SASM

Society of Anesthesia and Sleep Medicine (SASM)

SASM 2024 14th Annual Meeting

Monitoring the Future of Anesthesia and Sleep: Developments in Technology and Treatment

October 18, 2024
Marriott Philadelphia Downtown | Philadelphia, PA

6.75 AMA PRA Category 1 Credits

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Dr, Vidya Raman, MD, MBA, FASA, FAAP, The Ohio State University Wexner Medical Center
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3030 Warrenville Rd., Suite 450-38, Lisle, IL 60532
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WELCOME

Welcome to the Society of Anesthesia and Sleep Medicine (SASM) 14th Annual Meeting: "Monitoring the Future of Anesthesia and Sleep: Developments in Technology and Treatment."

We are thrilled to have you join us as we dive into the latest innovations and breakthroughs in sleep medicine! This year's meeting promises to be a dynamic exploration of cutting-edge advancements in perioperative sleep medicine, with a lineup of renowned speakers sharing insights that will shape the future of our field.

SASM has a rich history of successful, interdisciplinary collaborations with other academic societies in anesthesiology, sleep, and pain medicine. Our leadership represents diverse perspectives and fosters partnerships that have driven important guidelines and advancements in the past. This meeting is a testament to that spirit of collaboration, innovation, and growth.

We've curated an exciting program, including hands-on workshops and sessions covering a broad range of topics within sleep medicine, highlighting new treatments and technologies that are pushing the boundaries of patient care. Be sure to take advantage of the networking opportunities, visit the exhibitor hall, and explore the groundbreaking research presented in our abstract poster sessions.
We extend our deepest gratitude to our sponsors for their unwavering support of SASM's mission, to our dedicated administrative team for making this event possible, and to the SASM Board of Directors for their tireless efforts in guiding our society forward, even through challenging times.

Meeting Highlights Include:

- **Keynote Speaker: Dr. Richard Schwab**
  - Don't miss his keynote presentation, "Understanding the Improvements in OSA with Weight Loss Medications," where he will give us a first-hand look into the SURMOUNT-OSA trials and how these groundbreaking medications are revolutionizing sleep medicine.
- **Hands-On Workshops:**
  - Gain practical experience with the latest diagnostic tools, explore cutting-edge sleep devices for both home and hospital use, and learn how to implement high-flow nasal oxygen therapy, plus much more.
- **Award-Winning Abstract Presentations:**
  - Discover the best and brightest research in sleep and anesthesia medicine, presented by leading experts and emerging scholars.

We are excited for what lies ahead in this meeting and look forward to the discussions, learning, and collaboration that will shape the future of anesthesia and sleep medicine. Thank you for being part of this incredible event!

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Dallas, TX, USA

KEYNOTE SPEAKER

Richard Schwab, MD

Professor of Medicine in the Department of Medicine & Chief of the Division of Sleep Medicine of the University of Pennsylvania

Understanding the Improvements in OSA with Weight Loss Medications

Dr. Schwab received his undergraduate degree from Haverford College and his medical degree from the University of Pennsylvania School of Medicine. He completed his Pulmonary/Critical Care and Sleep Fellowship at the University of Pennsylvania in 1991. Dr. Schwab has emerged as a preeminent investigator in the field of upper airway imaging and sleep apnea. He has developed and utilized sophisticated magnetic resonance imaging and volumetric analysis paradigms to study the mechanisms leading to sleep apnea. His research has resulted in seminal observations about the genetics, pathogenesis and treatment of obstructive sleep apnea. He has shown the importance of the lateral pharyngeal walls and the volume of the tongue in the pathogenesis of sleep apnea. In addition, he has shown that reductions in tongue fat mediate the improvement in sleep apnea with weight loss. Finally, Dr. Schwab has successfully mentored a number of pulmonary/sleep fellows and he started the ASPIRE fellowship which provides a pipeline for the next group of pulmonary/sleep leaders.

ACCREDITATION INFORMATION

Sleep is a foundation of health, and the effects of sleep disorders can be broad and significant. The impact of sleep disorders on hospitalized patients and patients receiving anesthesia are complex, and new data continues to emerge about the most effective ways to diagnose and care for patients in the hospital and at home.

Join us for this high-impact meeting with experts discussing topics including post-operative respiratory monitoring, novel methods of delivering PAP therapy, wellness and sleep, and novel medications and their impact on anesthesia. Other topics include surgical evaluation and treatment of sleep apnea and pediatric sleep apnea. Additionally, we will hear from patient speakers as well as receive updates from SASM leaders related to perioperative care of patients with sleep disorders. Our meeting will also include a hands-on workshop where participants will be able to speak with experts in sleep medicine and anesthesiology.

This course is designed to be high-yield for people working in the fields of anesthesiology, sleep, medicine, perioperative and critical care, and inpatient medicine and will be valuable for people at any level of training.

PROGRAM OBJECTIVE

The objective of this meeting is to provide a forum for discussions pertaining to the common grounds between sleep and anesthesia. The goal is to promote excellence in medical care, research and education in anesthesia, sleep medicine and perioperative medicine

LEARNING OBJECTIVES

To identify how the advent of new weight loss medications and novel treatments has impacted sleep-disordered breathing and the nexus with perioperative care.

SATISFACTORY COMPLETION

Learners must complete an evaluation form to receive a certificate of completion. Your chosen sessions must be attended in their entirety. Partial credit of individual sessions is not available. If you are seeking continuing education credit for a specialty not listed below, it is your responsibility to contact your licensing/ certification board to determine course eligibility for your licensing/ ertification requirement

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After Attending This Program You Should Be Able To:

1. Describe how these new weight loss medications have affected sleep
2. Recognize the new home monitoring regimens and novel new treatments
3. Describe how OSA affects overall health and well-being

Disclosure of Conflict of Interest

The following table of disclosure information is provided to learners and contains the relevant financial relationships that each individual in a position to control the content disclosed to Amedco. All of these relationships were treated as a conflict of interest, and have been resolved. (C7 SCS 6.1- -6.2, 6.5)

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SCHEDULE OF EVENTS

Time	Session	Speaker
7:00 AM	Registration Opens	
8:00 - 8:10 AM	Welcome Address	Dr. Bhargavi Gali, MD *SASM President*
8:10 - 9:05 AM	WORKSHOP - Sleep Diagnostics: Traditional Diagnostics, Wearables & Point of Care Ultrasound	Dr. Mohamed Eissa, MBBCh, MSc, MD, EDAIC, FRCPC, Advanced PTEeXAM SASM Workshop Committee
	Exhibitor Showcase/Break	
9:10-9:35 AM	Eyes Wide Shut: Navigating the Hazards of Sleep Loss in Anesthesiology	Dr. Haleh Saadat, MD, FAAP
9:40 -10:05 AM	Surgical Selection for Sleep Apnea Patients	Dr. Juliana Rodin, MD
10:10 -10:35 AM	Home Monitoring of Post-Operative Orthopedic High-Risk Opioid Subjects	Dr. Robert Mazzola, MD, MSPH, FCCP
10:40 - 11:05 PM	New Discoveries in PAP Therapy	Dr. William Noah, MD
11: 10 - 11:30 AM	Perioperative Considerations in Patients on GLP-1 Agonists in 2024	Dr. Anu Wadhwa, MD
11:35 - 11:55 AM	Abstract Presentations	
	Exhibitor Showcase	
11:55 - 12:40 AM	Lunch	
	Exhibitor Showcase	
12:45-1:30 PM	KEYNOTE: Understanding the Improvements in OSA with Weight Loss Medications	Dr. Richard Schwab, MD
1:35 - 2:30 PM	WORKSHOP - Therapeutics: PAP therapy, High Flow Nasal Oxygen, Post-Op Monitoring	Dr. Mohamed Eissa, MBBCh, MSc, MD, EDAIC, FRCPC, Advanced PTEeXAM SASM Workshop Committee
	Exhibitor Showcase/Break	
2:35 - 2:55 PM	When Dreams Break Through, Living with REM Sleep Behavior Disorder	Ray Merrell, Project Sleep
3:00 - 3:20 PM	Rising Voices: Mary's Narcolepsy Story	Mary Schneider, Project Sleep
3:25 - 3:50 PM	Pediatric OSA and Anesthesia	Dr. Leah Templeton, MD
3:55 - 4:20 PM	Reimagining Diagnosis and Management of Sleep Apnea beyond the Apnea-Hypopnea Index	Dr. Ankit Parekh, PhD
4:25 - 4:50 PM	SASM Guidelines for Postoperative Management of patients with OSA	Dr. Satya Krishna Ramachandran, MD
4:50 - 5:10 PM	Award Ceremony	
5:10 - 5:15 PM	Closing Remarks	Dr. Bhargavi Gali, MD *SASM President*

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ABSTRACT AWARD WINNERS

Abduladem Alshabeb, MD:
Safety of Awake Craniotomy for Patients with Obesity: A Case Series

Enrico Camporesi, MD:
Postoperative Hypoxia in Bariatric Surgery Patients with Obstructive Sleep Apnea

Jasper Lee:
Recurrent EEG signatures Associated with Pre-Emergent Induction of Anesthesia Dreams Across Three Propofol Protocols

ABSTRACT 1

Low-Flow Nasal Mask-Face Tent for Immediate Pressure-Controlled Ventilation/Oxygenation in Obese OSA Patient during TEE

Affan Aamir, PharmD; Eric Otto, Jr., MD; Ashley Chan, BA, RDCS and James Tse, PhD, MD
Department of Anesthesiology and Perioperative Medicine, Rutgers Robert Wood Johnson Medical School, New Brunswick, NJ

Introduction: It is always very challenging to provide monitored anesthesia care (MAC) for patients at non-OR anesthesia (NORA). Over-sedation and/or airway obstruction may result in severe desaturation, especially in obese patients with obstructive sleep apnea (OSA). A pediatric facemask has been shown to provide nasal continuous positive airway pressure (CPAP) ventilation and improve O2 delivery in deeply sedated OSA patients (Fig. 1).1-2

A simple combined nasal mask-face tent provided pre/apneic nasal oxygenation and reduced aerosol/droplet spread during rapid sequence induction (RSI), video laryngoscopic endotracheal intubation and extubation in a COVID-19 patient 3 and during per-oral endoscopic myotomy (POEM) and extubation in a COVID-19 patient.4

We used this simple technique in an obese patient during outpatient TEE amid the ongoing COVID-19 surge.

Report of Case:
A 70-y/o male 5'9", 255 lbs, BMI 37,7 kg/m2, with OSA, iron deficiency anemia, abnormal findings of gastrointestinal tract and paroxysmal atrial fibrillation (PAF) presented for outpatient Transesophageal Echocardiogram (TEE) at the Echocardiography Lab. He had a Mallampati Class III airway. An infant facemask for delivering nasal CPAP was shown to the patient and he gave his consent for photography and case report.

The nasal mask-face tent was secured over his nose with elastic head-straps and connected to the anesthesia circuit/machine. Pads were placed over his nasal bridge and under the head-straps. The face tent covered his mouth that was kept open by a bite block.

The adjustable pressure-limiting (APL) valve was adjusted to deliver 8-10 cm H2O CPAP with fresh O2 flow of 4 L/min. A nasal cannula with air sampling tubing was taped below his lower lip underneath the face tent to continuously monitor orally exhaled CO2 and evacuate oral droplet/ aerosol. Following nasal CPAP pre-oxygenation, his SpO2 increased from 95% to 100%. Deep sedation was slowly titrated with lidocaine (100 mg), propofol boluses (70 mg) and propofol infusion (100 mcg/kg/min). He maintained spontaneous nasal ventilation and 100% SpO2 (Fig. 2).

During manipulation of the TEE probe, his airway was obstructed and his SpO2 decreased to 93% (Fig 3). Bilateral jaw thrust was immediately applied and maintained throughout the procedure (Fig. 4). His ventilation was supported with assisted nasal ventilation and subsequently with pressure-controlled nasal ventilation (PIP 20-38 cm H2O, PEEP 8 cm H2O and RR 20/min) (Fig. 5). He maintained 98-99% SpO2 during the remaining procedure (Fig. 3). Upon removal of the TEE probe, he maintained spontaneous nasal CPAP ventilation and 98-100% SpO2. He was awake and alert soon following TEE and was discharged home without any complications.

Conclusion: This simple low-flow nasal mask-face tent provided immediate pressure-controlled ventilation/oxygenation in an obese patient with OSA during TEE under MAC at NORA. As it is expected that within the next decade 50% of locations where anesthesia is provided will be outside the traditional operating room, it is imperative that the anesthesia community develop improved methodologies for the safe and efficient care of sedated/MAC patients.5 This simple mask allowed for an appropriate escalation in oxygen delivery when needed. It also reduced aerosol/droplet during the aerosol generating procedure.

References: 1. www.tsemask.com; 2. SAMBA 28th AM, MCC, 2013; 3. ASA virtual AM: MC1280, 2020; 4. IARS virtual AM: MCC1306, 202; 5. Curr Opin Anaesthesiol. 30(6): 644-651, 2017.

