The Relationship between Cold Exposure and Idiopathic Facial Nerve Palsy

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KEYWORDS
Facial palsy, Neuropathy, Idiopathic nerve palsy, Bell' palsy.

ABSTRACT
Background and Aim: Facial palsy, Paralysis of all the muscles supplied by the facial nerve on one side only, and without other symptoms, always means disease of the nerve trunk, characterized by weakness or paralysis of the facial muscles, can result from a variety of causes, including viral infections. While the exact relationship between cold exposure and facial palsy is not directly addressed, it is known that cold exposure can exacerbate certain neurological conditions. Therefore, it is possible that cold exposure could worsen the symptoms of facial palsy. To confirm relationship between cold exposure and facial palsy, we retrospectively analyzed 27 patients with BP in order to provide statistic data and draw up relevant connections between cold exposure and idiopathic facial nerve palsy.
Methodology: In a retrospective study of the medical record for 3 years from January 2021 to December 2023, approximately twenty-seven adult participants over the age of 18 were included in our analysis. They were clinically diagnosed with Bell's palsy as there is no underlying neurological or autoimmune disease known to cause such a condition. All demographic and laboratory data of the participants are used to determine the cause of facial palsy.
Results: Our analysis includes twenty seven participants, 17 males (63%) and 10 females (37%); they were divided into three age groups' from18 to 40, 41 to 60, and above 60 years old, with 17 (63%), 8 (29.6%) and 2 (7.4%) cases in each group, respectively. About 19 (70.4%) were exposed to cold within 24 hr of palsy while the other 11 (29.6%) were not exposed to cold. Moreover, Bell's palsy appeared for the first time in 21 (77.8%) of the cases, but it was a second or more occurrence in 6 (22.2%) the remaining cases. According to risk factors among the studied cases, there were 16 (59.3%) had DM, while the other 11 (40.7%) were not DM and 1 (3.7%) who uses immunosuppressive drugs, while the other 26 (96.3%) did not used them.
Conclusion: Our analytical data show that cold exposure is possibly one of risk factor in Bell's palsy, but further studies are a devised to confirm our result with randomized control group and with a large number of patients should be taken into consideration to support our result for better outcome and high satisfaction.

1. Introduction

Facial palsy, characterized by weakness or paralysis of the facial muscles, can result from a variety of causes, including viral infections (Djupesland et al., 1976). While the exact relationship between cold exposure and facial palsy is not directly addressed, it is known that cold exposure can exacerbate certain neurological conditions (Mark May & Hardin Jr, 1978). Therefore, it is possible that cold exposure could worsen the symptoms of facial palsy, but further research is needed to confirm that.

Bell's palsy is an acute-onset peripheral facial neuropathy characterized by lower motor neuron palsy; it constitutes the most common cause of facial paralysis (M May, 2000). Clinical manifestations include rapid onset of unilateral facial weakness, lower motor neuron-type palsy, postauricular pain, impaired taste sensation, subjective change of sensory perception, and hyperacusis (Karaca, Soydan, Yildiz, & Toros, 2019). Unilateral paralysis is the most common presentation of IFP occurs with the same frequency on the right and left sides of the face. The most common causes of the abrupt onset of unilateral facial weakness are stroke and Bell´s palsy. Due to the close similarity between the symptoms of IFP and cerebrovascular accident, it is essential for emergency physicians to differentiate them (Zohrevandi, Kasmaee, Asadi, & Tajik, 2014).

Bell’s palsy (BP) is the most common reason for facial nerve palsy. It is an acute, unilateral, partial, or complete paralysis of the VII nerve. It has been found that its prevalence has no bearing on sexual differences. Viral infection, vascular ischemia, disorder of the autonomic regulation, and inflammation are the most common assumed reasons for BP (Monini, Lazzarino, Iacolucci, Buffoni, & Barbara, 2010). Controversy still exists about the prevalence of bell's palsy and its exact causes. Several risk factors can cause IFP including viral infection, vascular ischemia, autoimmune inflammatory disorders, age, hypertension, and heredity.

There are several possible risk factors for BP, including severe preeclampsia (Aditya, 2014), psychological factors (Huang et al., 2012), glucose metabolism abnormalities (Bosco et al., 2011), radiation exposure (Khateri, Cheraghi, Ghadimi, & Abdollahi, 2018), hypertension and migraine (Peng, Chen, Fuh, Tang, & Wang, 2015).

