

THE MORBIDLY OBESE PATIENT

OBESITY REPRESENTS AN EXCESS PROPORTION OF ADIPOSE TISSUE TO TOTAL BODY WEIGHT AND IS DEFINED BY A BMI>30, MORBID OBEISITY AS A BMI>40

MANY PROBLEMS EXIST IN THE MANAGEMENT OF THE MORBIDLY OBESE PATIENT.

- PREHOSPITAL CARE MAY BE DELAYED DUE TO PROBLEMS IN MOVING/TRANSPORTING THESE PATIENTS,
- APPROPRIATE SIZED TROLLEYS MAY NOT BE READILY AVAILABLE,
- ACCESS TO BODY FLUIDS AND BODY CAVITIES MAY BE VERY DIFFICULT
- ADVANCED IMAGING TECHNIQUES ARE LIMITED BY WEIGHT

CHANGES OF MANAGEMENT DUE TO ALTERED PHYSIOLOGY

CARDIOPULMONARY DISEASE:

- Obese patients have higher cardiac output requirements and higher systemic blood pressures than non-obese patients
- Increased resting cardiac work
 - LV hypertrophy and diastolic dysfunction
- Compromises in pulmonary function:
 - Decreased chest wall and lung elasticity (\downarrow compliance)
 - Higher airway resistance
 - Increased energy to expand the rib cage and contract the diaphragm when supine
 - Increased work of breathing
 - compromised oxygenation & ventilation, esp. when sleeping
 - hypoxic pulmonary vasoconstriction and pulmonary hypertension, as well as hypercapnia
 - Obstructive sleep apnoea is highly correlated
 - Obesity also highly correlated with HT, insulin resistance, coronary artery disease and CHF
- Consider REVERSE TRENDLENBURG POSITION in management of these patients

Some numbers:

- Increased airway resistance. [FEV1 of 50–75% predicted]
- Maximal voluntary ventilation.
 - 20% reduction in 'healthy obese'
 - 45% reduction in obese patients with OHS.
 - Less capable of generating inspir/expir pressures.
- 16% of VO₂ utilised for 'respiratory work'.
 - compared to 5% of normal people.
- Reduced FRC.
 - TV & TLC remain the same.
- FEV1:FVC reduces w/ increasing obesity.
 - Restrictive & obstructive disease.

Associations;

- Polycythaemia
- Apnoea during sleep
- Pulmonary HTN
- Cardiac failure.

VENOUS THROMBOEMBOLISM:

- Increased risk, ESPECIALLY AFTER TRAUMA - thought to be due in part to decreased level of circulating antithrombin III, preexisting venous disease and increased immobility

PREGNANCY:

- Increased risk for HT, diabetes, preterm birth, preeclampsia and eclampsia.

TRAUMA:

- Obesity is associated with an increased risk of unintentional injury and they are more likely to hurt themselves even after minor trauma
- Increased risk for failed reduction (either CR or ORIF) of ankle fractures
- Need STRONG SPLINTS IN SETTING OF FRACTURE
- Consider wheelchair as crutches may prove difficult
- Obese patients are TWICE AS LIKELY TO BE INJURED IN A VEHICLE ACCIDENT AS NON-OBESE PATIENTS
 - OSA may be causative factor
 - Higher mortality rates in blunt trauma
 - Higher rates of thoracic and lower extremity injuries
 - Lower rates of head injuries
 - More infectious complications
 - Higher rates of death from respiratory complications of trauma
- The same principles of trauma management apply, but the presence of subcutaneous fat may obscure findings in thoracic or abdominal injuries.

COMPLICATIONS OF BARIATRIC SURGERY:

- Complications of weight loss surgery are common and are associated with high morbidity and mortality.
 - THE TWO MOST COMMON ARE ANASTOMOTIC LEAK AND ACUTE GASTRIC DISTENTION
- Various types of surgery discussed in earlier chapter

ANASTOMOTIC LEAK:

- Results in peritonitis and is the most common cause of death post bariatric surgery
- Must be considered in patients who present within 1 month of bariatric surgery with fever, abdominal pain, back pain or tachycardia.
- Because of poor sensitivity of exam and contrast studies, OPERATIVE RE-EXPLORATION MUST BE CONSIDERED IN ILL-APPEARING PATIENTS WITH SYMPTOMS SUGGESTIVE OF LEAKAGE

ACUTE GASTRIC DISTENTION:

- Typically occurs within first several days
 - NAUSEA, VOMITING, BLOATING AND HICCUPS