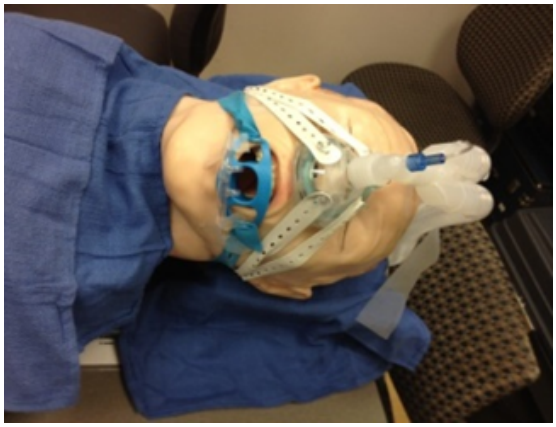

Fig. 1

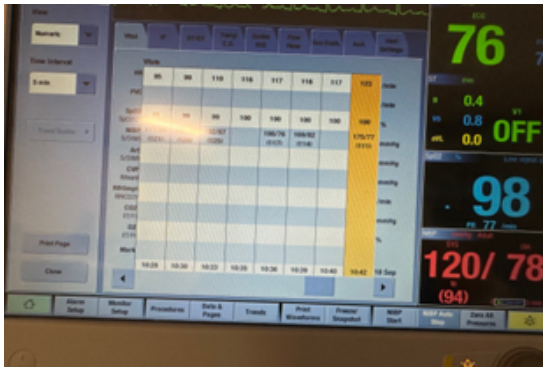

Fig. 2

Fig. 3

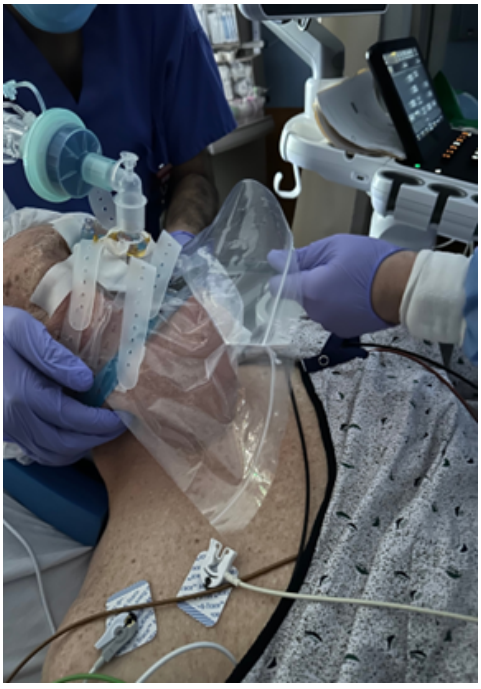

Fig. 4

ABSTRACT 1

Fig. 5

Student Presenter: Affan Aamir, PharmD, MS4
Email: aaa319@rwjms.rutgers.edu
Phone: (917) 686-9569

Financial Disclosure: All authors have no conflict of financial interest.

Affan Aamir, PharmD
Eric Otto, Jr., MD
Ashley Chan, BA, RDCS
James Tse, PhD, MD

ABSTRACT 2

Safety of Awake Craniotomy for Patients with Obesity: A Case Series

Investigators: 1Alshabeb A, , 1Polis T, 2Sinclair J, 2Catana D, 1Budiansky AS
1Department of Anesthesiology and Pain Medicine, University of Ottawa, Ontario, Canada
2Division of Neurosurgery, Department of Surgery, University of Ottawa, Ontario, Canada

Introduction: Obesity is frequently cited as a relative contradiction for awake craniotomy due to fear of increased chances of desaturation, oversedation and difficult airway.1,2 The Ottawa Hospital (TOH) neurosurgical program performs approximately 100-120 complex awake craniotomies per year, including in patients with obesity. Here we report our institutional experience of awake craniotomy for patients with obesity, including a close look at patient characteristics and complication rates.

Methods: This case series was completed under a Quality Improvement Waiver from the OHSN-REB. We conducted a retrospective electronic medical records review of adult patients with body mass index (BMI) of 35 kg/m2 or greater who have undergone awake craniotomy surgery for resection of primary or metastatic brain tumors under monitored anesthesia care (MAC) between June 01, 2019, and November 2023. Patients who had elective airway intervention or general anesthesia (GA), such as for a staged awake-asleep procedure, were excluded from this case series. We collected baseline demographic data including clinically confirmed diagnosis of obstructive sleep apnea (OSA), intraoperative events such need for airway intervention, cessation of cooperation and intraoperative mortality. The electronic medical records were also reviewed for postoperative complications, including cardiopulmonary events and ICU admission.

Results: Between June 2019 and November 2023, a total of 34 patients were identified, with an average BMI of 39.1 kg/m2 (range of 35 - 48.2). Eleven patients (32%) had a BMI greater than 40 kg/m2. Seven (21%) of the patients had a documented OSA diagnosis at the time of surgery. All patients received a combination of Propofol, Ketamine, and Remifentanil infusion for sedation, while only three patients (8.8%) received Dexmedetomidine infusion as well. All patients received scalp blocks, which were performed by the anesthesiologist in the form of a modified ring block or targeted nerve blocks. All patients completed the procedure successfully without loss of cooperation or the need to abort the surgery. Two patients (5.8%) required temporary airway intervention in the form nasal airway or temporary bag mask ventilation, while none needed conversion to GA, intubation or laryngeal mask airway. Two patients (5.8%) required ICU admissions during their hospital stay, one due to worsening of their primary lung cancer, while the other developed subdural hematoma 6 days post-surgery, resulting in deterioration of their level of consciousness.

Conclusion: Publications describing successful management of awake craniotomy in patients with obesity are limited to case reports. To the best of our knowledge, this case series describing successful anesthetic management of patients with BMI ≥ 35 kg/m2 undergoing awake craniotomy using MAC is the first of its kind. The rate of airway intervention (5.8%), loss of cooperation (0%), and conversion to GA (0%) in our case series is similar or lower to the rates described in the literature for various awake craniotomy techniques for patients without obesity.3,4 Our findings suggest that patients with obesity can safely undergo awake craniotomy under MAC and that obesity in and of itself should not be a contraindication for this procedure.

References:
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2.Fiore G, Abete-Fornara G, Forgionae A et al. Indication and eligibility of glioma patients for awake surgery: a scoping review by a multidisciplinary perspective. Front Oncol. 2022;12:951246.
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4. Natalini D, Ganau M, Rosenkranz R et al. Comparison of the asleep-awake-asleep technique and monitored anesthesia care during awake craniotomy: a systematic review and meta-analysis. J Neurosurg Anesthesiol. 2022;34(1):e1-e13.

Table 1. Patient Characteristics and Perioperative Data

	n ***N* = 34**	**%**
Demographics		
Male	9	27
OSA	7	21
BMI (35-39.9 kg/m²), *n* (range)	23 (35– 39.5)	68
BMI > 40 (kg/m²), *n* (range)	11 (40.2-48.2)	32
Average BMI (kg/m²)	39.1	
Anesthetic medications		
Propofol	34	100
Remifentanil	34	100
Ketamine	34	100
Dexmedetomidine	3	8.8
Intraoperative airway intervention		
Nasal airway	1	2.9
Oral airway	0	0
Bag mask ventilation	1	2.9
Intubation	0	0
Intraoperative loss of Cooperation	0	0

Postoperative Hypoxia in Bariatric Surgery Patients with Obstructive Sleep Apnea.

Authors: Naveen Perisetla BS, Jose Malavet BS, Christopher Popiolek BS, Ashley Mooney MD, Chris DuCoin, MD, Steve Docimo, MD, Maha Balouch CCRP, Peter Wu MD, Jeffrey Weiss DO, John Hodgson MD and Enrico Camporesi MD.

Chris Popiolek: cmpopiolek@usf.edu
Naveen Perisetla: perisetlan@usf.edu
Jose Malavet: malavetj@usf.edu
Jeffrey Weiss: Jeffrey_Weiss@teamhealth.com
ashleymooney@usf.edu
cducoin@usf.edu
sdocimo@usf.edu
john_hodgson@teamhealth.com
Peter_wu@teamhealth.com

Introduction
Patients undergoing obesity surgery frequently suffer from Obstructive Sleep Apnea (OSA), leading to increased postoperative risk for systemic complications. Intermittent hypoxemia during recovery has been observed after this surgery. The timing and the extent of postoperative desaturations have not been clearly described in obese patients with OSA. In this study, we investigated the timing of desaturation events for several hours after surgery, and we determined the impact of OSA status on postoperative desaturations for a range of SpO2 levels (80% to 95%) in patients after bariatric surgery.

Methods
We collected data from 195 consenting patients who had bariatric surgery at our hospital between June 2022 and December 2023 (IRB # 00036836). After surgery, extubation, and discharge from PACU, patients were continuously monitored in a ward using Masimo Rad 97 (Masimo). The electronic recordings until the next morning were analyzed with TRACE software. Preoperative screening comprised PRODIGY scores and STOP-BANG > or = 3 to obtain preoperative polysomnography. Patients received robot-assisted gastric bypass or gastric sleeve insertion. Opiate use was minimized intraoperatively and at all postoperative times. We followed ERAS guidelines and recovered with chest elevation and PAP as per individual prescriptions. A desaturation event was defined as a drop in SpO_2 by 3% for a minimum duration of 30 seconds or a drop to SpO_2 < 89%. Exposure duration to four SpO2 ranges (<80%, 80-84%, 85-89%, 90-95%) was compiled from the recorded data. We collected postoperative events every 2-hour intervals. We completed descriptive statistics, Pearson chi-square tests, and student's t-test to compare OSA vs non-OSA patients, and high PRODIGY scores (>15) to lower scores.

Results
Patients were mainly female (88.7%) with a mean age of 44.5 years (SD: 11.5). One hundred and twenty-six patients (64.6%) were OSA positive, and 69 (35.4%) were OSA negative. There was no significant difference in monitor duration between the two groups. Exposure duration to the 80-84%, 85-89%, and 90-95% SpO_2 ranges was significantly longer among patients with OSA (see Table). Patients with OSA showed significantly more frequent desaturations during the study period than those without OSA (9.06 vs. 2.16, p=0.010). Patients with high PRODIGY scores (> 15) also had significantly more desaturation events. Patients with OSA reported most desaturation events within the first 6 hours after PACU discharge; however, later desaturations were also noted from 8 to 14 hr after PACU discharge. The bulk of desaturations was in patients with high (>15) PRODIGY scores.

Conclusion

Among bariatric surgery patients, the presence of OSA is significantly associated with postoperative and late desaturation events, especially with high PRODIGY scores. In our low-opiate regimen, these episodes were self-limited, and we did not record untoward events, though continued attention should be paid to the postoperative period for patients with OSA.

Table: Demographic and Clinical Variables Stratified by OSA Status (SD)			
	OSA Status:		p-value
	Yes: 112	No: 67	
Mean Age (years)	47.6 (11.1)	38.7 (9.85)	**<0.001**[a]
Gender (% Female)	84.1	97.1	**0.006**[b]
Mean BMI	45.1 (7.81)	44.3 (7.02)	0.480[a]
Mean Monitor Duration (minutes)	872 (200)	869 (181)	0.934[a]
Mean Desaturation Events Observed	9.06 (21.1)	2.16 (8.82)	**0.010**[a]
Mean Exposure Duration (minutes) SpO2 <80%	0.893 (4.10)	0.535 (1.67)	0.488[a]
SpO2 80-84%	2.88 (8.88)	0.956 (2.09)	**0.022**[a]
SpO2 85-89%	40.1 (78.9)	12.5 (41.4)	**0.007**[a]
SpO2 90-95%	467 (288)	278 (253)	**<0.001**[a]
[a]student's t-test, [b]Pearson chi-square test			

ABSTRACT 4

The Effect of Sleep Disorder Interventions in Patients with Obstructive Sleep Apnea undergoing Solid Organ Transplants: A Systematic Review

Authors: Bijal Desai1, Xiaole Li1, Joshua Andrusiak1, Terry Cho2, Austin Lam1, Ameya Pappu3,4, Marina Englesakis5, Mandeep Singh3.4, Justyna Bartoszko3,4

Institutions:
1 Temerty Faculty of Medicine, University of Toronto, Toronto, ON, Canada.
2 Michael G. DeGroote School of Medicine, McMaster University, Hamilton, Ontario
3 Department of Anesthesia and Pain Management, Sinai Health System, Women's College Hospital, University Health Network, Toronto General Hospital, Toronto, ON, Canada.
4 Department of Anesthesiology and Pain Medicine, University of Toronto, Toronto, ON, Canada.
5 Library & Information Services, University Health Network, Toronto, ON, Canada.

Introduction:
Obstructive Sleep Apnea (OSA) is a common sleep-related breathing disorder associated with perioperative cardio-respiratory complications. It may result in a wide range of health consequences and is highly prevalent among patients undergoing solid organ transplant. There is a paucity of research examining whether interventions such as continuous positive airway pressure (CPAP) can improve outcomes in patients with OSA undergoing solid organ transplantation. This review investigates the impact of OSA therapies (i.e. CPAP) on perioperative outcomes in solid-organ transplant to better inform the management of solid organ transplant patients with OSA.

Methods:
A systematic review was reported in accordance with PRISMA guidelines. Databases searched included: MEDLINE, MEDLINE ePubs Ahead of Print and In-process Citations, Embase, Cochrane Central Register of Controlled Trials, CINAHL, and PsycINFO. The inclusion criteria included studies investigating interventions used in adult patients with OSA undergoing solid organ transplantation.

Results:
The initial search identified 1407 studies, and screening identified 38 studies for full-text review (Figure 1). The final analysis consisted of 3 studies for data extraction, evaluating 457 patients with OSA out of a cohort of 4307 patients undergoing solid organ transplant (Table 1). CPAP adherence data was limited; in one study 6 of 8 (75%) patients discontinued CPAP by the end of the follow-up period. Only one study in heart transplant patients evaluated changes in sleep parameters and demonstrated that the implementation of nasal CPAP led to significant improvements in AHI, Arousal Index, and total sleep time with oxygen saturation <90%, however the number of patients studied was low (n=11) (GRADE: Very low certainty). Further, those with untreated OSA were more likely to develop graft dysfunction earlier than patients with treated or no OSA (GRADE: Very low certainty). There was no detectable impact of CPAP on 1-year mortality or 5-year overall survival after adjustment (GRADE: Very low certainty).

Conclusion:
Patients with OSA on the waiting list for solid-organ transplantation and in the subsequent months to years following transplantation can face serious health consequences. Data examining the impact of interventions for sleep apnea, particularly CPAP for OSA, are extremely limited in this population despite the high prevalence of this diagnosis. There is notably minimal data in liver and pancreatic transplant populations, as no studies were identified that met the inclusion criteria. Thus, future studies, notably randomized control trials, should be conducted to assess the tolerability, compliance, and effectiveness of CPAP in this at-risk population. Additional studies should focus on optimizing sleep in solid-organ transplant populations by providing interventions and education that best match individual patient needs, through engagement with patient partners.