Recently, epidemiological studies have revealed that the incidence of BP is also related to extreme temperature exposure. Furthermore, a community-based study was conducted to assess the factors that precipitated cases of BP in Qena Governorate, Egypt (Khedr et al., 2016). The most frequent precipitating factors were exposure to air draft (40%) and upper respiratory tract infection (13.3%). This might be related to variations between daytime and nighttime temperatures in the community, and especially susceptibility to air draft exposure during the night.

The incidence of BP increases with acute cold exposure and in places with large diurnal temperature differences, indicating that sharp temperature changes may be a risk factor for facial nerve palsy. Subcutaneous fat serves as a defense against cold stimulation. At present, adipose tissue is considered an endocrine organ that releases various bioactive substances, called secretory factors or adipokines (Colitti & Grasso, 2014; Wang, Mariman, Renes, & Keijer, 2008). It has also recently been proposed that adipose tissue is a member of the diffused neuroendocrine system (Chaldakov, Fiore, Tonchev, & Aloe, 2010). Under cold stimulation, the factors secreted by fat cells change, with inflammatory factors such as McP-1 and CD68 being up regulated and brain derived neurotrophic factor and neuronatin being down regulated (Luo, Jia, Zhang, Sun, & Yan, 2016; Rosell et al., 2014). Subcutaneous fat may thus serve as a line of defense against cold stimulation, which causes the release of various secretory factors or adipokines that infuence the immune system and the susceptibility to proinfammatory events such as BP (Huh, Park, Ham, & Kim, 2014; Vielma, Klein, Levingston, & Young, 2013). Whether changes in fat affect inflammatory responses, the nervous system, and acute demyelination are thus worthy of further mechanistic study increased rate of disease in colder months (autumn and winter) (Zhang et al., 2020).

Besides, the incidence of the IFP were increased in the spring (Narcı, Horasanlı, & Uğur, 2012; Zohrevandi et al., 2014). BP is found to occur more frequently during the colder period (autumn and winter). However,(Narcı et al., 2012)and(Zohrevandi et al., 2014) showed an increased rate of BP during warmer months (spring).

Incidence of IFP increased in the third and fourth decades of life and (Movahedian, Ghafoornia, Saadatnia, Falahzadeh, & Fateh, 2009; Savadi Oskoui, Abedi, & Rostami, 2004) reported that the increased incidence of BP is found among people who are 30–39 years old. Also, (Zhao et al., 2017) mentioned that BP equally affects men and women in middle and older age but is less common under 15 and over 60 years of age. Its prevalence among males and females is more or less equal and its peak incidence is in the fourth decade of life. The occurrence of familial Bell´s palsy is about 14% and its recurrent risk is about 10%(Zohrevandi et al., 2014).

Bell's palsy is seen more frequently in cold regions; this fact supports this hypothesis. It is thought that with vasomotor changes in a facial region exposed to cold, the development of partial ischemia in that area creates inflammation around the nerve and cold air again more easily reactivates the latent remaining viral infection (Murakami et al., 1996; Takahashi et al., 2001). There is known to be a relationship between Bell's palsy and cold. Therefore, it is thought that theoretically, the incidence should be lower in hot climates. However, studies of incidence conducted in cities of the Mediterranean region have shown no significant decrease in the incidence of Bell's palsy compared to cities in other colder climates. Nevertheless, even in temperate climate conditions, Bell's palsy is seen more frequently in the coldest seasons (Baugh et al., 2013; Ferreira et al., 2016; Yilmaz, Gur, Kucuktepe, Ensari, & Yilmaz, 2019).

2. Methods

In a retrospective study, 27 cases of BP were observed from January 2021 to December 2023. Patients with paralysis secondary to trauma, zoster oticus, hypertensive cerebral hemorrhage, and cerebellopontine angle tumors were excluded. Data including gender, age, and cold exposure within 24 hours of palsy and clinical features were recorded(Zhao et al., 2017).

