

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 Relate Dies 2007;3:134-140

DeMaria EJ et al Ann Surg 2007;246:578-584


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

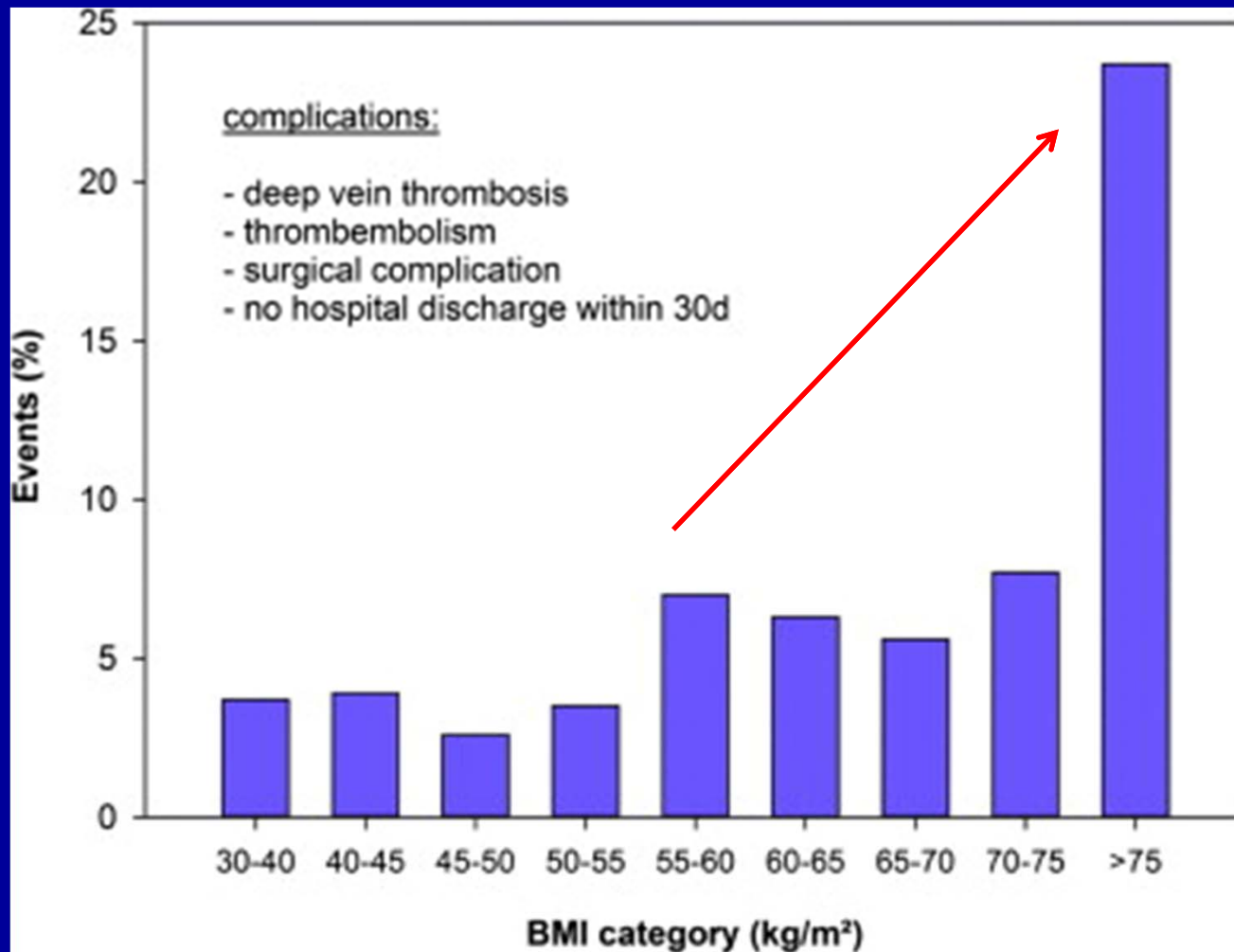
Flum DR NEJM 2009; 361: 445-54

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)**

Kakarla VR Surg Obes Relat Dis 2011; 7: 452–8.

