

# Labor and Delivery Management of the Morbidly Obese Parturient

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## CASE PRESENTATION

S.E. is a 28-year old G2P1 undergoing induction at term for worsening chronic hypertension. Her current weight is 520 lbs. (236 kg, BMI 84). She has a history of asthma for which she uses a steroid inhaler QID and an inhaled bronchodilator PRN. Obstructive sleep apnea was diagnosed by sleep study, and she has been on a 3L nasal cannula during her final trimester of pregnancy with an oxygen saturation of 94%. She is confined to a wheelchair because of dyspnea on exertion. Her first pregnancy was delivered by cesarean section using epidural anesthesia; at that time she weighed 300 lbs. Her obstetrician plans a trial of labor.

Care of the morbidly obese parturient is a challenge for the obstetricians, anesthesiologists, and nurses involved in her delivery. Studies of obesity during pregnancy use body mass index (BMI) to define obesity, where BMI = weight in kg/height in m<sup>2</sup> and BMI >40 is morbidly obese. Using those criteria, 6–10% of parturients are morbidly obese. Morbid obesity is associated with numerous adverse pregnancy outcomes (OR = odds ratio).<sup>1,2,3</sup>

|                             |         |
|-----------------------------|---------|
| • Preeclampsia              | OR 4.82 |
| • Gestational diabetes      | OR 4.00 |
| • Fetal macrosomia          | OR 3.82 |
| • Neonatal death            | OR 3.41 |
| • Gestational hypertension  | OR 3.20 |
| • Shoulder dystocia         | OR 3.14 |
| • Meconium aspiration       | OR 2.85 |
| • Intrauterine fetal demise | OR 2.79 |
| • Cesarean delivery         | OR 2.69 |
| • Fetal distress            | OR 2.52 |
| • Instrumental delivery     | OR 1.34 |

It has been estimated that 1 in 7 cesarean deliveries may be due to obesity.<sup>4</sup> Both fetal neural tube defects<sup>5</sup> and the risk of fetal/neonatal death are increased in obese women compared to normal weight parturients.<sup>6</sup> At weeks 28–36, the odds ratio of fetal death compared to normal weight women was 2.1, at weeks 37–39 it was 3.5, and at 40+ weeks the odds ratio was 4.6.<sup>6</sup> The risk for stillbirth increases in a dose-dependent fashion with increases in BMI; OR 1.9 for BMI >40.<sup>7</sup>

The cardiac and pulmonary physiologic changes associated with obesity are well known.<sup>8</sup> Although all pregnant women are considered to be “full stomach”

patients, obesity may or may not increase that risk. Gastric emptying of clear liquids does not seem to be delayed in obese pregnant patients. A small study showed *no* difference in gastric emptying times for 50 or 300 mL water, and the emptying times were similar to non-obese pregnant and non-pregnant women (~30 minutes).<sup>9</sup> In contrast, two studies in non-pregnant subjects found strong correlations between increasing BMI and reflux symptoms, with OR 6.3 for women with BMI >35.<sup>10,11</sup>

Increasing BMI is associated with increased rates of cesarean delivery.<sup>12</sup> Nulliparous women with a BMI >35 in the first trimester had an increased rate of cesarean delivery following onset of spontaneous labor at term when compared to women with BMI <25 (OR 3.8). For parturients attempting vaginal birth after cesarean delivery (VBAC), success rates are lower and infection rates higher as BMI increases. Both BMI >29 and pregnancy weight gain >40 pounds decreased the chance of successful VBAC.<sup>13</sup> Overall success rate of VBAC was 77%, but with BMI >29 the success rate was 68%, and with >40 pound weight gain the success rate was only 67%. A prospective observational study compared 14,142 women having trial of labor after one prior cesarean to 14,304 women having an elective repeat cesarean.<sup>14</sup> The authors found that increasing BMI was directly associated with failed trial of labor, from 15.2% in normal weight to 39.3% in morbidly obese women. Among morbidly obese women, trial of labor carried greater than five-fold risk of uterine rupture/dehiscence (2.1% vs 0.4%) and risk of neonatal injury (1.1% vs 0.2%). Morbidly obese women failing a trial of labor and then requiring cesarean had a six-fold greater composite maternal morbidity than those undergoing a successful trial of labor (14.2% vs 2.6%). Consequently, it may be more cost effective to simply offer an elective cesarean delivery to patients weighing more than 300 pounds.<sup>15,16</sup> A study of 298 deliveries to parturients with a history of bariatric surgery (both laparoscopic and open) also found an increased risk of cesarean delivery (OR 2.4) but no other adverse perinatal outcomes.<sup>17</sup>