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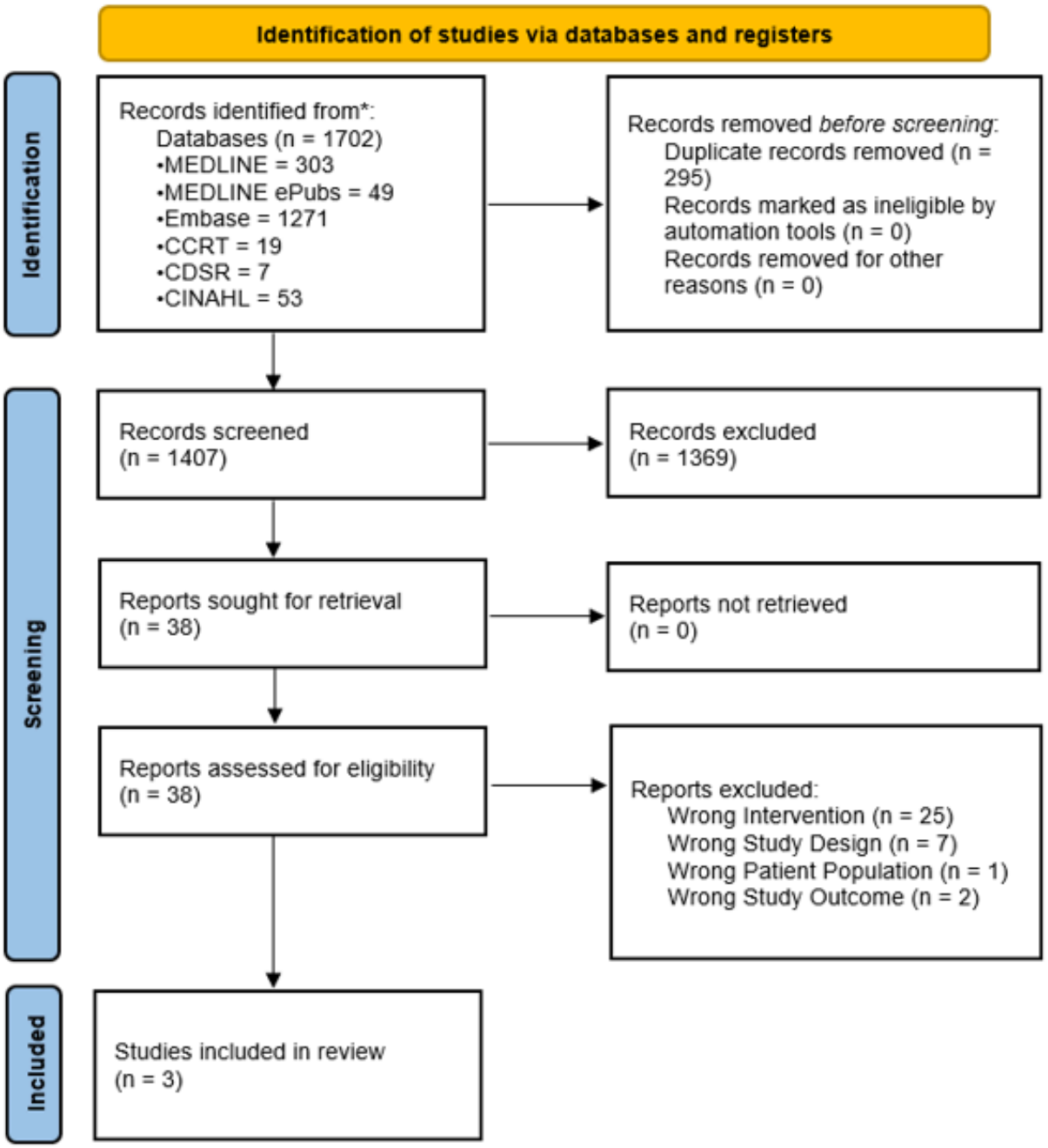
Table 1. Compared to patients with OSA who do not receive treatment, does treatment of OSA with CPAP influence postoperative outcomes in the transplant population?

Comparator Groups	No. of Studies	Study Design	No. of Patients		Effect	Certainty
			Intervention Group	Untreated OSA		
Mortality (3 or More Years Post-Transplant)						
Treated OSA to Untreated	1 (Tiwari)	Non-Randomized	**Treated OSA Only**: 28/217 (13%)	**Untreated OSA**: 15/134 (11%)	Not Estimable	Very Low
Treated OSA or No OSA to Untreated OSA	1 (Afzal)	Non-Randomized	**Treated OSA or No OSA**: 19/117 (16%)	**Untreated OSA**: 3/29 (10%)	Not Estimable	Very Low
Mortality (1 Year Post Transplant)						
Treated OSA or No OSA to Untreated OSA	1 (Afzal)	Non-Randomized	**Treated OSA or No OSA**: 14/117 (12%)	**Untreated OSA**: 2/29 (7%)	Not Estimable	Very Low
Long-Term Graft Dysfunction						
Treated OSA to Untreated	1 (Tiwari)	Non-Randomized	**Treated OSA Only**: 20/217 (10%)	**Untreated OSA**: 12/134 (9%)	Not Estimable;	Very Low
Treated OSA or No OSA to Untreated OSA	1 (Afzal)	Non-Randomized	**Treated OSA or No OSA**: 12/117 (10%)	**Untreated OSA**: 8/29 (28%)	Not Estimable; Comparing untreated OSA to treated or none showed a hazard ratio of 3.2, 95% CI (1.3-7.9) for delayed graft function; Patients with untreated OSA who developed delayed graft function did so more than a year earlier than those who had treated or no OSA (672 [452, 733] days vs. 1,078 [732, 1,088] days post-transplant, p=0.06.	Very Low
Polysomnography Parameters						
Within-patient comparison of PSG parameters before and after nasal CPAP implementation (Patients with OSA, n=11)	1 (Brilakis)	Non-Randomized	• Patients with OSA treated with nasal CPAP had significantly decreased AHI compared to those not using nasal CPAP [10(12) vs. 38 (29)], p=0.013 • Patients with OSA treated with nasal CPAP had significant decreased Arousal Index compared to those not using nasal CPAP [19(8) vs. 45 (25)], p=0.012 • Patients with OSA treated with nasal CPAP had significantly decreased total sleep time with <90% oxygen saturation [2(3) vs. 24 (28)], p=0.016 • Patients treated with nasal CPAP had no difference in Sleep efficiency compared to those not treated [84 %(8) vs. 80% (12)], p=0.24			Very Low

Figure 1. PRISMA Diagram



ABSTRACT 5

The Mechanism of Action of an Innovative Respiratory Stimulant, ENA-001

Errol M Gould, PhD, Thomas Miller, PhD, Jeanette Mathews, MPH, Robert B Raffa, PhD, Joseph V Pergolizzi, Jr, MD, MBA

Respiration, a fundamental physiological process regulated by the brainstem, incorporates inputs from the cortex and peripheral nerves. Chemoreceptors, responsive to various chemical stimuli such as oxygen and carbon dioxide tension, as well as pH, are distributed in the brainstem and peripheral vasculature. Notably, the carotid bodies, located on the type I glomus cells at the carotid artery bifurcation, serve as primary peripheral sensors for hypoxia. These cells transmit signals via the carotid sinus nerve to the nucleus tractus solitarius (NTS) in the brainstem, a pivotal termination site for respiratory-related sensory inputs from the lungs, airways, and peripheral chemoreceptors. The pre-Bötzinger complex, identified as the primary pacemaker for normal respiration in rats, is connected to the NTS. In humans, the stimulation of the respiratory control arc involves the activation of several ion channels (e.g., BK, TASK-1, and TASK-3) within the glomus cells of the carotid body. Interruption of this intricate respiratory control system is a common iatrogenic occurrence in the peri-procedural setting and can be the result of the medical procedure, drug treatments (such as anesthesia and opioids), or underlying diseases like central/sleep apnea or combination of these factors.

The post-procedural setting poses challenges in predicting the onset, duration, and severity of pulmonary complications, with numerous contributing factors like drug sensitivity, pharmacokinetics, and concomitant medications. Patients with additional risk factors, such as advanced age or pre-existing respiratory pathology, are particularly prone to respiratory compromise, necessitating acute intervention and potentially increasing morbidity and mortality. In response to these challenges, ENA-001 is being developed as an innovative intravenous therapeutic agent designed for short to intermediate-term use to stimulate ventilation and address respiratory depression in post-operative patients. Its primary mechanism of action involves the functional inhibition of large-conductance Ca2+ and voltage-activated K+ channels (Maxi-K, BK, BK(Ca2+), KCNMA1, Slo1) in the carotid body, leading to increased minute ventilation primarily through enhanced tidal volume and secondarily through minor increases in respiratory rate. The effect of ENA-001 on BK channels is evidenced by electrophysiology studies, demonstrating reversible, concentration-dependent inhibition of single BK channel activity. Additionally, in glomus cells isolated from rat carotid body, ENA-001 selectively inhibits BK-like K+ current. The beneficial impact on respiration is attributed to the mimicry of hypoxic inhibition of BK channels, promoting depolarization of carotid body type I cells and inducing voltage-gated Ca2+ influx. This cascade results in increased neurotransmitter release, activating sensory afferent discharge to the brainstem via the carotid sinus nerve, ultimately leading to corrective changes in breathing. Experimental evidence further supports the proposed mechanism of action of ENA-001, particularly in rats with carotid sinus nerve transection, which resulted in a significant blunting of the response to ENA-001.

In conclusion, the mechanism of action of ENA-001, independent of opioids and other agents used in the peri-operative environment, is a potentially promising solution for reversing respiratory depressant effects without interfering with the primary pharmacology of analgesic or anesthetic compounds. This novel therapeutic agent holds considerable potential in mitigating respiratory compromise and improving patient outcomes in post-operative settings.

ENA-001, a Novel BK-channel Blocker, Enhances Hypoxic Ventilatory Sensitivity and Mitigates Propofol-induced Respiratory Effects in Healthy Volunteers

Errol Gould1, Laurence Moss2,3, Philip Kremer2,3, Thomas Miller1, Albert Dahan3,

1 Enalare Therapeutics Inc., Princeton, NJ USA
2 Centre for Human Drug Research (CHDR), Leiden, The Netherlands
3 Leiden University Medical Centre (LUMC), Leiden, The Netherlands

During procedural sedation, the risk of respiratory depression and airway obstruction rises due to drug interference with ventilatory control. Predicting the onset, duration, or severity of respiratory events is challenging due to various factors such as individual drug sensitivity, pulmonary and central nervous system dysfunction, underlying diseases, and concomitant medications. Therefore, the appropriate use and management of medications during procedural sedation is crucial to ensure patient safety and optimize recovery outcomes including the adoption of agnostic respiratory stimulants.

ENA-001 is being developed as an agnostic therapy for treating respiratory depression in procedural patients. ENA-001 is a fast acting and short duration intravenous agent that acts by partially blocking BKCa2+ (Maxi K channels) in the carotid body to stimulate respiration. Previous reports have demonstrated the ability of ENA-001 to stimulate ventilation in healthy subjects and significantly counteract ventilation suppression by the opioid alfentanil.

In this randomized, double-blinded, placebo-controlled, three-period crossover phase 1b study, the effect of two intravenous doses of ENA-001 on propofol-induced respiratory depression was investigated in 14 healthy volunteers. Each period involved intravenous infusion of ENA-001 or placebo for 270 minutes (ENA-001 low dose: 33.3 µg.kg-1.min-1 for 10 min followed by a continuous infusion of 6.7 µg.kg-1.min-1 for 260 min; ENA-001 high dose: 33.3 µg.kg-1.min-1 for 20 min followed by a continuous infusion of 18.3 µg.kg–1.min–1 for 250 min). During each period, the loading dose of ENA-001 or placebo was followed by three blocks in which participants received intravenous placebo or propofol in a predetermined order (open label): placebo – propofol low dose – propofol high dose (targeting plasma concentration of 600 and 1200 ng/mL, respectively). During the infusions, Bispectral Index (BIS) and cardiovascular parameters were continuously monitored. The primary endpoint was the acute hypoxic ventilatory response (AHR), assessed during each propofol block at normal and high end-tidal CO2 concentration. Safety parameters were included as secondary endpoints.

ENA-001 high dose significantly increased AHR compared to placebo (the lower dose did not show a significant difference). Propofol inhibited AHR, with an even greater effect on the hypercapnic response. ENA-001 high dose blunted the propofol effect, maintaining AHR comparable to pre-propofol values. There were no differences in BIS between treatment groups, and no serious adverse events occurred during the study. The most common adverse event attributed to ENA-001 was mild infusion site pain. Blood pressure, heart rate, and cardiac index increased during hypoxic measurements, but did not significantly differ versus placebo. Changes in clinical laboratory values and ECG were similar across treatments.
These findings suggest that ENA-001 high dose significantly increases AHR while maintaining a favorable safety profile, even when co-administered with clinically relevant plasma concentrations of propofol. ENA-001 demonstrates potential as a respiratory stimulant in clinical settings, effectively enhancing ventilation without inducing antagonistic effects with other drugs.

Is Time of Day of Total Knee Arthroplasty Surgery Associated with Patients' Sleep During Postoperative Night One?

Authors: Illescas, A.1, Tailor, M.1, Thor, P.1, Lauzadis, J.1,3, Poeran, J.1, Memtsoudis, S.1,2, Kalsi, M.S.1 Jules-Elysee, K.M.1,2

Institutions: 1Department of Anesthesiology, Critical Care, & Pain Management, HSS, 2Department of Anesthesiology, Weill Cornell Medicine, 3Pain Prevention Research Center, Hospital for Special Surgery

Introduction:

Increasing demand for elective total knee arthroplasty (TKA) has prompted providers to schedule surgeries and extend their operating times ever later into the afternoon. It is unclear whether the surgical start time has an impact on the quality of postoperative sleep in patients who undergo surgery later in the day. Postoperative sleep disturbances (POSD) are changes in sleep patterns and overall sleep quality that occur following surgery1. According to the Society of Anesthesia and Sleep Medicine, adequate sleep is essential for rest and recovery following a major surgical procedure and insufficiencies in the duration, quality, or timing have adverse effects2. Patients' sleep quality will vary depending on several factors related to the surgical process, including preoperative activities, the duration of the surgery itself, postoperative care, and the length of time spent in the post-anesthesia care unit (PACU). In this analysis, we explore the impact of surgery start-time on several sleep characteristics.

