Morbidly obese patients: A clinical challenge for everyone

Frances Chung
Professor, Dept. of Anesthesiology
Toronto Western Hospital
University Health Network
University of Toronto
Case Presentation

- Male patient 55 years old
- BMI 50
- Hx of hypertension
- Laparoscopic colon resection
- Hx of heavy snoring
- Preop clinic: O2 saturation 88%
Case Presentation

• Does this patient has obstructive sleep apnea?

• Does this patient has obesity hypoventilation syndrome?

• Does this patient has underlying COPD?
Periop Mx of Morbidly Obese Pt

• Prevalence
• Preop evaluation and preparation
  Metabolic syndrome
  OSA, OHV
• Intraop Mx
  Difficult intubation
  Position
  Ventilation strategy
• Postop Mx
Morbidity and mortality

- Do morbidly obese patients have increased morbidity and mortality?

1. Yes
2. No
What is the BMI cut-off that increases mortality and morbidity?

1. BMI > 35
2. BMI > 40
3. BMI > 45
4. BMI > 50
5. BMI > 55
What is the age cut-off that increases mortality or morbidity?

1. Age > 40
2. Age > 45
3. Age > 50
4. Age > 55
5. Age > 60
Obesity surgery mortality risk score: To predict risk in pts for gastric bypass

5 factors

- BMI > 50
- 45 yrs. or older
- Risk of thromboembolism
- Male
- Hypertension

DeMaria EJ et al. Surg Obese Relat Dies 2007;3:134-140
Periop safety in longitudinal assessment of bariatric surgery

Factors affecting periop outcome

• BMI >53 kg/m²
• Hx of DVT
• Hx of sleep apnea
• Inability to walk > 200 feet
• Coexisting medical conditions
• Invasiveness of the surgical procedure

Flum DR NEJM 2009; 361: 445-54
Are laparoscopic bariatric procedures safe in super obese (BMI ≥50 kg/m²) pts?

- Super obese (>50 kg/m²) vs. morbidly obese (40-49 kg/m²)
- Superficial and deep wound infections
- Sepsis, septic shock
- 30-day mortality (OR 13X)

Higher BMI: Higher incidence of Cx

Obesity Paradox in Surgical pts

Moderately-obese pts had a lower 30 day mortality vs. pts with normal BW

Mild/moderate obese pts do better

Cut off: BMI >40

Mullen JT et al  Ann Surg 2009; 250: 166-72
Glance et al Ann surg 2009 250: 166 -172
30 day mortality & Cx in pts with non-bariatric surgery and bariatric surgery

Would you do morbidly obese patients for gastric banding as outpatient procedure?

1. Yes

2. No
Do you have a BMI cut off for morbidly obese undergoing outpatient surgery?

1. BMI >35
2. BMI >40
3. BMI >45
4. BMI >50
5. BMI >55
Low hospital readmission following bariatric surgery: gastric banding (N = 26,002)

- 30-day readmission rate: 1.2%
- Mortality: 0.02%, 3 MI + 3 indeterminate deaths

Dorman RB PLoS ONE 2012; 7(3): e32506
Low hospital readmission following bariatric surgery (N = 26,002)

- 5 Factors that influenced readmission:
  - Male
  - OSA
  - Hx of DVT or PE
  - GERD
  - Symptomatic asthma

Dorman RB PLoS ONE 2012; 7(3): e32506
Systematic review of same-day laparoscopic adjustable gastric band surgery

- 6 studies, 1 randomized trial and 5 cohort studies

- < 1% pts had to be admitted

Thomas H, Obes Surgery 2011;21;805-10
Selection of pts with obesity undergoing ambulatory surgery: A systematic review

- 20 studies: 11 prospective cohorts, 9 retrospective studies
- No differences in the rate of unplanned admission between obese and non-obese cohorts

Girish J et al Anesth Analg 2013
Selection of pts with obesity undergoing ambulatory surgery: A systematic review

- Increased respiratory events:
  O2 desat., bronchospasm, laryngospasm, airway Cx

- Prolonged PACU stay (1 study)
- Wound infection and UTI more common

Girish J et al Anesth Analg 2013
Selection of pts with obesity undergoing ambulatory surgery: A systematic review

