



# DIABETES MELLITUS AND HYPERTENSION ARE ASSOCIATED WITH BELL'S PALSY

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## ABSTRACT

**Background:** Bell's palsy occurs in approximately 40-70% of all cases of acute peripheral facial nerve paralysis, and its cause is unknown. Bell's palsy has several risk factors, including diabetes mellitus and hypertension.

**Objective:** This study aims to identify the association between diabetes mellitus and hypertension with the occurrence of Bell's palsy.

**Methods:** This research was conducted at RSUD Tugurejo Semarang in March 2022 using a retrospective study design and purposive sampling technique. Data collected included the history of diabetes mellitus, hypertension, and the occurrence of Bell's palsy. Medical records were used as research instruments. Hypothesis testing was performed using the Fischer exact test.

**Results:** A total of 32 samples were included in this study. There were 11 patients (34.4%) with a history of diabetes mellitus, 21 patients (65.6%) with a history of hypertension, 11 patients experienced acute Bell's palsy (34.4%), and 21 patients had subacute Bell's palsy (65.6%). The statistical analysis showed a significant association between diabetes mellitus ( $p=0.017$ ) and hypertension ( $p=0.033$ ) with the occurrence of Bell's palsy.

**Conclusion:** This study reveals a significant correlation between diabetes mellitus and hypertension and the occurrence of Bell's palsy. Several studies also suggest that hypertension is linked to a poorer prognosis in patients with comorbidities and facial paralysis in Bell's palsy. However, there are also studies stating that age and gender are associated with the occurrence of Bell's palsy independently of diabetes and hypertension.

**Keywords:** diabetes mellitus, hypertension, Bell's palsy



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## Introduction

There has been a total of 381 reported instances of Bell's palsy, resulting in an annual cumulative incidence rate of 53.3 cases.<sup>1</sup> Bell's palsy entails the paralysis of the peripheral facial nerve and typically manifests acutely and without a clear cause. Acute inflammation of the facial nerve within the temporal bone can trigger the onset of Bell's palsy. It is worth noting that nearly all cases of Bell's palsy are unilateral. Furthermore, it has been indicated that Bell's palsy constitutes a significant portion, approximately 40-70%, of all occurrences of acute peripheral facial nerve paralysis.<sup>2</sup>

In Indonesia, Bell's palsy predominantly affects women, with the highest incidence observed during the rainy

season. The age group most susceptible to this condition falls between 46 and 55 years old. Among the prevailing symptoms reported are post-auricular pain and neuropraxia.<sup>3</sup>

Regarding the factors that can impact an individual's susceptibility to Bell's palsy, diabetes mellitus and hypertension play significant roles. The prevalence of diabetes mellitus among Bell's palsy subjects, as reported in a study by Mustafa, stands at approximately 10.7%.<sup>4</sup> Individuals with diabetes mellitus face a 29% elevated risk of developing Bell's palsy compared to those without diabetes. Another research conducted in Sudan involving 746 Bell's palsy patients revealed that 8% of them had hypertension.<sup>5</sup>

The correlation between diabetes mellitus and the onset of Bell's palsy is linked to neuropathy. The fundamental factors influencing the mechanism of peripheral neuropathy vary based on the underlying condition. One of the prevalent culprits is diabetes, which can lead to heightened accumulation of Advanced Glycosylated End products (AGEs), an increase in polyol accumulation, reduced nitric oxide levels, disruption of endothelial function, and interference with Na/K ATPase activity. These changes collectively contribute to decreased blood circulation in peripheral nerves, consequently playing a role in the development of neuropathy associated with Bell's palsy.<sup>6</sup>

The correlation between hypertension and the occurrence of Bell's palsy is attributed to oxidative stress caused by an excess of reactive oxygen species, a reduction in antioxidant capacity, or a combination of both factors. This oxidative stress initiates an inflammatory response, leading to elevated pressure within the facial canal and subsequently resulting in ischemia. As a result, the conditions become conducive to the development of Bell's palsy.<sup>7</sup>

Research analyzing the relationship between diabetes mellitus and hypertension in relation to the occurrence of Bell's palsy remains limited. The research question addressed in this study is whether there is an association between diabetes mellitus and hypertension with the occurrence of Bell's palsy.