Higher BMI: Higher incidence of Cx



Huschak G et al Best Practice & Research Clin End & Met 2013; 27: 247-260

Obesity Paradox in Surgical pts

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

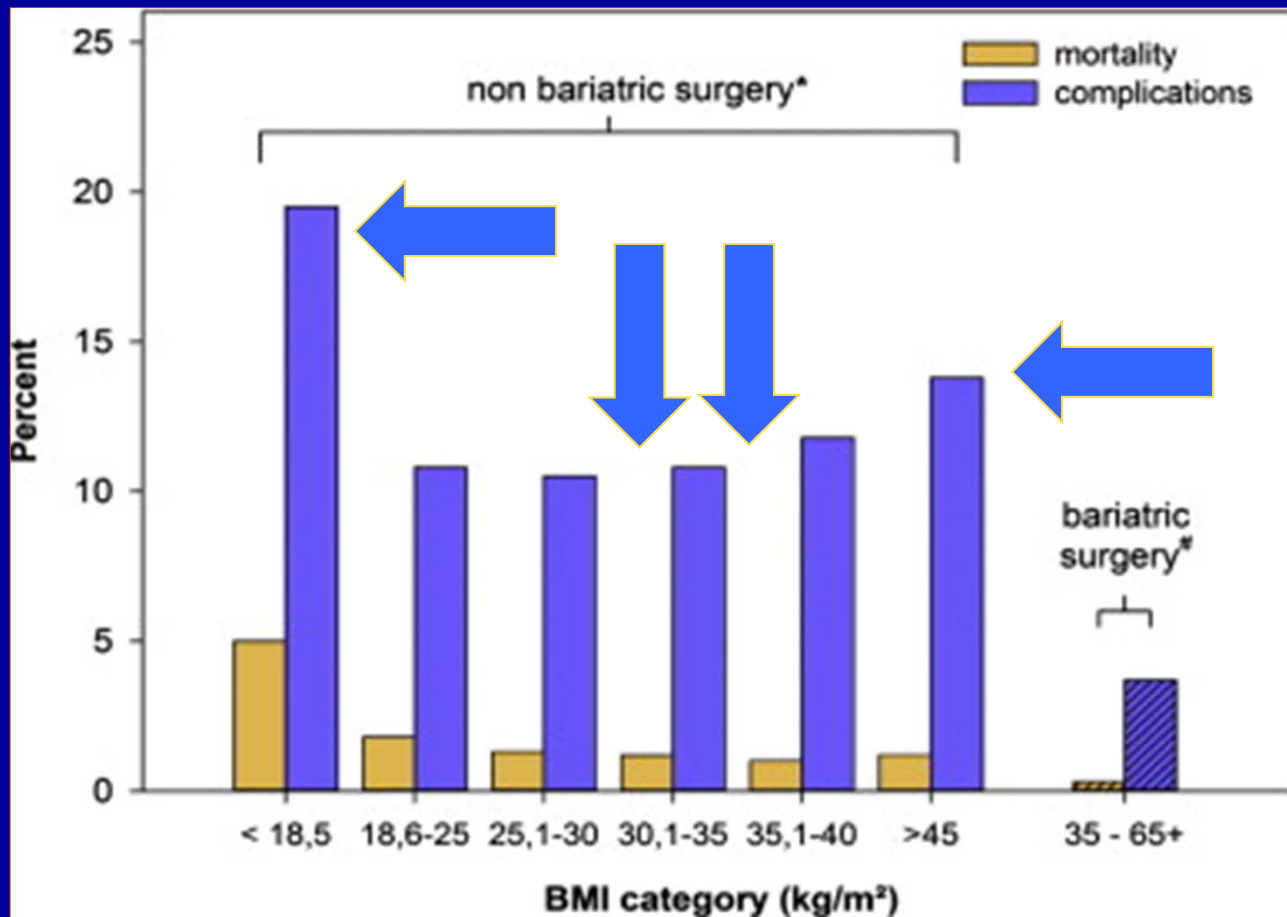
Mild/moderate obese pts do better

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



Huschak G et al Best Practice & Research Clin End & Met 2013; 27: 247-260

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

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

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