Methods:

Sleep data during the first post-operative night were obtained from a previous study of 85 patients undergoing elective TKA between 2019-2023 (IRB#2019-1416). All subjects were administered the same regional anesthetic protocol (spinal anesthesia, adductor canal block and IPACK block, and periarticular injection). Participants wore an ActiLife Wgt3x-BT actigraph wrist device starting in the PACU until discharge. Sleep data were collected using the actigraph wrist device to measure sleep-wake patterns and sleep quality for patient sleep cycles between 22:00 and 06:00. A chi-square test assessed whether there were sleep differences between patients undergoing an early (before 11am) versus late (after 11am) surgery start time.

Results:

Overall, 25 and 60 subjects had an early (before 11am) versus late (after 11am) surgery start time, respectively. The gender distribution in each group was early group (male = 15, female = 10) and the late group (male = 24, female = 36). The mean age of both groups was similar: early (M = 62.2) and late (M = 61.6). We found no significant relationship between surgery start time and sleep efficiency, number of sleep cycles, number of awakenings, number of pain medications taken overnight, and procedure time. We found a significant difference in total sleep minutes, with patients in the "late" procedures having more total sleep minutes [late 265.3 versus early 226.0 minutes (median); p=0.0426].

Conclusions:

We found a significant difference in total sleep minutes between early and late start time groups with late procedure patients having longer sleep time. However, we did not find differences in any other sleep measures. While our trial was not powered for these secondary sleep outcomes these findings suggest that surgical start times may affect postoperative sleep measured on the first night after surgery, particularly total sleep time. Whether the effect of residual anesthesia from late start surgery is playing a role is something to be explored. As the number of surgical procedures keeps increasing, in patients concerned with sleep postoperatively, timing of surgery should be considered.

Table 1. Subject Demographics by Surgery Timing

	Early (N=25)	Late (n=60)	P-value
Gender			0.0918
Male	15 (60.0)	24 (40.0)	
Female	10 (40.0)	36 (60.0)	
Mean age (SD)	62.2 (6.1)	61.6 (5.0)	0.6092
Race			0.0333
Asian	3 (12.0)	1 (1.7)	
Black or African American	0 (0.0)	7 (11.7)	
White	22 (88.0)	48 (80.0)	
Other/Decline to Answer	0 (0.0)	4 (6.7)	
Ethnicity			0.1976
Hispanic or Latino	0 (0.0)	4 (6.7)	
Not Hispanic or Latino	25 (100.0)	52 (86.7)	
Unknown/Declined to Answer	0 (0.0)	4 (6.7)	
ASA			0.6535
1	0 (0.0)	1 (1.7)	
2	24 (96.0)	58 (96.7)	
3	0 (0.0)	1 (1.7)	
Missing	1 (4.0)	0 (0.0)	

Table 2. Sleep Quality by Surgery Timing

	Early (n=25)	Late (n=60)	P-value
Total sleep time, minutes	226 [178-263]	265.3 [196-311]	0.0426
Sleep efficiency	88.5 [85.6-91.7]	90.4 [85.4-94.0]	0.2295
Number of sleep cycles	3 [2-4]	3 [2-4]	0.766
Number of awakenings	9 [6-13]	9 [5-12]	0.8283
Medications taken overnight	1 [0-2]	1 [0-1]	0.9068
Procedure time, minutes	87 [77-105]	84.5 [74-95.5]	0.3094

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ABSTRACT 8

Recurrent EEG signatures Associated with Pre-Emergent Induction of Anesthesia Dreams Across Three Anesthesia Propofol Protocols

Authors: J. Lee, T. Ishii, P. Sikka, M. Kawai, B. Heifets, H. Chow*

Introduction:

Depth of anesthesia can be monitored with electroencephalography (EEG). [BH1] While anesthesiologists often use distinct EEG patterns to monitor a patient's depth of anesthesia, the question remains whether the phenomenon of vivid dreams during surgical anesthesia can too be characterized by distinct EEG patterns. The mechanism of anesthesia dreams is still poorly understood. Understanding these patterns can enhance our knowledge of conscious states and improve anesthetic management. We studied patients experiencing anesthetic dreaming under three different pre-emergence protocols associated with anesthesia dreams, seeking to identify common EEG signatures using a 4-lead [2] frontal SedLine monitor.

Materials and Methods:

We conducted a comparative analysis on the EEG of 869 patients undergoing anesthesia induction – among which 554 reported dreaming – with one of the following pre-emergence protocols:

1. Propofol only
2. Propofol-remifentanil (pre-dominant procedure)
3. Propofol-sevoflurane (sevo)

Specifically, we investigated 154 propofol only, 694 propofol-remifentanil, and 21 propofol-sevoflurane surgical patients at Stanford Medical center[BDH3] – primarily under EEG guidance. Of the 154 patients administered with propofol only, 97 patients reported dreaming, and 78 patients were able to recall their dreams. In the propofol-remifentanil group, 444 out of 694 patients reported dreaming and 397 patients were able to recall their dreams. Among the 21 patients who received propofol-sevoflurane, 13 patients reported dreaming, and 7 patients were able to recall their dreams. We followed an institution-based anesthetic (Total IntraVenous Anesthesia or TIVA) medication protocol based on the intra-operative infusion of propofol only and propofol and remifentanil – methods requiring titrated intravenous infusion. Each patient's EEG was recorded using a 4-lead[4] frontal SedLine monitor. We attempted to achieve and maintain a pre-emergent anesthetic state using the TIVA-based anesthetic titration for at least 5 minutes with the help of EEG guidance. Patients awoke from anesthesia either by spontaneously opening their eyes or were awoken by the anesthesiologists when their frontal EEG indicated emergence from anesthesia. We focused on identifying specific EEG[BDH5] signatures that were indicative of the transition from unconsciousness to wakefulness and associated dream states during anesthesia.

Results:

Across all three anesthesia protocols, we commonly observed consistent EEG patterns[6] at the pre-emergence state characterized by:

- Delta Band Fade: A gradual reduction of low-frequency delta waves preceding alpha band fade. [7]
- Alpha Band Fade: A gradual reduction in alpha band activity following delta band fade.
- Beta Band [BDH8] Emergence: A subsequent increase in beta band activity on the spectrogram.

These findings were consistently [BDH9] noted in the pre-emergence anesthesia spectrograms of patients induced with Propofol only, Propofol-remifentanil, and Propofol-sevoflurane. Moreover, there was no significant marker that differentiated one induction method from the others.

Conclusions:
The study demonstrates that there exist common EEG signatures associated with the pre-emergent induction of anesthesia dreams – specifically the decrease in delta band power, and the alpha band fade followed by beta band emergence[10] – that are common across different anesthetic protocols involving Propofol. The consistency in EEG patterns could serve as a reliable biomarker for monitoring anesthesia-induced dream states.

Our findings suggest that there may be a common neural mechanism underlying the induction of anesthesia dreams irrespective of the anesthetic combination used or surgical procedure performed. Further clinical research and experience should be encouraged to explore the implications of these findings to enhance the study of anesthesia dreams and patient care.

ABSTRACT 9

The Reliability of BIS and qCON Monitors During Drug-Induced Sleep Endoscopy in Obstructive Sleep Apnea Syndrome

Authors:
MincolelliG1(mincolellig@gmail.com),AltamuraS1(sabrina.altamura@icloud.com),MarchelloE1(vincenzomarchello@libero.it),VerziccoA2(andreaverzicco64@gmail.com),PianoG3(giuseppe.piano@operapadrepio.it),D'EcclesiaA2(aureliodecclesia@alice.it),AmorusoL4(l.amoruso@operapadrepio.it),CassanoL2(l.cassano@operapadrepio.it),CopettiM5(m.copetti@operapadrepio.it),IzziA1(antonioizzi1201@gmail.com),BarileA1(a.barile88@gmail.com),RecchiaA1(a.recchia@operapadrepio.it) , Manuali A1 (a.manulai@operapadrepio.it), De Vincentis G3(g.devincentis@operapdprepio.it).

1. Department of anesthesia and intensive care II , Irccs Casa Sollievo Sofferenza , San Giovanni Rotondo , Foggia, Italy
2. Department of Maxillofacial surgery and Otolaryngology, Irccs Casa Sollievo Sofferenza , San Giovanni Rotondo , Foggia, Italy
3. Health department, Irccs Casa Sollievo Sofferenza , San Giovanni Rotondo , Foggia, Italy
4. Unit of Neurology, Irccs Casa Sollievo Sofferenza , San Giovanni Rotondo , Foggia, Italy
5. Unit of Biostatistics, Irccs Casa Sollievo Sofferenza , San Giovanni Rotondo , Foggia, Italy

Introduction

- Obstructive sleep apnea syndrome (OSAS) is a prevalent condition associated with cardiovascular disorders, cognitive dysfunction, and increased mortality1.
- Drug-induced sleep endoscopy (DISE) enables direct visualization of the upper airway during sleep, which is crucial for surgical planning in OSAS patients2.
- Accurate monitoring of sedation depth is essential during DISE to ensure patient safety.
- This study evaluated the reliability of the BIS and qCON monitors in monitoring sedation depth during DISE, in comparison to electroencephalographic (EEG) analysis-3-4-5.

Methods

- 20 patients with moderate-to-severe OSAS underwent DISE with propofol sedation with Targed control infusion (Schnider model-site effect)
- Patients were divided into two groups: the BIS group (n=10) and the qCON group (n=10) (Tab. 1).
- BIS, qCON, and EEG parameters were recorded at specific time points during the procedure: T0, T1, T2, T3, Tapn (apneic time)2..Before initiating the drug infusion, we record the basal time (T0). The intravenous Propofol administration is started and the concentration is gradually increased until the sedation level reaches < 3 on the OAAS scale. The evaluation of the EEG parameters and the BIS/CONOX value is carried out at five minutes (T1), ten minutes (T2), and 15 minutes (T3) from the start of the infusion. The time of apnea (Tapn) is also noted. After the endoscopic examination to assess the site and severity of obstruction according to the VOTE system, the intravenous Propofol delivery is stopped to allow the patient to wake up. Subsequently, the patient is transferred to the post-anesthesia care unit (PACU) for observation and discharge.
- EEG data was analyzed for power spectral density and fast Fourier transformation(Fig. 6-9)

Results

- Patients in the BIS group exhibited a wider range of BIS values (60-91) compared to qCON values (61-80) at loss of consciousness.(Fig 1-5) (Tab 2-3)
- EEG frequencies corresponding to BIS values ranged from 1.8-16 Hz, while qCON values corresponded to 10.5-23.5 Hz.
- 70% of patients in the BIS group reached target sedation at 5 minutes, while 70% in the qCON group reached it at 10 minutes.
- During apnea, qCON values were lower than BIS, but EEG frequencies ranged more widely from delta to beta waves.

Discussion/Conclusions

• EEG monitoring of sedation or anaesthesia necessitates a deep understanding of the medications employed, their target receptors, and the specific neural pathways they engage within the central nervous system. This knowledge is of the highest importance for the adept management of sedation3.
• Patients with obstructive sleep apnea (OSA) may have varied responses to hypnotic medications. While pEEG monitoring is useful for brain monitoring during hypnosis anesthesia, its accuracy in sedating OSAS patients is uncertain2-3.
• The Integration of pEEG responses with advanced monitoring like EEG presents a promising avenue for determining the appropriate sedation level during Drug-Induced Sleep Endoscopy (DISE)2.
• The qCON monitor may be a more reliable tool for monitoring sedation depth in OSAS patients undergoing DISE.
• The need for further research with larger sample sizes is urgent and crucial to validate these findings and advance our understanding of sedation management.

Keywords: Obstructive sleep apnea syndrome, drug-induced sleep endoscopy, BIS, qCON, electroencephalography

