delta, and Omicron have arisen. Vaccines and social distancing remain the best public health measures to protect people from COVID-19. As the massive vaccination is completed and new waves are controlled, our challenge is also to reduce the risk of complications due to unhealthier lifestyles and aggravation of lifestyle-related diseases during confinements.

Conclusions

This study provides evidence that during the COVID-19 pandemic, there was a higher prevalence of foot drop due to spontaneous peroneal neuropathy among children in Ontario. We believe that this finding is likely associated with the increased indoor time and non-recommended positions during virtual activities in the pandemic period. Strategies like using proper chairs with correct sitting positions (bending knees at the right angle and keeping feet flat on the floor) and education for avoiding sitting with crossed legs, especially for a long period of time and eventually padding the knee, should be recommended for students during the pandemic restrictions and in virtual activities.

Supplementary Material. To view supplementary material for this article, please visit https://doi.org/10.1017/cjn.2022.266.

Statement of Authorship. AA and HDG conceived the study, critically reviewed the literature, and drafted the manuscript. AA acquired and analyzed the data. EN critically reviewed and edited the manuscript.

Conflict of Interest. The authors have no conflicts of interest (financial or non-financial) to disclose relevant to this study.

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