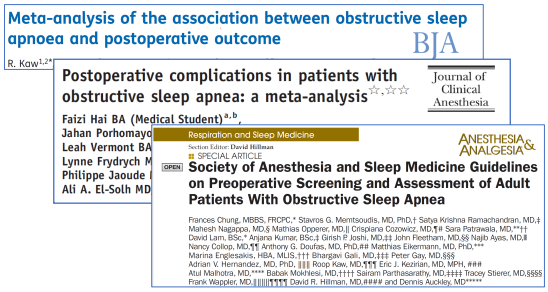
Regional anesthesia for the OSA patient — Is there a benefit and when should it be used?

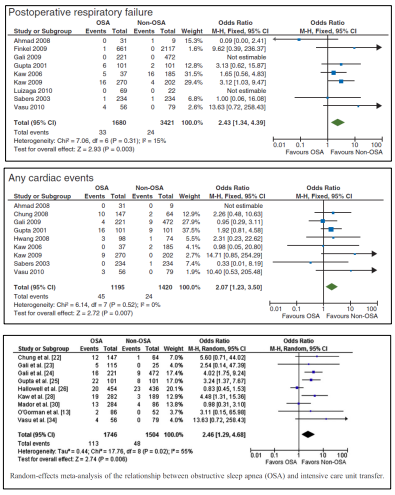
Crispiana Cozowicz, MD

Nothing to disclose

OSA patients at increased risk for perioperative complications

Complications	OSA vs non-OSA
Respiratory failure	OR 2.43 p=0.003
Cardiac events	OR 2.07 p=0.007
ICU transfer	OR 2.46 p=0.006





Random-effects meta-analysis of the relationship between obstructive sleep apnea (OSA) and intensive care unit transfer.

Impact of Anesthesia Technique in OSA

Sleep Apnea and Total Joint Arthroplasty under Various Types of Anesthesia:

A Population-Based Study of Perioperative Outcomes

Stavros G. Memtsoudis, MD, PhD, FCCP*, Ottokar Stundner, MD*, Rehana Rasul, MPH†, Xuming Sun, MS†, Ya-Lin Chiu, MS†, Peter Fleischut, MD‡, Thomas Danninger, MD*, and Madhu Mazumdar, PhD†

Regional Anesthesia & Pain Medicine

Reg Anesth Pain Med | 2013

Healthcare question

- Association between type of anesthesia and perioperative outcomes in OSA

Population based analysis

- Premier, national administrative database
- Claims data >540 US hospitals
- 30,024 OSA patients (ICD-9 code), 2006 – 2010
- GA 74%, NA 11%, GA/NA 15%

Complications	NA vs GA	NA + GA vs GA
Combined complications	OR 0.83 p=0.03	OR 0.89 p=0.03
Mechanical ventilation	OR 0.64 p<0.0001	OR 0.64 p<0.0001
ICU	OR 0.43 p<0.0001	OR 0.67 p<0.0001
Prolonged length of stay	OR 0.75 p<0.0001	OR 0.70 p<0.0001
Increased cost	OR 0.88 p=0.04	OR 0.70 p<0.0001
Pulmonary complications		OR 0.77 p=0.01

+ PNB → additional reduction in mechanical ventilation, ICU and LOS

Impact of Anesthesia Technique in OSA

Primary Arthroplasty

Perioperative Complications in Patients With Sleep Apnea Undergoing Total Joint Arthroplasty

Syed Y. Naqvi, MD, MSc [a], Amin H. Rabiei, MD [b], Mitchell G. Maltenfort, PhD [b], Camilo Restrepo, MD [b], Eugene R. Viscusi, MD [c], Javad Parvizi, MD, FRCS [b], Mohammad R. Rasouli, MD [c, d, *]

The Journal of Arthroplasty | 2017

Healthcare question

- Does anesthesia technique influence perioperative complications in OSA?

Retrospective observational analysis

- Institutional data: Thomas Jefferson University, PA
- 2005 – 2016 (ICD-9 code)
- 1,246 OSA matched to 3,738 non-OSA patients (1:3)

Complications	**GA vs NA in OSA**
Pulmonary complications	OR 4.48 p=0.004
Gastrointestinal complications	OR 4.70 p=0.02
Acute hemorrhagic anemia	OR 2.14 p=0.04
Mortality	OR 14.0 p=0.008
	GA impact overall
Pulmonary complications	OR 5.04 p<0.001
Cardiac complications	OR 2.11 p=0.02
Gastrointestinal complications	OR 4.60 p<0.001
Acute hemorrhagic anemia	OR 3.58 p<0.001
Shock	OR 3.26 p=0.003
Wound complications	OR 13.01 p=0.001
Mortality	OR 15.88 p<0.001

Impact of Anesthesia Technique in OSA

The prevalence of perioperative complications in patients with and without obstructive sleep apnoea: a prospective cohort study

