



## Predictive Efficacy of the STOP-BANG Scoring System in Obstructive Sleep Apnea After Multilevel Airway Reconstructive Surgery: A Comprehensive Clinical Case Study Analysis

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### ABSTRACT

Obstructive Sleep Apnea (OSA) is a sleep disorder characterized by recurrent collapse of the upper airway. The STOP-BANG questionnaire has been validated as a highly sensitive screening tool to identify surgical patients at high risk for OSA. This report aims to evaluate multilevel surgical management in a patient with a high STOP-BANG score and review the literature regarding its clinical efficacy. A 55-year-old male presented with chronic snoring, daytime fatigue, and witnessed apnea episodes over the last six months. Physical examination revealed a Body Mass Index (BMI) of 28.4 Kg/m<sup>2</sup>, a neck circumference of 45 cm, tonsillar hypertrophy, an elongated uvula, and turbinate hypertrophy. The patient's STOP-BANG score was 6, indicating a high risk for moderate-to-severe OSA. A STOP-BANG score  $\geq 5$  has a strong correlation with OSA severity and an increased risk of postoperative respiratory complications. Multilevel surgery is

more effective than single-level procedures because it targets multiple collapse sites simultaneously (nasal and oropharyngeal). Integrating the STOP-BANG score into preoperative evaluations allows for accurate risk stratification. Multilevel surgery in well-selected patients can provide significant symptomatic improvement and reduce the long-term morbidity burden of OSA.

**Keywords :** Obstructive Sleep Apnea, STOP-BANG Score, Multilevel Surgery

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## INTRODUCTION

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Obstructive Sleep Apnea (OSA) is a chronic medical condition characterized by recurrent partial or complete obstruction of the upper airway during sleep, leading to repetitive episodes of gas exchange abnormalities and sleep fragmentation.<sup>1</sup> The global prevalence of OSA is estimated to be approximately 939 million adults between the ages of 30 and 69, with nearly 425 million individuals suffering from moderate-to-severe disease.<sup>2</sup> Despite its high prevalence and severe long-term consequences—including hypertension, cardiovascular disease, and neurocognitive impairment—nearly 80% to 90% of cases remain undiagnosed within the general and surgical populations.<sup>1-3</sup>

In the surgical setting, the presence of undiagnosed OSA poses a significant challenge for anesthesiologists and surgeons alike. Patients with OSA are at a substantially increased risk for perioperative complications, particularly those involving the respiratory and cardiovascular systems. The administration of sedatives, anesthetics, and opioids can exacerbate airway collapsibility and depress ventilatory drive, leading to desaturation, difficult intubation, and unplanned admissions to the intensive care unit. Consequently, preoperative screening is not merely a diagnostic step but a critical safety intervention intended to minimize perioperative morbidity and mortality.<sup>4-6</sup>

The STOP-BANG questionnaire has emerged as the most widely used and validated screening tool in the perioperative environment. Developed specifically to meet the need for a concise and reliable instrument, the acronym represents eight categories: Snoring, Tiredness, Observed apnea, high blood Pressure, BMI, Age, Neck circumference, and Gender. Its high sensitivity makes it particularly effective at excluding severe OSA, while higher scores (typically  $\geq 5$ ) correlate strongly with an increased probability of moderate-to-severe disease.<sup>7</sup>

Surgical management of OSA has evolved significantly since the introduction of uvulopalatopharyngoplasty (UPPP) by Fujita in 1981. Traditional techniques focused on the aggressive excision of soft tissues, which often led to complications like velopharyngeal insufficiency and chronic dry throat. Modern approaches prioritize reconstructive, tissue-preserving strategies and acknowledge the "multilevel" nature of airway collapse. Many

patients exhibit obstruction at several anatomical sites, including the nasal cavity, the velum, the lateral pharyngeal walls, and the tongue base. Addressing these multiple levels in a single-stage procedure has been shown to improve success rates compared to single-level interventions.<sup>8-11</sup>

This report presents a detailed case study of a 55-year-old male with a high-risk STOP-BANG score who underwent successful multilevel surgical intervention. By examining the patient's clinical journey, laboratory data, and surgical outcomes in the context of current evidence-based guidelines, this report aims to provide a comprehensive understanding of the role of anatomical reconstruction and risk stratification in managing OSA.

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### CASE REPORT

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The patient, a 55-year-old male, presented for an otolaryngology evaluation in December 2025 with complaints of chronic, heavy snoring and nocturnal choking episodes that had intensified over the preceding six months. He reported persistent daytime sleepiness, frequent morning headaches, and a sense of unrefreshing sleep. According to his bed partner, he frequently experienced periods of breath-holding (apnea) followed by loud gasping.

