



Procedural Sedation in Patients With OSA

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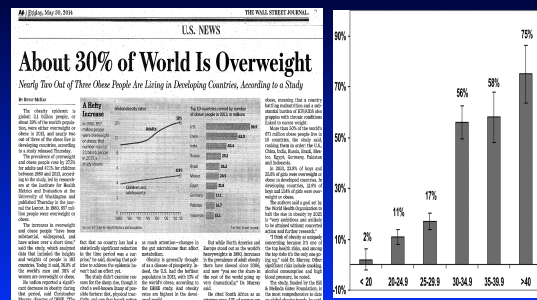
Conflict Of Interests Research Grants and/or Honoraria

- Baxter Pharmaceuticals
- Mallinkrodt Pharmaceuticals
- Pacira Pharmaceuticals

Sedation Practice in the US

- More than 40 million procedures performed per year with sedation
- Expected increase in procedures requiring sedation/analgesia in ER, MRI, IR, EP
- Increased use of deep sedation
 - Increased patient expectations
 - Rex DK et al: Am J Gastrointest 2002; 97: 1159-63
 - Improved efficiency of a facility
 - Walker et al: Am J Gastroenterol 2003; 98: 1744-50
 - Lower overall costs
 - Vargo et al: Gastroenterology 2002; 123: 8-16

Obesity: An International Epidemic



How Does Sedation/Analgesia Influence The Pathophysiology of OSA?

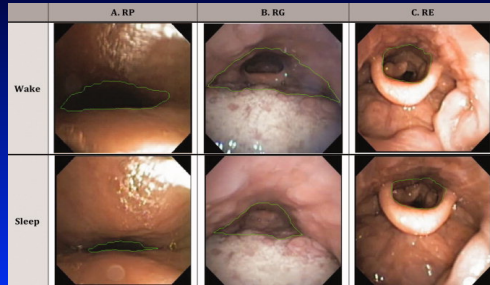
- Hypoventilation, airway obstruction, apnea
- Life threatening hypoxemia and hypercarbia, due to lack of arousal
- Increased incidence unplanned airway intervention including tracheal intubation
 - Difficult tracheal intubation
 - Herder et al: BMJ 2004; 329: 955-9, Brodsky et al: Anesth Analg 2002; 94: 732-6, Kim and Lee: Can J Anesth 2006; 53: 393-7, Chung et al: Anesth Analg 2008; 107: 915-20
- Cardiovascular complications
- High risk of GERD, regurgitation, aspiration
 - Sabati et al: Obes Surg 2008; 18: 1479-84

Drug-Induced Sleep Endoscopy (DISE)

- Visualization of the upper airway using flexible videoendoscope during drug-induced sleep
- Assess site and nature of airway obstruction
- Guides surgical decision making
- Prevents unnecessary surgery
- Done as a stand alone procedure or just prior to airway surgery after induction of GA
- Requires deep sedation to induce sleep-like loss of consciousness

Kezirian EJ: Laryngoscope 2011; 121: 1320-6; Borek RC et al: Laryngoscope 2012; Victores AJ et al: Laryngoscope 2012; Soares D et al: Otolaryngology-Head Neck Surg 2012

Drug-induced Sleep Endoscopy For Evaluation Of OSA



Victores AJ et al: Laryngoscope 2012; 122: 2606-10

Sedation/Analgesia: General Principles

Patient Comfort and Safety: Balancing The Imperatives

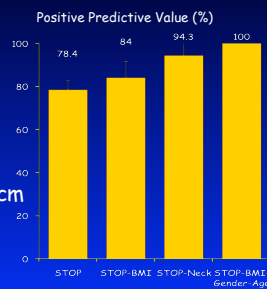
Agitation
Hypertension/tachyarrhythmia
Patient injury



Pre-procedure Evaluation/Preparation

Pre-procedure Assessment For OSA

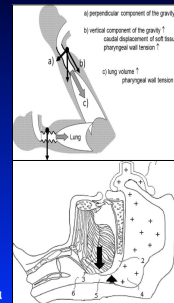
- Loud snoring
- Daytime somnolence
- Observed apnea
- Hypertension
- BMI > 35 kg/m²
- Age > 50 yrs
- Neck circumference > 40cm
- Male
- ≥ 3 yes = high risk of OSA



