Outcomes for Ambulatory Shoulder Surgery Patients With Sleep Apnoea

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Abstract

Background: Obstructive sleep apnea poses significant risks for patient in the perioperative period. We evaluated respiratory outcomes and complications in a population of ambulatory shoulder surgery patients, during the perioperative period and on the first postoperative day

Methods: After interscalene block with a mixture of mepivacaine and ropivacaine, 50 patients received anesthesia with propofol and ketamine in beach-chair position for arthroscopic shoulder surgery. Respiratory parameters were collected before surgery, in recovery and step-down recovery, and via phone call on the first postoperative day.

Results: Oxygen saturations were lower in the postoperative phase, but not to a degree of clinical significance. There were no episodes of severe hypoxemia or respiratory obstruction. No patient required admission to the hospital. 10.1% of patients noted mild dyspnea at home.

Discussion: Use of regional anesthesia and sedation provided favorable postoperative respiratory effects, for the first 24 hours, substantiating this approach for ambulatory patients

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Keywords: Interscalene Block, Obstructive Sleep Apnoea, Ambulatory Surgery.

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Introduction

Obstructive sleep apnoea (OSA) is a disease process characterized by disordered breathing during sleep. This disease is under-diagnosed and is estimated to affect 17% of adults ages 30-69 [1]. The degree of effect of this disease can vary from mild to severe, which poses many problems for the anesthesia provider. It is estimated that 24% of patients have undiagnosed OSA [2], so a large portion of the surgical population may come to surgery without ever being tested for OSA. This affects the anesthetic techniques used during surgery.

Shoulder arthroscopy is a common outpatient surgical procedure for which interscalene block (ISB) is commonly utilized to provide perioperative pain control. One disadvantage of ISB is paresis of the ipsilateral hemidiaphragm caused by blockade of the phrenic nerve, which has been shown classically to occur in 100% of patients [5]. Although this is well tolerated by most patients, it may be particularly problematic for patients with preexisting pulmonary disease or a predisposition to hypoxemia, such as those with OSA. OSA patients may have a collapsible upper airway and common co-existence with obesity puts these patients at risk for difficult mask ventilation and tracheal intubation [3]. They are also at increased risk for postoperative airway obstruction, and have a nearly threefold increased risk of postoperative complications compared to non-OSA patients [4].

At our outpatient center, approximately 9% of the shoulder surgery population present with known sleep apnea. In seeking optimal anesthetic management of these patients, we evolved a technique which utilizes an intermediate-duration mixture of local anesthetics for interscalene block, followed by propofol-ketamine sedation with a natural airway in beach-chair position, with an attempt to minimize perioperative opioids. In this prospective, observational investigation, our primary aim was to characterize the respiratory events and self-reported symptoms of ambulatory shoulder surgery patients with OSA utilizing our preferred anesthetic plan, during the immediate recovery period and in the same day surgery unit, as well as at home on the first postoperative day. We also evaluated the duration of effective pain control with the interscalene block, as well as the occurrence of unplanned induction of general anesthesia, or admission to an inpatient unit. In addition, we compared the subset of morbidly obese OSA patients (BMI over 40) to those with lower BMI with regard to respiratory and oxygenation parameters.

Methods

The prospective, observational portion of the study was performed at three ambulatory surgical centers at the University of Pittsburgh Medical Center, a large network of hospitals located in Western Pennsylvania. After obtaining institutional review board approval, patients were enrolled in the study based on a known or suspected history of OSA [6]. Patients were designated as having suspected OSA based on high clinical suspicion as outlined by the ASA Practice Guidelines [7]. Exclusion criteria included age <18, refusal of nerve block, true allergy to amide-type local anesthetic, infection at the desired site of needle insertion, coagulopathy, pregnancy, COPD with hypoxemia, and preexisting neuropathy in the extremity to be blocked. For the patients who met inclusion criteria, written informed consent was obtained after a thorough discussion of the study and its goals.

Baseline demographic characteristics were recorded for each patient, which included age, sex, BMI, home OSA therapy, and smoking status. For the ISB, standard ASA monitors were applied, and supplemental oxygen was supplied via nasal cannulae. Midazolam 1–2 mg and Fentanyl 50–100 mcg were administered, titrated to a level of sedation which permitted verbal interaction during the ISB procedure. Ultrasound-guided ISB was performed with a Sono-Site

S-Nerve unit, utilizing a 6-13 MHz linear array transducer (Sono-Site, Bothell, Washington), in combination with nerve stimulation. When the C-5 and C-6 nerve roots were visualized in vertical alignment between the scalene muscles, 20 ml of a mixture of local anesthetic agents (0.2% ropivacaine + 1.6% mepivacaine) was injected in small aliquots into the interscalene groove, following repeated negative aspirations. Patients then underwent shoulder arthroscopy in beach-chair position with combined propofol and ketamine sedation, including supplemental fentanyl for additional analgesia if necessary.