Recent publications have highlighted the contribution obesity makes to anesthesia-related maternal mortality. A review of maternal deaths in Michigan found that 75% of the 8 anesthesia-related maternal

deaths involved obese parturients.<sup>18</sup> All occurred during emergence (*not* induction) from general anesthesia or sedation and involved hypoventilation or airway obstruction. These cases raise questions of appropriate PACU management after general anesthesia on L&D and the use of additional monitoring for obese patients at risk for sleep-obstructed breathing. Great Britain published their “Confidential Enquiry into Maternal and Child Health, Saving Mother’s Lives, 2003–2005”, the seventh report from the United Kingdom.<sup>19</sup> Four of their six direct anesthetic deaths involved obese women; three with postoperative respiratory failure after spinal or general anesthetics. They emphasize the additional care and expertise required for safe anesthetic care of obese parturients.

When you are faced with a morbidly obese parturient, it is important to have a flexible anesthetic plan. Despite a planned induction of labor or spontaneous onset of labor, the patient may still require an urgent cesarean delivery due to failure to progress or an emergent cesarean for maternal or fetal complications. Be prepared for anything!

### PREOPERATIVE MANAGEMENT

The LDR and operating room should be prepared with a bed of appropriate width and strength, wider arm supports and pads, and a ventilator capable of high peak airway pressures. Many operating room beds are only rated for weights to 300 pounds. Additional items may be needed for regional and general anesthesia such as longer spinal and epidural needles and difficult airway equipment. The patient should be interviewed early in the course of labor, or preferably during an antepartum visit. Be frank about the additional problems posed by her obesity and make recommendations about how these will be managed. If the patient is seen antepartum, consider additional tests such as a chest film with shielding to assess heart size, 12-lead electrocardiogram, sleep study, and/or pulmonary function tests with arterial blood gases – but only if those tests will affect your management.

When the patient arrives on L&D, help nursing personnel obtain adequate IV access. An arterial line should be considered if the arms are excessively obese or their shape makes it difficult to correctly wrap a cuff. Assess the airway carefully. BMI alone does *not* predict difficulty with intubation. Several studies have shown that the best predictors of difficult laryngoscopy in obese patients are Mallampati class  $\geq 3$  and large neck circumference.<sup>20,21,22</sup> Aspiration prophylaxis should be administered early and continued throughout labor. An H<sub>2</sub> receptor antagonist, metoclopramide, and a clear antacid should all be considered. If intubation will be required, administer an anticholinergic agent to decrease secretions. Supplemental oxygen should be administered throughout labor and delivery with continual monitoring of oxygen saturation. Alert your colleagues that you have a complicated patient so that additional experienced hands can

be available in case of an emergency delivery. Discuss plans with your obstetricians for *any* eventuality - a trial of labor and vaginal delivery, labor followed by cesarean delivery for failure to progress (non-urgent), or emergency cesarean delivery for fetal distress. They should understand that nothing can be done STAT with this patient.