Romanian Journal of Anaesthesia and Intensive Care | 2016

Tatiana Ambrosii, Serghei Şandru, Adrian Belii

Healthcare question

- Incidence of perioperative complications by anesthesia technique

Prospective observational study

- Institutional data: Nicolae Testemitanu University, Romania
- 2014 – 2015, Berlin questionnaire
- 400 patients; abdominal and orthopedic surgery

Results

- Highest number of complications in OSA/abdominal surgery under GA
- Best outcomes in OSA patients with orthopedic surgery under RA
- Respiratory complications most frequent
- Risk for complications depends on type of surgery and anesthesia

	Abdominal cavity	**Orthopedic**
Complications	**GA vs NA**	**GA vs NA**
Respiratory complications	+17.3%	+16.0%
ICU (unplanned)	+5.7%	+4.3%
Stroke	+0.7%	0%
Postoperative fever	+1.4%	-2.6%
Postoperative ventilation	+20.3%	+20%
Difficult intubation	3.5% in GA	
Prolonged awakening from anesthesia	2.5% in GA	13% in GA

NA + PNB → additional reduction in respiratory complications

Impact of Anesthesia Technique in OSA

Postoperative Hypoxemia in Orthopedic Patients with Obstructive Sleep Apnea

Spencer S. Liu, MD · Mary F. Chisholm, MD · Justin Ngeow, BA · Raymond S. John, BA · Pamela Shaw, BS · Yan Ma, PhD · Stavros G. Memtsoudis, MD, PhD

HSS

HSSJ | 2011

Healthcare question

- Incidence and risk factors for postoperative hypoxemia in OSA
- Hypoxemia: SpO2 <90% for over 5min

Retrospective analysis

- OSA surgical patient records at the Hospital for Special Surgery (2005 – 2008)
- 527 OSA patients undergoing ambulatory orthopedic surgery (ICD-9)
  (minimum one-night PACU for continuous monitoring)

Results

- GA identified as a risk factor hypoxemia in OSA
  (+ blood loss, IV fluids and surgery type)
- Hypoxemia associated with major respiratory complications, increased LOS, and wound infections

Anesthesia	Hypoxemia
GA only	29%
Spinal	4%
Spinal + PNB	1%
Epidural	5%
PNB	4%
IV-PCA	32%
Continuous PNB	4%

Airway Management in OSA

Complications	OSA vs non-OSA
Difficult intubation	OR 3.46 p<0.0001
Difficult mask ventilation	OR 3.39 p<0.0001
Combined	OR 4.12 p<0.0001
Supraglottic airway failure	OR 1.34 p=0.38

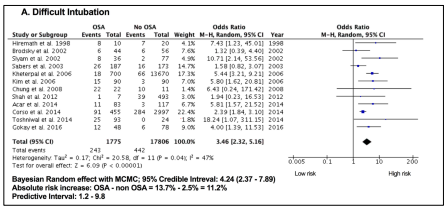
RESEARCH ARTICLE

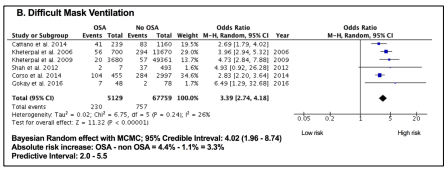
Is obstructive sleep apnea associated with difficult airway? Evidence from a systematic review and meta-analysis of prospective and retrospective cohort studies

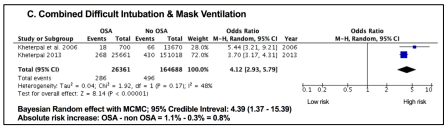
PLOS ONE

Mahesh Nagappa[1☯], David T. Wong[2☯], Crispiana Cozowicz[3,4‡], Satya Krishna Ramachandran[5‡], Stavros G. Memtsoudis[3‡], Frances Chung[2☯*]

PLOS ONE | Oct 2018







Airway Management in OSA

Perioperative Complications in Obstructive Sleep Apnea Patients Undergoing Surgery: A Review of the Legal Literature

Nick Fouladpour, MD,* Rajinish Jesudoss, MD,† Norman Bolden, MD,‡ Ziad Shaman, MD,† and Dennis Auckley, MD†

ANESTHESIA & ANALGESIA®
A&A | Jan 2016

Increasing litigation cases in OSA

Death or anoxic brain injury due to difficult airway management

- Difficult intubation
- Postoperative failure to reintubate after premature extubation

Airway Management in OSA

Known or suspected OSA should be considered an independent risk factor for difficult intubation, difficult mask ventilation, or both

SASM
The Society of Anesthesia and Sleep Medicine

ANESTHESIA & ANALGESIA®
Respiration and Sleep Medicine
Section Editor: David Hillman
SPECIAL ARTICLE

Society of Anesthesia and Sleep Medicine Guideline on Intraoperative Management of Adult Patients With Obstructive Sleep Apnea

Stavros G. Memtsoudis, MD, PhD,*† Crispiana Cozowicz, MD,*† Mahesh Nagappa, MD,‡ Jean Wong, MD, FRCPC,§ Girish P Joshi, MBBS, MD, FRACSI,|| David T. Wang, MD, FRCPC,§ Anthony G. Doufas, MD, PhD,¶ Meltem Yilmaz, MD,# Mark H. Stein, MD,** Megan L. Krajewski, MD,†† Mandeep Singh, MBBS, MD, MSc, FRCPC,‡‡§§¶¶## Lukas Pichler, MD,*† Satya Krishna Ramachandran, MD,*** and Frances Chung, MBBS, FRCPC§

A&A | 2018

Patients with known or suspected OSA should be managed according to the

Anesthesiology. 2013 Feb;118(2):251-70. doi: 10.1097/ALN.0b013e3182773b2.

