Impact of Hypoglossal Nerve Stimulation on Diabetes Control in Obstructive Sleep Apnea

Ahsan Ahmed, B.S[1], Shaynie Segal, B.A[1], Marc Gibber, MD[1,2]

[1]Albert Einstein College of Medicine; [2]Department of Otorhinolaryngology – Head and Neck Surgery, Montefiore Medical Center

Introduction

- Obstructive sleep apnea (OSA) is a highly prevalent disorder, affecting nearly 1 billion people worldwide.[1]
- OSA is strongly linked to type 2 diabetes, a comorbidity observed in nearly 30% of patients with OSA.[2,3]
- OSA has been shown to worsen diabetes control through multiple mechanisms, including intermittent hypoxia and sympathetic activation.[4]
- Hypoglossal Nerve Stimulation (HNS) is a novel therapeutic modality that offers an alternative to CPAP and improves OSA by stimulating the hypoglossal nerve to improve airway patency (Figure 1).
- We theorize that by mitigating OSA, HNS might confer metabolic benefits, including improved glycemic control and reduced reliance on diabetes medications.
- Understanding the impact of HNS on diabetes regulation has significant implications for the management of both conditions.

Figure 1. HNS Device Implantation

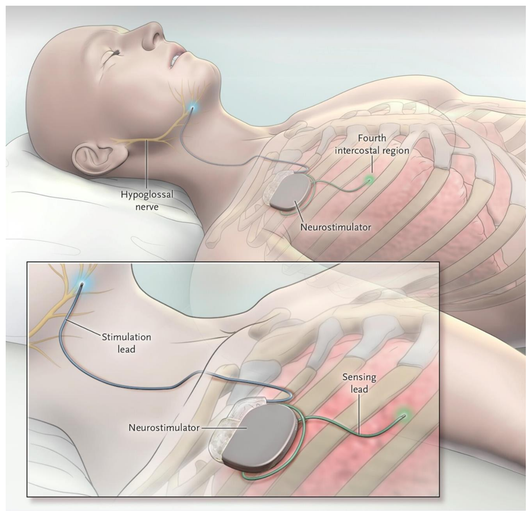


Image Citation: Strollo PJ Jr, Soose RJ, Maurer JT, et al. Upper-airway stimulation for obstructive sleep apnea. N Engl J Med. 2014;370(2):139-149.

Methods

- Design: A retrospective cohort study of patients who underwent HNS therapy between June 2020 and October 2024 at an academic institution.
- Inclusion criteria: Patients with type II diabetes with moderate-to-severe OSA who underwent HNS therapy.
- Exclusion criteria: Patients who did not acquire pre- and post-operative polysomnography (PSG) and did not have follow-up of diabetes status.
- Population: Out of 80 charts reviewed, 17 adults met the criteria for the study and were included.
- Outcome Measures:
  - Apnea-hypopnea index (AHI) from full-night PSGs.
  - Hemoglobin A1c (HbA1c), insulin dependence, number and type of diabetes medications, assessed before and at-least 3 months after HNS implantation.
- Statistics Analysis: Paired t-tests and correlation analysis using Microsoft Excel (P<0.05 significant).

Results

- The study cohort included 17 patients, 52.9% male, with a mean age of 65.3 years and mean BMI of 30.4.
- OSA Outcomes:
  - Mean AHI decreased from 32.4 to 8.8 events/hour (Δ-24.0, *P<0.001*).
  - Device adherence was high, with an average usage of 6.7h/night.
- Diabetes Control:
  - Average HbA1c decreased from 6.60 to 6.26 (Δ -0.31, *P=0.27*) (Table 1).
  - Of the 6 patients who were insulin-dependent prior to HNS therapy, 50% were able to discontinue insulin following implantation (Table 2).
  - There was no significant reduction in diabetes medication regimen after HNS therapy. However, GLP-1 agonists saw an increase during follow-up (3 → 4 patients).
- Correlation analysis: Greater reductions in AHI were significantly associated with improvements in HbA1c (r= -0.69, *P=0.027*) (Figure 4).