### REGIONAL ANESTHESIA

A spinal or epidural catheter should be inserted early in labor in case fetal distress occurs. Landmarks will be difficult to palpate so optimize what you can. Have the patient in a sitting position. Use ultrasound guidance to identify midline bony structures, the distance from the skin to the epidural space, and the intervertebral space.<sup>23</sup> Using ultrasound imaging in non-obese parturients, the success of the initial insertion point chosen was 92%, with no need to redirect in 74%. Correlation with depth was 0.881. Even small directional errors are exaggerated with increasing depth of the epidural space. Infiltrate generously and be patient. The patient can often help guide you to the midline by telling you if she senses pressure or pain from your needle advancement to her left or right. It is rare to need an extra-long epidural needle in the midline approach, but it is appropriate to have one available. Thread the catheter *at least* 5 cm into the space and secure well. Position the patient sitting upright or lateral recumbent before securing the catheter to allow inward movement without dislodgement.<sup>24</sup> Minimizing motor block during labor will aid nursing care.

Consider a *planned* “wet tap” with your epidural needle, or if one occurs unexpectedly, consider converting to a continuous spinal anesthetic, administering dilute local anesthetic and opioid for labor (e.g., 0.125% bupivacaine with fentanyl 5  $\mu\text{g}/\text{mL}$  at 1–2 mL/h or  $\sim 3$  mL/h of the usual epidural infusion solution) or more concentrated local anesthetics for operative or cesarean delivery (e.g., 1–3 mL 0.5% bupivacaine in increments, with 25  $\mu\text{g}$  fentanyl and 0.25 mg morphine). Post-dural puncture headaches occur rarely in morbidly obese patients.<sup>25</sup> Although spinal catheters may dislodge as frequently as epidural catheters, they are easier to assess by simply attempting to withdraw spinal fluid, and replacement can be started more expeditiously. When epidural catheters dislodge it is often only discovered when an attempted top-up dose fails to provide relief. Expect to replace the catheter eventually, as 44% require replacement at least once, and 20%  $>2$  times.<sup>26</sup> Dose cautiously! Local anesthetic requirements for spinal and epidural anesthesia may be reduced and are certainly unpredictable. Adequate respiration is maintained even with a block to T5, but continuous oxygen administration by nasal cannula and monitoring with pulse oximetry are necessary. For cesarean delivery, place the block in the operating room to avoid the

necessity of moving the patient once motor block has occurred. Both the abdominal fat pad and the gravid uterus will contribute to supine hypotension. Position and pad carefully for what may be a lengthy surgery. Accept *only* a perfect block before allowing the surgeons to make skin incision.

## GENERAL ANESTHESIA

Additional experienced hands must be available, plus ancillary airway equipment such as a fiberoptic bronchoscope, short-handled laryngoscope, assortment of laryngeal mask airways, etc. Obesity alone does *not* predict a difficult airway.<sup>9,10</sup> If a rapid sequence induction seems inadvisable, consider awake oral intubation with topical anesthesia. Aspiration prophylaxis and a drying agent should have been administered previously. In the obstetric patient, minimal sedation should be given to avoid newborn respiratory depression. The mucosa is friable during pregnancy and nasal intubations are problematic due to bleeding. Landmarks for blocks (e.g., superior laryngeal, transtracheal) will be obscure in the obese patient. Nebulized 4% lidocaine is an option for topical anesthesia. Full-stomach precautions should be balanced with the need for adequate airway anesthesia. Use continuous oxygen supplementation.

The patient should be fully denitrogenated prior to a rapid sequence induction. Positioning is extremely important: the head, neck and shoulders should be raised so that there is a straight line between the sternal notch and the external auditory meatus.<sup>27</sup> The patient should be in reverse Trendelenburg position until the airway is secure.<sup>28</sup> Pre-oxygenation in the head-up position was more effective at achieving higher oxygen tensions and increasing the desaturation period in non-obstetric patients, and the same should be true for cesarean delivery.<sup>29</sup> A laryngeal mask airway or equivalent should be immediately available in case ventilation is necessary and mask ventilation is difficult.<sup>30</sup> Drug doses may be based on actual or ideal body weight.<sup>31</sup> Highly lipophilic medications (barbiturates, benzodiazepines) have a significantly increased volume of distribution compared to non-obese patients, so their dosages are increased but their elimination half-lives are longer. Non- or weakly lipophilic drugs are administered based on lean body mass.<sup>32</sup> Administer sufficient succinylcholine to provide optimal intubating conditions. Atracurium is preferable to vecuronium, rocuronium and cisatracurium in terms of predictability of duration.<sup>33,34,35</sup>