## Methods

This study is retrospective cross-sectional research conducted at Tugurejo Regional General Hospital in Semarang City in March 2022. The sampling technique employed was purposive sampling, and the sample size comprised 32 individuals. The respondents of this study were patients diagnosed with Bell's palsy at Tugurejo Hospital in Semarang between January 2017 and December 2021. The inclusion criteria specified patients who received a Bell's palsy diagnosis during this period at Tugurejo Hospital. The exclusion criteria applied to Bell's palsy patients who were pregnant during this timeframe, paralysis due to head trauma, zoster oticus, cerebral hemorrhage, and cerebellopontine angle tumors. Data was obtained from medical records. The Fisher Exact test was utilized to evaluate the relationship between Bell's Palsy and the comorbidities of Diabetes Mellitus and Hypertension.

## Results

In Table 1, most respondents were patients aged < 60 years, female, non-diabetic, hypertensive, and had subacute onset Bell's palsy.

**Table 1.** Characteristics of Respondent

| Variable       | Frequency | %    |
|----------------|-----------|------|
| Age (in years) |           |      |
| <60            | 25        | 78,1 |
| ≥60            | 7         | 21,9 |
| Sex            |           |      |

|                      |    |      |
|----------------------|----|------|
| Male                 | 14 | 43,8 |
| Female               | 18 | 56,3 |
| Diabetes mellitus    |    |      |
| Yes                  | 11 | 34,4 |
| No                   | 21 | 65,6 |
| Hypertension         |    |      |
| Yes                  | 21 | 65,6 |
| No                   | 11 | 34,4 |
| Bell's palsy (onset) |    |      |
| Acute                | 11 | 34,4 |
| Subacute             | 21 | 65,6 |

In Table 2, most Bell's palsy patients experienced acute onset and had diabetes mellitus, totaling 7 individuals. The research yielded a p-value of 0.017, indicating a significant association between diabetes mellitus and the occurrence of Bell's palsy. The analysis results show a significant connection between Diabetes Mellitus and the risk of Bell's Palsy occurrence. The calculated Odds Ratio (OR) of 7.44, with a 95% confidence interval ranging from 1.44 to 38.4, suggests that individuals with Diabetes Mellitus have a 7.44 times higher risk of developing Bell's Palsy compared to those without Diabetes Mellitus.

**Table 2.** Relationship between Diabetes Mellitus and the Occurrence of Bell's Palsy

| Diabetes Mellitus | Bell's Palsy |          | p-value | OR (95% CI)           |
|-------------------|--------------|----------|---------|-----------------------|
|                   | Acute        | Subacute |         |                       |
| Yes               | 7            | 4        | 0,017   | 7,44<br>(1,44 – 38,4) |
| No                | 4            | 17       |         |                       |
| Total             | 11           | 21       |         |                       |

These findings underscore the significance of the association between Diabetes Mellitus and the risk of Bell's Palsy, while also providing insight into the magnitude of risk difference between the two groups.

In Table 3, the largest group of Bell's palsy patients had subacute onset and were experiencing hypertension, totaling 11 individuals. The research yielded a p-value of 0.033, indicating a significant association between hypertension and the occurrence of Bell's palsy.

**Table 3.** Relationship between Hypertension and the Occurrence of Bell's Palsy

| Hypertension | Bell's Palsy |          | p-value | OR (95% CI)      |
|--------------|--------------|----------|---------|------------------|
|              | Acute        | Subacute |         |                  |
| Yes          | 10           | 11       | 0,033   | 9,09 (0,98-84,3) |
| No           | 1            | 10       |         |                  |
| Total        | 11           | 21       |         |                  |

The study also found an OR of 9.09 with a 95% confidence interval ranging from 0.98 to 84.3. These results suggest that individuals with a history of hypertension have a 9.09 times higher risk of developing Bell's Palsy compared to those without hypertension.

