REVIEW ARTICLE

PERI OPERATIVE MANAGEMENT OF OBESE PATIENTS

Varsha Dubal

M.D Anaesthesia, Assistant Professor, Department of Anesthesia. Gujarat Adani Institute of Medical Sciences, Bhuj, Gujarat, India.

ABSTRACT:
Morbid obesity in both adults and children is becoming more prevalent in the developed and developing countries. An understanding of the relevant patho-physiology and drug pharmacokinetics aids the anesthetist in providing safe anesthesia. The patient must be monitored in appropriate facility after operation. Level 2 or 3 care should be available, if required. Regional anesthesia is an attractive option but presents technical challenges in obese patients..
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Corresponding author: Dr. Varsha Dubal, Assistant Professor, Department of Anesthesia. Gujarat Adani Institute of Medical Sciences, Bhuj, Gujarat, India.

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INTRODUCTION

The obesity in the developed world and in developing countries has increased significantly in recent times. These obese patients can present for planned or emergency surgery. Although, patients with mild degrees of obesity pose fewer additional problems for peri operative management, but those with moderate to severe obesity associated with co morbid conditions, require special attention, equipment and handling.

Pre-operative through assessment and preparation of the patient is very important. Secondly choice of anesthesia technique, positioning and handling of the patient, and postoperative care all require special attention and differs qualitatively as well as quantitatively from those of normal patients. This article discusses what individuals and departments should do to be prepared for obese patients who will present for surgery.[1]

RISK REDUCTION

Appropriate risk reduction strategies and protocols should be evolved to manage such morbidly obese patients. Following measures are suggested to this effect:

1. Each hospital should have its own policy or protocol for the management of the morbidly obese patient.
2. Each patient should be individually risk assessed and the care and treatment for that patient should be consulted.
3. Each hospital should implement an early warning system similar to that for latex allergy

Special equipment: Items such as larger gowns, larger TED stockings, blood pressure cuffs and tourniquets should be available.

DEFINITION OF OBESITY

Two types of obesity are described.

1. Central Android type of obesity (more common in men) fat is located in the abdomen and upper body. It is associated with the "metabolic syndrome" with an increased risk of cardiovascular disease.
2. Peripheral Gynecoid type of obesity (more common in women) fat is located primarily in the hips, buttocks and thighs.

Body mass index (BMI), an indirect measure of obesity, is calculated by dividing weight in kilograms (kg) by square of height in meters (m2). BMI does not consider gender or other contributing factors (water, muscle) as causes of increased TBW.

- BMI of 20-25 kg/m2 is defined as normal weight.
- BMI of 26 - 29 kg/m2 is "overweight".
- BMI > 30 kg/m2 is "obese".
- "Morbid obesity" obesity is defined as, if remains untreated, will significantly shorten life span of a person. BMI > 40 kg/m2 is "morbid obesity".

Metabolic Syndrome (Central Obesity) is said to occur if three or more of the following must be present:

- Waist circumference > 102 cm (men), > 88 cm (women)
- Serum triglycerides > 150 mg/dl
- HDL cholesterol < 40 mg/dl (men), < 50 mg/dl (women)
- Systolic blood pressure > 130 mmHg and/or diastolic 85 mmHg, or, on treatment at pre operative assessment.

Morbidity and mortality doubles with a BMI > 35 kg/m2 and rises exponentially with increasing BMI. Obesity is associated with chronic medical condition that must be recognized and optimized before surgery. Endocrine conditions such as Cushing's disease, hypothyroidism and polycystic ovary syndrome are also associated with obesity.

MEDICATION

All recent medications, including those prescribed for weight reduction, must be identified since many have important implications for anesthesia.

1. Combination of phentermine and fenfluramine ("Phen-Fen") is no longer prescribed, but phentermine is still used world-wide. An association between Phen-Fen and heart and lung problems has been clearly established. These medications must be stopped 2 weeks before surgery and a complete cardiac evaluation obtained.
2. Sibutramine works in the brain by inhibiting reuptake of nor-epinephrine, serotonin and dopamine, producing a feeling of "anorexia" limiting food intake. It can cause arrhythmias and hypertension.
3. Orlistat blocks absorption of dietary fat causing deficiencies in fat-soluble vitamins (A, D, E, and K). Reduced vitamin K level can increase the anticoagulation effects of coumadin.

OBESITY AND ITS EFFECTS

Pulmonary system: Adipose tissue is metabolically active and O2 consumption and CO2 production rise with increasing weight. The work of breathing is increased since more energy must be spent to carry additional body mass, while respiratory muscle performance is impaired. The fatty chest and abdominal walls reduce chest wall compliance.

Functional residual capacity (FRC) is significantly reduced due to a decrease in expiratory reserve volume (ERV), so is total lung capacity (TLC). Airways close during normal ventilation. Continued perfusion of non-ventilated alveoli results in a PaO2 that is lower than predicted for similar aged non obese patients. All these changes are directly proportional to increasing BMI.

Younger obese patients have an increased ventilatory response to hypoxia. An arterial blood sample usually shows alveolar hyperventilation (PaCO2 30-35 mmHg) and relative hypoxemia (PaO2 70-90 mmHg) on room air. With increasing age sensitivity to CO2 decreases, PaCO2 rises and PaO2 falls.

