Anesthetic Considerations for the Morbidly Obese

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NDANA 10-23-09
Why We Are Here: Oops Wrong Lecture.
It’s always about the airway……
Society for Airway Management

• 2009 SAM Meeting  September 25-27, 2009
• The Venetian
• Las Vegas, NV
• September 25-27, 2009
• The Venetian
• Las Vegas, NV

• http://sam.zorebo.com/index.php
Eritrea School of Nurse Anesthesia

Class of 2007
Friday, 3-31-06 after 2 weeks of Zwerling-Wilson Brain Washing
Upside to being a PD

- Have to commit to an evidence based practice.
- Vow of poverty.
- Learn the negotiation skills of an UN mediator.
- Learn to delegate as if there’s anyone to delegate to.
- Participate in clinical research.
Applied Clinical Research
2008
Collate Outcome Data
AIRWAY JEOPARDY

- SRNA’s Only!!!!!!!!!!!!
- For $20.00 and the BRAINIAC Award
- Topic Area: Famous Experimental Subjects in Airway research.
- Who was.....................?
- The first SRNA to get the correct answer to me before I leave for Philly wins.
Take homes

- Airway is the predominant clinical concern with morbidly obese patients.
- Utilization of central alpha 2 agonists along with low solubility inhalational agents is an ideal approach to decrease residual airway compromise.
- Dexmedetomidine is an easily titrateable central alpha two agonist with potent analgesic and MAC sparing properties.
FCCC Applications

- Sedation for awake FOI
- Cardioprotection
- Narcotic sparing
- MAC sparing
- OSA patients &/or compromised airway
- Opioid tolerant
- Avoidance of emergence delirium
How Did a Receptor Specificity Purest Get Subverted?

- They hid all his infusion pumps?
- His chairman told him he can use all the propofol he wants if he’s buying?
- The surgeons were complaining about all those d—n beeping pumps?
- He developed a new appreciation for the titrability of inhalational agents?
- The Sevo rep had fresher bagels than the propofol rep?
Inhaled Anesthetics and Immobility: Mechanisms, Mysteries, and Minimum Alveolar Anesthetic Concentration

James M. Sonner, et. al.
Anesth Analg 2003;97:718-740
Mechanisms of action of inhalational anesthetics: Neurotransmitter receptor candidates

- Inhibitory Neurotransmitter Receptors:
  - GABAA
  - Glycine

- Excitatory Transmitters:
  - NMDA
  - AMPA
  - Kainate
  - Nicotinic
  - 5-HT3
The anatomical candidates
Morbid Obesity
Anyone who wants to ask what the ROI on obesity treatment is must first tell me what the ROI is for the treatment of Erectile Dysfunction?

<table>
<thead>
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<th>Attributable Deaths</th>
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<td><strong>Obesity</strong>#</td>
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<tr>
<td><strong>Impotence</strong>*</td>
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# Range of estimates from CDC
* Excludes death from embarrassment

But there’s a new trend. Organizations that “own” someone for life are starting to offer obesity treatment.
How Does Obesity Cause Disease?
Abnormal production of hormones and inflammation in fat

DM=diabetes mellitus; FFA=free fatty acid; PAI-1=plasminogen activator inhibitor-1; TNFα=tumor necrosis factor alpha; IL-6=interleukin 6.

Slide: After Dr. G Bray
Medical Complications of Obesity: Almost every organ system is affected

**Pulmonary disease**
- abnormal function
- obstructive sleep apnea
- hypoventilation syndrome

**Nonalcoholic fatty liver disease**
- steatosis
- steatohepatitis
- cirrhosis

**Gall bladder disease**

**Gynecologic abnormalities**
- abnormal menses
- infertility
- polycystic ovarian syndrome

**Osteoarthritis**

**Skin**

**Gout**

**Phlebitis**
- venous stasis

**Idiopathic intracranial hypertension**

**Stroke**

**Cataracts**

**Coronary heart disease**

**Diabetes**

**Dyslipidemia**

**Hypertension**

**Severe pancreatitis**

**Cancer**
- breast, uterus, cervix
- colon, esophagus, pancreas
- kidney, prostate
How does weight loss improve health?
Reducing fat cell mass reduces hormone production and inflammation.