Be prepared for prolonged surgery, and optimize padding and positioning once asleep. Remember the hemodynamic and ventilatory consequences of the abdominal fat pad in the supine position.<sup>36</sup> Expect increased blood loss and assure adequate IV access. Extubate conservatively and in the reverse Trendelenburg position. The incidence of dangerous post-extubation obstruction is ~5% in patients with obstructive sleep apnea, so extubate with oral or nasal airways in place. If there

are concerns about re-intubation, extubate over an airway exchange catheter.

## POSTOPERATIVE CONSIDERATIONS

The patient should be kept in the semi-recumbent or reverse Trendelenburg position during the recovery period. Thromboembolism and pulmonary complications are the patient's greatest postoperative risk, consequently good analgesia is important to encourage mobilization. Analgesia with neuraxial opioids with or without local anesthetics is preferable to IM (IM) injections. Since IM injections will likely be deposited in fat, IV patient-controlled analgesia (PCA) is preferable if no spinal or epidural catheter is present. Dose on the basis of ideal body weight and avoid a basal rate. The combined use of non-steroidal anti-inflammatory medications should be considered to improve analgesia without additional respiratory depression.

Continue respiratory monitoring for hypoxia and hypoventilation and consider CPAP if the patient has obstructive sleep apnea. A monitored or step-down bed may be a more appropriate location for recovery than L&D if respiratory issues are a concern. Mobilization and incentive spirometry are key in preventing postoperative complications. Begin anti-coagulation soon after surgery with low molecular weight or unfractionated heparin. Later complications are wound infection and dehiscence as well as thromboembolism. These may require another trip to the operating room, and many of the same principles will apply.

## CONCLUSIONS

The risks of anesthesia, surgery, and childbirth are higher in obese patients, and the prevalence of obesity in parturients is increasing. Two recent ACOG publications address care of the obese parturient. *The Role of the Obstetrician-Gynecologist in the Assessment and Management of Obesity* notes that all patients should have a BMI calculated and should be offered interventions and counseling when appropriate.<sup>37</sup> *Obesity in Pregnancy* addresses pre-conception counseling and peripartum care.<sup>38</sup> Certainly the risk of dying prematurely increases for people who are overweight. In developing countries, obesity is associated with affluence, while in industrialized countries it is usually associated with poverty. Unlike most parturients, medical disease commonly complicates care of the morbidly obese patient. Their anesthetic management requires patience, planning, and collaboration.

## REFERENCES

1. *Obstet Gynecol* 2004;103:219
2. *Am J Obstet Gynecol* 2004;190:1091
3. *Obstet Gynecol* 2005;105:537
4. *Am J Obstet Gynecol* 2005;192:832
5. *Obstet Gynecol* 2005;105:261
6. *Obstet Gynecol* 2005;106:250
7. *Obstet Gynecol* 2007;110:552
8. *Anaesthesia* 2006;61:36

9. Anesth Analg 2007;105:751
10. JAMA 2003;290, 66
11. N Engl J Med 2006;354:2340
12. Am J Obstet Gynecol 2007;196:163
13. Obstet Gynecol 2005;106:741
14. Obstet Gynecol 2006;108:125
15. Am J Obstet Gynecol 2001;185:349
16. Am J Obstet Gynecol 2003;189:385
17. Am J Obstet Gynecol 2004;190:1335
18. Anesthesiology 2007;106:1096
19. The Confidential Enquiry into Maternal and Child Health, London: CEMACH
20. Anesth Analg 2002;94:732
21. Anesth Analg 2003;97:595
22. Am J Resp Crit Care Med 1994;150:1279
23. Anesth Analg 2007;104:1188
24. Anesthesiology 1997;86:778
25. Reg Anesth 1994;19:361
26. Anesthesiology 1993;79:1210
27. Anesth Analg 2003;96:1841
28. Anesth Analg 2000;91:1520
29. Anesthesiology 2005;102:110
30. Anesthesiology 2001;95:1175
31. Anesthesiology 1993;78:657
32. Anesth Analg 2002;95:1793
33. Clin Pharmacol Ther 1990;48:18
34. Anesth Analg 2004;99:1086
35. Anesth Analg 2004;99:1090
36. Anesth Analg 1979;58:345
37. Obstet Gynecol 2005;106:895
38. Obstet Gynecol 2005;106:671