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

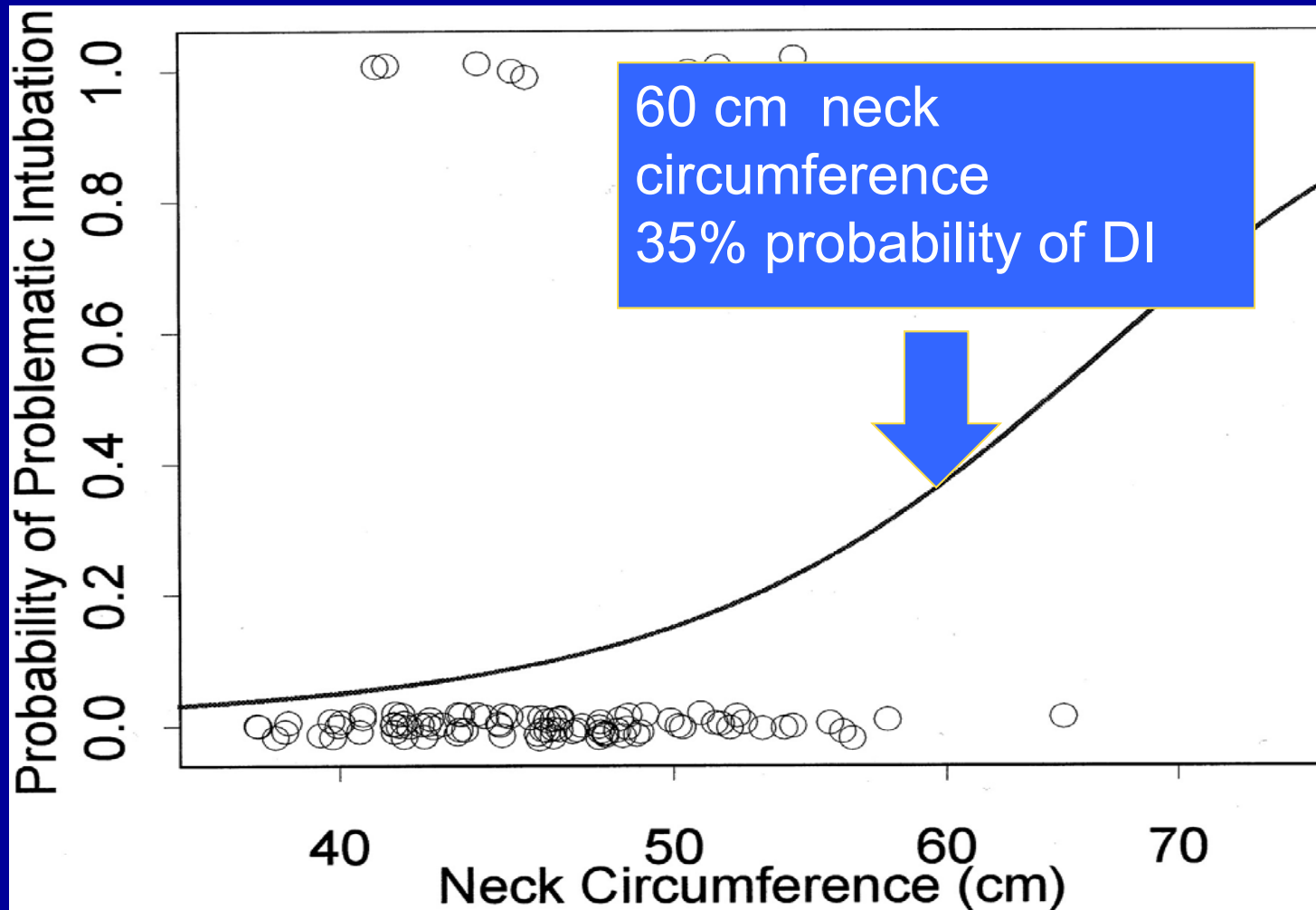
Android Obesity

- **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



Brodsky J B et al. *Anesth Analg* 2002;94:732-736

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

Still CD et al Arch Surg 2007;142:994-98

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 Surgery

- 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

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

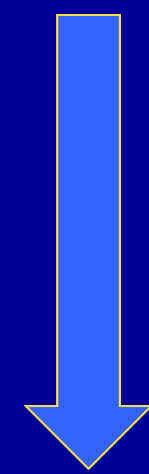
Do you look at HCO₃ level?