DM=diabetes mellitus; FFA=free fatty acid; PAI-1=plasminogen activator inhibitor-1; TNFα=tumor necrosis factor alpha; IL-6=interleukin 6.

Slide: After Dr. G Bray
Weight change at 1 year is consistent across all trials
The plateau is a physiological phenomenon!

Completers

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<th>Placebo</th>
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</tbody>
</table>

Weight change (kg)
Synergy of Leptin and Sibutramine in Treatment of Dietary Obesity in Rats

Body Weight Change After 6 Days Treatment

-40 -20 0 20 40
Veh Lep Sib Sib+Lep

Central Weight Regulating Mechanisms

↑Food intake  ↓energy expenditure

↓food intake  ↑energy expenditure
Central Weight Regulating Mechanisms and Treatments Which Will Impact Them

↑ Food intake
↓ energy expenditure

Implantable Gastric Stimulator (IGS)

PYY analog

Pramlintide
Rimonabant

↓ food intake
↑ energy expenditure

Pramlintide
Exenatide

Illustration by Katharine Sutliff
Alternative perspectives

- The epidemic of morbid obesity is an issue for all providers.
- The perspective that this is a chronic, progressive, ultimately fatal disease process is a reasonable start.
Scope of the Problem: The Metric

- Men Women Risk Factor
- less than 20.7 less than 19.1 Underweight. The lower the BMI the greater the risk
- 20.7 to 26.4 19.1 to 25.8 Normal, very low risk
- 26.5 to 27.8 25.9 to 27.3 Marginally overweight, some risk
- 27.9 to 30 27.4 to 30 Overweight. Moderate risk
- 30.1 to 34.9 30.1 to 34.9 Severely overweight, high risk
Scope of the Problem: The Metric

- 35 to 39.9
  - 35 - 39.9 Obesity Class II - Candidate for surgery with comorbidities.
- Greater than 40
  - Greater than 40 Obesity Class III -
  - Morbid obesity, very high risk
  - Candidate for surgery
Mortality Ratio

• Morbid obesity is defined by a Body Mass Index (BMI) of greater than 40 or between 35 and 40 where there are other major medical conditions such as high blood pressure and diabetes are present.

• Look at the escalation in mortality at BMI>32-35
I was thinking about how people seem to read the Bible a whole lot more as they get older; then it dawned on me . . they're cramming for their final exam.

George Carlin
The Epidemiology

- The numbers are down right scary!!
- From 1986 to 2000 the prevalence of Americans with a BMI of 40 or greater has quadrupled from 1:200 to 1:50
- There are approximately 325,000 deaths/yr attributable to obesity
- This approaches the 400,000 excess death/yr attributable to smoking
- The nation spends approximately $75 billion/yr on obesity related morbidities.
Laws of Anesthesia: The Essentials

• Air goes in and out.
• Blood goes round and round.
• Numb is good.
• Numb and hemodynamically stable is better.
• Numb, hemodynamically stable and amnestic is best.
• Numb, hemodynamically stable, amnestic and warm is better yet.
• Dead meat don’t beat.
Airway....airway......airway!
And Airway
The Challenge!

- Airway…..Airway……..Airway: Potentially difficult, decreased FRC, decreased compliance, increased airway resistance- just wait until we have a peritoneum full of CO2.
- Higher incidence of CAD, HTN, DVP, PE and pump failure geez and how about venous and arterial access. Superb teaching for ultrasound guidance!!!
- The joys of neuroaxial anesthesia without palpable landmarks. But what better population for epidural analgesia.
• Obesity in anaesthesia and intensive care
Prevention of Atelectasis Formation During the Induction of General Anesthesia in Morbidly Obese Patients

Marta Coussa, MD*, Stefania Proietti, MD, Pierre Schnyder, MD, Philippe Frascarolo, PhD*, Michel Suter, MD PhD, Donat R. Spahn, MD*, and Lennart Magnusson, MD PhD*

Departments of *Anesthesiology, Diagnostic Radiology, and General Surgery, University Hospital, Lausanne, Switzerland

Anesth Analg 2004;98:1491-1495
IMPLICATIONS

• Application of positive end-expiratory pressure during induction of general anesthesia in morbidly obese patients prevents atelectasis formation and improves oxygenation.

