Research Article

Length of Stay in Ambulatory Surgical Oncology Patients at High Risk for Sleep Apnea as Predicted by STOP-BANG Questionnaire

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Background. The STOP-BANG questionnaire has been used to identify surgical patients at risk for undiagnosed obstructive sleep apnea (OSA) by classifying patients as low risk (LR) if STOP-BANG score < 3 or high risk (HR) if STOP-BANG score ≥ 3. Few studies have examined whether postoperative complications are increased in HR patients and none have been described in oncologic patients.

Objective. This retrospective study examined if HR patients experience increased complications evidenced by an increased length of stay (LOS) in the postanesthesia care unit (PACU).

Methods. We retrospectively measured LOS and the frequency of oxygen desaturation (< 93%) in cancer patients who were given the STOP-BANG questionnaire prior to cystoscopy for urologic disease in an ambulatory surgery center.

Results. The majority of patients in our study were men (77.7%), over the age of 50 (90.1%), and had BMI < 30 kg/m² (88.4%). STOP-BANG results were obtained on 404 patients. Cumulative incidence of the time to discharge between HR and the LR groups was plotted. By 8 hours, LR patients showed a higher cumulative probability of being discharged early (80% versus 74%, P = 0.008).

Conclusions. Urologic oncology patients at HR for OSA based on the STOP-BANG questionnaire were less likely to be discharged early from the PACU compared to LR patients.

1. Introduction

Obstructive sleep apnea (OSA) is characterized by repetitive episodes of apnea or reduced inspiratory airflow due to upper airway obstruction, resulting in increased respiratory effort, oxyhemoglobin desaturation, and frequent neuronal arousals during sleep. General anesthesia and perioperative analgesia may often exacerbate this pathophysiology; thus, OSA patients may suffer from postoperative respiratory, cardiovascular, and neurological complications [1–6]. OSA can further complicate perioperative care by impacting recovery time and increasing hospital length of stay (LOS). Surprisingly, up to 70% of patients undergoing surgery may have undiagnosed OSA, thus increasing the need to develop strategies to identify patients at risk [7, 8].

The STOP-BANG is a simple patient-administered questionnaire developed by Chung and associates with screen for OSA in the perioperative setting, and it has a high sensitivity for detecting OSA in this setting [9]. The STOP-BANG consists of 8 items producing a numerical score that can be used to classify patients as low risk (LR, score < 3), intermediate risk (IR, score of 3 or 4), and high risk (HR, score ≥ 5) for OSA. Several studies have demonstrated that patients with higher preoperative STOP-BANG scores have increased
postoperative complications, including increased difficulty with intubations and unanticipated critical care admissions [10–12]. Although the American Society of Anesthesiologists (ASA) and the Society for Ambulatory Anesthesia have issued guidelines for the perioperative management of OSA, standardized data addressing the appropriate duration and setting for monitoring patients undergoing ambulatory procedures is lacking [13–15]. Furthermore, the optimal management strategy for mitigating the risk of complications in patients with OSA remains unclear. No previous study has examined the incidence and risk of perioperative OSA in an oncologic population. The purpose of our study was to use the STOP-BANG questionnaire to classify patients as LR or HR for OSA and determine if HR patients were less likely to be discharged early from the PACU when compared to LR patients.

2. Methods

This study is a retrospective review of the medical records of 1666 consecutive patients with urologic cancer who underwent cystoscopy in the ambulatory surgical center at University of Texas MD Anderson Cancer Center in Houston, Texas, from March 2013 to February 2015. The study was conducted with the approval of our institution's institutional review board. Due to the retrospective nature of this study does not persist beyond 20 hours, although, by then, most patients were discharged. All patients were discharged home, and there were no patients admitted overnight. Figure 2 demonstrates that the mean duration of anesthesia in LR and HR patients was similar.

Oxygen desaturation was examined as a potential etiology for increased LOS (Figure 3), but there was no statistical difference in the frequency of oxygen desaturation between the LR and HR groups (P = 0.131). However, there was a statistically significant positive correlation between LOS and frequency of oxygen desaturation (r = 0.30, P < 0.001).
Table 1: Patient characteristics.