1. Yes
2. No

Sensitivity and Specificity of Combining STOP-Bang and HCO₃

Severe OSA

	SN	SP
★ STOP-Bang ≥ 3	97.3	27.7
★ STOP-Bang ≥ 3 + HCO ₃ ≥ 28	48.6	79.4
STOP-Bang ≥ 3 + HCO ₃ ≥ 29	29.7	87.7
STOP-Bang ≥ 3 + HCO ₃ ≥ 30	16.2	95.5



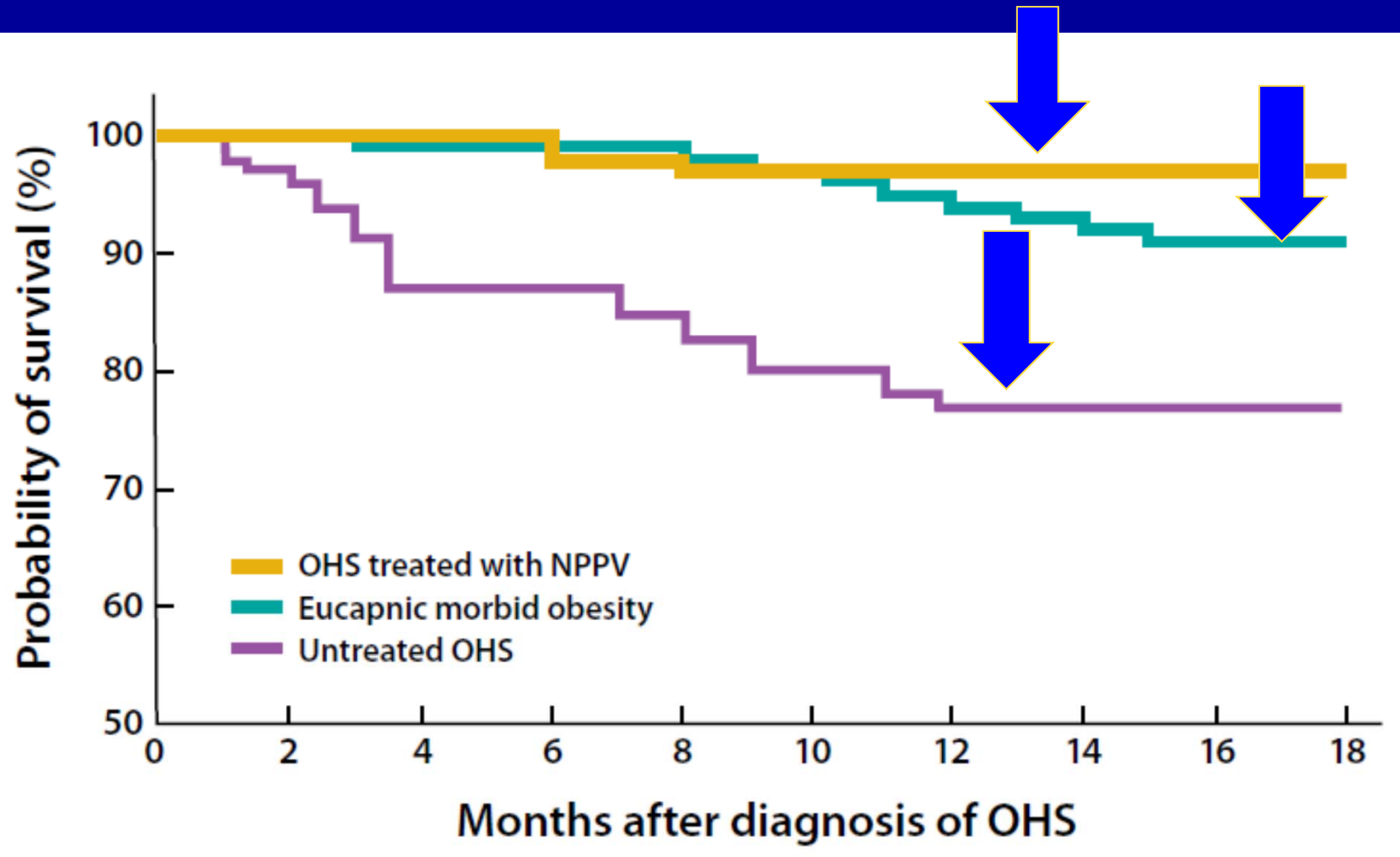
SN: Sensitivity; SP: Specificity

Chung F et al Chest 2013

Obesity Hypoventilation Syndrome

- 0.15-0.3% of general population
- Obesity BMI ≥ 30 kg/m²
- Daytime awake hypercapnia
 $\text{PaCO}_2 \geq 45$ mmHg
- Hypoxemia $\text{PaO}_2 < 70$ mmHg
- Pulmonary hypertension

