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# Bell's Palsy at High Altitude: Our Experience

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## Abstract

**Background:** Bell's palsy is the most common cause of acute unilateral lower motor neuron facial paralysis. Although its etiology remains incompletely understood, environmental factors such as cold exposure & hypobaric hypoxia encountered at high altitude may contribute to disease onset & severity. Published literature describing Bell's palsy among healthy individuals living at high altitude remains limited.

**Objective:** To describe our clinical experience with Bell's palsy in healthy adults residing at high altitude, with emphasis on clinical presentation, environmental risk factors, management, & short-term outcomes.

**Materials & Methods:** This prospective observational study included 25 healthy adults aged 25–45 years residing continuously at altitudes above 2000 meters for at least five months. Demographic details, environmental exposures, clinical characteristics, House–Brackmann facial nerve grading, treatment, & recovery at three months were analyzed. Statistical analysis was performed using the chi-square test & Student's t-test, with $p<0.05$ considered statistically significant.

**Results:** The mean age was 33.4±5.7 years, & 76% of patients were male. Grade III Bell's palsy was the most common presentation. Severe cold exposure & prolonged outdoor activity were significantly associated with higher House–Brackmann grades ($p=0.018$ & $p=0.031$, respectively). Patients presenting within 72 hours demonstrated significantly higher complete recovery rates than those presenting later ($p=0.004$). Overall, complete recovery was achieved in 80% of patients at three months.

**Conclusion:** Our experience suggests that Bell's palsy is not uncommon among healthy individuals residing at high altitude. Environmental exposure, particularly severe cold & prolonged outdoor activity, appears to influence disease severity. Early diagnosis & prompt corticosteroid therapy result in favorable clinical outcomes.

**Keywords:** Bell's palsy, facial nerve palsy, high altitude, hypobaric hypoxia, mountain medicine, corticosteroids.

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## Introduction

About 60–75% of all occurrences of peripheral facial nerve palsy are caused by Bell's palsy, which is the most frequent cause of acute unilateral lower motor neuron facial paralysis. The abrupt onset of unilateral facial paralysis, inability to fully close the eye, drooping of the mouth's angle, reduced forehead wrinkling, and, in certain situations, altered taste perception, hyperacusis, or diminished lacrimation are its defining characteristics [1]. Even while the illness usually resolves on its own, insufficient recovery can lead to severe psychological suffering, permanent facial paralysis, synkinesis, & cosmetic deformities. The reported yearly incidence, which affects people of all ages & genders, is between 15 & 30 cases per 100,000 people, peaking in the fourth & fifth decades of life [2].

Despite substantial investigation, the exact cause of Bell's palsy is still unknown. A complex etiology including autoimmune processes, microvascular ischemia, hereditary vulnerability, inflammatory edema of the facial nerve, & reactivation of latent herpes simplex virus type 1 (HSV-1) is supported by current research [3]. The facial nerve is especially susceptible to compression after inflammatory swelling because it passes via the small facial canal inside the temporal bone. Nerve transmission is hampered by the ensuing ischemia & demyelination, which result in the typical clinical symptoms [4].

Environmental factors have long been suspected to influence the development of Bell's palsy. Exposure to cold weather, sudden temperature fluctuations, strong winds, & seasonal climatic changes has been associated with an increased incidence of facial nerve paralysis in several epidemiological studies[5]. Although these associations remain controversial, cold-induced vasospasm & reduced blood flow through the vasa nervorum have been proposed as potential mechanisms leading to ischemic injury of the facial nerve.

Particular physiological difficulties in high-altitude settings may put vulnerable people at much greater risk for peripheral nerve damage. Atmospheric pressure significantly drops above about 2000 meters, which causes hypobaric hypoxia & decreased oxygen delivery to tissues [6]. High altitude workers & residents are also subjected to persistently high-velocity winds, dehydration, elevated UV radiation, extremely low ambient temperatures, & decreased humidity. Numerous physiological changes involving the respiratory, cardiovascular, hematological, & neurological systems are brought on by these environmental stresses. Peripheral cranial neuropathies, especially Bell's palsy, have received very little attention, despite the fact that acute mountain sickness, high-altitude cerebral edema, & high-altitude pulmonary edema are well-known neurological consequences of altitude exposure [7-8].

Through a number of processes, such as oxidative stress, endothelial dysfunction, decreased microcirculation, increased vascular permeability, & inflammatory responses, hypoxia may negatively impact peripheral nerve function. Peripheral nerves are more vulnerable to ischemia injury in hypoxic environments, according to experimental research. Additionally, continuous exposure to cold may cause the tiny arteries supplying the facial nerve to sustainably constrict, exacerbating ischemia edema inside the restricted facial canal. In people who live at high altitudes, hypobaric hypoxia & extreme cold exposure may work in concert to raise the risk or severity of Bell's palsy [9].