Chung et al: Anesthesiology 2008; 108: 812-21

Positioning During Procedure

- Semi-upright (20-30°) position
 - ↓ airway collapse, ↑ lung volume
 - Tagaito Y et al: Anesthesiology 2010; 113: 812-8
- Prophylactic nasal airway
 - Nasal ventilation superior to oral
 - Liang Y et al: Anesthesiology 2008; 108: 998
- Nasal CPAP through nasal airway
 - Connect anesthesia circuit to the nasal airway, use FGF 15-20 L/min
 - Turbulence distends the pharyngeal area

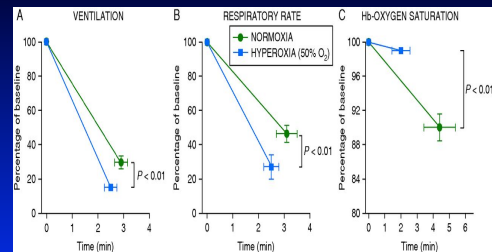


Supplemental Oxygen

- Use supplemental O_2 with caution
 - Masks respiratory depression as SaO_2 maintained even in presence of hypercarbia
- Treat recurrent hypoxemia with CPAP/BiPAP rather than increasing FiO_2
- CPAP is an insurance against catastrophe!

Söderberg et al. Acta Anaesthesiol Scand 1977; 21: 55-61; Sugerman HJ Gastroenterol Clin North Am 1987; 16: 225-37

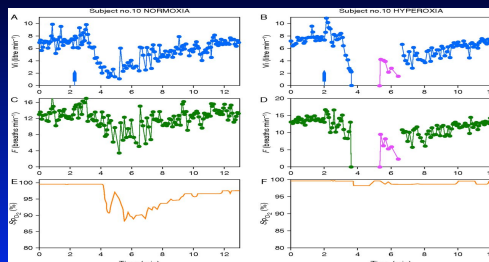
Hyperoxemia Exacerbates Opioid-Induced Respiratory Depression



50 µg/70 kg remifentanyl infusion over 60 s

Niesters M et al. Br. J. Anaesth. 2013;bja.aes494

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Monitoring For Airway Obstruction and Respiratory Depression

Monitoring During Procedure

- Dedicated practitioner for continuous monitoring and drug administration
 - Monitor depth of sedation/hypnosis (response to verbal command/response to procedure stimulation)
 - Early detection and rescue and resuscitation
 - **Lack of vigilance = perception of "minor" procedure**
- Clinical observation: cardiopulmonary function
- Monitoring: ECG, HR, BP, respiratory rate, oximetry, expired CO_2
- Duration of monitoring for the period of physiological deterioration

Indicators of Ventilation: Pulse Oximetry

- Does not reflect adequate ventilation
- Supplemental oxygen therapy masks respiratory depression and delay diagnosis
- False sense of security, delayed detection of airway obstruction and hypoventilation
- SpO_2 values $<93\%$, $<90\%$, $<85\%$, or $<80\%$

Lynn LA, Curry JP: Patterns of unexpected in-hospital deaths: a root cause analysis. Patient Safety in Surgery 2011; 5:3

Respiratory Monitors

- Expired Carbon dioxide
 - Acoustic Monitoring
 - Respiration (tidal volume x resp rate): ExSpirom
 - Tidal volume, minute ventilation
 - Respiratory flow curve shape
 - Breath-breath variation and variability (rate, vol, curve)
 - Respiratory rate monitor
 - Tri-axial accelerometer (Orient speck) and the data transmitted wirelessly
- Drummond GB et al: Br J Anaesth 2011; 107: 462-9

End-points for Sedation

- Comfort and relaxation
- Slurred speech, sleepy
- Immobilization
- Acceptable vital signs