• Therefore, this technique should be considered for anesthesia induction in morbidly obese patients.

• After intubation with a fraction of inspired oxygen of 1.0, PaO2 was significantly higher in the PEEP group compared with the control group (457 ± 130 mm Hg versus 315 ± 100 mm Hg, respectively; P = 0.035)
Respiratory System Resistance: Desflurane vs. Sevoflurane and Thiopental

Goff et al, *Anesthesiology* 2000;93(2):404-408
Atheism is a non-prophet organization.

George Carlin
Work Release
Anesthesia for a patient with morbid obesity using dexmedetomidine without narcotics

Roger E. Hofer, MD*, Juraj Sprung, MD PhD*, Michael G. Sarr, MD and Denise J. Wedel, MD** From the Departments of Anesthesiology, and Surgery, Mayo Clinic College of Medicine, Mayo Clinic, Rochester, Minnesota, USA.

Clinical Features

• **Clinical features:** We describe a 433-kg morbidly obese patient with obstructive sleep apnea and pulmonary hypertension who underwent Roux-en-Y gastric bypass. Because of the concern that the use of narcotics might cause postoperative respiratory depression, we substituted their intraoperative use with a continuous infusion of dexmedetomidine (0.7 µg•kg\(^{-1}•hr^{-1}\)). The anesthesia course was uneventful, and the intraoperative use of dexmedetomidine was associated with low anesthetic requirements (0.5 minimum alveolar concentration). After completion of the operation and after tracheal extubation, the dexmedetomidine infusion was continued uninterrupted throughout the end of the first postoperative day. The analgesic effects of dexmedetomidine extended narcotic-sparing effects into the postoperative period; the patient had lower narcotic requirements during the first postoperative day [48 mg of morphine by patient-controlled analgesia (PCA)] while still receiving dexmedetomidine, compared to the second postoperative day (morphine 148 mg by PCA) with similar pain scores.
Choice of volatile anesthetic for the morbidly obese patient: sevoflurane or desflurane

Shahbaz R. Arain MD, Christofer D. Barth MD1, Hariharan Shankar MD, Thomas J. Ebert MD, PhD
Design

• A randomized, prospective blinded study to determine the emergence profiles of desflurane and sevoflurane in MO patients when anesthetic drug titration is used.
• Patients were induced with fentanyl, midazolam, and propofol and maintained with desflurane or sevoflurane, mixed in air and oxygen. Intraoperative bispectral index (BIS) was targeted to 45 to 50 and to 60 in the last 15 minutes of surgery.
Main Results

- Demographic data (age, 61 [36-83] years; body mass index, 38 [35-47] kg/m²), surgical procedures, length of anesthesia (~3.5 hours), adjuvant drugs, and intraoperative BIS, heart rate, and mean arterial pressure were not significantly different.

- Hemodynamics, time to follow commands and to extubation, and results of Digit Symbol Substitution Test and Mini-Mental Status Test did not differ between anesthetic groups during recovery.
Dexmedetomidine and low-dose ketamine provide adequate sedation for awake fibreoptic intubation

Corey S. Scher, MD and Melvin C. Gitlin, MD From the Department of Anesthesiology, Tulane Health Sciences Center, New Orleans, Louisiana, USA.

Address correspondence to: Dr. Corey S. Scher, Department of Anesthesiology, Tulane Health Sciences Center, 1415 Tulane Ave. SL-4, New Orleans, LA 70112, USA. Phone: 504-588-5903, Fax: 504-584-1941; E-mail: cscher@anes.tulane.edu

The patient received a bolus of **dexmedetomidine** 1 µg•kg⁻¹ (Precedex-Abbott Laboratories, North Chicago, IL, USA) over ten minutes. After the bolus, the infusion was set at 0.7 µg•kg⁻¹•hr⁻¹. Neither hypotension or bradycardia were noted during **dexmedetomidine** administration. The patient reported comfort and sedation at the termination of the loading dose. The patient was rousable at all times, but when left unstimulated, tended to sleep. No changes in oxygen saturation and respiration were noted during the bolus or maintenance infusion. Upon completion of the **dexmedetomidine** bolus, 15 mg of ketamine were administered as a bolus and an infusion of 20 mg•hr⁻¹ was initiated. After the ketamine bolus, and during the infusion, the patient reported that he was calm, comfortable, sedated and stated that he was ready for the fibreoptic intubation. This low dose of ketamine did not result in adverse changes in mental status. There continued to be no change in oxygen saturation and respiratory status. He did complain of dry mouth.