Respiratory function was assessed for each patient in the different phases of care, including pre-sedation (baseline), post-sedation, post-block, post-operatively in the PACU, and prior to discharge in phase 2 of recovery. Assessments included direct observation for episodes of obstruction, pulse oximetry, respiratory rate, and oxygen requirements at each phase. Any necessity of converting the case to general anesthesia (defined as insertion of an endotracheal tube or laryngeal mask airway in the operating room) was noted.

Upon arrival to the PACU, numeric rating score (NRS) pain scores (0–10) were recorded, as well as the amount of hydromorphone or oral opioids administered. Patients were discharged from the PACU to Phase 2 recovery based on modified WAKE criteria [8]. Total PACU time was noted, as was any occurrence of unexpected admission to an inpatient facility was recorded.

All patients were contacted via phone on the first post-operative day for follow-up. At that time they were asked about the time of first pain experienced, and the time of first opiate use, in order to assess the duration of the block. They were also queried regarding subjective changes in breathing pattern, the ability to cough post-operatively, presence or absence of dyspnea, CPAP usage after discharge, and any persistence of neurological symptoms such as numbness, weakness or tingling.

Data was reported as simple descriptive statistics. We undertook a post-hoc comparison between overweight/obese (BMI < 40) and morbidly obese (BMI > 40) patients for oxygenation parameters, utilizing unpaired t-tests, with statistical significance defined as two-tailed p-value less than or equal to 0.05.

Results

51 patients were enrolled, however three were excluded due to an attending anesthesiologist preference for tracheal intubation from the onset of the case. All of the ISB were successful; there were no unplanned conversions to general anesthesia (three patients were excluded because they received a general anesthetic with endotracheal tube placement that was planned, due to the preferences of the attending anesthesiologist). Demographics are shown in Table 1, along with oxygen saturations throughout the perioperative course for all patients, and other durations of their perioperative course.

Table 1 Patient, Operative and Block Information.

Age, years (mean ± SD)	55.5 ± 9.9
Gender, n (male/female)	27/21
BMI (mean ± SD)	35.6 ±4.8
CPAP usage (yes/no)	25/23
Smoking status (smoker/nonsmoker)	7/41
Pre-block SpO_2 (mean ± SD)	97.1 ± 2.2
Post-block SpO_2 (mean ± SD) *	97.3 ± 2.4
PACU SpO_2 (mean ± SD) *	97.1 ± 2.3
SDS SpO_2 (mean ± SD)	96.3 ± 1.8
Surgery Duration, min (mean ± SD)	50.8 ± 17.7
PACU Stay, min (mean ± SD)	37 ± 27
Block Duration, h (mean ± SD)	10.83 ± 4.57

None of the patients experienced hypoxemia (SpO_2 less than 90%) before or after surgery, and none required supplemental oxygen after discharge from the PACU. There was a small but statistically significant difference between pre-block SpO_2 and SDS SpO_2 (97.1 vs. 96.1, $p < 0.005$). There were no reported episodes of respiratory obstruction in PACU or SDS. 4% of patients (2/48) experienced dyspnea in SDS. All of the patients rated this symptom as mild, and it did not interfere with their activities.

Results of the post-hoc comparison of those who were overweight/obese (BMI 25–40) or those with BMI greater than 40 are noted in Table 2. Oxygen saturations on room air before the block and after return to the same-day-surgery unit, were not different between the two groups. None of the patients had difficulty with effective cough. Mean pain scores were 1.02 in PACU. The mean block duration was 10.8 hours, and was not different in the two groups (Table 2). All of the nerve blocks had resolved by the time of the follow up phone call, and there were no residual neurologic symptoms. Five patients (10.1%) experienced mild dyspnea upon returning home. There were no required admissions to the hospital or emergency department visits for either group.

Discussion

We sought to evaluate the impact of a specific regimen of anesthesia for OSA patients presenting for ambulatory shoulder surgery. Specifically, we provided an intermediate duration ISB, with propofol plus ketamine sedation and mask oxygen/spontaneous ventilation. We found that none of the patients required admission to the hospital or had episodes of observed ventilatory obstruction in either PACU or same-day surgery. In addition, none required conversion to general

Table 2 Overweight/Obese (BMI<40) vs Morbidly Obese (BMI >40) patients.

	Morbidly Obese (n = 8)	**Obese (n = 40)**	**Significance**
Mean BMI (mean ± SD)	41.9 ± 3.39	33.95 ± 3.78	p<0.0005
Pre-block SpO_2, % (mean ± SD)	96.4 ± 2.13	97.3 ± 2.06	P = 0.25
Surgery Duration, min (mean ± SD)	51.4 ± 11.4	51.1 ± 18.8	p = 0.96
Phase 2 SpO_2, % (mean ± SD)	95.3 ± 0.7	96.3 ± 1.8	p = 0.11
Block Duration, hr (mean ± SD)	11.48 ± 6.35	10.5 ± 4.1	p = 0.6

anesthesia (i.e. requirement of laryngeal mask airway or tracheal tube due to inadequate analgesia and requirement of greater depth of anesthesia). Patients were able to wean to room air quickly, and had very few subjective respiratory complaints. Surprisingly, measured room air oxygen saturations after surgery were not meaningfully changed from baseline in these patients, despite the sedation, IV opioids and interscalene brachial plexus block with volumes likely to produce diaphragmatic paralysis.