- Probably safe to do obese patients for outpatient surgery
- Caution with pts with BMI >50
- Caution with pts with untreated pre-existing diseases

Girish J et al Anesth Analg 2013
Morbid obesity is associated with ischemic optic neuropathy (ION) after spinal fusion

- ASA Postop Visual Loss Registry
  Pts with ION matched with control pts without ION

- Obesity (OR 2.8) a risk factor

Anesthesiology 2012; 116: 15-24
Periop Mx of Morbidly Obese Pt

- Prevalence
- Preop evaluation and preparation
  - Metabolic syndrome
  - OSA, OHV
- Intraop Mx
  - Difficult intubation
  - Position
  - Ventilation strategy
- Postop Mx
Preoperative Assessment and Preparation

- Recognize metabolic syndrome
- Recognize OSA, Recognize OHV
Which is worse?

1. Android obesity
2. Gynecoid obesity
Periop outcomes in pts with MetS undergoing noncardiac surgery

Pts with MetS + super obese 2X risk of death

MetS 2-2.5 X risk of cardiac adverse events
MetS 3-7 X risk of acute kidney injury

Glance LG et al Anesthesiology 2010;113;859-72
Which is worse?

1. Large amt of intravisceral fat

2. Large amt of subcutaneous fat
Android Obesity

- **Extra visceral adiposity**
  - Thick subcutaneous fat
  - Scant intra-abdominal fat

- **Intra-visceral adiposity**
  - Scant subcutaneous fat
  - Thick intra-abdominal fat
Preop Measurement

- BMI ; IBW
- Waist and hip circumference; WHR
- Abdominal wall thickness; intra-abdominal fat
- What is the neck circumference that predicts difficult intubation?
- STOP-Bang questionnaire
Neck circumference & probability of problematic intubation

60 cm neck circumference
35% probability of DI
Preoperative Evaluation

- STOP-Bang questionnaire
- Baseline O2 saturation
- Glucose intolerance
- Liver function
Preop wt loss with a low energy diet reduces size of liver dramatically

- 8% reduction of wt: 80% reduction of liver volume 0-2 wks.
- Easier approach for surgery

Colles SL Am J Clin Nutr 2006;84:304-11
Preop 10% wt loss a shorter LOS, and few postop Cx after gastric bypass surgery

Benotti PN et al    Arch Surg 2009;144:1150-54
Periop Mx of Morbidly Obese Pt

• Prevalence

• Preop evaluation and preparation
  Metabolic syndrome
  OSA, OHV

• Intraop Mx
  Difficult intubation
  Position
  Ventilation strategy

• Postop Mx
Prevalence of OSA in Morbidly Obese Pt for Bariatric Sugary

• 71% dx to have OSA by sleep studies

WC Frey, Obese Surg 2003; 13:676-83
STOP questionnaire to screen OSA

• S - Snoring
• T - Tiredness / sleepiness / fatigue
• O - Observed apnea
• P - Blood Pressure (>140/90) treated or untreated

Chung et al. Anesthesiology 2008; 108:1-10
STOP- Bang

• STOP
• B BMI>35
• A Age >50
• N Neck circumference >40 cm
• G Gender male

• 4 / 8 questions positive

Chung et al. Anesthesiology 2008; 108:1-10
Predictive performance of STOP-Bang score for identifying OSA in obese pts

• STOP-Bang score 4 or greater is good to identify obstructive sleep apnea

• Sensitivity 88%
• Diagnostic odds ratio: 5 for identifying severe OSA

Chung F et al Obes Surg 2013 June
Do you look at HCO3 level?