Survival analysis of OHS 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

Juvin P et al A&A 2003;97:595-600

Ezri T et al CJA 2003;50:179-83

Brodsky JB et al A&A 2002;94:732-6

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

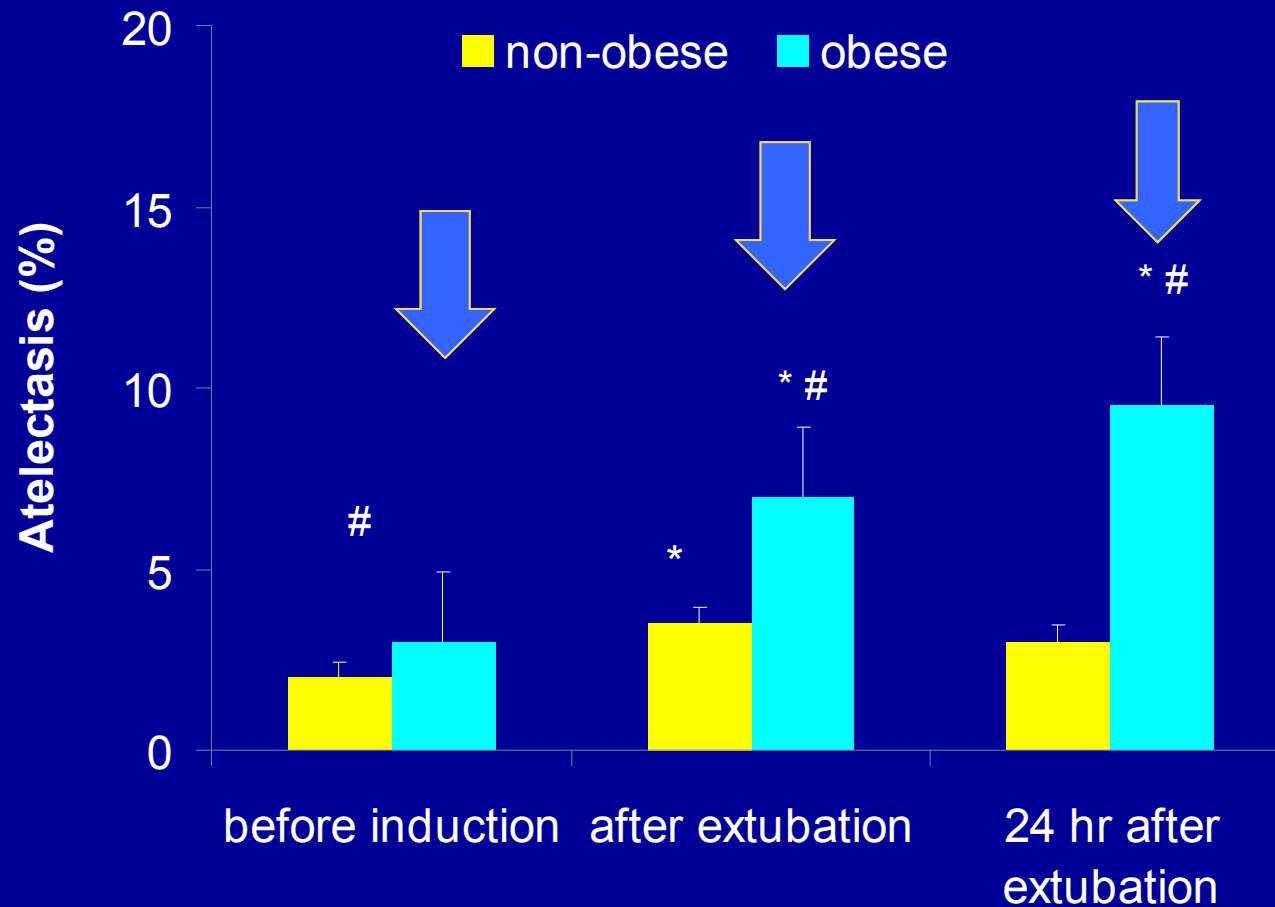
- Full mouth opening
- 26 degree of craniocervical extension from neutral