Obstructive sleep apnea is a sleep disorder characterized by episodes of apnea or hypopnea caused by complete or partial airway obstruction. Apnoea is defined as complete cessation of airflow during sleep, while hypopnea is reduced airflow during sleep. An apnoea-hypopnea index is used to characterize the severity of the disease based on the number of apnoea and/or hypopnea events within an average hour of sleep, as measured by polysomnography. A score of 5-14 is classified as mild OSA, 15-30 is moderate OSA, and > 30 events is considered severe OSA [9].

Obstructive sleep apnea also has a significant impact on perioperative care. Multiple studies have shown that patients with OSA are at increased risk for difficult mask ventilation [10–13] and difficult intubation [13–15]. Intraoperatively, OSA patients may require higher airway pressures to deliver adequate tidal volumes during mechanical ventilation, given the restrictive-type respiratory pathology caused by their obesity. This may prove to be a challenge during laparoscopic procedures, in particular.

It has been well-documented that patients with OSA are at increased risk for hypoxaemia post-operatively [16]. Anesthetics agents are known to adversely affect patients with OSA [17], and opioids in particular may predispose to disruptions of sleep, and increased apnoeic epidoses [18]. This may underlie the increased frequency of adverse postoperative events that occur in this population [19]. Some large-scale, national database studies provide evidence that regional anesthesia reduces postoperative complications and mortality in patients with OSA [20]. In light of these data, many authorities recommend avoiding opiates and emphasize use of alternative multimodal analgesia techniques, including the most recent recommendations by the ASA Task Force for the management of patients with OSA [7].

Given the high potential for perioperative complications stemming from OSA, there has predictably been a large amount of debate as to who should be considered for outpatient ambulatory surgery. Recently, the Society for Ambulatory Anesthesia released guidelines for the preoperative selection of adult patients with OSA for ambulatory anesthesia. These guidelines suggested that patients with known OSA whose comorbid conditions are optimized and are able to use CPAP postoperatively are suitable candidates for ambulatory anesthesia. However, patients with OSA or presumed OSA with non-optimized comorbid conditions are considered not suitable for ambulatory anesthesia [21]. Due to a paucity of data in outpatients, such recommendations are necessarily based primarily on expert opinion, and further evidence is necessary to guide decision-making in this area.

In a recent retrospective review, we assessed outcomes in over 15,000 patients who had undergone shoulder surgery in beach-chair position, with interscalene block and propofol-ketamine sedation [22]. Serious complications were very unusual, and the incidence of adverse occurrences in those with OSA in this population was similar to their proportion of the overall population, suggesting that there has been no predisposition to complications in this sub-group. This is true for the range of adverse outcomes and in particular for respiratory system occurrences. There have been no respiratory arrests or deaths among patients with OSA undergoing this anesthesia technique, in what we estimate is over 1500 patients with diagnosed sleep apnea (and undoubtedly a significantly higher number if one considers those who suffer from this condition but were not diagnosed at the time of surgery). This suggests, but does not guarantee, a reasonable margin of safety for this technique in this vulnerable subset of patients.

Both proven and suspected OSA patients are included in our prospective study, based on known history by the patient, a sleep study report in the chart, or clinical suspicion based on the ASA guidelines [7]. It is acknowledged that patients without formal sleep testing may not actually have the disease. Another limitation of this study is that patients were contacted at 24 hours, not later in their postoperative course. It is possible for patients to have complications related to OSA several days after surgery, though such adverse outcomes would be very unlikely to be related to the anesthetic regimen, and more likely to be related to oral opioid analgesics. In addition, our sports orthopedic service keeps us well-informed of complications that occur with patients we have anesthetized, which may be detected on follow up visits but not initially elicited in phone calls by our service. For SpO_2 levels, we relied on nurses' entry of vital signs in the electronic medical record, as well as our own observations at bedside- we did not have access to records of continuous readout in PACU, though nurses are required to call the attending physician for hypoxemia (SpO_2 at 90% or less) or for any evidence of respiratory obstruction. SpO_2 levels in phase 2 recovery are obtained only on admission from PACU, and later if any clinical respiratory symptoms are reported or adverse event occurs. Reported events that patients experienced after returning home are necessarily subjective. 24-hour inpatient observation would provide a more comprehensive record of symptoms, hypoxia or airway obstruction during this period.[17] Lastly, this is a relatively small, prospective observational study, to establish the practicality of this approach. However, our large retrospective database [22] provides additional substantiation of the safety of this approach.

In conclusion, evidence of airway or oxygenation compromise was unusual in this OSA population undergoing shoulder surgery in beach-chair position, with interscalene block, and propofol-ketamine sedation and natural airway. The described approach has proven effective for management of patients with OSA in the outpatient setting, minimizing postoperative respiratory complications or complaints.

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