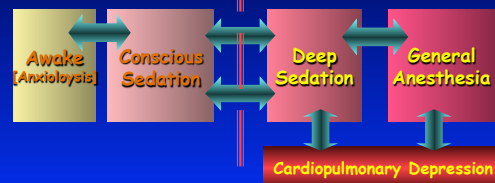
Drugs For Sedation/Analgesia

Continuum of Depth of Sedation

Consciousness is a dose-dependent continuum

Responds appropriately
Protective reflexes maintained
Patent airway

No response
Loss of reflexes
Unable to maintain airway

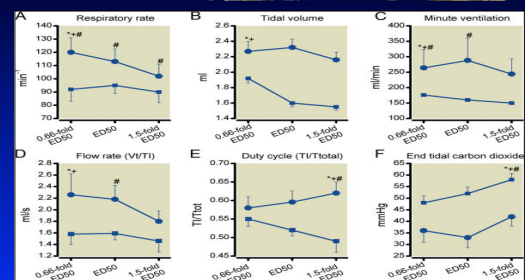


Wide variability in patient response to sedative-hypnotics and opioids makes it difficult to determine optimal dose for a specific level of sedation

Drugs For Sedation/Analgesia in OSA Patients

- Propofol allows earlier recovery than midazolam
 - Norton et al: Anesthesiology 2006; 104: 1155-64
- Combination of propofol and ketamine
 - Reduces propofol requirements and side effects
 - Provides analgesia
 - Propofol 200 mg + Ketamine 20-40 mg
- Combination of dexmedetomidine (0.5-1 mcg/kg) and ketamine (0.5-1 mg/kg)
 - Both have sedative analgesic effects
 - Both have no effects on respiration
 - Complement each other

Upper Airway Dilator Function: Ketamine Versus Propofol



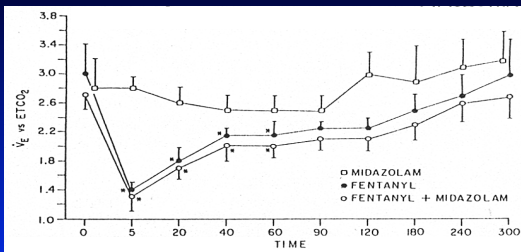
ketamine (circles) and propofol (squares)

Eikermann M, et al: Anesthesiology 2012; 116: 35-46

Do not compensate
inadequate analgesia with
excessive sedative-hypnotics

Avoid/Limit Opioid Doses

Combination of Midazolam and Fentanyl: Ventilatory Response to CO₂



Midazolam and fentanyl combination increases the risk for hypoxemia and apnea

Bailey et al: Anesthesiology 1990; 73: 826-30

Morphine and Midazolam: Pharyngeal Function, Airway Protection

- Morphine 0.1 mg/kg, midazolam 0.05 mg/kg, IV
 - Sedation from these doses was minimal
- Pharyngeal dysfunction with impaired airway protection
- Impaired coordination between breathing and swallowing, increased risk of aspiration
- Morphine-induced attenuation of cough aggravates consequences of pharyngeal dysfunction
- Morphine prolonged apneic period preceding swallowing

Hardemark C, et al: Anesthesiology 2015; 122: 1253-67

Analgesia During Procedure

- Local/Regional analgesia techniques
 - Topical analgesia
 - Wound infiltration
 - Peripheral nerve blocks
- Non-steroidal anti-inflammatory drugs
 - Ketorolac/Ibuprofen/Diclofenac
- Acetaminophen (1 gm, IV)
- Analgesic adjuvants
 - Dexamethasone (4-8 mg)
 - Ketamine (0.5-1 mg/kg)
 - Demetomidine (0.2-1 mcg/kg/h)

Joshi GP and Kehlet H: Anesthesiology 2013

Summary

- Develop clinical pathways
- Risk reduction strategy
 - Prefer ketamine and dexmedetomidine, if possible
 - Prefer propofol vs. midazolam, in smallest possible doses
 - Avoid/limit opioid dose, if necessary use short-acting
 - Use non-opioid analgesics (acetaminophen/NSAIDs)
 - Understand that combination of drugs are synergistic
- Monitor for airway obstruction and resp dep
- Educate patients and family members regarding post-procedure concerns, sleep in head-up position, use CPAP until complete recovery