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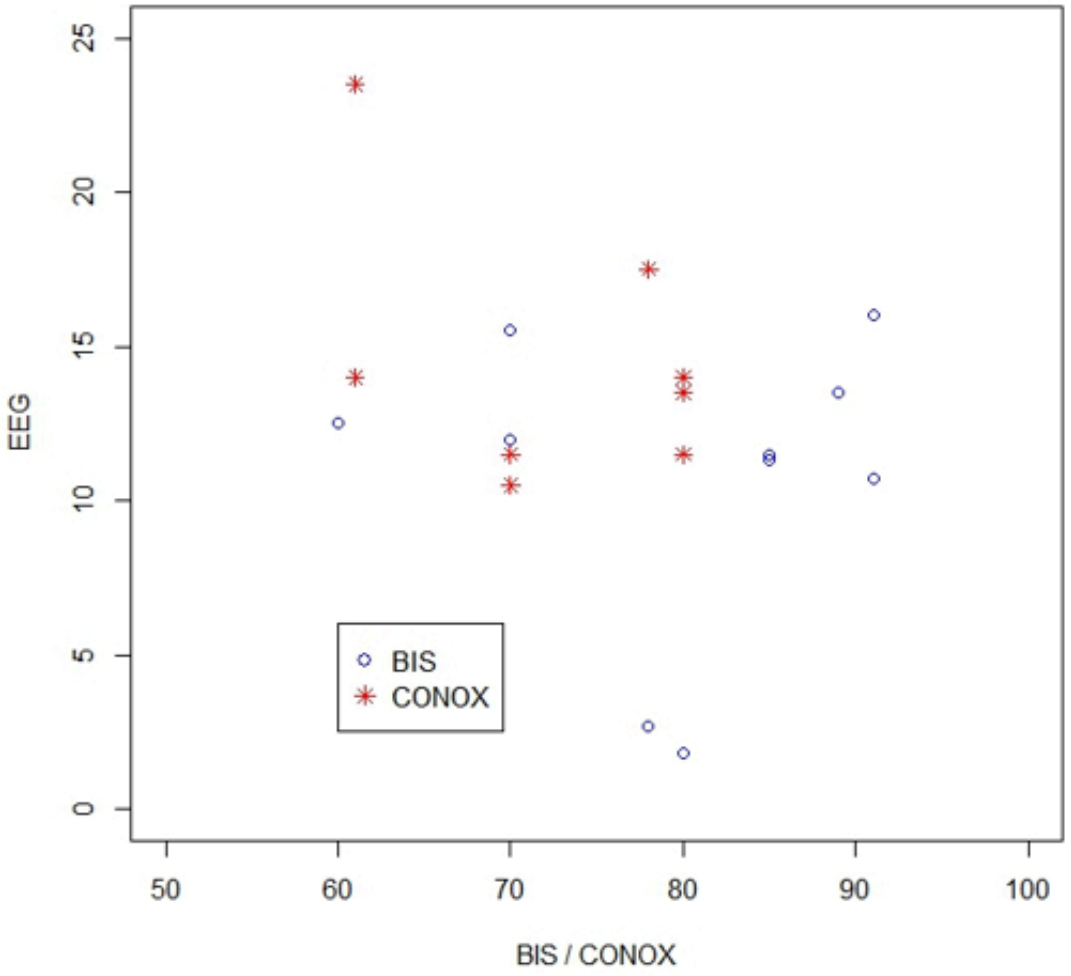
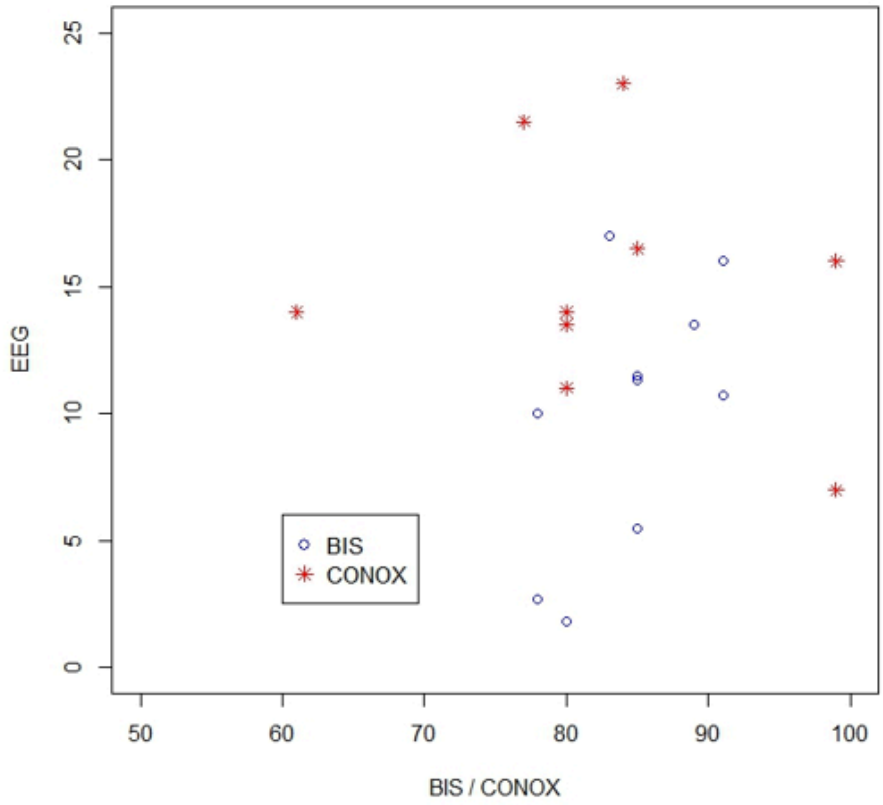


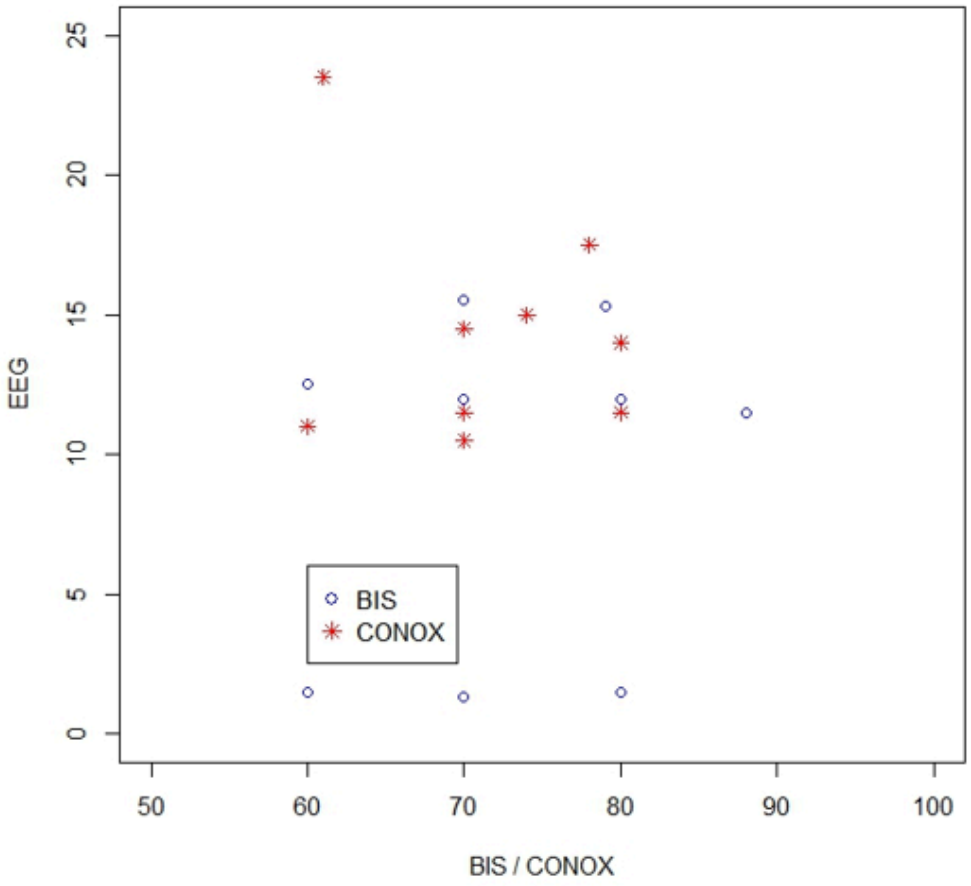
SCATTEERPLOT

Fig. 1 BIS Vs CONOX AND EEG VALUES OF ALL PATIENTS ENROLLED AT THE TIME OF LOSS OF CONSCIOUSNESS (OAA/S 3) (each point corresponds to a patient included in the study, lower numbers are related to the presence of patients with the same values of EEG indices and frequency.)



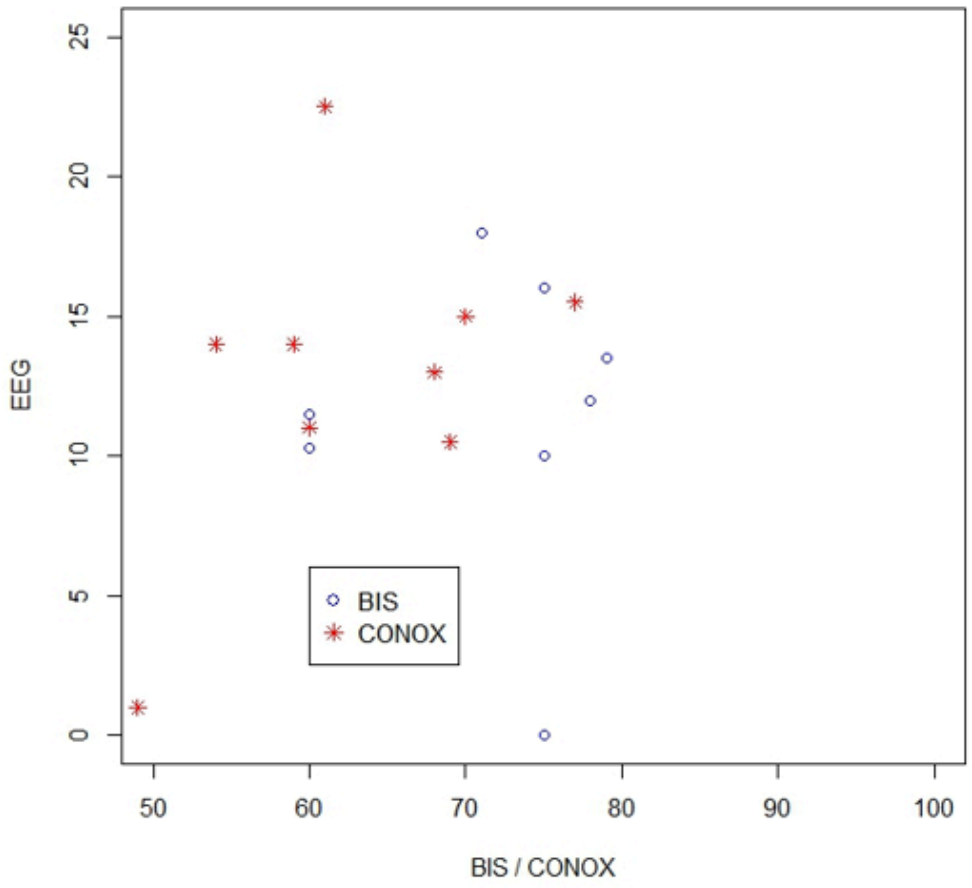
SCATTERPLOT at T1

Fig 2 At time 1 70% of patients monitored with BIS had reached the loss of consciousness, therefore with a value between 80 and 90, while patients monitored with qCON had reached only 30% LOC, In fact we can highlight values that oscillate between values of 100 and a single patient with a qCON of 60.



SCATTERPLOT at T2

Fig 3 At time T2, 100% of patients in both groups achieved LOC. We can also observe in this graph a more comprehensive range of BIS values than the qCONs, which are increasingly concentrated in the 60-80 range



SCATTERPLOT T3

Fig.4 At time T3, the patients have all reached the LOC, and the indices stabilize in the sedation range. Both the BIS and CONOX values remain in the range 60-80, with an EEG prevalence of frequencies between 10 and 16, therefore alpha and alpha spindle waves.

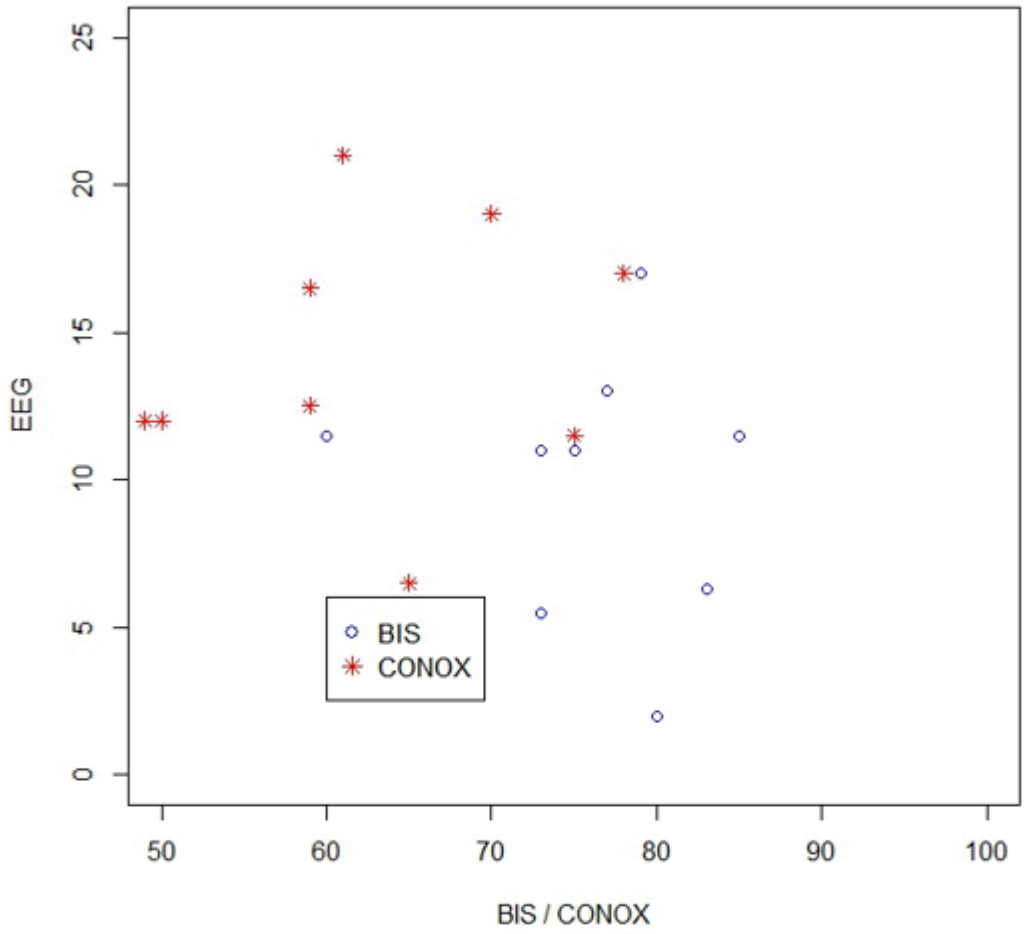


Fig.5 At the time of apnea we observe lower values of qCON than the values of BIS even if all remain below the value of 90 but a corresponding value of frequency EEGgraphic in a range between delta and beta.