Practice guidelines for management of the difficult airway: an updated report by the American Society of Anesthesiologists Task Force on Management of the Difficult Airway.

Apfelbaum JL[1], Hagberg CA, Caplan RA, Blitt CD, Connis RT, Nickinovich DG, Hagberg CA, Caplan RA, Benumof JL, Berry FA, Blitt CD, Bode RH, Cheney FW, Connis RT, Guidry OF, Nickinovich DG, Ovassapian A; American Society of Anesthesiologists Task Force on Management of the Difficult Airway.

American Society of Anesthesiologists™

SPECIAL ARTICLES

Practice Guidelines for the Perioperative Management of Patients with Obstructive Sleep Apnea

An Updated Report by the American Society of Anesthesiologists Task Force on Perioperative Management of Patients with Obstructive Sleep Apnea

Anesthesiology | 2014

Neuromuscular Blockade in OSA

Patients with a high risk for obstructive sleep apnea syndrome: Postoperative respiratory complications

H. Pereira[a], D. Xará[a], J. Mendonça[a], A. Santos[a], F.J. Abelha[a,b,*]

revista portuguesa de PNEUMOLOGIA portuguese journal of pulmonology www.revportpneumol.org

Rev Port Pneumol | 2013

Healthcare Question

- Early postoperative respiratory complications in high risk OSA after GA

Observational prospective double cohort study

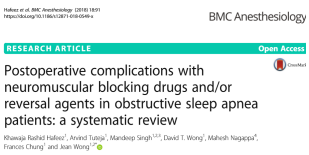
- Institutional, Centro Hospitalar São João in Porto, Portugal
- PACU after non-cardiac, non-neurological surgery, 2011
- 340 patients (STOP-BANG)

Results

- Residual neuromuscular blockade more frequent in OSA
- Inability to breathe deeply more frequent in OSA
- Increased respiratory complications in OSA after GA
- Residual neuromuscular blockade independent risk factor for adverse respiratory complications

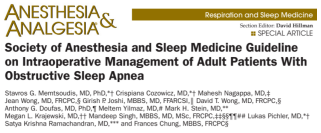
Complications	OSA	non-OSA	P-value
Hypoxia	9%	3%	0.012
Respiratory complications	39%	10%	<0.001
Inability to breathe deeply	34%	9%	0.001
Residual Neuromuscular blockade	20%	16%	0.035
PACU LOS	120 min	99 min	0.04

Neuromuscular Blockade in OSA


BMC Anesthesiology

RESEARCH ARTICLE Open Access

Postoperative complications with neuromuscular blocking drugs and/or reversal agents in obstructive sleep apnea patients: a systematic review


ANESTHESIA & ANALGESIA

Respiration and Sleep Medicine

SPECIAL ARTICLE

Society of Anesthesia and Sleep Medicine Guideline on Intraoperative Management of Adult Patients With Obstructive Sleep Apnea


SASM

The Society of Anesthesia and Sleep Medicine


American Society of Anesthesiologists

OSA compared to non-OSA patients receiving neuromuscular blocking agents may be at increased risk of effects of

- Postoperative residual neuromuscular blockade
- Hypoxemia
- Respiratory failure

Full reversal of NMB should always be verified before extubation

- Effects may persist even after the use of reversal agents
- In general population, sugammadex vs neostigmine more efficient in decreasing residual paralysis
- In OSA population, insufficient evidence to demonstrate superiority of sugammadex

Impact of Anesthesia in OSA

Postoperative Changes in Sleep-disordered Breathing and Sleep Architecture in Patients with Obstructive Sleep Apnea

Frances Chung, M.B.B.S., Pu Liao, M.D., Balaji Yegneswaran, M.B.B.S., Colin M. Shapiro, F.R.C.P.C., Weimin Kang, M.D., R.P.S.G.T.