1. Yes
2. No
Sensitivity and Specificity of Combining STOP-Bang and HCO$_3$-Severe OSA

<table>
<thead>
<tr>
<th>STOP-Bang ≥ 3</th>
<th>HCO$_3$ ≥ 28</th>
<th>HCO$_3$ ≥ 29</th>
<th>HCO$_3$ ≥ 30</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sensitivity (SN)</td>
<td>97.3%</td>
<td>48.6%</td>
<td>29.7%</td>
</tr>
<tr>
<td>Specificity (SP)</td>
<td>27.7%</td>
<td>79.4%</td>
<td>87.7%</td>
</tr>
</tbody>
</table>

SN: Sensitivity; SP: Specificity

Chung F et al Chest 2013
Obesity Hypoventilation Syndrome

- 0.15-0.3% of general population
- Obesity BMI $\geq 30 \text{ kg/m}^2$
- Daytime awake hypercapnia
  \[ \text{PaCO}_2 \geq 45 \text{ mmHg} \]
- Hypoxemia \[ \text{PaO}_2 < 70 \text{ mmHg} \]
- Pulmonary hypertension
Survival analysis of OHV pts
Periop Mx of Morbidly Obese Pt

• Prevalence
• Preop evaluation and preparation
  Metabolic syndrome
  OSA, OHV
• Intraop Mx  Difficult intubation
  Position
  Ventilation strategy
  Anesthetic strategy
• Postop Mx
Difficult tracheal intubation: controversial literature

- 13-20% of all intubation in MO
- High Mallampati score ≥ 3
- Increased neck circumference > 43 cm
- Excessive pre-tracheal fat

Ezri T et al    CJA 2003;50:179-83
Gonzalez H et al  A&A 2008;106:1132-6
MO accounts for high incidence of difficult airway: ASA closed claims study

- Obese pts
- 37% of all adverse events at induction
- 58% at extubation

Peterson GN Anesthesiology 2005;103:33-9
Morbid obesity and difficult airway
Mx – What is the risk?

Difficult mask ventilate 1.4%
Impossible mask ventilate 0.15%

Predictors of difficult mask ventilation
• Increased BMI
• OSA or history of snoring
• Beard
• Older age

Kheterpal S et al Anesthesiology 2006;105:885-91
Mouth opening and morbid obesity

- Full mouth opening
- 26 degree of craniocervical extension from neutral
- Pts with restricted craniocervical movement
- Reduced mouth opening ability

Calder I et al. Anesthesiology 2003;99:799-801
Periop Mx of Morbidly Obese Pt

- Prevalence
- Preop evaluation and preparation
  - Metabolic syndrome
  - OSA, OHV
- Intraop Mx
  - Difficult intubation
  - Position
  - Ventilation strategy
  - Anesthetic strategy
- Postop Mx
Pulmonary atelectasis between morbidly obese and non-obese pts

AS Eichenberger et al, Anesth Analg 2002; 95:1788-95
Preoxygenation is effective in 25* head-up vs. supine position

- 25* head-up vs. supine for pre-oxygenation 3 min

- Prolong apnea time to desaturate to 92%
  1 min

Lower FiO2 prevent atelectasis at induction

- 100% O2  7 % atelectasis
- 80% O2  1 % atelectasis

- Decrease critical time available for intubation
- Cannot be recommended

Akca O et al Anesthesiology 1999;91:991-8
Edmark I et al Anesthesiology 2003;98:28-33
Do you do recruitment maneuver after intubation?

1. Yes

2. No
Recruitment maneuvers open up collapsed area by plateau pressure

- What is a RM? Valsalva

- 40 cm H₂O for 10-30 s
  PEEP after CPAP maneuvers keep lung open
NPPV and RM improve PaO2 after intubation of MO pts

• Noninvasive positive pressure ventilation (Pr support 8 ml/kg)
• PEEP 8 cm
• RM 40 cm H2O for 40 s

• Improves PaO2

Futier E et al Anesthesiology 2011;114:1354-63
RM + PEEP prevent atelectasis

Ventilation strategies in obese surgical pts: A systematic review and meta-analysis

- 13 studies (505 obese pts)

- RM + PEEP vs. PEEP alone

- Improves intraop oxygenation and compliance without adverse effects

Summary of ventilation strategy

- Troop pillow; 25 to 35 degree head up
- Recruitment maneuvers after intubation
- 40 cm for 10-30 sec, repeated 4 times
- Noninvasive positive pressure ventilation (Pr support 8 ml/kg)
- PEEP 8 cm
- Extubation 25-35 degree head up
Periop Mx of Morbidly Obese Pt

• Prevalence
• Preop evaluation and preparation
  Metabolic syndrome
  OSA, OHV
• Intraop Mx
  Difficult intubation
  Position
  Ventilation strategy
  Anesthetic strategy
• Postop Mx
Obese Patients