During the continuous drug infusion, blocks of the recurrent laryngeal nerve and internal branch of the superior laryngeal nerve bilaterally were performed in the usual manner. The tongue and hypopharynx were sprayed with benzocaine. The patient remained both sedated and cooperative during these blocks. A Macintosh laryngoscope (#4 blade) was inserted and the patient remained very cooperative although the epiglottis and vocal cords were not visualized.

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AIRWAY

• An endoscopic oral airway was placed in the mouth and fibreoptic intubation was performed. The endoscopist noted excellent conditions including a secretion free airway. The patient was able to respond to requests to take slow, large deep breaths. The epiglottis and vocal cords were visualized and intubation proceeded without difficulty. General anesthesia was then induced and the drug infusions were discontinued. After an uncomplicated surgery, the trachea was extubated after the patient met criteria for extubation. The patient had no recall of the nerve blocks, direct laryngoscopy, or fibreoptic intubation.

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Conclusions

- Dexmedetomidine may be a useful anesthetic adjunct for patients who are susceptible to narcotic-induced respiratory depression.
- In this morbidly obese patient the narcotic-sparing effects of dexmedetomidine were evident both intraoperatively and postoperatively.
Dexmedetomidine infusion during laparoscopic bariatric surgery: the effect on recovery outcome variables.

Burcu Tufanogullari, et. al.

Anesth Analg 2008; 106:1741-1748
CONCLUSIONS

- Adjunctive use of an intraoperative Dex infusion (0.2–0.8 µg · kg⁻¹ · h⁻¹) decreased fentanyl use, antiemetic therapy, and the length of stay in the PACU. However, it failed to facilitate late recovery (e.g., bowel function) or improve the patients’ overall quality of recovery. When used during bariatric surgery, a Dex infusion rate of 0.2 µg · kg⁻¹ · h⁻¹ is recommended to minimize the risk of adverse cardiovascular side effects.

Anesth Analg 2008; 106:1741-1748
Cardiovascular Considerations

- Obesity in anaesthesia and intensive care

Consider an Arterial Line
Human Volunteers Under Anesthesia

Heart Rate

Beats/min

Conscious baseline 0.5 1.0 1.5 MAC

- isoflurane
- sevoflurane
- desflurane

* p<0.05

Sevoflurane Does Not Activate Sympathetic Nervous System

* $p < 0.05$ vs. baseline

The Challenge

- Predisposition to hemodynamic instability due to often increased basal increase in SVR and SVO2.
- What better patient population to test all of our clinical skills?
- Let’s look at some of the options
Whom
Bariatric Surgery and the Prevention of Postoperative Respiratory Complications

Meg A. Rosenblatt, MD, David L. Reich, MD, and Ram Roth, MD Department of Anesthesiology, Mount Sinai School of Medicine, New York, NY
Consider

- Airway team: both anesthesia providers agree on airway approach.
- 2 attendings and difficult airway cart available for all non FOB intubations.
- Thoracic Epidural Analgesia for RNY
- 5 minutes of High Humidity NRB 100% with SAO2 monitoring before transfer to PACU
Difficult Tracheal Intubation Is More Common in Obese Than in Lean Patients

Philippe Juvin, MD PhD, Elisabeth Lavaut, MD, Hervé Dupont, MD, Pascale Lefevre, MD, Monique Demetriou, MD, Jean-Louis Dumoulin, MD, and Jean-Marie Desmonts, MD

Anesth Analg 2003;97:595-600
IMPLICATIONS

- We report a difficult intubation rate of 15.5% in obese patients and 2.2% in lean patients.
- None of the risk factors for difficult intubation described in the lean population was satisfactory in the obese patients.
- We also report a high risk of desaturation in obese patients with difficult intubation.
The neurosciences evidence

- Compelling evidence for the primacy of genetic influences.
- There is exciting evolving investigations that implicate dysregulation of leptin and ghrelin production in the etiology of morbid obesity.
Insulin resistance, leptin and TNF-alpha system in morbidly obese women after gastric bypass.