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During our clinical practice in a high-altitude healthcare setting, we encountered several otherwise healthy adults presenting with Bell's palsy following prolonged exposure to cold weather & outdoor activity. These observations prompted the present prospective observational study. The study was undertaken to describe our institutional experience with Bell's palsy in individuals residing at high altitude, evaluate environmental factors associated with disease severity, & assess short-term outcomes following standard corticosteroid therapy.

**Objectives**

**Primary Objective**

1. To describe our experience with Bell's palsy among healthy adults residing at high altitude.

**Secondary Objectives**

1. To evaluate clinical presentation & disease severity.
2. To identify environmental factors associated with severe Bell's palsy.
3. To assess treatment outcomes & recovery following corticosteroid therapy.
4. To identify factors associated with complete recovery.

**Materials & Methods**

Present study is Prospective observational study. High-altitude residential & occupational settlements situated above 2000 meters above sea level. Twenty-five patients diagnosed with Bell's palsy.

**Inclusion Criteria**

1. Age between 25 & 45 years
2. Healthy active adults
3. Continuous residence at high altitude for at least five months
4. Newly diagnosed unilateral Bell's palsy
5. No major medical comorbidities

**Exclusion Criteria**

1. Diabetes mellitus
2. Hypertension
3. Chronic kidney disease
4. Previous Bell's palsy
5. Stroke or central nervous system disorders
6. Otitis media or temporal bone trauma
7. Pregnancy
8. Connective tissue disorders

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**Data Collection**

The following variables were recorded:
Age
Sex
Duration of altitude exposure
Daily outdoor activity
Cold exposure
Side of facial involvement
Time to presentation
House–Brackmann grading
Treatment received
Recovery at three months

**Statistical Analysis**

Data were analyzed using SPSS version 26. Continuous variables were expressed as mean ± standard deviation, while categorical variables were presented as frequencies & percentages. Comparisons were performed using Student's t-test & chi-square test. Statistical significance was defined as $p<0.05$.

**Results**

**Table 1: Baseline Demographic Characteristics of Study Population (n=25)**

| Variable | Number (%) |
|---|---|
| Age 25–30 years | 8 (32%) |
| Age 31–35 years | 9 (36%) |
| Age 36–40 years | 5 (20%) |
| Age 41–45 years | 3 (12%) |
| Male | 19 (76%) |
| Female | 6 (24%) |
| Mean altitude exposure >8 months | 14 (56%) |
| Outdoor activity >8 hours/day | 16 (64%) |

**Demographic Characteristics**

The mean age was 33.4±5.7 years.

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Nineteen participants (76%) were male while six (24%) were female.

Mean duration of stay at altitude was 8.3±2.1 months.

**Table 2: Clinical Presentation & Severity**

| Clinical Variable | Number (%) |
|---|---|
| Left-sided palsy | 14 (56%) |
| Right-sided palsy | 11 (44%) |
| House-Brackmann Grade II | 4 (16%) |
| Grade III | 10 (40%) |
| Grade IV | 7 (28%) |
| Grade V | 4 (16%) |
| Presented within 72 hours | 17 (68%) |
| Presented after 72 hours | 8 (32%) |

Grade III Bell's palsy was the most common presentation. Left-sided facial paralysis was slightly more frequent than right-sided involvement.

**Table 3: Environmental Factors Associated with Severe Bell's Palsy**

| Variable | Mild-Moderate (Grade II-III) n=14 | Severe (Grade IV-V) n=11 | p value |
|---|---|---|---|
| Severe cold exposure | 5 | 9 | 0.018 |
| Outdoor activity >8 hours/day | 7 | 9 | 0.031 |
| Altitude stay >8 months | 6 | 8 | 0.072 |
| Wind exposure >4 hours/day | 8 | 9 | 0.081 |

Severe cold exposure & prolonged outdoor activity demonstrated statistically significant associations with Grade IV–V Bell's palsy.

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**Table 4: Factors Affecting Recovery**

| Variable | Complete Recovery (n=20) | Partial Recovery (n=5) | p value |
|---|---|---|---|
| Treatment within 72 hours | 16 | 1 | 0.004 |
| Steroid initiation within 24 hours | 14 | 1 | 0.009 |
| Grade II-III palsy | 13 | 1 | 0.015 |
| Grade IV-V palsy | 7 | 4 | 0.015 |

Complete recovery occurred in 20 patients (80%). Early initiation of corticosteroid therapy within 72 hours significantly improved recovery.

**Discussion**

Our experience with Bell's palsy in healthy young adults living in a high-altitude setting is summarized in this prospective observational study. Despite the fact that Bell's palsy is typically thought of as an idiopathic ailment, our research indicates that environmental factors specific to high-altitude locales may have an impact on both the severity of the disease & its clinical outcome. While early corticosteroid medication initiation was linked to significantly better recovery, severe cold exposure & extended outdoor exercise showed significant relationships with higher House-Brackmann grades [10].