# OBESITY & OUTCOME

A prospective review of 2,350 patients with BMI>30 found they were at increased risk for:

- Gestational diabetes OR 4.0
- Preeclampsia OR 3.3
- Gestational hypertension OR 3.2
- Macrosomia (>4500 g) OR 2.4
- Cesarean delivery 47% vs 20%

Am J Obstet Gynecol 2004;190:1091

# VBAC & OBESITY

Obesity also decreases the chance of a successful vaginal delivery after a previous cesarean delivery (VBAC).

- BMI 25-30      OR 0.81 for vaginal delivery.
- BMI 30-35      OR 0.66
- BMI > 35      OR 0.38

Am J Obstet Gynecol 2005;193:1517

# VBAC & OBESITY

Should we even offer a trial of labor for obese women (BMI $\geq$ 40) or just repeat a cesarean delivery?

- Failed TOL  $\uparrow$  from 15% in normal weight women to 39% when BMI  $\geq$  40.
- Uterine rupture / dehiscence during TOL  $\uparrow$  from 0.9% in normal weight to 2.1% if morbidly obese.
- Women with BMI  $\geq$  40 had a 2-fold risk of *maternal* injury and 5-fold risk of *newborn* injury.
- Morbidly obese women who failed TOL had 6-fold  $\uparrow$  morbidity than those successful (14% vs 2.6%).

Obstet Gynecol 2006;108:125

# OBESITY & OUTCOME

Two studies found an increase in stillbirth with increasing maternal obesity.

- A meta-analysis of 9 studies found OR 1.47 when overweight and 2.07 for obese mothers.

Am J Obstet Gynecol 2007;197:223

- A review of a state database found OR 1.3 when overweight and 1.9 when extremely obese.
- Obese *black* mothers experienced the highest rate of stillbirths (OR 2.3 vs obese white mothers).

Obstet Gynecol 2007;110:552

# ARTERIAL BLOOD GASES

|                  | Non-<br>Pregnant | Pregnant | Obese<br>& Pregnant |
|------------------|------------------|----------|---------------------|
| pH               | 7.40             | 7.44     | 7.44                |
| pO <sub>2</sub>  | 95               | 103      | 85                  |
| pCO <sub>2</sub> | 42               | 32       | 30                  |
| BE               | +5               | -3       | -4                  |

# OBSTRUCTIVE SLEEP APNEA

- Overnight polysomnography was performed in pregnant women who were obese (mean BMI 34) or normal weight (BMI 23).
- Both groups of mothers slept poorly close to term and less often in the supine position.
- In early and late pregnancy obese mothers had more apneic events (1.7 vs 0.2/hour), desaturations, and snoring (32% vs 2%).

Chest 2001;120:1448

# OBESITY / PREECLAMPSIA

Do changes in BMI between a woman's first two pregnancies influence the incidence of preeclampsia?

- Baseline rate of 2% in second pregnancy.
- ↑ from normal weight to obese: OR 3.2
- ↑ from overweight to obese: OR 3.7

Obstet Gynecol 2007;110:1319

# GI PHYSIOLOGY: REFLUX

- There is a strong correlation between increasing body mass index and reflux symptoms, with a significantly stronger association in women ( $p < .001$ ).
- Compared with normal weight, the risk of reflux is increased significantly when  $BMI > 25$  (OR = 2.43) and when  $> 35$  (OR 2.93).
- An 3.5 unit increase in BMI increases the frequency of symptoms (OR 2.80), even if still normal weight.