The results

- Leptin and the TNF-alpha system could be involved in the pathogenesis of obesity and insulin resistance.
- We conducted a study after GBP to analyze the pattern of variation of anthropometric and body composition variables, leptin and sTNFR1 and 2.
The results

- **METHODS**: 29 morbidly obese women were studied, at baseline and throughout 6 months after gastric bypass.
- **RESULTS**: At baseline, the BMI was 49 +/- 6 kg/m(2) and patients showed a higher fasting insulin resistance index (FIRI), leptin, leptin/fat mass and sTNFR1 and 2 than did controls.
- **CONCLUSIONS**: Morbidly obese women after GBP became less insulin resistant with lower leptin concentrations, but showed an initial increase of sTNFR1 and 2.
If a man is standing in the middle of the forest speaking and there is no woman around to hear him... is he still wrong?

George Carlin
Plasma Ghrelin Levels after Diet-Induced Weight Loss or Gastric Bypass Surgery

David E. Cummings, M.D., David S. Weigle, M.D., R. Scott Frayo, B.S., Patricia A. Breen, B.S.N., Marina K. Ma, E. Patchen Dellinger, M.D., and Jonathan Q. Purnell, M.D.
NEJM Volume 346:1623-1630 May 23, 2002 Number 21
Conclusions

• *Conclusions* The increase in the plasma ghrelin level with diet-induced weight loss is consistent with the hypothesis that ghrelin has a role in the long-term regulation of body weight.

• Gastric bypass is associated with markedly suppressed ghrelin levels, possibly contributing to the weight-reducing effect of the procedure.
Treatment options

- Pharmacologic
- Diet
- Exercise
- Surgery
- Combinations
Gastric Banding

- Decreases stomach surface area
- No associated malabsorptive syndromes
- Now adjustable laparoscopic gastric banding available
Gastric Bypass

- Decreases stomach surface area
- Bypasses significant portion of duodenum & jejunal digestive surface area
- Malabsorptive syndromes common
- Open vs laparoscopic
Sevoflurane Anesthesia in the Obese Surgical Patient: Overview

- Numerous clinical studies document the suitability of sevoflurane anesthesia for the obese surgical patient
- Sevoflurane has distinctive properties that are well-suited to these patients
  - Nonpungent and does not cause respiratory irritability
  - Rapid, predictable hemodynamic response to titration
  - Does not increase heart rate at concentrations below 2 MAC
  - Smooth emergence and rapid recovery from anesthesia

Sevoflurane for Laparoscopic Gastric Banding

- Randomized, blinded study of 30 ASA status II and III morbidly obese patients (BMI >35)
- Following standard IV induction, anesthesia was maintained with sevoflurane or isoflurane (1.4 MAC-hr exposure per group)
- Extubation, emergence, and response times were significantly shorter in the sevoflurane group
- Median time to PACU discharge eligibility was 15 min in the sevoflurane group vs 27 min in the isoflurane group
- Overall, no between-group differences in hemodynamic effects
  - 20% of sevoflurane patients required therapy for minor hemodynamic side effects vs 46% of isoflurane patients
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Would a fly without wings be called a walk?

George Carlin
Sevoflurane for Gastric Bypass Procedures: Extubation

**Times to Extubation**

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38% difference

*P<0.05 vs isoflurane.

### Aldrete Recovery Scores After Surgery

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*P<0.05 vs Isoflurane.

References

- Maxwell GM. The effects of 2-(2,6-dichlorphenylamine)-2-imidazoline hydrochloride (Catapres®) upon the systemic and coronary haemodynamics and metabolism of intact dogs. Arch Int Pharmacodyn Ther 1969; 181: 7–14.
References