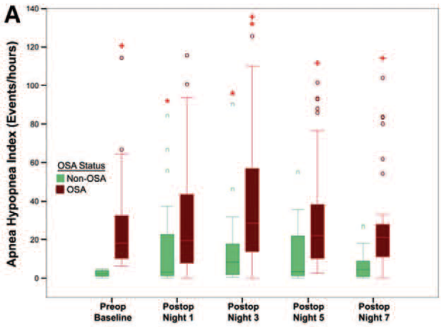
ANESTHESIOLOGY
Trusted Evidence: Discovery to Practice
Anesthesiology | 2014

Prospective observational study

- Institutional: Toronto Western and Mt. Sinai, Canada
- 58 patients, PSG preop. + postop. night 1, 3, 5, 7

Postoperative worsening of

- **SDB:** AHI increased, exacerbation of nocturnal hypoxia and hypercapnia OSA > non-OSA
  peak postoperative night 3, sustained 7 days
- **Sleep architecture:** REM sleep, slow wave sleep
  peak on postoperative night 1



Impact of Anesthesia in OSA

Factors Associated with Postoperative Exacerbation of Sleep-disordered Breathing

Frances Chung, M.B.B.S., Pu Liao, M.D., Hisham Elsaid, M.D., Colin M. Shapiro, F.R.C.P.C., Weimin Kang, M.D.

ANESTHESIOLOGY
Trusted Evidence: Discovery to Practice
Anesthesiology | 2014

Drivers of postoperative sleep-disordered breathing

Prospective observational study

- Institutional: Toronto Western and Mt. Sinai, Canada
- 376 patients, orthopedic, spinal, or general surgery
- PSG preop., postop. nights 1 and 3

Result

- GA associated with increased postoperative Central Apnea Index
- 72h opioid dose positively correlated with AHI severity

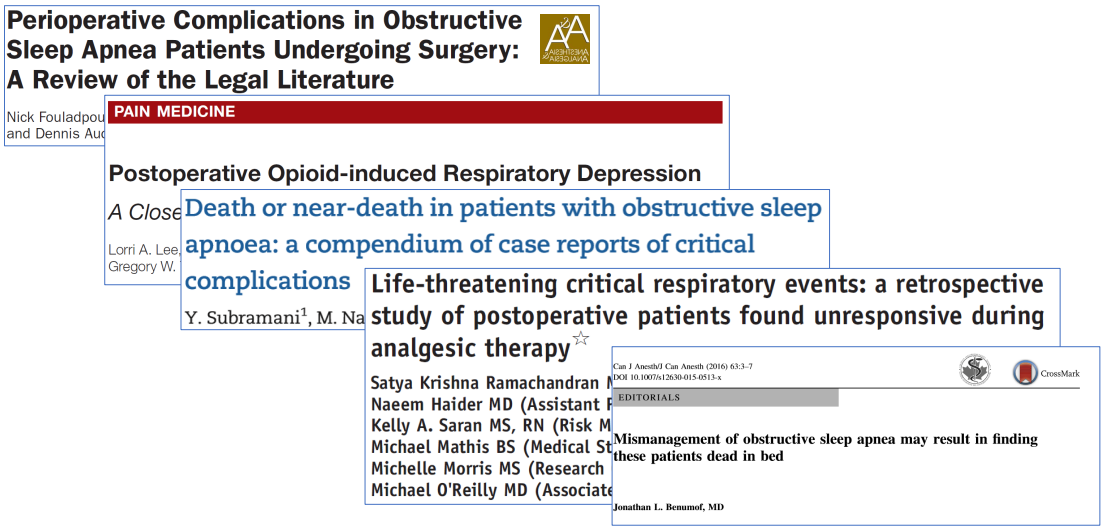
Drivers of postoperative Apnea Hypopnea Index (AHI)

- Preoperative AHI
- Age
- 72 hours opioid dose

Drivers of postoperative Central Apnea Index

- Preoperative central apnea index
- Male sex
- GA

Postoperative Death and Critical Events in OSA



Postoperative Death and Critical Events in OSA

Commonly shared postoperative course

- Patients awake, alert, and stable (favorable sedation scores)
- Preceding high pain scores and use of pain medication e.g. PCA
- Typical or less than typical doses of narcotics and sedatives
- After going to sleep found dead or in critical condition
- Cardiorespiratory arrest

Retrospectively often deemed a preventable

- Lapses in monitoring often implicated

Critical Components of OSA Pathogenesis

Understanding Phenotypes of Obstructive Sleep Apnea: Applications in Anesthesia, Surgery, and Perioperative Medicine

Yamini Subramani, MD*, Mandeep Singh, MBBS, FRCPC*,†, Jean Wong, MD, FRCPC*, Clete A. Kushida, MD, PhD‡, Atul Malhotra, MD§, and Frances Chung, MBBS, FRCPC*

ANESTHESIA & ANALGESIA
A&A | Jan 2017

Upper airway anatomy

- Narrower, higher pharyngeal collapsibility, obesity (parapharyngeal fat deposition), craniofacial abnormalities

Ability of upper airway dilator muscles to respond pharyngeal collapse during sleep

- Decreased tone of upper airway dilatator muscles – obstructive events

Arousal threshold - propensity to wake up from respiratory stimulus during sleep

- Hypercapnic respiratory drive and diaphragmatically generated negative pressure during airway obstruction predispose repeated arousal
- Low arousal threshold, disruptive sleep, wake up before reaching very low oxygen saturation
- High arousal threshold - preoperative identification not feasible

Inherent instability of ventilatory control

Death and life-threatening events in OSA

Lynn and Curry *Patient Safety in Surgery* 2011, 5:3
http://www.pssjournal.com/content/5/1/3