- Goals for Obese pts:
  - Rapid awakening & assessment
  - Recovery of mobility & function
  - Rapid recovery of airway patency, effective ventilation and protective airway responses
## Summary of Drugs and Pharmacokinetic Considerations

<table>
<thead>
<tr>
<th>Drug</th>
<th>Base dose on</th>
</tr>
</thead>
<tbody>
<tr>
<td>Propofol</td>
<td>TBW</td>
</tr>
<tr>
<td>Succinylcholine</td>
<td>TBW</td>
</tr>
<tr>
<td>Rocuronium</td>
<td>IBW</td>
</tr>
<tr>
<td>Cis-atracurium</td>
<td>IBW</td>
</tr>
<tr>
<td>Vecuronium</td>
<td>IBW</td>
</tr>
</tbody>
</table>

Lean BW: a more appropriate wt-based scalar for propofol infusion for induction of GA in MO pts

## Summary of Drugs and Pharmacokinetic Considerations

<table>
<thead>
<tr>
<th>Drug</th>
<th>Base dose on</th>
</tr>
</thead>
<tbody>
<tr>
<td>Propofol</td>
<td>TBW</td>
</tr>
<tr>
<td>Succinylcholine</td>
<td>TBW</td>
</tr>
<tr>
<td>Rocuronium</td>
<td>IBW</td>
</tr>
<tr>
<td>Cis-atracurium</td>
<td>IBW</td>
</tr>
<tr>
<td>Vecuronium</td>
<td>IBW</td>
</tr>
</tbody>
</table>

Succinylcholine Dose

Increased conc. of pseudocholinesterase
- Increased volume of ECF
- Increased Sux requirements
- Based on TBW
- Better intubating condition

### Summary of Drugs and Pharmacokinetic Considerations

<table>
<thead>
<tr>
<th>Drug</th>
<th>Base dose on</th>
</tr>
</thead>
<tbody>
<tr>
<td>Propofol</td>
<td>TBW</td>
</tr>
<tr>
<td>Succinylcholine</td>
<td>TBW</td>
</tr>
<tr>
<td>Rocuronium</td>
<td>IBW</td>
</tr>
<tr>
<td>Cis-atracurium</td>
<td>IBW</td>
</tr>
<tr>
<td>Vecuronium</td>
<td>IBW</td>
</tr>
</tbody>
</table>

Rocuronium

• Rocuronium dose in MO : IBW

• When dosed on TBW
  duration of action 2X

<table>
<thead>
<tr>
<th>Drug</th>
<th>Base dose on</th>
<th>Pharmacokinetic Considerations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fentanyl</td>
<td>LBW</td>
<td>Expect prolonged recovery</td>
</tr>
<tr>
<td>Isoflurane</td>
<td></td>
<td>Expect rapid recovery</td>
</tr>
<tr>
<td>Sevoflurane</td>
<td></td>
<td>Expect rapid recovery</td>
</tr>
<tr>
<td>Desflurane</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Neostigmine</td>
<td>0.04-0.08 mg/kg</td>
<td></td>
</tr>
<tr>
<td>Sugammadex</td>
<td></td>
<td>No data available</td>
</tr>
</tbody>
</table>

Fentanyl for MO pts: Use LBW

- High CO in MO pts results in lower fentanyl conc.
- Dose of fentanyl ; based on LBW
- Dose based on TBW may cause overdosing in MO

Shibutani K et al BJA 2005;95:377-83
## Summary of Drugs and Pharmacokinetic Considerations

<table>
<thead>
<tr>
<th>Drug</th>
<th>Base dose on</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fentanyl</td>
<td>LBW</td>
</tr>
<tr>
<td>Isoflurane</td>
<td>Expect prolonged recovery</td>
</tr>
<tr>
<td>Sevoflurane</td>
<td>Expect rapid recovery</td>
</tr>
<tr>
<td>Desflurane</td>
<td>Expect rapid recovery</td>
</tr>
<tr>
<td>Neostigmine</td>
<td>0.04-0.08 mg/kg</td>
</tr>
<tr>
<td>Sugammadex</td>
<td>No data available</td>
</tr>
</tbody>
</table>