- Statistical Analysis:

SPSS 20.0 was used for statistical analysis; $p < 0.05$ indicated statistical significance. Student t test and $\chi 2$ test were performed to compare the mean continuous data and the categorical data respectively(Zhao et al., 2017).Qualitative data were presented as frequency and percentage (%) and were analyzed using the Chi-square test or Fisher's exact test when appropriate. Multinomial logistic regression was used to predict the probabilities of the possible differences among categories. Effects of age, gender, comorbid disease, and clinical factors were investigated using frequency and percentage (%) and results were expressed as P-value.

3. Results

This study includes Twenty Seven participants were diagnosed as facial nerve palsy, 17 males (63%) and 10 females (37%), the majority of them were between ages from 18 to 40 years old, where they represented 63.0% (17 cases). Also, about 8 cases their ages were ranged from 41 to 60 and they represented 29.6 %. The last 2 cases were above 60 years and they represented 7.4% of the study. There was a significant difference ($P < 0.05$, $\chi 2 = 12.6$) between the age groups of cases in this study. The highest incidence was identified between the ages of 18 to 40 years (Table 1, 2: Figure 1,2).

Table(1): The incidence of Bell's palsy according to age			
Age groups	Frequency N = 27	**Percent %**	***p*-value**
18 – 40	**17**	**63.0**	**P < 0.05 χ^2 =12.6**
41 – 60	**8**	**29.6**	
above 60	**2**	**7.4**	

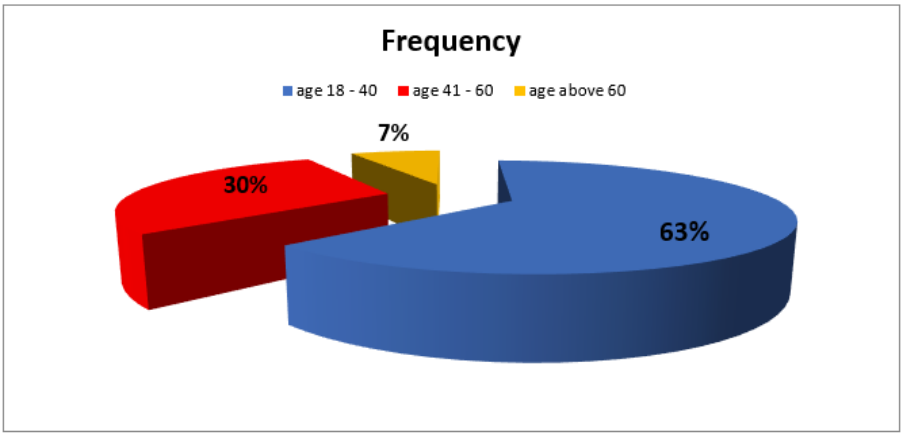
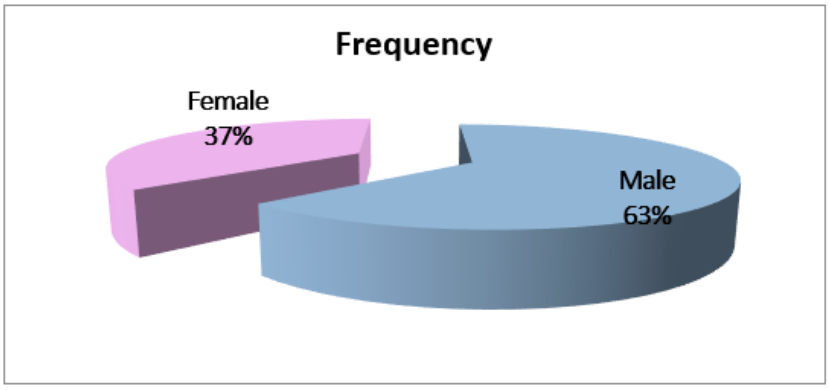


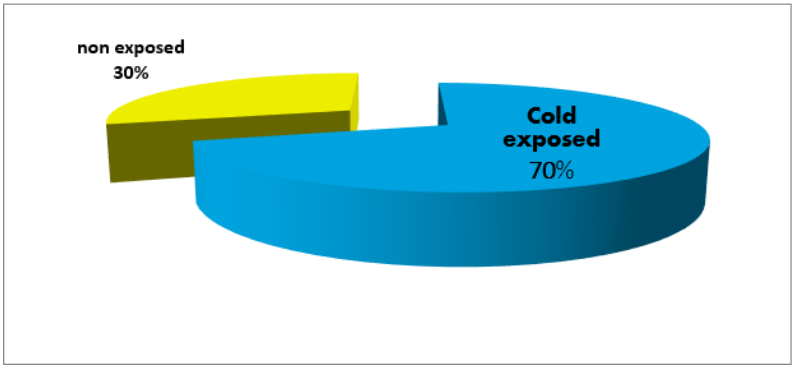
Figure1. The incidence of Bell's palsy according to age