PATIENT SAFETY IN SURGERY

REVIEW Open Access

Patterns of unexpected in-hospital deaths: a root cause analysis

Lawrence A Lynn[1], J Paul Curry[2,3*]

Table 2 The Three Clinical Pattern Types of Unexpected Hospital Death (PUHD)

TYPE I	**Hyperventilation Compensated Respiratory Distress (e.g. Sepsis, PE, CHF)** Stable SPO2 with progressively falling PaCO2 eventually yields to slow SPO2 decline (mitigated by respiratory alkalosis) and followed by precipitous SPO2 decline when metabolic acidosis dominates
TYPE II	**Progressive Unidirectional Hypoventilation (CO2 Narcosis)** Progressive rise in PaCO2 (and etCO2) and fall in SPO2 over 15 minutes to many hours. (Often due to overdosing of narcotics or sedatives)
TYPE III	**Sentinel Rapid Airflow/SPO2 Reductions Followed by Precipitous SPO2 Fall.** A state of "arousal dependent survival" that occurs only during sleep. Arousal failure allows precipitous hypoxemia during apnea causing terminal arousal arrest.

Type III Pattern of ventilation and SPO_2 cycling during sleep

Instability of ventilation and/or upper airway control followed by precipitous and fatal oxygen desaturation if arousal failure is induced by narcotics and/or sedation

Lynn and Curry *Patient Safety in Surgery* 2011, **5**:3
http://www.pssjournal.com/content/5/1/3

PATIENT SAFETY IN SURGERY

REVIEW Open Access

Patterns of unexpected in-hospital deaths: a root cause analysis

Lawrence A Lynn[1], J Paul Curry[2,3*]

OSA related cycling scores of apneas due to instability of upper airway control

- Perpetual arousal dependent survival during sleep - reopening of upper airway

Sentinel instability component: arousal failure in the presence of sleep apnea

- Precipitous hypoxemia - steep fatal oxygen desaturation
- Severe arousal failure - profound cerebral hypoxemia "Lights Out Saturation" sufficient to induce central arousal arrest
- Patients dead in bed without warning from prolonged apneas

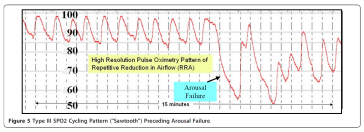


Figure 5 Type III SPO2 Cycling Pattern ("Sawtooth") Preceding Arousal Failure.

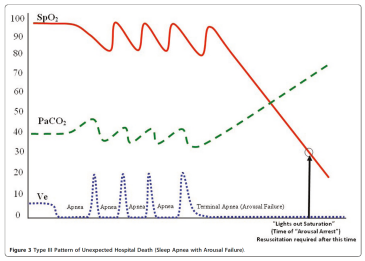


Figure 3 Type III Pattern of Unexpected Hospital Death (Sleep Apnea with Arousal Failure).

Lynn and Curry *Patient Safety in Surgery* 2011, **5**:3
http://www.pssjournal.com/content/5/1/3

PATIENT SAFETY IN SURGERY

REVIEW Open Access

Patterns of unexpected in-hospital deaths: a root cause analysis

Lawrence A Lynn[1], J Paul Curry[2,3*]

Delayed arousal

- Subgroups of OSA patients exhibit severely delayed arousals
  - Occult arousal failure
- OSA acquired arousal failure
  - Central arousal system failure in response to daily repetitive hypoxemia and
  - Sleep fragmentation
- CPAP initiation – sleep rebound
- Anesthetic, sedative and narcotic agents additional factors that delay respiratory arousal

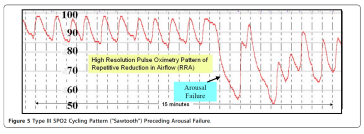


Figure 5 Type III SPO2 Cycling Pattern ("Sawtooth") Preceding Arousal Failure.

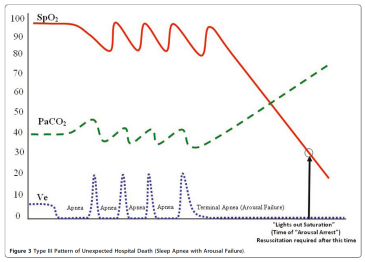


Figure 3 Type III Pattern of Unexpected Hospital Death (Sleep Apnea with Arousal Failure).