- Pts with restricted craniocervical movement
- Reduced mouth opening ability

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

Dixon BJ et al Anesthesiology 2005;102:1110-5

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

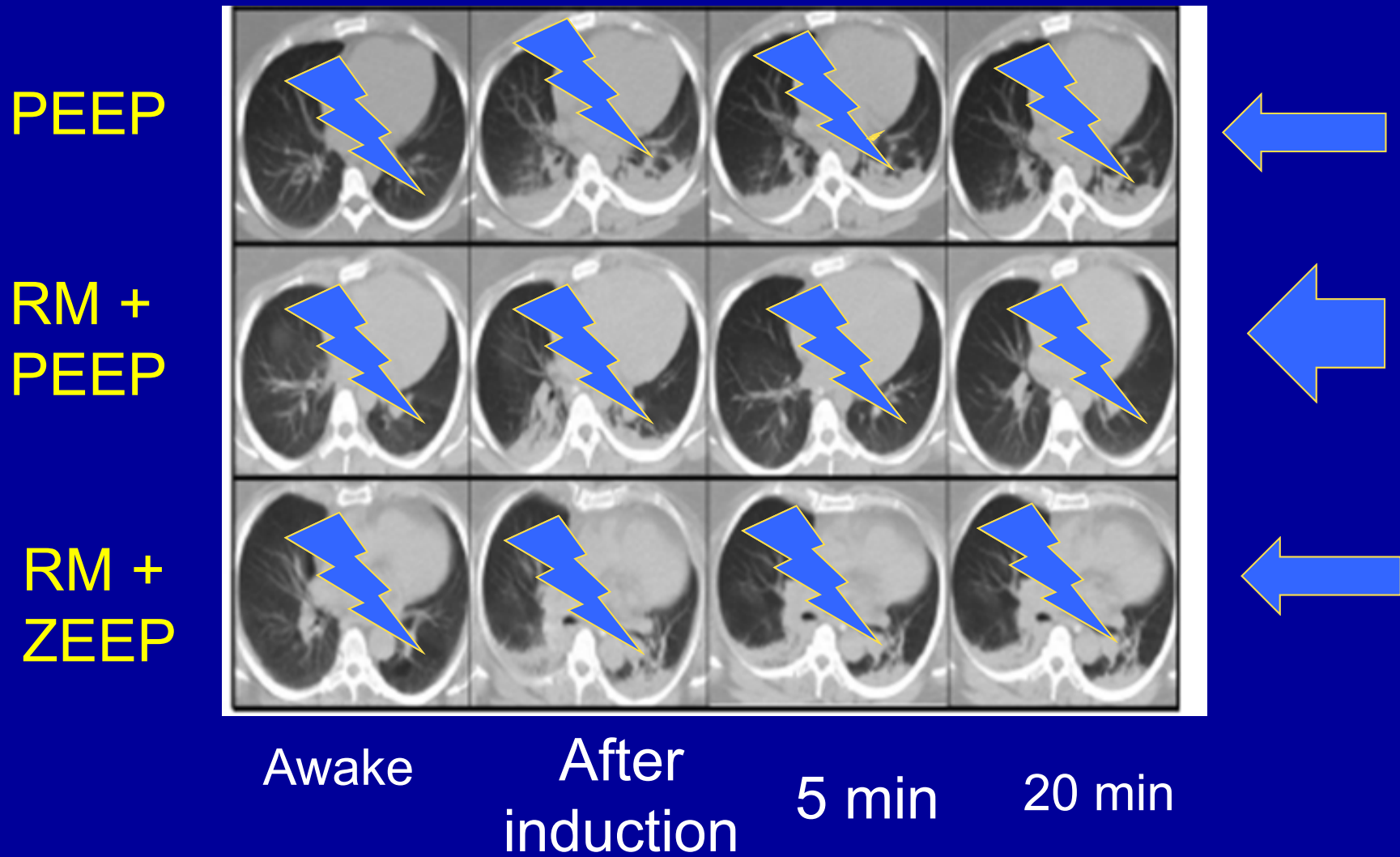
- Noninvasive positive pressure ventilation (Pr support 8 ml/kg)
- PEEP 8 cm
- RM 40 cm H₂O for 40 s

- Improves PaO₂

Futier E et al Anesthesiology 2011;114:1354-63

RM + PEEP prevent atelectasis

Reinius H, et al, Anesthesiology 2009; 111:979-87



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

Aldenkortt M BJA 2012;109: 493-502

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

Drug	Base dose on
Propofol	TBW
Succinylcholine	TBW
Rocuronium	IBW
Cis-atracurium	IBW
Vecuronium	IBW