## Discussion

The results of this study indicate a notable connection between the occurrence of Bell's palsy and patients who have diabetes mellitus and hypertension. This finding is consistent with other research emphasizing that diabetes mellitus and hypertension may increase the risk of Bell's palsy among elderly individuals. The observed poorer prognosis in patients with both conditions could be attributed to the presence of vascular factors, including diabetes mellitus, hypertension, and microangiopathy. These factors collectively contribute to compromised microcirculation within the facial nerve vasculature, potentially leading to facial nerve ischemia and the potential occurrence of infarction.<sup>8</sup>

In another study conducted, it was found that hypertension serves as a risk factor for Bell's palsy. However, the precise underlying causes for this connection remain elusive. Speculations suggest that this linkage may arise due to several factors, including the occurrence of minor hemorrhages within the facial canal, the presence of vascular lesions, and partial nerve necrosis, all of which could potentially result in facial paralysis. Hypertension-triggered hematoma or thrombus formation within the facial canal might exert pressure on the facial nerve, leading to compression. Moreover, distortions in vessels caused by hypertension and the accompanying perineural edema could also contribute to the pressure on the facial nerve. Notably, uncontrolled hypertension is more likely to result in heightened bleeding within the facial canal and greater chances of facial nerve necrosis compared to well-managed hypertension.<sup>9</sup> This study also acknowledges that diabetes mellitus is a contributing risk factor for Bell's palsy. The presence of microangiopathy, characterized by vascular insufficiency and diabetic polyneuropathy, is linked to an unfavorable prognosis in cases of Bell's palsy.<sup>10</sup>

The vascular mechanism within the metabolic pathway is thought to play a role in the development of facial paralysis in individuals with diabetes. This mechanism involves chronic nerve ischemia resulting from decreased endoneurial oxygen, reduced nerve blood flow, and the presence of epineural arteriovenous shunting. As a compensatory reaction to endoneurial ischemia or hypoxia, microangiopathy develops. Furthermore, hyperglycemia directly damages nerves through heightened oxidative stress, the accumulation of advanced glycation end-products, disturbances in axonal function, and interference with the polyol pathway.<sup>11</sup>

The research conducted by Tomek et al. in London revealed a link between malignant hypertension and facial paralysis in adult patients. It is hypothesized that the underlying cause of this association is substantial arteriolar damage resulting from malignant hypertension. The vulnerability of the facial nerve to hypertension-induced injury is emphasized, potentially leading to conditions like hemorrhage, edema, or focal ischemia within the facial canal.<sup>11</sup>

In general, uncontrolled hypertension is connected to the occurrence of facial paralysis. The correlation between severe hypertension and peripheral facial paralysis is more

commonly observed in children. Effective management with appropriate antihypertensive treatment is linked to a positive prognosis in these cases.<sup>12</sup>

Conversely, the research conducted by Chang et al. suggests that age and gender are correlated with the development of Bell's palsy, while diabetes and hypertension are not deemed to have a significant association with paralysis occurring in cases of Bell's palsy categorized under House-Brackmann grade 3-6.<sup>13</sup> In their study, Riga et al. also concluded that hypertension does not exhibit a correlation with the severity of Bell's palsy upon initial diagnosis, nor is it connected to the recovery process of Bell's palsy within a span of six months.<sup>14</sup>

This study presents several important shortcomings, including a small sample size and the use of a retrospective study design, which may limit the generalizability of the results. Reliance on medical record data, which could be incomplete or biased, and the lack of control over confounding variables, could potentially impact the accuracy of the findings. The study is also geographically limited to one location in Indonesia, restricting the diversity and global relevance of the findings.

The primary limitations of this research include its small sample size, limiting the ability to generalize findings. The use of a retrospective study design with data from a single hospital introduces potential selection bias and limits external validity. The dependence on possibly incomplete or inaccurate medical records can also affect the validity of the results. Additionally, the lack of a control group and adjustments for other confounding variables raises questions about the accuracy of the observed relationship between diabetes mellitus, hypertension, and Bell's palsy. The study is also confined to a specific geographic and demographic context (Indonesia), which could affect the applicability of the findings elsewhere.

## Conclusion

This study reveals a significant correlation between diabetes mellitus and hypertension and the occurrence of Bell's palsy. Based on the data collected and analyzed in this study, we found a significant correlation between diabetes mellitus and hypertension and the occurrence of Bell's palsy in our patient cohort. Our findings indicate that patients with these comorbidities may have an increased risk of developing Bell's palsy. While other studies have suggested links to age, gender, and prognosis, our study specifically focused on the relationship between diabetes, hypertension, and Bell's palsy. The results underscore the importance of considering these comorbidities in the clinical assessment and management of Bell's palsy. Further research is needed to explore the potential mechanisms behind this correlation and to determine if similar patterns are observed in broader populations.

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