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Reduced Recovery Times with Total Intravenous Anesthesia in Patients with Obstructive Sleep Apnea

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Total IV Propofol vs. Sevoflurane Gas Anesthesia in Patients with Obstructive Sleep Apnea

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- No disclosures to report

Introduction

- Obstructive sleep apnea (OSA) is a common, yet serious condition¹
 - Repetitive nocturnal airway collapse, leading to cessation of breathing
 - Associated with stroke, hypertension, arrhythmias, decreased cognitive function, and diminished quality of life²
- Diagnosis of OSA includes either a home or in-laboratory sleep study to establish the extent of airway obstruction
 - Study results will typically report an apnea-hypopnea index (AHI), denoting severity of disease
 - AHI – apnea and hypopnea events per hour
- Effective first-line treatments of OSA include continued positive airway pressure (CPAP) therapy or mandibular repositioning³

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Compliance!

Introduction

- Following failure of CPAP or mandibular device, several surgical manipulations for OSA treatment exist
 - Procedures selected depend on location of obstruction and individual patient anatomy⁴
- Currently, a standard of care does not exist for the anesthetic approach utilized for OSA patients receiving surgery
 - Two highly utilized general anesthetic agents were evaluated in this study: Total Intravenous Anesthesia (TIVA) and Sevoflurane Gas (SEVO)
 - Conflicting literature exists as to which method is superior
 - Meta-analyses have shown that TIVA leads to faster recovery times with less postoperative nausea⁵
 - Potential impacts on efficiency and cost of recovery care, and patient satisfaction

Objectives & Hypothesis

- Research Question: How does Total Intravenous Anesthesia (TIVA) compare with Sevoflurane Gas (SEVO) with respect to resultant postoperative experience and recovery time in OSA patients undergoing surgery?

- Hypothesis: OSA patients undergoing surgery will experience reduced postoperative nausea and faster recovery times following administration of TIVA compared with patients that receive SEVO.

Approach & Results

- Study design: Retrospective Cohort Study
- Population: OSA patients undergoing corrective surgery (Jan. 2019-Dec 2019)
 - Surgeries included nasal surgeries, uvulopalatopharyngoplasty (UPPP) and upper airway stimulation (UAS)
 - SEVO (n=86)
 - Nasal (n=47)
 - UAS (n=29)
 - UPPP (n=10)
 - TIVA (n=62)
 - Nasal (n=24)
 - UAS (n=30)
 - UPPP (n=8)
- Intervention: Administration of TIVA with propofol + remifentanyl
- Comparison: Outcomes of patients receiving SEVO
- All data was obtained from Epic medical history charts
 - Outcomes collected included time-based measures (total surgery and anesthesia time, time to emergence, time to PACU phase I/II completion, and total recovery time), incidence of postoperative nausea
- Rationale behind this approach:
 - Retrospective review of patients with known anesthesia modality
 - Appropriate time data was available to conclude if recovery times differed
 - Adverse events and complications occurring weeks later were also obtainable with this approach

Procedure

Emergence

Phase I

Phase II

Discharge

Activity: able to move voluntarily or on command	
4 extremities	2
2 extremities	1
0 extremities	0
Respiration	
Able to deep breathe and cough freely	2
Dyspnea, shallow or limited breathing	1
Apneic	0
Circulation	
BP $\pm$ 20 mm of preanesthetic level	2
BP $\pm$ 20-50 mm of preanesthesia level	1
BP $\pm$ 50 mm of preanesthesia level	0
Consciousness	
Fully awake	2
Arousable on calling	1
Not responding	0
O ₂ saturation	
Able to maintain O ₂ saturation >92% on room air	2
Needs O ₂ inhalation to maintain O ₂ saturation >90%	1
O ₂ saturation <90% even with O ₂ supplementation	0

Approach & Results

- Methods of analysis:
 - Analyses were performed using Graphpad Prism software using the following tests:
 - Unpaired nonparametric Mann-Whitney U tests (time comparisons/demographics)
 - Fischer's Exact tests (categorical data)
 - Multiple linear regression (correlating OSA severity with recovery time)