**JAMA 2003;290;66**

**NEJM 2006;354:22**

# GASTRIC EMPTYING

Practice Guidelines allow clear liquids in labor.

Should that include obese patients also? Yes!

- 10 obese (mean BMI 41) term pregnant volunteers drank 50 and 300ml water (crossover on 2 occasions) and had gastric emptying and ultrasound measurements.
- Times were no different than lean patients ( $T_{1/2}$  ~30 minutes) and emptying was no different between 50 and 300ml volumes.

Anesth Analg 2007;105:751

# REGIONAL ANESTHESIA

If a “wet tap” occurs, consider conversion to continuous spinal analgesia.

The risk of PDPH may be only 9.5% in morbidly obese parturients versus > 60% in non-obese parturients.

Reg Anesth 1994;19:361

Anesthesiology 1997;87:A886

# CONTINUOUS SPINAL ANALGESIA FOR LABOR

## Initial dose:

- 5 $\mu$ g sufentanil alone, or
- 25 $\mu$ g fentanyl + 0.5ml 0.25% bupivacaine

## Maintenance infusion:

- 0.125% bupivacaine + 5 $\mu$ g/ml fentanyl (or your usual infusion mixture) at 1-3ml/hour

Titrate for analgesia without motor block.

# CONTINUOUS SPINAL ANESTHESIA FOR CESAREAN

- Use 0.5% “epidural” bupivacaine.
- Give 1ml + 25 $\mu$ g fentanyl and wait for ~5 minutes to see extent of spread.
- Give another 1ml + 0.1-0.25mg morphine
- Provides excellent surgical conditions and postoperative pain relief, often without complete motor block.

# AIRWAY AND OBESITY

A study of 100 non-obstetric patients with BMI>40 identified factors which complicate direct laryngoscopy (view) and intubation.

- ↑ neck circumference: 40cm = 5% incidence of difficulty, 60cm = 35% difficulty
- ↑ Mallampati score:  $\geq 3$  predicted difficulty.
- BMI did not predict difficulty.