Table(2): The incidence of Bell's palsy according to Gander			
Gander	**Frequency N = 27**	**Percent %**	***p*-value**
Male	**17**	**63.0**	**P =0.177 χ^2=1.81**
Female	**10**	**37.0**	



Figure(2): The incidence of Bell's palsy according to gander

Table 3: Frequency of cases exposed to cold within 24 hour of palsy:			
	Frequency N = 27	**Percent %**	***p*-value**
Cold exposed	**19**	**70.4**	**P <0.05 χ^2= 4.481**
Non exposed	**8**	**29.6**	



Figure(3): Frequency of cases exposed to cold within 24 hour of palsy

Table (4): Time of onset. Cases admitted within 24 h from the onset of symptoms.			
	Frequency N= 27	**Percent %**	***p*-value**
First time	**21**	**77.8**	**P <0.05** χ^2**= 8.33**
Second time or more	**6**	**22.2**	

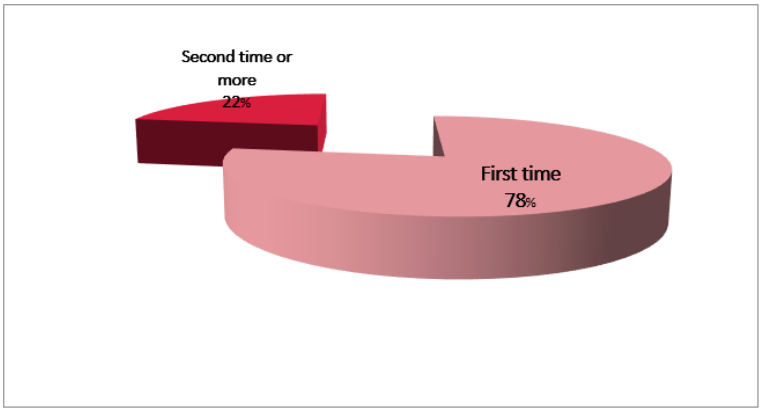


Figure (4): Time of onset. Cases admitted within 24 h from the onset of symptoms.

Table (5): Comorbidities of the studied Cases				
		Frequency	**Percent %**	***p-value***
Diabetes Mallets	Diabetic	16	59.3	**P =0.335** χ^2**= 0.925**
	Non- Diabetic	11	40.7	
Immunosuppressive drugs	received	1	3.7	**P <0.0001** χ^2**= 23.15**
	Not received	26	96.3	

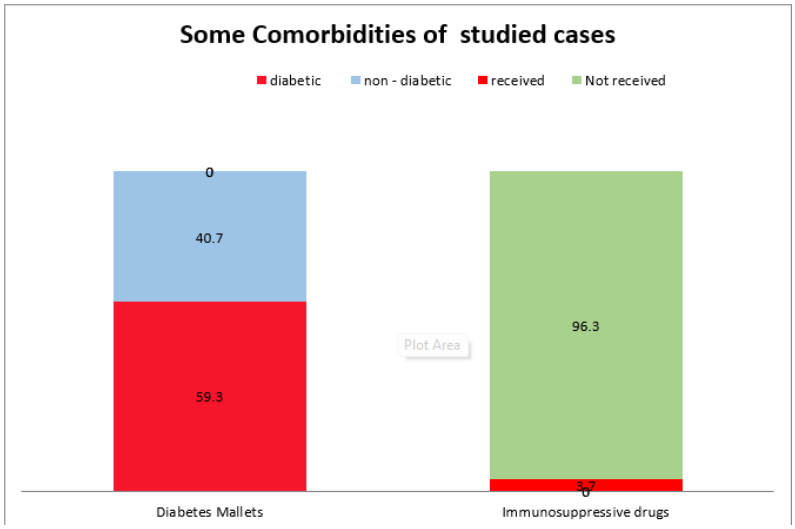


Figure (5): Comorbidities of the studied Cases

As shown in Table 3, about 70.4% (or 19) of patients were exposed to cold within 24 hours of Bell's palsy while other 29.6% (8 patient) were not exposed. There was a significant difference ($P < 0.05$, $\chi 2 = 4.481$) between individuals group who exposed to cold and not exposed to cold. (Table 3: Figure 3)