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

Ingrande J et al A & A 2011;113:57-62

Summary of Drugs and Pharmacokinetic Considerations

Drug	Base dose on
Propofol	TBW
Succinylcholine	TBW
Rocuronium	IBW
Cis-atracurium	IBW
Vecuronium	IBW

Succinylcholine Dose

Increased conc. of pseudocholinesterase

- Increased volume of ECF
- Increased Sux requirements

- Based on **TBW**
- Better intubating condition

Lemmens HJ et al A & A 2006;102:438-42

Summary of Drugs and Pharmacokinetic Considerations

Drug	Base dose on
Propofol	TBW
Succinylcholine	TBW
Rocuronium	IBW
Cis-atracurium	IBW
Vecuronium	IBW

Y Leykin et al, Best Prac Rese Clin Anaesth 2011; 25:27-36

Rocuronium

- Rocuronium dose in MO : **IBW**
- When dosed on TBW
duration of action **2X**

Leykin Y et al A & A 2004;99:1086-9

Summary of Drugs and Pharmacokinetic Considerations

Drug	Base dose on
Fentanyl	LBW
Isoflurane	Expect prolonged recovery
Sevoflurane	Expect rapid recovery
Desflurane	Expect rapid recovery
Neostigmine	0.04-0.08 mg/kg
Sugammadex	No data available

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

Drug	Base dose on
Fentanyl	LBW
Isoflurane	Expect prolonged recovery
Sevoflurane	Expect rapid recovery
Desflurane	Expect rapid recovery
Neostigmine	0.04-0.08 mg/kg
Sugammadex	No data available

Summary of Drugs and Pharmacokinetic Considerations

Drug	Base dose on
Fentanyl	LBW
Isoflurane	Expect prolonged recovery
Sevoflurane	Expect rapid recovery
Desflurane	Expect rapid recovery
Neostigmine	0.04-0.08 mg/kg
Sugammadex	IBW may be inadequate

Y Leykin et al, Best Prac Rese Clin Anaesth 2011; 25:27-36
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 $\mu\text{g}/\text{kg}/\text{hr}$
- Dex infusion rate **0.2 $\mu\text{g}/\text{kg}/\text{hr}$**
- 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 ht 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 $\mu\text{g}/\text{ml}$
 - 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**

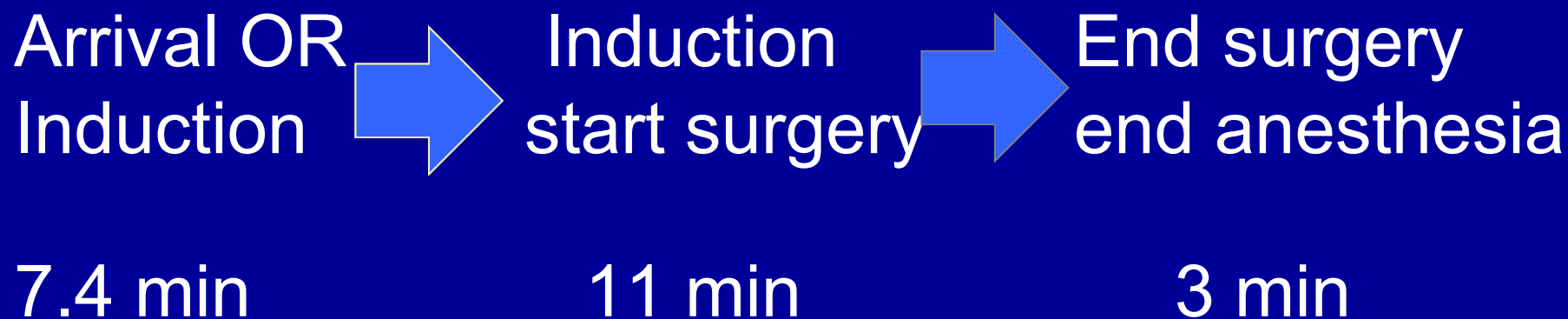
Acetaminophen 1 gm IV

Parecoxib 40 mg

Bupivacaine infiltration

Fast-track surgery for bariatric laparoscopic gastric bypass

- Perioperative Time



A Bergland et al, Acta Anaesth Scand 2008; 52:1394-9

Fast-track surgery for bariatric laparoscopic gastric bypass

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

A Bergland et al, Acta Anaesth Scand 2008; 52:1394-9

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