General anesthesia and dose dependent depression of upper airway activity

Anesthetic, sedative, and narcotic drug effects

Worsened upper airway collapsibility

Depression of central respiratory activity

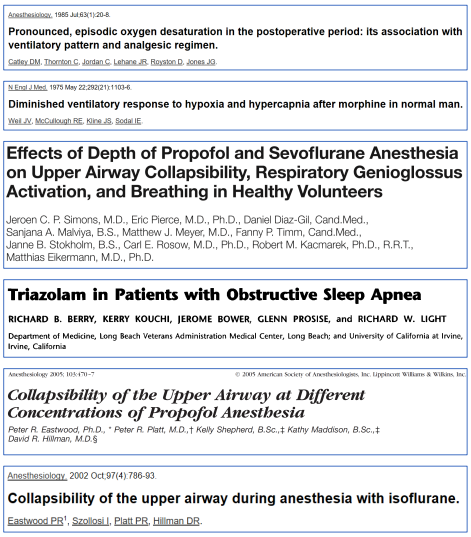
- Diminished ventilatory response to hypercarbia and hypoxia
- Delayed respiratory arousal response to airway occlusion
- Depression of central respiratory output to upper airway dilator muscles and upper airway reflexes (e.g. genioglossus muscle)

Depression of peripheral reflex pathways of upper airway muscle activity

Exacerbated SDB

→ May precipitate complete arousal arrest in patients with high arousal threshold

→ Sudden, unexpected death



Anesthesiology. 1985 Jul;63(1):20-8.

Pronounced, episodic oxygen desaturation in the postoperative period: its association with ventilatory pattern and analgesic regimen.

Catley DM, Thornton C, Jordan C, Lehane JR, Royston D, Jones JG.

N Engl J Med. 1975 May 22;292(21):1103-6.

Diminished ventilatory response to hypoxia and hypercapnia after morphine in normal man.

Weil JV, McCullough RE, Kline JS, Sodal IE.

Effects of Depth of Propofol and Sevoflurane Anesthesia on Upper Airway Collapsibility, Respiratory Genioglossus Activation, and Breathing in Healthy Volunteers

Jeroen C. P. Simons, M.D., Eric Pierce, M.D., Ph.D., Daniel Diaz-Gil, Cand.Med., Sanjana A. Malviya, B.S., Matthew J. Meyer, M.D., Fanny P. Timm, Cand.Med., Janne B. Stokholm, B.S., Carl E. Rosow, M.D., Ph.D., Robert M. Kacmarek, Ph.D., R.R.T., Matthias Eikermann, M.D., Ph.D.

Triazolam in Patients with Obstructive Sleep Apnea

RICHARD B. BERRY, KERRY KOUCHI, JEROME BOWER, GLENN PROSISE, and RICHARD W. LIGHT

Department of Medicine, Long Beach Veterans Administration Medical Center, Long Beach; and University of California at Irvine, Irvine, California

Anesthesiology 2005; 103:470–7 © 2005 American Society of Anesthesiologists, Inc. Lippincott Williams & Wilkins, Inc.

Collapsibility of the Upper Airway at Different Concentrations of Propofol Anesthesia

*Peter R. Eastwood, Ph.D., * Peter R. Platt, M.D.,† Kelly Shepherd, B.Sc.,‡ Kathy Maddison, B.Sc.,‡ David R. Hillman, M.D.§*

Anesthesiology. 2002 Oct;97(4):786-93.

Collapsibility of the upper airway during anesthesia with isoflurane.

Eastwood PR[1], Szollosi I, Platt PR, Hillman DR.

OSA complicating opioid analgesia

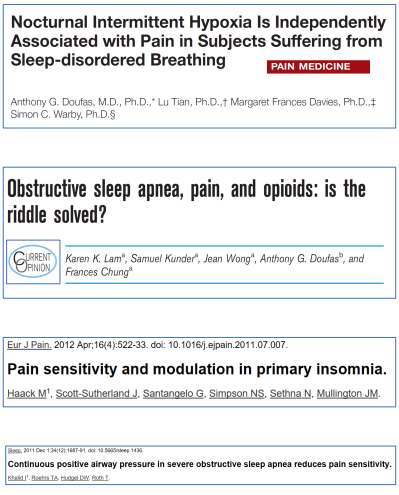
Enhanced pain sensitivity conferred by OSA features

Chronic intermittent hypoxia

- Nocturnal arterial desaturation may be associated with increased pain in patients with SDB

Sleep fragmentation

- Hyperalgesia in insomnia
- CPAP with improved sleep continuity reduced pain sensitivity in OSA



Nocturnal Intermittent Hypoxia Is Independently Associated with Pain in Subjects Suffering from Sleep-disordered Breathing PAIN MEDICINE

Anthony G. Doufas, M.D., Ph.D.,* Lu Tian, Ph.D.,† Margaret Frances Davies, Ph.D.,‡ Simon C. Warby, Ph.D.§

Obstructive sleep apnea, pain, and opioids: is the riddle solved?

CURRENT OPINION

Karen K. Lam[a], Samuel Kunder[a], Jean Wong[a], Anthony G. Doufas[b], and Frances Chung[a]

Eur J Pain. 2012 Apr;16(4):522-33. doi: 10.1016/j.ejpain.2011.07.007.

Pain sensitivity and modulation in primary insomnia.

Haack M[1], Scott-Sutherland J, Santangelo G, Simpson NS, Sethna N, Mullington JM.

Sleep. 2011 Dec 1;34(12):1687-91. doi: 10.5665/sleep.1436.

Continuous positive airway pressure in severe obstructive sleep apnea reduces pain sensitivity.