Time of onset Bell's palsy, Cases admitted within 24 h from the onset of symptoms were mentioned in Table 4. Twenty one patients (77.8%) subjects had BP for the first time while recurrence rate was 6 patients (22.2%) The recurrence rate was significantly differ ($P < 0.05$, $\chi 2 = 8.33$) as first onset was frequently more the second referrers. (Table 4: Figure 4)

The incidence of some Comorbid disease, there was insignificant correlations ($P = 0.335$, $\chi 2 = 0.925$) between palsy and comorbid disease including diabetes Mallets. As 59.3% of patients (n= 16) were diabetic and others 40.7% of patients (n= 11) were non diabetic. Meanwhile, the percentage of patients given immunosuppressive drug was 3.7% (n=1) and 96.3% of the patients (n=26) did not received immunosuppressive drugs, so the Bell's palsy was highly incidence in patient who did not received immunosuppressive drugs ($P < 0.0001$, $\chi 2 = 23.15$). (Table 5: Figure 5)

4. Discussion

In the present study, the idiopathic facial nerve palsy shown high incidence in age from 18 to 40 years old and 63% of patients were male. Monini et al. (2010) presented that the age of peak incidence of BP was 50 years and 53.7% of cases were male. Males were slightly more affected (53.7%) than females. Zhao et al. (2017) mentioned that the mean age of patients was 46.21 ± 9.38 years and the highest incidence was identified between 39 and 50 years of age and 55.1% were male. Also, Zohrevandi et al. (2014) noticed that the maximum incidence rate of IFP was in the fourth decade of patient's life and 52.9% cases were male.

The result of current study demonstrated that about 70.4% of patients were exposed to cold within 24 hours of Bell's palsy. In a previous study, Mustafa and Suleiman (2020) diagnosed Bell's palsy in 48 patient and found that 13 (27.1%) gave a history of exposure to cold, while 35 (72.1%) patients did not give a history of exposure to cold. was seen mostly in January as the temperature become 11.7C°. The Bell's palsy incidence significantly increase in winter (Yilmaz et al., 2019). Campbell and Brundage (2002) investigated climate and season correlates of BP risk and revealed that both season and climate were independent predictors of BP risk. There is a clear correlation between the cold season and the number of cases observed (Hsieh, Wang, & Lee, 2013; Spengos et al., 2006).El-Ebiary (1971) found 5.4% of the patients gave a history of exposure to cold and concluded that this provides strong evidence against refrigeration theory of Bell's palsy. Danielides et al. (2001) failed to demonstrate any significant relation between cold weather as a predisposing factor for the development of Bell's palsy.

Our investigation clarified that Twenty one patients (77.8%) subjects had BP for the first time while recurrence rate was 6 patients (22.2%). In the same line, Zohrevandi et al. (2014) found that (77.7%) experienced IFP for the first time and (22.3%) recurrence rate. Most patients were referred to the hospital within 24 h from the onset of the symptoms. Zhao et al. (2017) appeared that (87.1%) of patients had BP for the first time and 12.9% recurrence rate.

Our present analytical study found that, there was an insignificant correlation between palsy and diabetes Mallets. As 59.3% of patients were diabetic and others 40.7% was non diabetic. Hsieh et al. (2013); Zohrevandi et al. (2014) found that no significant correlations between a patient's number of comorbidities especially Diabetes Mallets and incidence of Bell's palsy.

Meanwhile, the percentage of patients given immunosuppressive drug was 3.7% (n=1) and 96.3% of the patients (n=26) did not received immunosuppressive drugs, so the Bell's palsy was highly incidence in patient who did not received immunosuppressive drugs

5. Conclusion

Our analytical data show that cold exposure is possibly one of risk factor in Bell's palsy, but further studies are a devised to confirm our result with randomized control group and with a large number of patients should be taken into consideration to support our result for better outcome and high satisfaction.

Ethics approval and consent to participate:

Conflict of interests: The authors have no conflict of interest to declare.

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