Approach & Results

Demographics	SEVO Patients (n=86)	TIVA Patients (n=62)	P Value
Age	52.7 ± 11.2 years	55.4 ± 12.1 years	P=.1265
Sex	78% Males (n=67) 22% Females (n=19)	77% Males (n=48) 23% Females (n=14)	P=1.00
Race	78% Caucasian (n=67) 14% African American (n=12) 5% Hispanic (n=3) 6% Other (n=4)	91% Caucasian (n=56) 3% African American (n=2) 6% Hispanic (n=4) 0% Other (n=0)	P=.0737 P=.0433 P=.4530 P=.1426
BMI	31.1 ± 4.7 kg/m ²	29.8 ± 3.6 kg/m ²	P=.1424
AHI	31.6 ± 24.9	30.5 ± 18.9	P=.8848
OSA Severity			
% Mild OSA AHI ≥5 - <15	24% Mild OSA (n=21)	19% Mild OSA (n=12)	P=.0774
% Moderate OSA AHI ≥15 - <30	34% Moderate OSA (n=29)	37% Moderate OSA (n=23)	P=.1247
% Severe OSA AHI ≥30	42% Severe OSA (n=36)	44% Severe OSA (n=27)	P=.3585
Surgical Procedure			
% Nasal Surgery	55% Nasal (n=47)	39% Nasal (n=24)	P=.0672
% Upper Airway Stimulation (UAS)	34% UAS (n=29)	48% UAS (n=30)	P=.0893
% Uvulopalatopharyngoplasty (UPPP)	12% UPPP (n=10)	13% UPPP (n=8)	P=.8051

Approach and Results

Median PACU phase I time decreased with TIVA across all surgical subtypes. Total recovery decreased in all surgeries except UPPP.

UAS Median PACU phase I difference: 42.5 min (p<.001, 95% CI 20.00 - 61.00)

UPPP Median PACU phase I difference: 36 min (p=.022, 95% CI 6.00 - 83.00)

Nasal Median PACU phase I difference: 35.5 min (p<.001, 95% CI 18.00 - 52.00)

Approach and Results

Median PACU phase I time decreased with TIVA across all severities of OSA with surgeries combined.

Mild Median PACU phase I difference: 23.5 min (p=.004, 95% CI 11.00 - 55.00)

Moderate PACU phase I difference: 52 min (p=.004, 95% CI 11.00 - 63.00)

Severe Median PACU phase I difference: 47 min (p<.001, 95% 16.00 - 56.00)

Approach and Results

Logarithmic 2-fold AHI increases correlates with increased PACU phase I time in SEVO patients.

SEVO phase I time increase: 16.8 min ($p < .001$, 95% CI 9.2 to 22.4)

TIVA phase I time increase: 4.3 min ($p = .489$, 95% CI -7.9 to 16.5)

Approach and Results

Incidence of postoperative nausea and vomiting (PONV) did not differ in cohorts based on anesthesia received.

	PONV	No PONV
SEVO	10	76
TIVA	2	60

Fischer's Exact Test of PONV Incidence: $p=.07$

Conclusions

- Based on this retrospective cohort:
 - Surgical OSA patients experience reduced recovery time with TIVA regardless of OSA severity or surgery received
 - OSA patients receiving SEVO experience increased time spent in recovery with increasing OSA severity
 - Incidence of PONV did not differ based on anesthesia received, but may do so with an increased sample size
- Overall, our findings of reduced recovery time after TIVA are consistent with meta-analyses of the general population⁵
- Implications of these findings may include improved efficiency of care delivery and patient satisfaction, and potentially reduced cost of recovery care
 - Further studies are needed to confirm these impacts

Future Directions

- Extensions of this study include:
 - Prospective RCT placing patients in either a TIVA or SEVO group
 - More thorough assessment of postoperative pain and nausea
 - Cost analysis of this cohort utilizing Jefferson financial data and billing to insurance
 - Assessment of TIVA vs. SEVO in non-OSA patients undergoing otolaryngologic procedures (tonsillectomy, rhinoplasty, facelift, etc.)

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References

- 1. Punjabi NM. The epidemiology of adult obstructive sleep apnea. *Proceedings of the American Thoracic Society*. 2008; 5: 136-43.
- 2. Krieger J, McNicholas WT, Levy P, et al. Public health and medicolegal implications of sleep apnoea. *The European respiratory journal*. 2002; 20: 1594-609.
- 3. Lorenzi-Filho G, Almeida FR and Strollo PJ. Treating OSA: Current and emerging therapies beyond CPAP. *Respirology (Carlton, Vic)*. 2017; 22: 1500-7.
- 4. . Carvalho B, Hsia J and Capasso R. Surgical therapy of obstructive sleep apnea: a review. *Neurotherapeutics : the journal of the American Society for Experimental NeuroTherapeutics*. 2012; 9: 710-6.
- 5. Gupta A, Stierer T, Zuckerman R, Sakima N, Parker SD, Fleisher LA. Comparison of recovery profile after ambulatory anesthesia with propofol, isoflurane, sevoflurane and desflurane: a systematic review. *Anesth Analg*. 2004;98(3):.