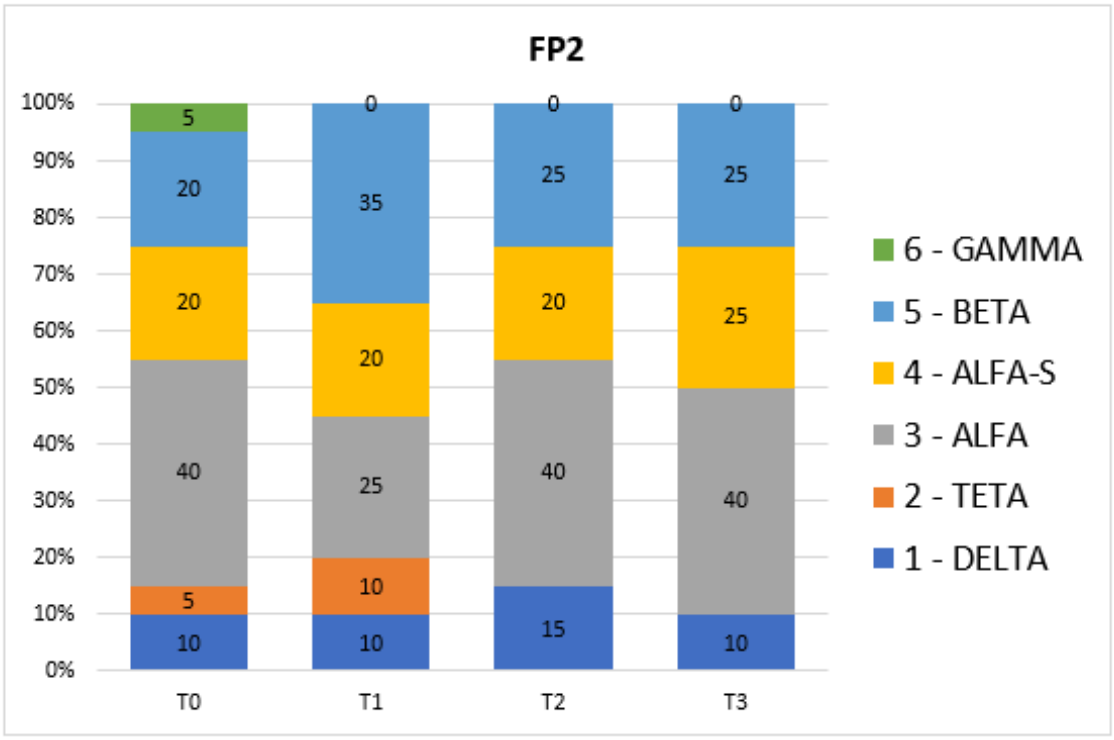


Fig.6 % eeg waves in Fp2 right

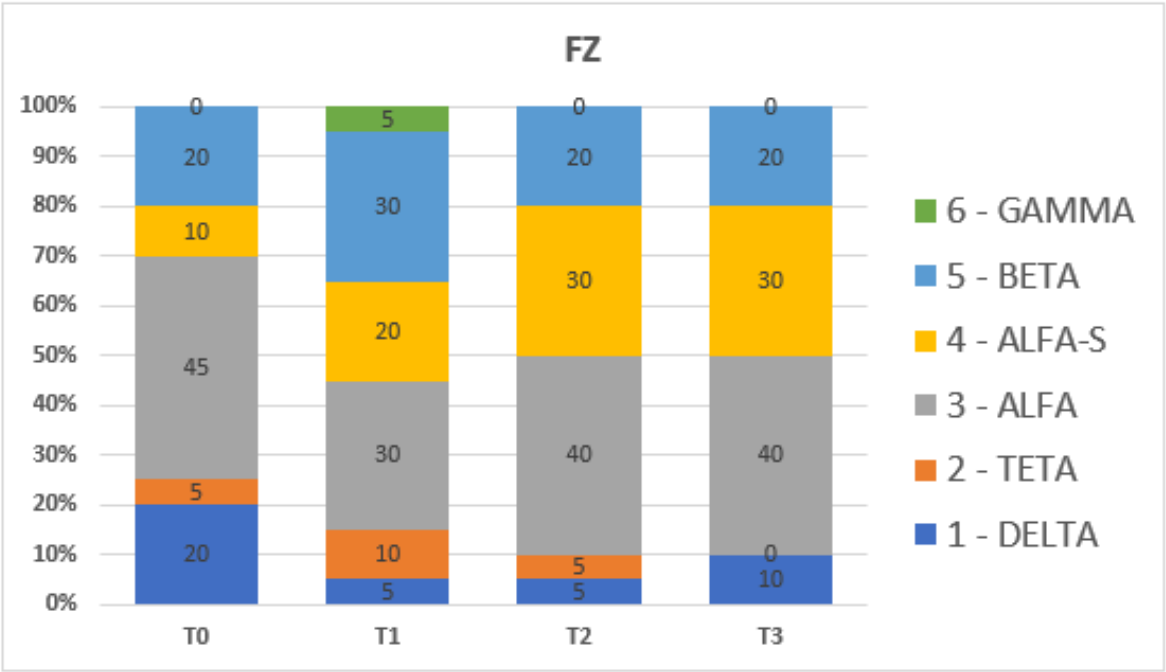


Fig.7 % eeg waves in Fz

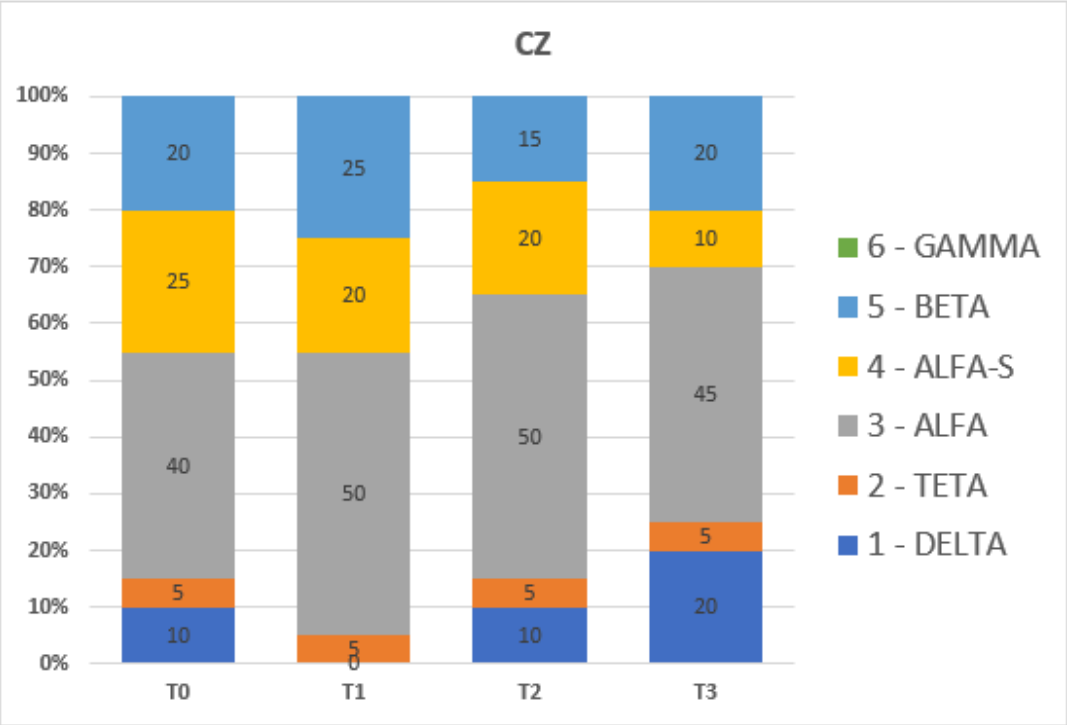


Fig. 8 % eeg waves registrate Cz

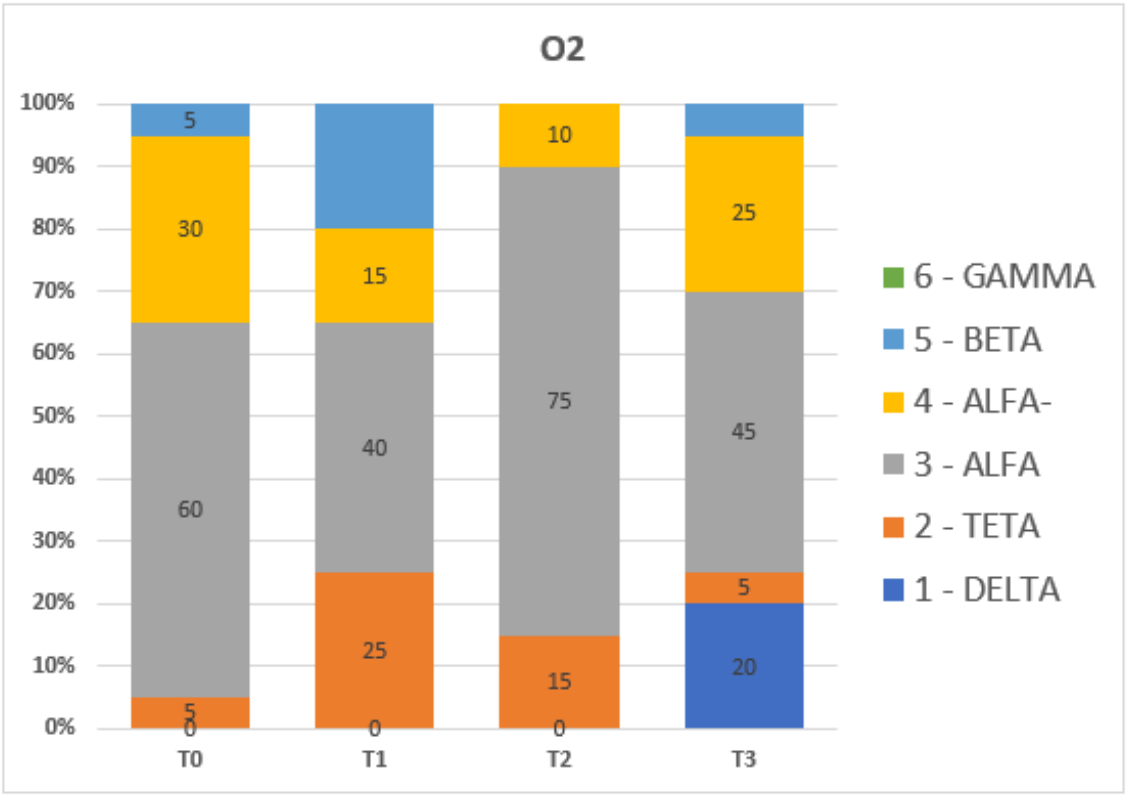


Fig 9 % eeg waves O2 .

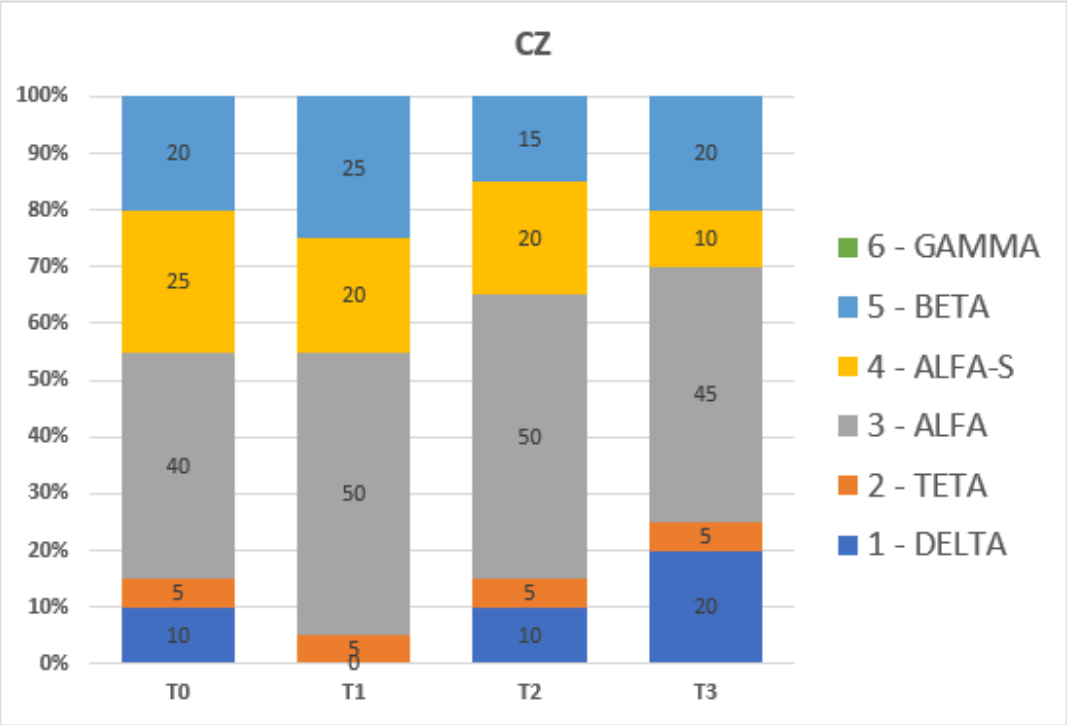


Fig. 8 % eeg waves registrate Cz

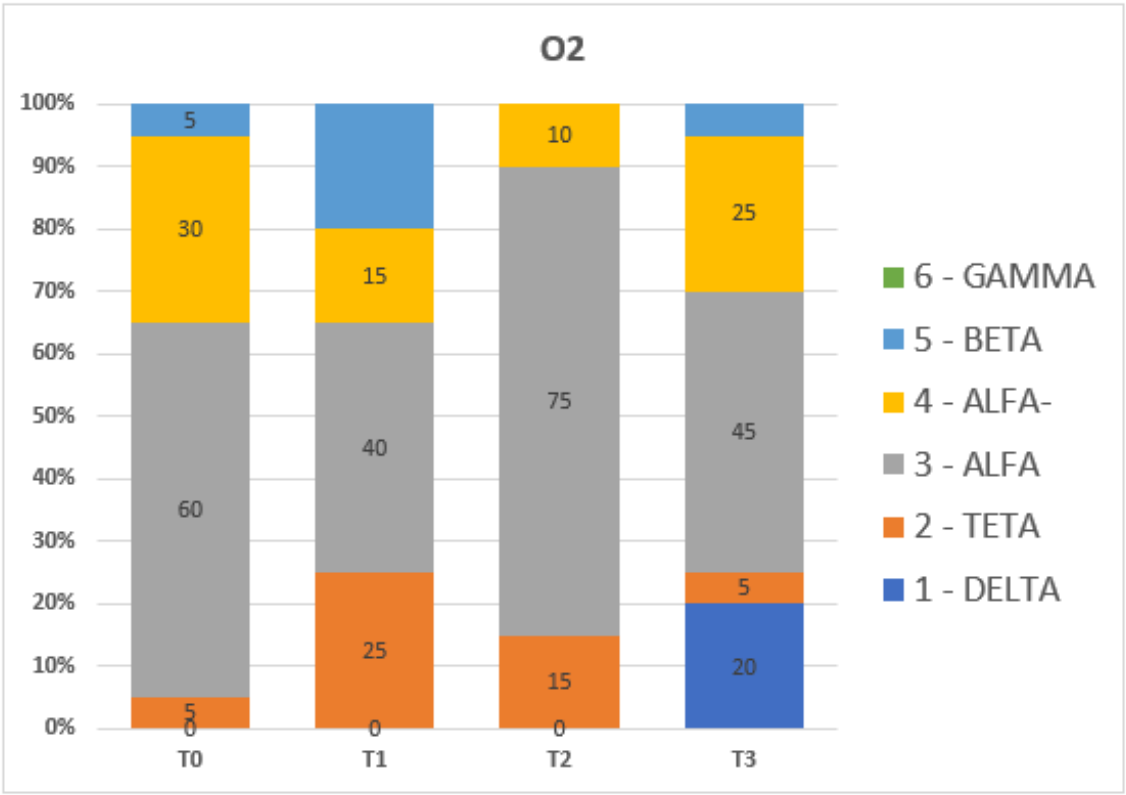


Fig 9 % eeg waves O2 .