- Beware that NG insertion has the risk of disrupting the suture lines in cases of recent surgery and generally should not be performed until discussed with the surgical consultant
 - NB - NG decompression is ineffective in treating distention of the remnant stomach following Roux-en-Y gastric bypass
- *LATE COMPLICATIONS:*
 - Incisional and internal hernias
 - Stomal stenosis
 - Band erosion or migration
 - Small bowel obstruction
- *MIGRATION:*
 - Refers to movement of a portion of the stomach initially below the band to above the band
 - Can occur at any time
 - Presents with symptoms of acute gastric obstruction
 - May progress to gastric necrosis and perforation

NONSURGICAL COMPLICATIONS:

- Venous thromboembolism
 - PE is the second-most common cause of death following weight loss surgery
- Malnutrition
 - Rare after restrictive surgeries (gastric band)
 - Common following malabsorptive procedures (eg. Roux-en-Y gastric bypass)
 - Deficiency of B1 --> peripheral neuropathy and myopathy
- Gastric ulcers
- *DUMPING SYNDROME:*
 - Caused by rapid transfer of undigested food into the small bowel presents with satiety pain, nausea and weakness
 - Frequent small meals, avoidance of simple sugars and consumption of liquids separate from meals

RECOMMENDATIONS FOR ALTERED MEDICATION DOSING IN OBESITY:

PATHOPHYSIOLOGY:

- Several factors alter drug metabolism
 - Greater stores of adipose tissue increase VOL-D OF LIPOPHILIC DRUGS --> lower serum levels and longer clearance times
 - INCREASED CREATININE CLEARANCE
 - Increased activity of CYP2E1 and decreased CYP3A4
 - Decreased tissue perfusion --> lower concentrations of antibiotics in skin and soft tissues

- CONSIDER TOTAL BODY WEIGHT (versus IDEAL BODY WEIGHT, lean body weight)
 - Some drugs need an adjustment prior to dosing
 - Lean body weight ~1.3x IBW

Table 296-1 Formulas for Calculation of Ideal, Lean, and Adjusted Body Weights

Ideal body weight (males) = 50 kg + 2.3 kg for each in. over 5 ft

Ideal body weight (females) = 45 kg + 2.3 kg for each in. over 5 ft

Lean body weight = 1.3 x ideal body weight

Adjusted body weight = ideal body weight + [0.4* (total body weight - ideal body weight)]

SELECTED NEUROMUSCULAR BLOCKING AGENTS:

- SUCCINYLCHOLINE:
 - 1mg/kg of TOTAL BODY WEIGHT provides more consistent paralysis than dosing by ideal or lean body weight, but has a LONGER DURATION OF PARALYSIS (8 MINUTES).
- VECURONIUM:
 - May be dosed as 0.1mg/kg TBQ, but time to recovery is increased by 50% to average 75 minutes vs 46 minutes in non-obese

HEPARIN AND ENOXAPARIN:

- Unfractionated heparin may be given as it would a non-obese patient
- There is limited data supporting us of enoxaparin at 1.5x lean body weight bd for patients >100kg

SELECTED MEDICATIONS FOR PROCEDURAL SEDATION:

- OPIOIDS especially FENTANYL AND BENZODIAZEPINE are LIPOPHILIC
- Have a prolonged half-life in obese patients
 - Initial dose based on TBW but then on IBW thereafter
- PROPOFOL is lipophilic, but controlled studies have not shown any prolonged effects or increased duration of in TBW dosing
- DEXMEDETOMIDINE (α -2 AGONIST) provides sedation and analgesia without respiratory depression

SELECTED ANTIBIOTICS:

- Recommended initial dose of VANCOMYCIN in obese patients is 30mg/kg/day using TBW.
- By contrast, the initial dose of AMINOGLYCOSIDES SHOULD BE BASED ON ADJUSTED BODY WEIGHT USING A CORRECTION FACTOR OF 0.4 (see above table)
 - Subsequent doses of both aminoglycosides and vancomycin based on peak and trough levels

- Using non-weight based guides for dosing of penicillins and cephalosporins results in inadequate serum levels
 - Give 2g ceftriaxone, 2g cephazolin as standard dosing
- FLUOROQUINOLONES --> given at the maximum acceptable dose

Table 296-2 Dosing of Medications for Obese Patients

Medication	Standard Dose	Dose for Obese Patients	Notes
Succinylcholine	1.0–1.5 milligrams/kg	1 milligram/kg TBW	Prolonged duration.
Vecuronium	0.1 milligram/kg	0.1 milligram/kg TBW	Prolonged duration.
Unfractionated heparin*	80 units/kg, then 18 units/kg/h	80 units/kg, then 18 units/kg/h TBW	ABW dosing (factor of 0.5) also described.
Enoxaparin*	1 milligram/kg SC twice a day	1.5 milligrams/kg lean body weight SC twice a day	—
Vancomycin	1 gram	30 milligrams/kg TBW	Follow serum levels.
Aminoglycoside	Based on TBW	Based on ABW (factor of 0.4).	Follow serum levels.