Anesth Analg 2002;94:732

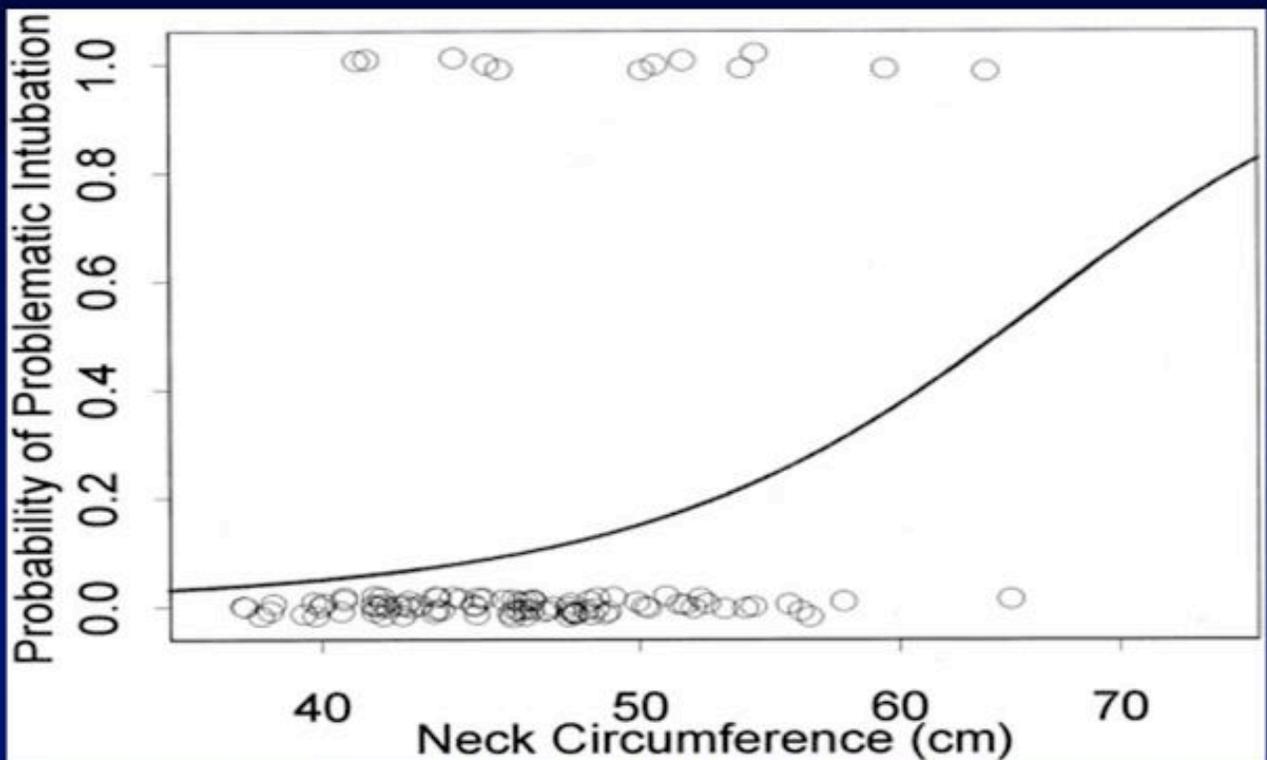
# AIRWAY AND OBESITY

Patients were compared for difficulty in intubation:  
129 obese (BMI >35) and 134 lean (BMI <30).

- 16% of obese and 2% of lean patients were difficult (no intubations were impossible).
- Mallampati  $\geq 3$  was independent risk factor (OR 12.5), but positive predictive value was only 29%.
- BMI did not predict difficulty.

Anesth Analg 2003;97:595

# AIRWAY AND OBESITY



**Anesth Analg 2002;94:732-736**

# AIRWAY AND OBESITY



- A horizontal line should connect the sternal notch to the external auditory meatus.
- The authors successfully intubated the tracheas of 99 of 100 morbidly obese patients by direct laryngoscopy in this position.

Anesth Analg 2003;96:1841

# GENERAL ANESTHESIA

A randomized, double-blind comparison of ketamine 1mg/kg or thiopental 4mg/kg for induction prior to cesarean favored ketamine:

- Postop PCA morphine consumption was less.
- Time to first PCA demand was greater.
- Apgar scores were similar, but pH was higher.
- No patient had unpleasant dreams.
- Allows initial use of 100% O<sub>2</sub> without awareness.

Anesth Analg 1997;85:1294

# GENERAL ANESTHESIA

- The LMA-Fastrack™ was used in 254 non-obstetric patients with recognized difficult airways. The success rates were 96.5% for blind intubations (within 3 attempts) and 100% with fiberoptics.

Anesthesiology 2001; 95:1175

- The intubating LMA can be inserted just as successfully in obese as normal patients with similar success rates for tracheal intubation (96%).

Anesthesiology 2005;102:1106

# MUSCLE RELAXANTS

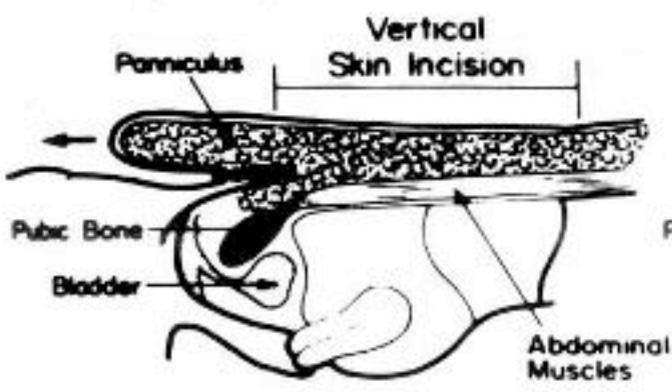
- Duration of rocuronium is significantly prolonged in obese patients when dosed by real (vs. ideal) body weight.
- Duration of cisatracurium was also markedly prolonged when dosed by real body weight.