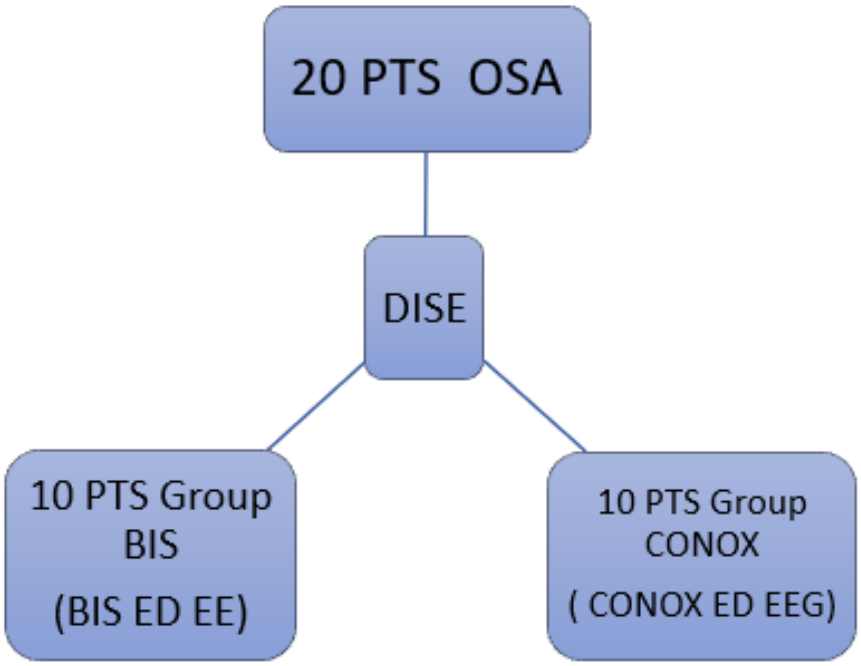


Table1 patients included in the study

		MEAN (STDEV)		
		BIS	**CONOX**	**p-value**
n		10	10	
AGE_(mean (sd))		59.50 (11.00)	56.80 (11.91)	0,605
Weight_kg (mean (sd))		83.00 (8.72)	78.50 (8.06)	0,246
Height _ cm (mean (sd))		171.00 (5.44)	168.40 (8.00)	0,407
BMI (mean (sd))		28.70 (3.50)	27.47 (3.86)	0,465
Hypertension_1_Yes_2_No_(%)	1	8 (80)	7 (70)	1
	2	2 (20)	2 (30)	
Diabetes_1_Yes_2_No_(%)	1	2 (20)	1 (10)	1
	2	8 (80)	9 (90)	
Carotid intima media thickness_1_Yes_2_No_(%)	1	1 (10)	2 (20)	1
	2	9 (90)	8 (80)	
Mallampati(%)	1	2 (20)	1 (10)	
	2	6 (60)	4 (40)	
	3	1 (10)	3 (30)	
	4	1 (10)	1 (10)	
ASA_score (%)	2	5 (50.0)	1 (10)	
	3	5 (50.0)	9 (90)	
AHI(mean (sd))		25.59 (8.78)	25.31 (10.09)	0,929
EPWORTH_Scale(mean (sd))		8.10 (4.20)	9.70 (4.24)	0,408
CPAP Therapy_1_Yes_2_No_(%)	1	2 (20)	1 (10)	1
	2	8 (80)	9 (90)	

Table2 demographic data

		MEAN (STDEV)		
		BIS	**CONOX**	**p-value**
n		10	10	
Time procedure (mean (sd))		22.60 (4.12)	19.90 (9.59)	0,424
TOT_Propofol_mg (mean (sd))		159.90 (64.20)	146.17 (77.81)	0,672
Lower_SPO2_ (%)		62.30 (8.47)	69.10 (13.31)	0,19
Lower_BIS_ (mean (sd))		60.90 (13.80)		
Lower_CONOX_ (mean (sd))			62.70 (12.13)	
Apnea_Time (%)	T1	7(70.0)	3(30.0)	0,18
	T2	3(30.0)	7(70.0)	

Table3

Preoperative CPAP Use Is Associated with Improved Outcomes in Patients with Obstructive Sleep Apnea Undergoing Orthopedic Surgery

Authors and Institutions: Jashvant Poeran MD PhD1, Haoyan Zhong MPA1, Alex Illescas MPH1, Lisa Reisinger MD1,2, Crispiana Cozowicz MD1,2, Periklis Giannakis MD1, Jiabin Liu MD PhD1, Stavros G. Memtsoudis MD PhD MBA1,2,3

1Department of Anesthesiology, Critical Care and Pain Management, Hospital for Special Surgery, New York NY

2Department of Anesthesiology, Perioperative Medicine and Intensive Care Medicine, Paracelsus Medical University, Salzburg, Austria

3Department of Anesthesiology / Department of Healthcare Policy and Research, Weill Cornell Medical College, New York, NY

Introduction: Obstructive sleep apnea (OSA) is associated with elevated complication risk among patients undergoing surgery, including high-volume procedures such as total hip or knee joint arthroplasty (TJA). While guidelines support preoperative initiation of continuous positive airway pressure (CPAP) therapy, it is unclear how prevalent this is and to what extent this modifies perioperative outcomes. Such data are especially prudent given the shift from inpatient to outpatient TJA surgery as the latter may prohibit adequate monitoring of patients for perioperative adverse outcomes. Therefore, we assessed whether preoperative use of CPAP among OSA patients was associated with improved outcomes compared to OSA patients without preoperative CPAP therapy.

Methods: This retrospective cohort study was deemed exempt from full review by our IRB given the deidentified nature of the data used. From the Merative MarketScan national claims data (representing patients and their dependents with employer-sponsored healthcare coverage) we extracted cases of outpatient hip and knee TJAs performed between 2018 and 2022. The main outcomes of interest were a visit to the emergency department (ED) within 1 day or 1 week after discharge (as a proxy for a post-discharge complication). The main effects of interest were yes/no OSA and yes/no preoperative CPAP use (defined by billing information). Three comparisons were made in multivariable mixed-effects regression models: 1) patients with OSA and preoperative CPAP use compared to patients with OSA and no preoperative CPAP use (OSA+/CPAP+ versus OSA+/CPAP-), 2) patients with OSA and no preoperative CPAP use compared to patients without OSA (OSA+/CPAP- versus OSA-), and 3) patients with OSA and preoperative CPAP use compared to patients without OSA (OSA+/CPAP+ versus OSA-). We report odds ratios (OR) and 95% confidence intervals (CI).

Results: Overall, n=123,349 (36.6% hips and 63.4% knees) TJAs were included of which n=23,923 were classified as those with OSA (53.2% and 46.8% with and without preoperative CPAP use, respectively). Among the OSA-, OSA+/CPAP+, and OSA+/CPAP- cases, incidence of 1-day ED visits was 2.0% (n=1,997), 2.0% (n=226), and 2.6% (n=331). After adjustment for relevant covariates, these patterns persisted in the three main comparisons: 1) OSA+/CPAP+ versus OSA+/CPAP- OR 0.77 CI 0.65-0.92 (p=0.003), 2) OSA+/CPAP- versus OSA- OR 1.30 CI 1.16-1.46 (p<0.001), and 3) OSA+/CPAP+ versus OSA- OR 1.01 CI 0.88-1.16 (p=0.932). Similar directions of results were seen for the outcome of ED visits within 1-week of surgery.

Discussion/Conclusion: While OSA without preoperative CPAP use is associated with increased odds of post-TJA ED visits (as a proxy for complications), the preoperative use of CPAP appears to modify this risk to the extent that there is no difference between patients with OSA (and CPAP use) and those without OSA. These findings are in support of the current guidelines but do warrant caution among same-day surgery patients with OSA that are not on CPAP preoperatively.

Support: This study was supported by the Research and Education Fund of the Department of Anesthesiology, Critical Care and Pain Management, Hospital for Special Surgery, New York NY

References: N/A

Tables, Figures: N/A

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Care-Related Activities and Impact on Sleep Disturbances in Total Knee Arthroplasty Patients During the First Postoperative Night

Authors: Tailor, M.1, Thor, P.1, Illescas, A.1, Lauzadis, J.1,3, Poeran, J.1, Memtsoudis, S.1,2, Kalsi, M.S.1 Jules-Elysee, K.M.1,2

Institutions: 1Department of Anesthesiology, Critical Care, & Pain Management, HSS, 2Department of Anesthesiology, Weill Cornell Medicine, 3Pain Prevention Research Center, Hospital for Special Surgery

Introduction:

Following surgery, the greatest level of pain and discomfort is usually observed in patients within the initial 24-48 hours. As a result, patients are visited multiple times during their hospital stay for postoperative care activities such as monitoring vital signs, administering analgesics, and evaluating wound healing. While these activities are essential to ensuring a complete recovery, they can disturb the patient's rest and overall recovery. This may be particularly true in major orthopedic procedures, such as total knee arthroplasty (TKA) as these are painful procedures and often require opioids and other analgesic medications to alleviate post-operative pain. Providers must carefully balance patients' need for sleep and recuperation against disturbances due to required care that may impact the patient's overall experience and outcomes. Understanding how these factors impact patients' sleep during the first night after surgery is crucial for optimizing patient health and recovery outcomes. This analysis provides a descriptive look at TKA patients' sleep characteristics during their first postoperative night.

Methods:

114 TKA patients were recruited from a single institution (IRB #2019-1416) starting in March 2021 and ending in October 2023. In the PACU, patients were connected to the ActiLife Wgt3x-BT actigraph wrist device used to measure sleep-wake patterns and sleep quality for overnight sleep cycles (between 22:00 and 06:00). In total, 85 inpatient subjects who stayed at least one night in the hospital were included in this analysis. We provide descriptive results for several sleep characteristics such as number of sleep cycles, sleep efficiency, total sleep time, number of awakenings, and number of times awoken for medications during the overnight hours.

Results:

Among 85 patients assessed, we found that patients had a median of 3 [interquartile range, IQR: 2-4] sleep cycles during the overnight hours. Median sleep time was 247 [IQR: 186-306] minutes and the median minutes in bed was 276 [IQR: 219-329]. The median sleep efficiency, based on a scale of 0-100, was 89.5 [IQR: 85.6-93.4]. The median number of awakenings per night was 9 [IQR: 5-12], where 1 [IQR: 0-2] were awakenings for medication use (Table 2).

Conclusions:

Aside from being woken up to take medication, patients experienced repeated awakenings and only had a brief amount of sleep between the hours of 22:00 and 6:00 on the first night of their surgery. Previous studies have identified pain as the main cause of sleep disturbances; however, our study points towards additional environmental culprits such as nursing interventions, noise from shared recovery rooms, acute health issues, housekeeping and room services. Future studies should focus on balancing the importance of these potential disruptors against the positive impact of quality sleep on the recovery process.

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Table 1. Subject Demographics

Gender	N=85
Male	39 (45.9)
Female	46 (54.1)
Age, Mean (SD)	61.7 (5.4)
Race	
Asian	4 (4.7)
Black or African American	7 (8.2)
White	70 (82.3)
Other/Decline to Answer	4 (4.7)
Ethnicity	
Hispanic or Latino	4 (4.7)
Not Hispanic or Latino	77 (90.6)
Unknown/Declined to Answer	4 (4.7)
ASA	
1	1 (1.2)
2	82 (96.5)
3	1 (1.2)
Missing	1 (1.2)

Table 2. Sleep Data on Postoperative Night 1

Variables	N=85 Median [IQR]
Number of sleep cycles	3 [2-4]
Total sleep time, minutes	247 [186-306]
Total minutes in bed	276 [219-329]
Sleep efficiency	89.5 [85.6-93.4]
Number of awakenings	9 [5-12]
Number of awakenings (for medications intake only)	1 [0-2]

Acute pain management in patients with Severe-Obesity and Obstructive Sleep Apnea

S. Talab, A.S. Budiansky, M. Eissa, N. Eipe.
Department of Anesthesiology and Pain Management, University of Ottawa.

Abstract

Introduction:

The prevalence of Obstructive Sleep Apnea(OSA) in patients undergoing elective surgery is high(almost 20%)and can be up to 70% in certain populations(e.g.bariatric surgical patients).1 As obesity in Canada has risen from 21% in 2003 to nearly 30% in 2022,2 more surgeries now involve patient with obesity and OSA.

OSA-related perioperative complications have been well-documented, and these may potentially lead to increased resource utilization, health care costs, and malpractice lawsuits.3

Conventional pain management, which is typically and traditionally, predominantly opioid-based, can lead to respiratory depression, resulting in worsening OSA postoperatively, which can translate into an increased risk of postoperative cardiopulmonary complications such as airway obstruction, respiratory failure requiring resuscitation, atrial fibrillation, cardiac arrest and anoxic brain injury.4–6

Methodology:

In this review we provide an update on currently available acute pain management strategies in surgical patients with severe-obesity and OSA as well as present recommendations based on the available evidence.