Patient's medical history was notable for the absence of diagnosed hypertension or diabetes mellitus, although his physical profile suggested a high likelihood of undiagnosed metabolic or cardiovascular risk factors common in OSA.<sup>12</sup> Initial consultations at the ENT clinic involved nasal endoscopy, which revealed significant bilateral inferior turbinate hypertrophy and nasal septal deviations, contributing to nasal obstruction. Oropharyngeal examination identified an elongated uvula and tonsillar hypertrophy.

A comprehensive physical examination was performed during the preoperative visit. The patient was a 55-year-old male with a body weight of 82 kg and a height of 170 cm, resulting in a BMI of 28.4 kg/m<sup>2</sup>. This represents an overweight status that contributes to parapharyngeal fat deposition and airway narrowing.

The calculation of the STOP-BANG score was a central component of his risk assessment:

| STOP-BANG Parameter                                    | Patient Status | Point Value |
|--------------------------------------------------------|----------------|-------------|
| Snoring (Loud enough to be heard through closed doors) | Yes            | 1           |
| Tiredness (Feeling tired or sleepy during the day)     | Yes            | 1           |
| Observed Apnea (Has anyone seen you stop breathing?)   | Yes            | 1           |
| Pressure (Treated for or have high blood pressure)     | No             | 0           |
| BMI (>35 kg/m <sup>2</sup> )                           | No (28.4)      | 0           |
| Age (>50 years)                                        | Yes (55)       | 1           |
| Neck Circumference (>40 cm)                            | Yes (45 cm)    | 1           |
| Gender (Male)                                          | Yes            | 1           |
| <b>Total Score</b>                                     |                | <b>6</b>    |

The STOP-BANG score <3 indicates a low risk of OSA, between 3 and 4 a moderate risk, and ≥5 a high risk of moderate to severe OSA. If the score is >7, there is a high risk of having severe OSA. It is particularly good at detecting severe OSA patients<sup>13</sup>

Preoperative blood work and serology were obtained to ensure medical optimization for general anesthesia. The results demonstrated a healthy hematological profile but slight elevations in liver enzymes and renal parameters.



**Figure 1. Pre-Operation Presentation**

The patient was scheduled for "OSA Surgery" in January 2026. The surgery was a single-stage multilevel procedure performed under general anesthesia with endotracheal intubation.

The procedure components were:

1. **Tonsillectomy:** To remove the obstructive palatine tonsils.
2. **Uvuloplasty:** Reshaping the soft palate and uvula to increase the retropalatal space
3. **Lateral Pharyngoplasty:** To stabilize the lateral pharyngeal walls
4. **Concha Reduction:** To alleviate nasal resistance and facilitate nasal breathing

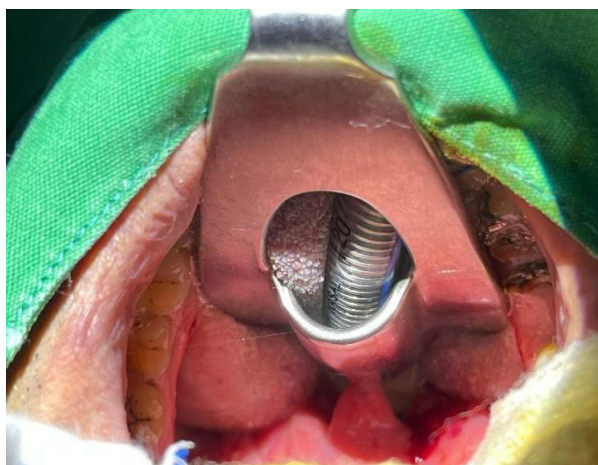


**Figure 2. Durante Operation**

Following the operation, the patient was monitored for airway patency and signs of hemorrhage. Initial assessments showed no active bleeding, and vital signs were stable. The pharmacological regimen was intensive, targeting pain control, edema reduction, and infection prophylaxis. By the time of discharge, the patient reported significantly improved nasal breathing and minimal pain (VAS 1-2).



**Figure 3. 1 Week Post Operation**

At the one-week follow-up, the patient demonstrated a favorable and stable recovery. He reported a significant reduction in throat pain, noted markedly improved nasal breathing. A Clinical examination revealed well-healing surgical sites without signs of active bleeding, infection, or significant edema. The patient was compliant with postoperative care instructions, including regular nasal irrigation and a soft diet. Vital signs remained within normal limits, and no respiratory distress or desaturation episodes were observed. These early findings suggested an improvement in the patient's STOP-BANG score from 6 to 5. A positive initial response to the multilevel surgical intervention, with effective symptom relief and no immediate complications.