Khalid I, Roehrs TA, Hudgel DW, Roth T.

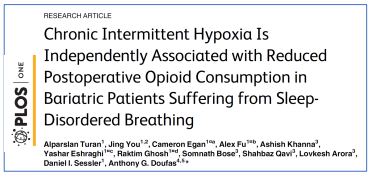
OSA complicating opioid analgesia

Chronic cycling hypoxia potentiating opioid analgesic effects

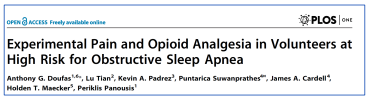
- Decreased postoperative opioid consumption in OSA with recurrent nocturnal hypoxia
- Nocturnal hypoxia OSA associated with increased potency of opioids

Altered pain sensitivity and opioid potency should be considered in OSA

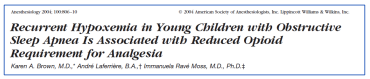
- Preoperative nocturnal hypoxia determinant of postoperative opioid pharmacology
- Opioid and analgesic requirements potentially lower


RESEARCH ARTICLE

Chronic Intermittent Hypoxia Is Independently Associated with Reduced Postoperative Opioid Consumption in Bariatric Patients Suffering from Sleep-Disordered Breathing


Experimental Pain and Opioid Analgesia in Volunteers at High Risk for Obstructive Sleep Apnea


Intermittent Hypoxia and the Practice of Anesthesia


Recurrent Hypoxemia in Young Children with Obstructive Sleep Apnea Is Associated with Reduced Opioid Requirement for Analgesia

Multimodal pain management in OSA

Non-opioid analgesic modes of pain management are associated with reduced postoperative complications and resource utilisation: a retrospective study of obstructive sleep apnoea patients undergoing elective joint arthroplasty

C. Cozowicz[1,2], J. Poeran[3], N. Zubizarreta[3], J. Liu[4], S. M. Weinstein[3], L. Pichler[1,2], M. Mazumdar[3] and S. G. Memtsoudis[1,2,*]

BJA

British Journal of Anesthesia | 2019

Healthcare question

- Impact of multimodal analgesia on opioid use and complication risk

Population based retrospective cohort study

- Premier national healthcare database
- 2006-2016; Claims-based data >540 US hospitals (25%)
- 181,182 OSA patients undergoing total hip/knee arthroplasty (ICD-9)

Intervention

- Multimodal analgesia vs opioids-only
- Systemic opioids + 1, 2, or >2 non-opioid analgesic modalities
  - NSAIDs, Cox-2 inhibitors, Acetaminophen/paracetamol, Peripheral nerve blocks, Steroids, Gabapentin/pregabalin, Ketamine

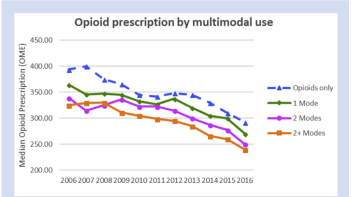


Fig 3. Trends in opioid dose prescription by utilisation of multimodal analgesia. OME, oral morphine equivalents.

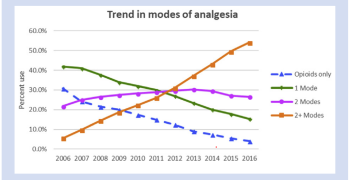


Fig 2. Trends in the utilisation of multimodal analgesia by number of modes used.

Multimodal pain management in OSA

Results

- Stepwise beneficial effects with increasing number of non-opioid analgesic modes added to opioids
  - Opioid prescription dose
  - LOS
  - Gastrointestinal complications
  - Mechanical ventilation
  - Postoperative ICU
- Strongest opioid sparing with Cox-2 inhibitors and NSAIDs
- Lower PCA use

Conclusion

- Multimodal analgesia associated with opioid sparing and reduced complications
- **dose response gradient**

Non-opioid analgesic modes of pain management are associated with reduced postoperative complications and resource utilisation: a retrospective study of obstructive sleep apnoea patients undergoing elective joint arthroplasty

C. Cozowicz[1,2], J. Poeran[3], N. Zubizarreta[3], J. Liu[1], S. M. Weinstein[1], L. Pichler[1,2], M. Mazumdar[3] and S. G. Memtsoudis[1,2,*]

BJA

British Journal of Anesthesia | 2019

Opioid analgesia +	1 additional mode	2 additional modes	≥3 additional modes
Opioid dose POD-1	-5.0%	-10.4%	-14.9%
Opioid dose POD-1+	-5.7%	-9.0%	-12.5%
LOS	-4.6%	-7.8%	-11.8%
Cost	-1.4%	-2.5%	-3.2%
GI complications	OR 0.75	OR 0.69	OR 0.65
Mechanical ventilation	OR 0.60	OR 0.33	OR 0.23
ICU admission	OR 0.81	OR 0.73	OR 0.60
PCA use	19.2%	13.7%	7.7%

all outcomes p < 0.0001

Comparative effectiveness: GA vs RA

BJA

British Journal of Anaesthesia, 123 (3): 269–287 (2019)

doi: 10.1016/j.bja.2019.05.042
Advance Access Publication Date: 24 July 2019
Review Article