Anesth Analg 2004;99: 1086, 1090

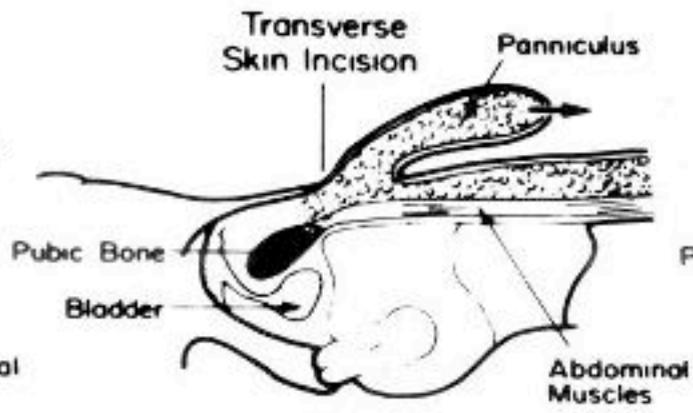
# SURGICAL ISSUES

The panniculus can be managed in 3 ways:

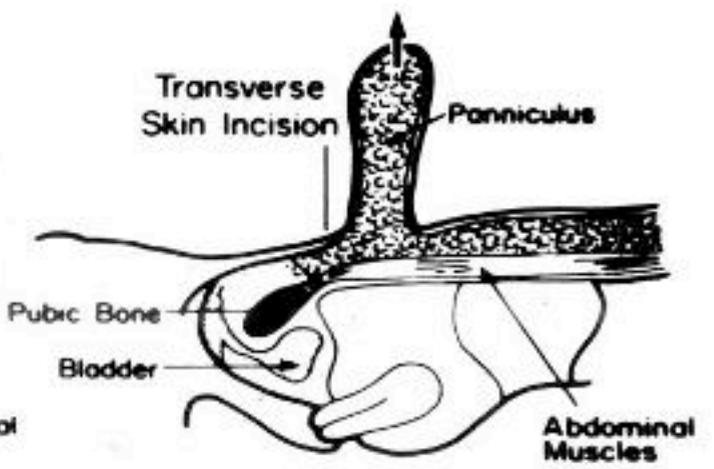
1. Retracted caudad with a vertical incision above
2. Retracted cephalad with a Pfannenstiel incision (caval compression, chest wall compliance)
3. Vertical retraction with a Pfannenstiel incision



(A)



(B)



(C)

← FEET

HEAD →

# EMERGENGE

- The incidence of dangerous post-extubation obstruction is ~5% in patients with OSA.
- Extubate with nasal and/or oral airways in place.
- If there are concerns about re-intubation, extubate over an airway exchange catheter.
- Nasal CPAP or BIPAP may be needed in PACU.
- Consider recovery in your main O.R. PACU.
- Keep in semi-sitting position; never supine!

# MATERNAL MORTALITY

A review of maternal deaths in Michigan 1985-2003 found 8/855 were anesthesia-related.

- 5/8 were airway obstruction during emergence from GETA or sedation → PACU issues, MD supervision / availability
- 2/8 were spinal-related; high block or late arrest
- 1/8 was post-op PCA respiratory depression / OSA
- 75% black, 75% obese (BMI>30)

Anesthesiology 2007;106:1096

# MATERNAL MORTALITY

*The Confidential Enquiry into Maternal and Child Health: Saving Mother's Lives, 2003-5:*

- 6 anesthesia deaths; 0.28 per 100K maternities
- 4/6 involved **GETA and obesity**; 3 were post-op respiratory failure, 1 was an intra-op cardiac arrest during postpartum surgery for infection

Saving Mother's Lives 2003-5, London: CEMACH