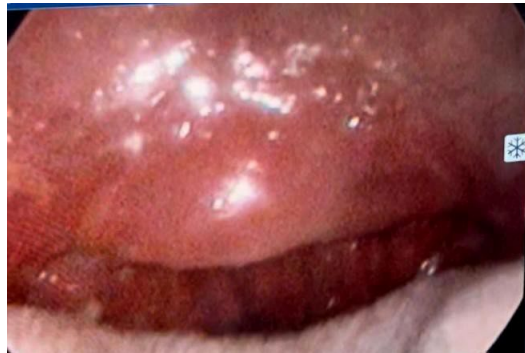


**Figure 4. 1 Month Post Operation**

By the one-month postoperative visit, the patient exhibited continued and substantial clinical improvement. Symptoms of chronic snoring, witnessed apnea, and daytime fatigue had notably diminished, as corroborated by his bed partner. Objective assessment showed complete mucosal healing at the surgical sites, with no evidence of stenosis or velopharyngeal insufficiency. The patient indicated a consistent improvement in sleep quality and daytime alertness, resulting in a notable reduction in the STOP-BANG score from a preoperative value of 6 to a follow-up level of 5 at one week, and further to a score of 3 at one month postoperative.

These results align with the expected trajectory for multilevel reconstructive surgery in appropriately selected high-risk OSA patients, reinforcing the efficacy of combined anatomical correction and comprehensive preoperative management.

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## DISCUSSION

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This case underscores the diagnostic power of the STOP-BANG questionnaire. With a score of 6, the patient was correctly identified as having a high risk of moderate-to-severe OSA. Statistical evidence indicates that as the STOP-BANG score increases, the probability of severe OSA rises linearly. The clinical utility of this high score extends beyond diagnosis. It serves as

a vital marker for perioperative risk. Patients with STOP-BANG scores  $\geq 3$  exhibit higher rates of postoperative desaturation and an increased likelihood of difficult airway management. In the context of the reported liver (SGPT 49) and renal (Urea 41) elevations, the patient's high STOP-BANG score suggests that chronic intermittent hypoxia may have already begun to exert systemic metabolic stress.<sup>4,14,12</sup>

Traditional OSA surgery often focused on a single site, most commonly the palate. However, research has demonstrated that single-level surgery often yields a success rate of only about 40%. The patient underwent a turbinectomy as part of his multilevel treatment. While nasal surgery alone rarely results in a significant reduction in the AHI, it is essential for facilitating nasal breathing and improving CPAP compliance if further therapy is needed. Combination of tonsillectomy, uvuloplasty, and lateral pharyngoplasty used in this case represents the reconstructive era of OSA surgery. The management of a high-risk OSA patient under general anesthesia requires meticulous attention. Anesthetics and opioids dose-dependently decrease the activity of the genioglossus muscle, the primary dilator of the upper airway. For a patient with a STOP-BANG score of 6, this vulnerability is heightened.<sup>8,15-16</sup>

Management priorities focus on airway, pharmacologic, and monitoring considerations. Patients with high-risk scores have a higher incidence of difficult mask ventilation and tracheal intubation. From a pharmacologic standpoint, the use of short-acting agents and multimodal analgesia is recommended to minimize postoperative respiratory depression. Close postoperative monitoring is essential, with continuous pulse oximetry recommended, particularly because the risk of oxygen desaturation increases during periods of REM sleep rebound.<sup>5,7,16</sup>

Surgical success is traditionally defined by the Sher criteria (AHI reduction  $> 50\%$  and final AHI  $< 20$ ). Meta-analyses suggest that multilevel surgery achieves a success rate of approximately 60.2%, with significant improvements in daytime sleepiness.<sup>15,17</sup>

Reported success rates of surgical therapies for obstructive sleep apnea in relation to disease severity and durability of treatment effect. Isolated tonsillectomy is associated with high success rates (85.2%) in selected patients, particularly those with marked tonsillar hypertrophy and mild to moderate disease ( $AHI < 30$ ), emphasizing the role of phenotypic stratification in surgical outcomes. Traditional uvulopalatopharyngoplasty (UPPP) demonstrates modest efficacy, with success rates of 40–50% and evidence suggesting reduced effectiveness over time. Tonsillectomy with uvulopalatopharyngoplasty has been shown to be safe and effective in patients who are of normal weight or only slightly overweight and who have obstructive sleep apnea and oropharyngeal obstruction (64.5%). Multilevel surgical approaches offer improved outcomes, with success rates of 60–67%, and appear most beneficial in patients with moderate to severe obstructive sleep apnea involving multilevel airway collapse. Maxillomandibular advancement provides the most consistent and durable improvement, with success rates exceeding 90%, although its higher invasiveness requires careful consideration of patient-specific risk–benefit profiles.<sup>18-20</sup>

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## CONCLUSION

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The management of Obstructive Sleep Apnea has transitioned into a more personalized field. This case report highlights the critical intersection between preoperative risk stratification and comprehensive surgical intervention. The STOP-BANG questionnaire provided an essential baseline, identifying the patient as high-risk and prompting an aggressive management plan. Successful outcomes in such cases reinforce the validity of current guidelines recommending multimodal analgesia and meticulous monitoring.

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