| Characteristic                      | N = 404 * | Percentage |
|-------------------------------------|-----------|------------|
| BMI (kg/m²)                         | N = 404 * | Percentage |
| Mean ± SD                           | 28.5 ± 5.7|            |
| Median (min to max)                 | 27.3 (16.5 to 51) | |
| Neck circumference (cm)             | N = 404 * | Percentage |
| Mean ± SD                           | 39.8 ± 4.6|            |
| Median (min to max)                 | 40 (28 to 54) | |
| PACU LOS (minutes)                  | N = 404 * | Percentage |
| Mean ± SD                           | 372.4 ± 433.0|      |
| Median (min to max)                 | 137.5 (39 to 1667) | |
| Procedure time (minutes)            | N = 404 * | Percentage |
| Mean ± SD                           | 61.7 ± 24.2|            |
| Median (min to max)                 | 55 (26 to 256) | |
| Oxygen saturation below 93% (count) | N = 404 * | Percentage |
| Mean ± SD                           | 3.7 ± 3.8 |            |
| Median (min to max)                 | 2 (1 to 18) | |
| STOP-BANG items                     | N = 404 * | Percentage |
| Snoring                             | No        | 305        | 75.5 |
|                                    | Yes       | 99         | 24.5 |
| Tiredness                           | No        | 227        | 56.2 |
|                                    | Yes       | 177        | 43.8 |
| Observed apneas                     | No        | 361        | 89.4 |
|                                    | Yes       | 43         | 10.6 |
| High blood pressure                 | No        | 169        | 41.8 |
|                                    | Yes       | 235        | 58.2 |
| BMI > 35 kg/m²                      | No        | 357        | 88.4 |
|                                    | Yes       | 47         | 11.6 |
| Age > 50 years                      | No        | 40         | 9.9 |
|                                    | Yes       | 364        | 90.1 |
| Neck > 40 cm                        | No        | 234        | 57.9 |
|                                    | Yes       | 170        | 42.1 |
| Gender                              | Female    | 90         | 22.3 |
|                                    | Male      | 314        | 77.7 |

STOP-BANG criteria

| Criteria       | N = 404 * | Percentage |
|----------------|-----------|------------|
| Low risk (<3)  | 100       | 24.8       |
| High risk (≥3) | 304       | 75.2       |

Table 1: Continued.

| Characteristic                      | N = 404 * | Percentage |
|-------------------------------------|-----------|------------|
| Bicarbonate ≥ 28 mmol/L             | N = 404 * | Percentage |
| No                                  | 194       | 48         |
| Yes                                 | 210       | 52         |

BMI, body mass index; SD, standard deviation; PACU, postanesthesia care unit. * 404 patients provided complete STOP-BANG information to derive a total score.

Figure 1: Cumulative incidence of discharge over time in the PACU.

4. Discussion

Our study demonstrates a longer LOS for those stratified as HR patients based on the STOP-BANG questionnaire in an ambulatory oncologic setting. Although more frequent oxygen desaturations were not observed, an increased time to discharge between the LR and HR groups was noted. Our data further corroborates other published works using this screening tool for postoperative outcome in general surgery patients. It is the first study to utilize the STOP-BANG and assess outcomes in a purely oncologic and ambulatory population.

Many oncologic patients require general anesthesia and surgery multiple times throughout the treatment of their cancer. Although little is known about the clinical impact of OSA in surgical oncology patients, undiagnosed OSA in the perioperative setting has been shown to have more complications, especially cardiac or respiratory in origin [16]. The nature of anesthesia places patients with sleep apnea at higher risk due to multiple factors including medications (sedation, analgesics), alterations in upper airway patency, and positioning [17]. The supine position required in many surgeries may create dead space thus reducing lung volumes and oxygen saturations. Atelectasis as a result of pain induced splinting or sedation may further contribute to hypoventilation and respiratory insufficiency [18]. Sedation, neuromuscular blockade, and postsurgical opioid pain...
Table 2: Patient characteristics based on STOP-BANG questionnaire.

|                  | STOP-BANG < 3 (LR) | STOP-BANG ≥ 3 (HR) | P value |
|------------------|---------------------|---------------------|---------|
| **BMI (kg/m²)**  |                     |                     |         |
| Mean ± SD        | 25.7 ± 3.9          | 29.4 ± 5.9          | —       |
| Median (min to max) | 25.4 (18.4 to 36.8) | 28 (16.5 to 51)    |         |
| **Neck circumference (cm)** |                 |                     |         |
| Mean ± SD        | 36.0 ± 3.3          | 41.1 ± 4.2          | —       |
| Median (min to max) | 36 (28 to 46)      | 41 (29 to 54)      |         |
| **PACU LOS (minutes)** |                |                     |         |
| Mean ± SD        | 278.6 ± 358.6       | 403.2 ± 451.1       | — #     |
| Median (min to max) | 117.5 (39 to 1492) | 146 (44 to 1667)   |         |
| **Anesthesia duration (minutes)** |            |                     |         |
| Mean ± SD        | 63.0 ± 32.1         | 61.3 ± 20.9         | 0.560*  |
| Median (min to max) | 52 (30 to 256)    | 55.5 (26 to 147)   | 0.277** |
| **Oxygensat below 93% (count)** |           |                     |         |
| Mean ± SD        | 2.7 ± 2.6           | 3.9 ± 3.9           | 0.131*  |
| Median (min to max) | 2 (1 to 12)        | 3 (1 to 18)        |         |

LR, low risk; HR, high risk; SD, standard deviation.