Cardiovascular system: Cardiac output rises about 0.1 liter/min for each 1 kg addition in weight. Stroke volume is elevated since total blood volume increases to perfuse the added body fat. Increased cardiac output combined with normal peripheral vascular resistance leads to systemic hypertension. Increases in blood volume and cardiac output eventually produce dilation and cardiac hypertrophy. Left ventricular dysfunction is often presents. Even normo tensive patients have increased pre-FRC

Gastrointestinal and urinary systems: It was once believed that obese patients were at greater risk for acid aspiration because of increased intra-abdominal pressure, high incidence of GERD and hiatus hernia, and increased gastric volume with low gastric fluid pH. Recent work has challenged this belief. There were no differences in gastric volume or pH between lean and moderately obese surgical patients. Obese patients without symptoms of GERD have relatively normal gastro-esophageal sphincter tone and may have faster gastric emptying time. Obesity is associated with increased renal blood flow and increased glomerular filtration rate.

Obstructive Sleep Apnea: This is important and frequent occurrence in obese patients. Many patients maintain normal PaCO2 during the day but have CO2-retention, sleep disturbances, intermittent airway obstruction with hypoxemia, pulmonary hypertension and cardiac arrhythmia's at night.

Obstructive sleep apnea (OSA) syndrome is characterized by frequent episodes of apnea (> 10 sec cessation of airflow despite continuous respiratory effort against a closed airway) and hypo pnea (50% reduction in airflow or reduction associated with a decrease of SpO2 > 4%). Patients

may not be aware of these symptoms, so it is important to inquire from their spouses. A definitive diagnosis can only be confirmed by poly somno grapy in a sleep laboratory.

Because of fragmented sleep patterns, patients may complain of daytime sleepiness and headaches. Chronic OSA leads to secondary polycythemia, hypoxemia, and hypercapnia; all increase the risk of cardiac and cerebral vascular disease.

OSA patients can be difficult to mask ventilate, and their tracheas can be difficult to intubate. OSA patients requiring nasal continuous positive airway pressure (N-CPAP) at home, and should bring it to the hospital to be used in the Pre Anesthetic Care Unit (PACU).

A few patients experience the "obesity hypoventilation syndrome" characterized by somnolence, cardiac enlargement, polycythemia, hypoxemia and hypercapnia. Hypoventilation is central and independent of intrinsic lung disease, and is probably due to progressive desensitization of the respiratory center to CO2 from nocturnal sleep disturbances.

It's most severe form, "Pickwickian Syndrome", is characterized by marked obesity, hyper somnolence, hypoxia, hypercapnia, pulmonary hypertension, right ventricular enlargement and hypervolemia. Patients rely on a hypoxic ventilatory drive and may hypoventilate or become apneic during emergence from general anesthesia when given O2.

OPERATIVE CONSIDERATIONS

Pre Medication:

1. Sedation is better avoided.
2. If fiber optic broncho scopic intubations are planned an anti-cholinergic is given.
3. Medications for chronic hypertension are continued; except ACE-inhibitors, since their presence can lead to profound hypotension during anesthesia.
4. Anti Diabetic medications are usually withheld on the morning of surgery, but blood sugar must be closely monitored before, during, and after surgery.
5. Prophylaxis antibiotics is indicated for wound infection,
6. Heparin is advice to prevent deep venous thrombosis (DVT).
7. H2-receptor antagonists or a proton pump inhibitor is advised if GERD is present.

Positioning:[2]

1. In the supine position FRC is markedly reduced causing ventilation/perfusion (V/Q) mismatch, and significant increases in O2 consumption, cardiac output, and PAP.
2. The reverse Trendelenburg position (RTP) or a "head-elevated" position is best tolerated since the diaphragm is "unloaded".
3. Trendelenburg (TP) and lithotomy positions decrease lung volumes.
4. In properly positioned prone patient ventilation is actually improved.
5. The lateral decubitus position is tolerated if the panniculus is displaced off the abdomen.

Monitoring:

1. For laparoscopy only standard monitoring is applied.
2. Non-invasive cuff pressure may be inaccurate if the wrong size cuff is used. If the anatomy of the upper arm doesn't allow proper fit, cuff pressures are obtained from the wrist or ankle.
3. For laparotomy a radial artery is cannulated.
4. Central lines (CVP, PA) can be useful for major abdominal and thoracic procedures. Since venous access is often limited a central line may be required for postoperative needs.
5. A nerve stimulator is used to assess neuromuscular blockade. Excess fat may make surface electrodes inaccurate. A BIS monitor or another "depth of anesthesia" device can be useful.

PHARMACOLOGICAL CONSIDERATIONS

Physiological changes in obesity affect distribution, binding and elimination of the various anesthetic agents. In normal weight patients drugs are usually administered on the basis of per unit body weight... Obese patients have a decreased fraction of total body water, increased blood volume and cardiac output, increased fat content, increased Lean Body Weight, altered tissue protein binding from increased concentrations of free fatty acids, triglycerides, lipoproteins, cholesterol and other serum constituents. In addition to this, renal blood flow and GFR are increased while cardio pulmonary function may not be optimal. Hepatic clearance is usually normal or even increased. Highly lipophilic medications (barbiturates, benzodiazepines) have a significant increase in volume of distribution; loading dose of these drugs is usually increased.