Table 1: Primary results of HNS Stimulation

	Pre-HNS	Post-HNS	Average Change	P value
AHI	33.47	8.71	-23.98	P<0.001
A1C	6.60	6.26	-0.31	P=0.27
BMI	30.35	29.72	-0.63	P=0.59

Figure 2a: Pre and Post AHI

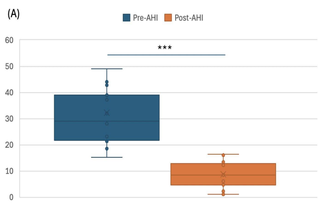


Figure 2b: Pre and Post BMI

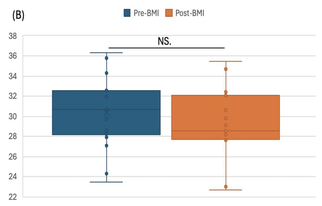


Figure 2c: Pre and Post A1C

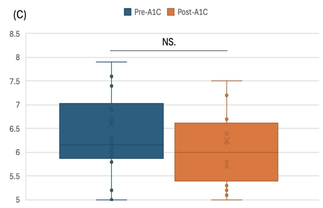
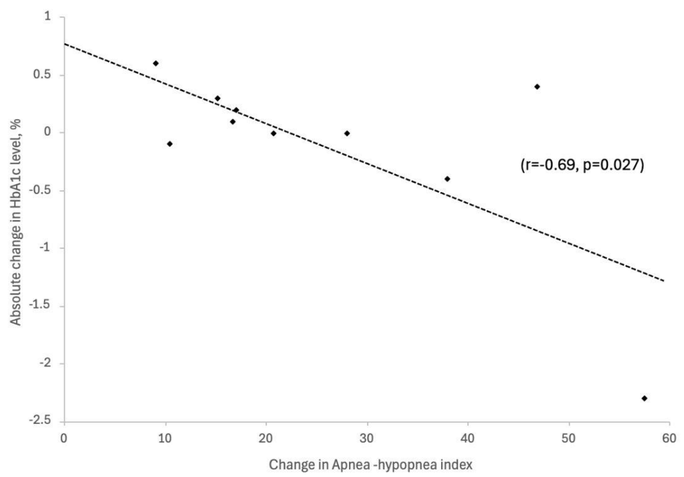


Table 2: Insulin Dependence

	Pre-HNS	Post-HNS	Pre-HNS	Post-HNS
Insulin	6	3	35.3%	17.6%

Figure 3: Correlation between AHI Reduction and HbA1c Improvement



Discussion

- HNS significantly reduced OSA severity and was associated with moderate improvements in glycemic control, reflected by a decline in HbA1c and a 50% reduction in insulin dependence.
- On average, HbA1c decreased by 0.31% (Figure 2). While not statistically significant, prior meta-analyses show that decreases in HbA1c of ≥0.3% are associated with significantly lower rates of adverse cardiovascular events, underscoring the clinical relevance of our findings.[5]
- While overall medication usage did not show significant reduction, the use of GLP-1 receptor agonists increased during follow-up, demonstrating a shift in current medical practice. As GLP-1 therapy is now FDA-approved for OSA, its potential contribution highlights an important confounding factor.
- Our study also observed a significant correlation between improvements in AHI and reduction in HbA1c (Figure 3). These findings are consistent with randomized CPAP trials that demonstrate AHI improvements with HbA1c decline.[6]

Limitations

- Small cohort size (n=17) which may limit generalizability.
- Potential confounders could include diabetes treatment modification, weight loss, or lifestyle changes.

Future Directions

- Our study remains one of the first to assess the impact of HNS therapy on diabetes control, and studies with larger populations will provide greater insight.
- Conduct randomized controlled trials with standardized follow-up to determine the impact of HNS therapy on different measures of glycemic control.
- Assess the potential role of GLP-1/GIP agonists in improving type 2 diabetes and OSA outcomes.

References

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