Results:

Interventions for more effective and safe management of pain after surgery should begin in the pre-operative period and extend to intraoperative and postoperative period(Fig.1).7,8 Preoperative screening, and evaluation is very important with patients with severe-obesity and OSA who are at risk of persistent pain after surgery should be identified and referred to pain specialists if possible.9 Patients' education can also help to improve perioperative pain management by helping the patients set realistic expectations for their postoperative course. Expert consensus guidelines on perioperative use of opioids in the UK recommend reducing preoperative anxiety and catastrophizing through counselling to improve postsurgical outcomes.10

Moreover, engagement and empowerment are more recent aspects of preoperative preparation that aim to have patients actively involved in their own perioperative care with the potential to improve the outcomes from pain management.11

Multimodal analgesia and opioid sparing techniques should be considered. The commonly used perioperative pain modalities in patients with severe-obesity and OSA should follow a stepwise, severity-based, opioid-sparing approach include Paracetamol, NSAIDS, Dexmedetomidine, Lidocaine, Gabapentinoids, Ketamine, Magnesium, Dexamethasone and Regional and neuraxial analgesia.8,12 Opioid analgesics have an important role in acute pain management after surgery. They are acceptable for patients with severe-obesity with appropriate precautions. The 2015 perioperative guidelines by the Association of Anaesthetists of Great Britain & Ireland and the Society for Obesity and Bariatric Anaesthesia(AAGBI/SOBA)recommends that lean body weight(LBW) should be used for opioid dosing in patients with obesity.13

Even when dosing longer acting opioids based on LBW, it is still necessary to closely monitor these patients, specifically for developing hypercapnia, and level-2 care may be indicated.12

Ultimately, selecting an appropriate acute pain treatment regimen in patients with severe-obesity should be based on the characteristics of the surgery, the patient and the severity and character of their pain(Fig.2).8

Conclusions:

Acute pain management in patients with severe-obesity and OSA can be improved with increased focus on preoperative optimisation combined with standardisation of protocols. Multimodal analgesia strategies based on a step-wise, severity-based, opioid-sparing approach can improve patient safety and outcomes. These protocols should be standardized and implemented in the perioperative care of patients with severe-obesity and OSA.

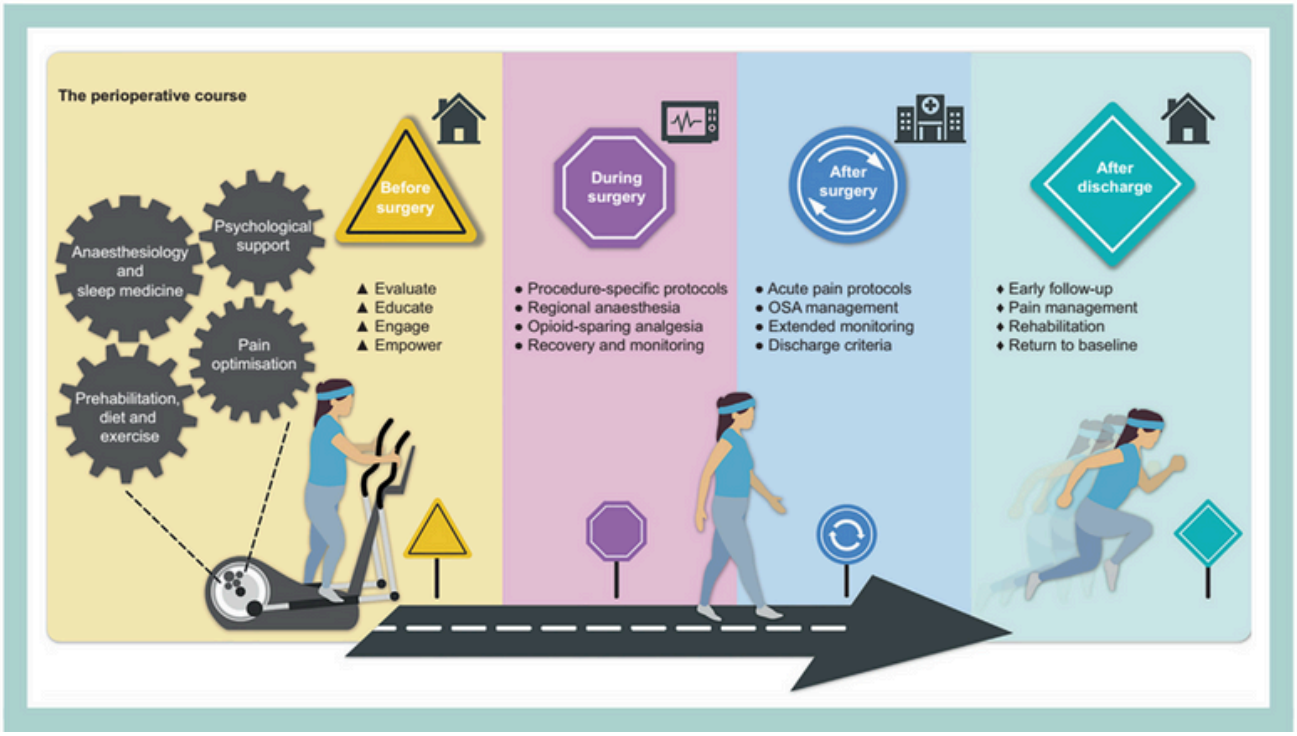

Fig 1. The perioperative course. Improving the safety and out-comes of acute pain management in patients with severe obesity and OSA begins with preparation and optimisation before surgery. Standardised evidence-based analgesic protocols are required for the intraoperative period followed by appropriate monitoring and discharge criteria. Adequate follow-up can ensure return to baseline function after discharge. OSA: obstructive sleep apnea. (reproduced with permission from Budiansky and Eipe, 2024) Illustration by Perry Ng.

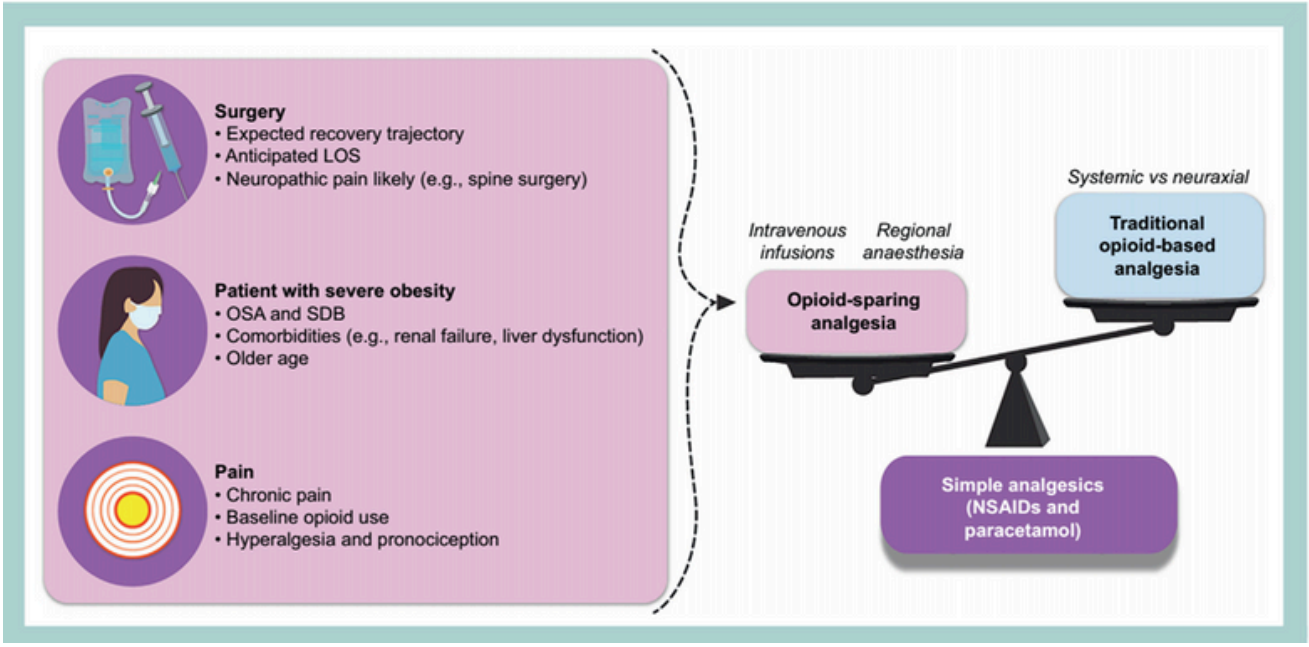

Fig 2. Rational of acute pain management in patients with severe obesity and OSA. Selection of an appropriate acute pain treatment regimen in patients with severe obesity and OSA should be based on the characteristics of the surgery, patient's comorbidities and the pain. LOS: length of stay, NSAIDS: non-steroidal anti-inflammatory drugs, OSA: obstructive sleep apnea, SDB: sleep disordered breathing. (reproduced with permission from Budiansky and Eipe, 2024) Illustration by Perry Ng.

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Actigraphy-Based Assessment of Sleep Patterns in Total Knee Arthroplasty Patients Administered Dronabinol

Authors: Thor, P.1, Illescas, A.1, Tailor, M.1, Lauzadis, J.1,3, Poeran, J.1, Memtsoudis, S.1,2, Kalsi, M.S.1 Jules-Elysee, K.M.1,2

Institutions: 1Department of Anesthesiology, Critical Care, & Pain Management, HSS, 2Department of Anesthesiology, Weill Cornell Medicine, 3Pain Prevention Research Center, Hospital for Special Surgery

Introduction:

Exposure to surgery, including common procedures such as total knee arthroplasty (TKA), can disturb the natural sleep-wake cycle and negatively affect sleep quality, particularly in the direct postoperative period.1 The extent of this disturbance has not been sufficiently quantified, and it is unclear to what extent novel therapeutics such as cannabinoids can alleviate this. In this context, actigraphy can improve accuracy of sleep data collection as it is a non-invasive method for assessing sleep quality and sleep-wake patterns over prolonged periods. Moreover, there has been substantial interest in the perioperative use of cannabinoid products such as dronabinol as it has been found to target neuropathic pain and the apnea/ hypopnea index in patients with obstructive sleep apnea2. Our objective was to determine whether dronabinol (compared to placebo) was associated with improved (actigraphy-measured) sleep patterns after TKA.

Methods:

This randomized clinical trial was approved by our IRB (#2019-1416) and registered on clinicaltrials.gov (NCT04734080). A total of 114 subjects planned for TKA were randomized between March 2021 and October 2023 to either the placebo or the dronabinol group. Both groups received neuraxial anesthesia with both adductor canal block and IPACK (infiltration between popliteal artery and posterior capsule of the knee) along with a standardized multimodal pain management regimen. Subjects were connected to a wearable ActiLife wGT3X-BT wrist device in the post-anesthesia care unit (PACU) (Figure 1) which remained attached for the first 24-28 hours postoperatively. Sleep data used in this analysis were gathered as secondary outcome variables in a larger prospective randomized controlled trial.

Results:

Baseline demographics and surgical characteristics were evenly distributed between the two groups (Table 1). The median duration of sleep (in minutes) during the major sleep period (total sleep time; TST) was 596 minutes for the control and 570 minutes for the dronabinol (Table 2). The proportion of time (in minutes) the patient is asleep during the total time in bed (sleep efficiency; SE) was 89.0 minutes for control and 88.2 minutes for dronabinol (Table 2). Oxygen desaturation events between the two groups showed no difference. The ActiLife monitor did not identify significant differences in sleep quality (sleep efficiency and wake after sleep onset) between the groups.

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Conclusions:
There were no differences in sleep patterns between dronabinol and placebo in patients undergoing TKA within the first 24-28 hours after surgery. The use of a standardized multimodal perioperative pain protocol may have influenced our patients' sleep patterns. Further studies extending sleep observation beyond resolution of nerve blocks, after opioid cessation, different anesthesia, and additional surgery subtypes are needed

Figure 1. Actigraphy Timeline

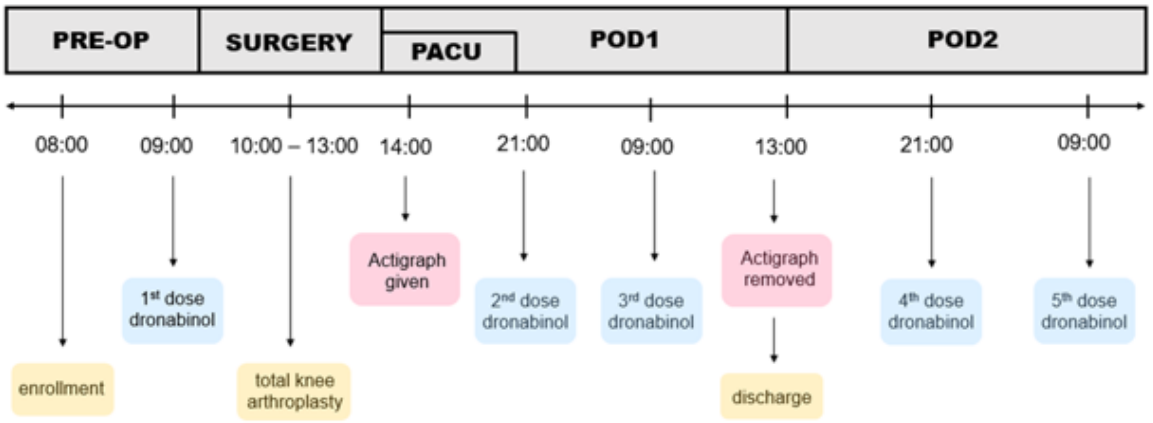

Table 1. Subject Demographics

	Control (n=49)	Dronabinol (n=49)
Gender		
Male	26 (53.1)	19 (38.9)
Female	23 (47.0)	30 (61.2)
Mean age (SD)	61.7 (5.1)	61.2 (6.0)
Race		
Asian	1 (2.0)	3 (6.1)
Black or African American	2 (4.1)	5 (10.2)
White	43 (87.8)	39 (79.6)
Other/Decline to Answer	3 (6.1)	2 (4.1)
Ethnicity		
Hispanic or Latino	3 (6.1)	3 (6.1)
Not Hispanic or Latino	45 (91.8)	43 (87.8)
Unknown/Declined to Answer	1 (2.0)	3 (6.1)
ASA		
1	1 (2.1)	0 (0.0)
2	45 (93.8)	49 (100.0)
3	2 (4.2)	0 (0.0)
Missing	1 (2.0)	0 (0.0)

Table 2. Actigraphy Sleep Outcomes by Group

	Control (n=49)	Dronabinol (n=49)	P-value
Total sleep time, minutes	596 [363-1024]	570 [432-732]	0.6351
Sleep efficiency	89 [86.1-91.1]	88.2 [85.7-91.3]	0.7769
Wake after onset sleep	69 [45-95]	77 [56-95]	0.7986
Number of awakenings	20 [16-34]	23 [13-26]	0.8122

Note. All values reported in Median [IQR]

References

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