Since elimination half-lives are longer, maintenance dosing should reflect IBW. Systemic absorption of oral medications is not significantly affected by obesity.

Inhalational agents: There is the misconception that release of volatile agents from the adipose tissue results in a prolonged recovery time from anesthesia. Sevoflurane and desflurane have lower lipid solubility than isoflurane. Inhaled anesthetics are stored in the fat much longer after surgery is over, all inhaled anesthetics are rapidly eliminated from the well perfuse brain and lungs once the anesthetic is discontinued. Despite claims that one is better over others, with proper timing, recovery from general anesthesia is similar with any inhalation agents.

Induction agents: Large doses of propofol or thiopental are needed due to increases in fat content, blood volume, and cardiac output. In theory dosing should be based on actual weight.[5] However cardiovascular effects of large doses limit the absolute amount that can be given. Induction dosing is based on LBW.

Opioids: Opioids are highly lipo philic, and in theory loading doses should be based on TBW. There is no clinical evidence that lipophilic opioids last longer in morbidly obese patients. Generous use of long-acting opioids (morphine, Demerol, hydromorphone) can be dangerous since respiratory depression must be avoided. The volume distribution of remifentanyl in obese patients is less than expected, probably because of hydrolysis by blood and tissue esterases. Dosing is based on IBW.

Muscle relaxants: Since pseudocholinesterase levels and extra cellular fluid space are increased in obesity high doses of succinylcholine (1.0 mg/kg TBW) are used for induction.[6] No clinical advantages have been reported between any of the non-depolarizing relaxants. Neuro-muscular recovery time is similar in obese and non-obese patients with atracurium, vecuronium or rocuronium. Muscle relaxants are administered in incremental doses based on IBW.

Fluids: Intra operative fluid requirements are usually greater than would be anticipated for laparoscopy. It is advised to infuse 40 ml/kg IBW of crystalloid.

AIRWAY MANAGEMENT

Patients cannot breathe adequately in the supine or lithotomy positions, and they may be at risk for gastric aspiration. So tracheal intubations and assisted or controlled ventilation should be considered for even short procedures. Potential airway management problems should all be evaluated preoperatively. If problems are anticipated fiber optic broncho scopic intubations is recommended. Increasing weight or BMI is not a risk factor for difficult laryngoscope.[3]Positioning the head, neck and shoulders elevated, in head elevated laryngoscopy position ("HELP") will facilitate direct laryngoscopy.[4]

VENTILATION

Obese patients should be mechanically ventilated with at least 50% O2 and a tidal volume (Vt) 12-15 mL/kg IBW, preferably in the reverse trendelenburg position. With mechanical ventilation, especially during laparoscopy, peak ventilatory pressures and end-tidal CO2 levels will increase. PEEP superimposed upon a large tidal volume (Vt) can worsen hypoxemia by depressing cardiac output, which in turn will reduce O2 delivery to the tissues. Placement of sub-diaphragmatic packs or retractors or changing to lithotomy or Trendelenburg Position will also worsen hypoxemia.

OTHER EFFECTS OF OBESITY

Homodynamic changes: Pulmonary capillary wedge and PAP pressures may be elevated secondary to increased pulmonary blood volume and chronic hypoxemia. The reverse trendelenburg will improve oxygenation but may also cause pooling of blood and hypotension.

Regional anesthesia: Regional blocks can be technically challenging but very promising. It should be given by expert Anesthetist in that field. Special long epidural and spinal needles may be needed. Insulated needles and a nerve stimulator can be used to identify the appropriate nerves for peripheral nerve blocks. Although it is difficult and challenging to give regional block anesthesia, it should not be with held and always a trial be given to prospective patients.

Anesthetic technique: For laparotomy and thoracotomy, a combination of general anesthesia with epidural analgesia produces a lower incidence of postoperative respiratory complications and shorter hospital stays.

Postoperative epidural opioids analgesia, with or without local anesthetics, is recommended. General anesthesia is maintained with an inhalational anesthetic. Long-acting opioids are used with caution or avoided completely to decrease the risk of postoperative respiratory depression. For laparoscopy it is advised to use a short-acting opioids infusion (remifentanyl) with small amounts of i.v. fentanyl. The patient is ventilated with an inhalational anesthetic agent and 100% O2.

POST OPERATIVE CARE

It's important to closely observe and monitor such patients in recovery room. After full recovery the patients need to be transferred to ICU for next 24 hours for close monitoring and observation.

CONCLUSION

From the above discussion it is seen that, obese patients who are subjected to surgery, need expertise of a Consultant Anesthetists, special equipments, close monitoring of blood gases, cardiac status, blood pressure and blood sugar levels.

One has to be very careful in administering medications and anesthetic agents. Intubation has also to be carried out by a Senior and expert Anesthetists.

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