Our patients' average age was 33.4 years, which is younger than the average age found in the majority of population-based research, where Bell's palsy often manifests in the fourth & fifth decades of life. This discrepancy might be explained by the demographics of people who live or work at high altitudes, where jobs like military deployment, border security, construction, & infrastructure maintenance typically involve younger adults who spend a lot of time outside. Rather than an innate sex-related susceptibility to Bell's palsy, the significant male preponderance in our research (76%) probably reflects similar employment characteristics [11].

Although there was a modest difference that most likely reflects random fluctuation, left-sided face involvement was somewhat more common than right-sided involvement. The idea that side of involvement has minimal clinical impact is supported by earlier research that similarly showed no consistent laterality in Bell's palsy.

The substantial correlation between severe cold exposure & advanced House-Brackmann grades was one of our study's most notable findings. One theory for temporary ischemia of the facial nerve is cold-induced vasospasm of the vasa nervorum. Even slight inflammatory swelling may raise intraneural pressure, impair venous outflow, & further lower arterial perfusion since the facial nerve is in a hard osseous canal. Hypobaric hypoxia, which can worsen tissue oxygenation & raise oxidative stress, may intensify this process at high

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altitudes. The increased severity seen in people exposed to extended cold environments may be explained by these combined effects [12–13].

In our investigation, there was no statistically significant correlation between the length of time spent at altitude & the severity of the illness. The comparatively small sample size & low statistical power could be the cause of this. Acute exposure to the environment, especially extreme cold & outdoor activities, may also have a bigger impact than the overall length of stay. The connection between long-term altitude exposure & Bell's palsy may become clearer in future research with bigger cohorts [14–15].

Overall, 80% of patients recovered fully by three months, which is similar to recovery rates from other studies from communities at sea level, where 70–90% of patients fully recover after early steroid treatment.^1,4 This implies that timely diagnosis & adequate care continue to result in excellent functional outcomes, even when high-altitude environmental factors may influence illness severity [16].

## Conclusion

Our experience indicates that Bell's palsy is encountered among healthy adults residing at high altitude & is frequently associated with prolonged cold exposure & outdoor activity. Severe environmental conditions may influence disease severity, while early diagnosis & prompt corticosteroid therapy are associated with excellent functional recovery. Larger multicenter comparative studies are warranted to further clarify the relationship between high-altitude exposure & Bell's palsy.

## References

1. Peitersen E. Bell's palsy: the spontaneous course of 2500 peripheral facial nerve palsies. Acta Otolaryngol Suppl. 2002;549:4-30.
2. Holland NJ, Weiner GM. Recent developments in Bell's palsy. BMJ. 2004;329:553-557.
3. Baugh RF, Basura GJ, Ishii LE, et al. Clinical practice guideline: Bell's palsy. Otolaryngol Head Neck Surg. 2013;149.
4. Gilden DH. Clinical practice. Bell's palsy. N Engl J Med. 2004;351:1323-1331.
5. Finsterer J. Management of peripheral facial nerve palsy. Eur Arch Otorhinolaryngol. 2008;265:743-752.
6. Hato N, Matsumoto S, Kisaki H, et al. Efficacy of early treatment of Bell's palsy with prednisolone. Otol Neurotol. 2003;24:948-951.
7. Sullivan FM, Swan IRC, Donnan PT, et al. Early treatment with prednisolone in Bell's palsy. N Engl J Med. 2007;357:1598-1607.
8. Murthy JM. Bell's palsy: treatment guidelines. Ann Indian Acad Neurol. 2011;14.
9. Basura GJ, Adams ME, Monfared A, et al. Clinical practice guideline update: Bell's palsy. Otolaryngol Head Neck Surg. 2022;166.
10. West JB. High-altitude medicine. Am J Respir Crit Care Med. 2012;186:1229-1237.
11. Hackett PH, Roach RC. High-altitude illness. N Engl J Med. 2001;345:107-114.
12. Wilson MH, Newman S, Imray CHE. The cerebral effects of ascent to high altitude. Lancet Neurol. 2009;8:175-191.

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13. Bailey DM, Davies B. Physiological implications of altitude exposure. Br J Sports Med. 2001;35:278-284.
14. Burtscher M. Effects of living at moderate altitude on health. Sports Med. 2014;44:1657-1668.
15. Basnyat B, Murdoch DR. High-altitude illness. Lancet. 2003;361:1967-1974.
16. Lisk DR, Conway JE, Khandelwal P. Peripheral nerve disorders at altitude exposure. J Neurol Sci. 2018;392:77-82.