PROCEDURES:

Table 296-3 Procedural Problems and Solutions in the Morbidly Obese

Procedure	Problem	Solution
Bag-mask ventilation	Reduced pulmonary compliance	Occlude pop-off valve, use two providers.
Oral intubation	Potentially difficult airway	Identify predictors of difficulty.
		Adjustable angle laryngoscope.
		Gum elastic bougie.
		Video laryngoscopy.
Surgical airway.		
Sphygmomanometry	Falsely elevated readings	Use larger cuff size.
Pulse oximetry	Poor signal	Earlobe probe.
Vascular access	Inability to locate vein/artery	Use 3- to 4-in. catheter.
		Patient positioning.
		US-facilitated cannulation.
		Consider central venous access.
Lumbar puncture	Difficulty in palpating landmarks	Upright patient positioning.
		Increase needle length to 5 in.
	Difficult to obtain cerebrospinal fluid	Use US to guide needle
Diagnostic peritoneal lavage	Accessing peritoneal cavity	Modified Seldinger technique.

AIRWAY MANAGEMENT:

- May be associated with difficult BVM ventilation and intubation, particularly if other predictors of difficulty are present (e.g. in-line immobilization, Mallampati grade III or IV)
- **OBESITY IS NOT A CONTRAINDICATION TO RAPID SEQUENCE**
- Preoxygenation is critical, as morbidly obese patients rapidly desaturate:
 - Higher rate of oxygen consumption
 - Low FRC
- Keep sitting upright or semirecumbent as long as possible to facilitate spontaneous ventilation
 - If BVM required, higher ventilatory pressure may be necessary to overcome reduced chest wall compliance
 - Use two person technique
- If intubation required consider:
 - Optimize position --> towels under shoulder blades/occiput to “ramp”
 - Apnoeic oxygenation (high-flow nasal prongs)
 - Awake oral or nasal intubation with topical LA
 - LMA (need higher cuff pressures to prevent excessive air leak)
 - Cricothyrotomy if fail above --> landmarks difficult (look ~4 finger-breadths above sternal notch)
- **INTUBATED PATIENTS SHOULD BE VENTILATED BASED ON IDEAL BODY WEIGHT NOT TBW** this avoids dangerously high airway pressures
 - Give higher PEEP to improve oxygenation
 - Reverse trendelenburg or “Beach-chair” position to improve oxygenation
 - Beware, as this decreases cardiac output, particularly in haemodynamically unstable patients.

ECG ANALYSIS:

- Demonstrate loss of voltage
- Flattening or inversion of the T wave in inferior or lateral leads in 30-50% patients
 - Thought to be due to leftward displacement of the base of the heart by abdominal adiposity

SPHYGMOMANOMETRY:

- Inadequate cuff width/circumference will **ARTIFICIALLY ELEVATE PRESSURE READINGS**
- To minimise errors a cuff width to arm circumference ratio of 2.5 and the bladder length should be 80% of the arm circumference

PULSE OXIMETRY:

- Tissue thickness can restrict light wave transmission in extreme obesity
 - Makes oximetry unreliable
 - Use earlobe probe instead of fingers

VENOUS ACCESS:

- Higher rate of CVC use due to difficulty with peripheral access
 - Higher rate of complications such as wound infection, pneumothorax, phlebitis or thrombosis
- OPTIMISE BEFORE ATTEMPT:
 - Heat/light
 - Tapping over the vessel
 - Active/passive movements of the extremity
 - REACTIVE HYPERAEMIA: occlude the circulation and then release sphygmo to 10-15 below diastolic
 - ULTRASOUND GUIDED ACCESS FOR BOTH PERIPHERAL AND CENTRAL VENOUS ACCESS
- CENTRAL LINE PLACEMENT:
 - Femoral catheterization assisted by placing towel under the ipsilateral buttock and having an assistant retract the panniculus
 - Alter standard length of needle required to access the vein

LUMBAR PUNCTURE:

- Perform in the sitting position
- Bone encountered after only a few centimeters represents spinous process (reposition above or below)
 - Deeper bony encounter is likely lamina and requires a medial adjustment
- Use longer needle
- Tight intervertebral disc space is common in this population

IMAGING:

- Radiographs have limited utility in the morbidly obese
- CT and MRI scans are clearly superior to radiographs, but many CT and MRI have weight capacity and girth limits
- Veterinary schools and zoos have scanners with a larger capacity