--; BMI and neck circumference were used to create the STOP-BANG score.
#P value is not provided; PACU LOS has a bimodal distribution.
*P value is based on independent samples t-test.
**P value is based on Wilcoxon rank-sum test.

medications decrease arousal and may elicit sleep apnea symptoms postoperatively by decreasing neuromuscular tone in the upper airway [19, 20]. Finally, sleep fragmentation after surgery can reduce rapid eye movement (REM) sleep stage, immediately postoperatively, following which REM sleep rebound can occur. REM sleep rebound is associated with muscle atonia and may promote sleep apnea and cardiac dysrhythmia days after surgery [7, 21]. We did not observe any new onset atrial fibrillation, ICU admissions, or respiratory distress in our cohort, and we suspect the selection of an ambulatory population with short procedure times likely influenced the lack of these complications. In general, however, complications related to OSA in the perioperative setting may result in longer length of stay and consequent increased resource utilization.

The application of the STOP-BANG questionnaire in an oncologic setting is novel. Intuitively, one may question the
use of this tool since most assume that cancer patients will be fatigued or tired, thus potentially reducing the specificity of the survey. Interestingly, in our study, only 43.8% of cancer patients affirmed feeling “tired.” It is unclear if that fatigue is due to undiagnosed OSA or cancer, but regardless the nonuniform response shows promise for this tool in surgical cancer patients. Given the success of this tool in the perioperative setting, the application to our cancer population seems logical. It is important to recognize however that the use of the STOP-BANG or any screening tools to diagnose sleep apnea and predict outcomes has limitations, for OSA shares common symptoms with many other diseases, thus lowering their specificity [22]. The score, itself, contains elements such as obesity, age, hypertension, gender, and fatigue. Each of these factors might be associated with increased postoperative stay, regardless of the presence or absence of OSA. Disentangling these contributors to sleep apnea from the disease itself, therefore, is challenging [23]. Finally, the discovery of an early discharge in LR patients despite short procedure duration in an outpatient setting further demonstrates the potential robustness of the STOP-BANG questionnaire. Our study establishes areas of application for the STOP-BANG questionnaire in cancer patients.

Our study has limitations inherent to most retrospective studies. We tried to use an adequate sample size and had controls for many of the variables. An electronic medical record and an integrated perioperative medical record were used so loss of patient data was minimal. The procedures for each patient, including the anesthetic agents, process of care, monitoring, and standardized criteria for discharge from the PACU, were the same. Although discharge criteria were standardized, variability due to factors, related to the delivery of care and unrelated to the risk for sleep apnea, such as patient transportation needs, nursing shift changes, and provider implementation, may have affected LOS. We attempted to minimize this variability by evaluating a large number of consecutive patients. All our patients were ambulatory and procedure times were similar and brief, so there may be selection bias since these procedures were not extensive or prolonged. In our study, the difference in time to discharge did not persist beyond 20 hours, although, by then, most patients were discharged. This finding may signify that factors other than risk for sleep apnea may be responsible for prolonged time to discharge from the PACU for some patients.

Expansion of our study to include the nonambulatory setting and longer surgery times may identify patients at increased risk of respiratory or cardiovascular complications. Evaluation of these patients may also magnify the difference found between the HR and LR groups.

Our findings support the recommendations of the ASA guidelines, which call for more intensive monitoring of patients with OSA [13]. Further delineation of the patient population and surgical procedures which are less prone to complications and lower risk, respectively, may help guide escalation of care for OSA. This would be especially beneficial for anesthesiologists, given the advent of the Affordable Care Act. As in other medical specialties, anesthesiologists will be asked to focus on cost containment by increasing the number of procedures performed in the ambulatory setting, without compromising patient safety. Alternatively, monitoring for complications beyond the PACU may also be considered, for it is known that the effects of anesthesia on respiratory and sleep patterns reach their peak approximately 72 hours postoperatively [24]. Further prospective studies in the oncologic population undergoing longer and more complex surgeries in hospitalized patients with the STOP-BANG score could also better define the role of this screening tool and correlate with more intensive and prolonged monitoring.

To date, this study represents the largest group of cancer patients screened preoperatively with the validated STOP-BANG. This study demonstrates that cancer patients undergoing a relatively minor procedure with less known cardiorespiratory morbidity may benefit from screening for OSA with the STOP-BANG questionnaire. Knowing the average duration of LOS for HR patients may assist healthcare providers in selecting an appropriate duration of monitoring. If the LOS is higher for ambulatory patients with suspected OSA, then guidelines that recommend an increase in the duration of observation are justifiable and worth the increased resources that such monitoring entails. Systematically designed studies to better define which patient may undergo higher risk surgery in ambulatory centers safely are needed. The potential role for the STOP-BANG survey in cancer patients may be greater than previously anticipated.

Competing Interests

The authors declare that there is no conflict of interests regarding the publication of this paper.

Acknowledgments

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