CLINICAL PRACTICE

Anaesthetic care of patients undergoing primary hip and knee arthroplasty: consensus recommendations from the International Consensus on Anaesthesia-Related Outcomes after Surgery group (ICAROS) based on a systematic review and meta-analysis

Stavros G. Memtsoudis[1,2,*], Crispiana Cozowicz[1,2], Janis Bekeris[1,2], Dace Bekere[1], Jiabin Liu[1], Ellen M. Soffin[1], Edward R. Mariano[3], Rebecca L. Johnson[4], Mary J. Hargett[1], Bradley H. Lee[1], Pamela Wendel[1], Mark Brouillette[1], George Go[1], Sang J. Kim[1], Lila Baaklini[1], Douglas Wetmore[1], Genewoo Hong[1], Rie Goto[1], Bridget Jivanelli[1], Eriphyli Argyra[4], Michael J. Barrington[5], Alain Borgeat[6], Jose De Andres[9,10], Nabil M. Elkassabany[11], Philippe E. Gautier[12], Peter Gerner[2], Alejandro Gonzalez Della Valle[1], Enrique Goytizolo[1], Paul Kessler[13], Sandra L. Kopp[4], Patricia Lavand'Homme[14], Catherine H. MacLean[15], Carlos B. Mantilla[4], Daniel Maclsaac[16], Alexander McLawhorn[17], Joseph M. Neal[18], Michael Parks[17], Javad Parvizi[19], Lukas Pichler[2], Jashvant Poeran[20], Lazaros A. Poultsides[21], Brian D. Sites[22], Otto Stundner[1], Eric C. Sun[23], Eugene R. Viscusi[24], Effrossyni G. Votta-Velis[25], Christopher L. Wu[1], Jacques T. Ya Deau[1] and Nigel E. Sharrock[1]

Complications	NA vs. GA
Mortality	OR 0.67 CI 0.57-0.80
Pulmonary	OR 0.65 CI 0.52-0.80
CNS	OR 0.39 CI 0.23-0.65
Thromboembolism	OR 0.61 CI 0.53-0.71

Year	Author	RCTs	Outcomes decreased with Neuraxial anesthesia
2019	Memtsoudis	94	Mortality, pulmonary, renal, DVT, infections, blood transfusion
2014	Guay 9 Cochrane reviews	117	30-mortality, pneumonia
2016	Meng	8	LOS, intraoperative hypertension and tachycardia, analgesic requirement in the PACU, PONV
2016	Johnson	29	LOS
2016	Guay		Hypertension
2013	Barbosa		Pneumonia
2009	McFarlane	18	Postoperative pain, morphine consumption, opioid related adverse effects
2010	Luger	34	Mortality, reduced postoperative confusion, DVT, postoperative hypoxia, pneumonia
2006	Mauerman		DVT, PE, blood transfusions
2000	Parker	17	Mortality 30 day, DVT
2000	Rodgers	141	Mortality 30%, DVT 40%, pneumonia 50%, respiratory depression 60%, myocardial infarction, blood transfusion, wound infections renal failure

Quality of the Body of Evidence

Study design

- Lack of RCTs, mostly observational, no causality, residual confounding

Risk of bias

- Accuracy of OSA identification: STOP-BANG, Berlin Questionnaire, PSG rarely
- OSA severity, which subpopulations are at higher perioperative risk?
- Surgical invasiveness
- OSA treatment and compliance e.g. CPAP
- Anesthesia and analgesia/consumption of anesthetics and narcotics
- Indication bias selection bias

Imprecision

- Most studies do not reach OIS

Directness

- Sparseness of direct comparative effectiveness research in OSA
- Judgements regarding the strength of the association required

Consistency

- Results largely consistent in demonstrating detrimental effects of GA vs RA
- Consistency in size of effect

Publication bias

- Low risk

Lack of evidence on the impact of interventions of precaution

- e.g. CPAP, feasibility of randomization

Rationale supporting regional anesthesia

Improved outcomes with regional anesthesia

Reduced complications and resource utilization

Avoidance of airway manipulation

Difficult airway

Avoidance of neuromuscular blockade

Efficient pain relief

Altered pain and opioid sensitivity

Reduced consumption of opioids and anesthetic medication

Multimodal pain management
High vulnerability in patients with delayed arousal

Suppression of surgical catabolic stress response

Block of systemic endocrine catabolic response

Expedited mobilization/recovery

What is the preferred anesthesia technique in patients with OSA?

American Society of Anesthesiologists

SASM
The Society of Anesthesia and Sleep Medicine

- When applicable, RA preferable over GA in patients with OSA
- Potential for postoperative compromise should be considered in selecting intraoperative anesthetic medications
- Superficial procedures: use of local anesthesia and PNB (with/without moderate sedation)
- GA with secure airway preferable to deep sedation without secure airway
- Major conduction anesthesia (spinal/epidural) for peripheral procedures