## Summary of Drugs and Pharmacokinetic Considerations

<table>
<thead>
<tr>
<th>Drug</th>
<th>Base dose on</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fentanyl</td>
<td>LBW</td>
</tr>
<tr>
<td>Isoflurane</td>
<td>Expect prolonged recovery</td>
</tr>
<tr>
<td>Sevoflurane</td>
<td>Expect rapid recovery</td>
</tr>
<tr>
<td>Desflurane</td>
<td>Expect rapid recovery</td>
</tr>
<tr>
<td>Neostigmine</td>
<td>0.04-0.08 mg/kg</td>
</tr>
<tr>
<td>Sugammadex</td>
<td>IBW may be inadequate</td>
</tr>
</tbody>
</table>

Llaurado et al Anesthesiology 2012; 117:1–1
Opioid requirements after lap. bariatric surgery

• 42% severe pain
• More opioids in first 48h postop
• Predictors of severe pain
  Younger pt
  Male
  Previous psychiatric hospitalization

Weingarten TN et al Obes Surg 2011 ;21:1407-12
Dexmedetomidine Infusion during laparoscopic bariatric surgery

- Dose ranging study 0.2, 0.4, 0.8 μg/kg/hr
- Dex infusion rate 0.2 μg/kg/hr
- Recommended to minimize risk of CVS side effects

B Tufanogullari, Anesth Analg 2008; 106:1743-8
Dexmedetomidine Infusion during Laparoscopic Bariatric Surgery

- Reduce average end-tidal desflurane
- PACU stay shorter 20 min
- Reduce PACU fentanyl
- Reduce nausea
- Fail to facilitate late recovery

B Tufanogullari, Anesth Analg 2008; 106:1743-8
Sugammadex 2mg/kg vs. neostigmine 0.05mg/kg in MO pts

• Sugammadex prevents postop residual curarization better in MO pts

Gaszynski T et al  BJA 2012;108:236-9
Impact of morbid obesity on epidural Cx in labor (250 pts)

- MO pts vs. control
- Systolic hypotension 16% vs. 4%
- Diastolic hypotension 49% vs. 29%
- Prolonged fetal heart decelerations
- 16% vs. 5%

Vricella LK et al AJOG 2011;205:307.e1-6
Fast-track surgery for bariatric laparoscopic gastric bypass

• Preoxygenation: 10 cm PEEP

• Induction: TCI
  - Propofol target 6 μg/ml
  - Remifentanil target 8 ng/ml
  - Fentanyl 100 μg

• Intubation: vecuronium

Fast-track surgery for bariatric laparoscopic gastric bypass

- Maintenance
  - Desflurane 3-6% (0.5-1 MAC)
  - Oxygen 40%
  - Remifentanyl TCI

- End
  - Fentanyl 100 µg
  - Reversal agents
  - BIS
  - PEEP 5 cm

Fast-track surgery for bariatric laparoscopic gastric bypass

- **Antiemetic Prophylaxis**
  - Droperidol 1.25 mg
  - Ondansetron 4 mg
  - Dexamethasone 8 mg

- **Postop Pain**
  - Acetaminophen 1 gm IV
  - Parecoxib 40 mg
  - Bupivacaine infiltration

Fast-track surgery for bariatric laparoscopic gastric bypass

- Perioperative Time

Arrival OR → Induction start surgery → End surgery end anesthesia

7.4 min → 11 min → 3 min

Fast-track surgery for bariatric laparoscopic gastric bypass

- PACU
  - 3-4 hr stay
  - 20 m walk to toilet
  - Discharge to ward
  - 2-day stay

5 Principles in the anesthetic Mx of MO pt

• RA when possible
• Be prepared: Boy Scout’s motto
• GA: tracheal intubation and ventilation
• Postop care: monitoring, early mobilization
• Judicious use of any opioid by any route
Morbidly obese pt: 5 tips

- STOP-Bang questionnaire to screen OSA, OHV
- Use Troop pillow for intubation
- RM + PEEP to prevent atelectasis
- Use short acting agents
- Reverse Trendelenburg position for extubation
To cure sometimes
To relieve often
To comfort always