Challenges of Caring for the Obese Patient in Perianesthesia Setting

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Epidemiology

- **Obesity is a global epidemic .**
- **Worldwide obesity has nearly tripled since 1975.**
- Over 1.9 billion adults are overweight, and more than 650 million obese. **(WHO 2021)**
  - In 2019, more than 38 million children younger than five years old were obese.

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Epidemiology

- **It is projected that 60% of the world's population (3.3 billion people) will be overweight (2.2 billion) or obese (1.1 billion) by 2030 if recent trends continue**.
- Projections using extrapolated data from the BRFSS (Behavioral Risk Factor Surveillance System) and NHANES (National Health and Nutrition Examination Survey) **suggest by 2030, almost half of all United States adults will be obese, and almost one-fourth will be severely obese.**

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Pathophysiology of Obesity

- Fat distribution is an important aspect.
- Distribution is classified as:
  - Peripheral (gynaecoid, pear -shaped) or lower body obesity. (hips and thighs in women).
  - Central (visceral, android, apple-shaped) or upper body obesity. (abdominal and thoracic in men)
- **Central fat is more important as it is more frequently associated with inflammation**.

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Pathophysiology of Obesity

- Central adipose tissue produces numerous protein hormones, cytokines, and metabolites (termed as adipokines).
- These hormones generally influence energy metabolism.
- They trigger systemic inflammation and interact with many different organs.
- **Adipocytokines and chronic inflammation have a role in the development of obesity-related metabolic dysfunction**.

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BMI

- Obesity is defined by body mass index (BMI), the ratio of weight (in kilograms) to the square of height (in meters squared.)
- In adults, the World Health Organization and the National Institute of Health define obesity as BMI $\geq 30\ kg/m^2$.
- **Its advantage is that is simple to calculate. It does not describe the composition and distribution of body tissue (muscle/adipose) or metabolic state. Key factors in the onset of comorbidities.**

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Distribution of Fat

- Central obesity is defined by WHO as a waist circumference > 102 cm (40 in) for men and > 88 cm (35 in)for women.
- Fat distribution can be accurately demarcated by CT and MRI.
- **Measuring waist circumference or visual assessment of the fat distribution will identify those with greater perioperative risk and associated comorbidities**.

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Distribution of Fat

- **Fat distribution predicts risk more accurately than BMI.**
- **Central obesity has associated greater risks of:**
  - Metabolic Syndrome (MetS)
  - Cardiovascular Disease
  - Difficulty in Airway and Ventilation Management
  - Overall Perioperative Risk

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WHO and NHI Classification of Obesity and ASA Grades

Category	BMI (kg m $^{-2}$)	ASA grade
Underweight	< 18.5	1
Normal weight	18.5- 24.9	1
Overweight	≥ 25	1
Preobese	25- 29.9	1
Obese	≥ 30	1
Class 1	≥ 30- 34.9	1
Class 2	≥ 35- 39.9	2
Class 3	≥ 40	3

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Physiologic Changes Associated with Obesity

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Respiratory Physiology

- Impairment on lung volumes and chest movement from abdominal fat along with increased metabolic requirements of excess tissue, lead to **increased work of breathing**.
- **Resulting in increased oxygen (O_2)consumption, increased carbon dioxide (CO_2) production, and disordered ventilation to perfusion matching.**

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Respiratory Physiology

- Respiratory rates are increased related to the decreased compliance and higher resistance of the airways.
- **An obese patient uses about 15% of his oxygen reserve to breathe as compared to 3% in a lean patient**. (Cataldo,2020)
- **Functional residual capacity (FRC) and expiratory reserve volume (ERV) are decreased**.

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Respiratory Physiology

- Functional residual capacity (FRC) is the volume of air present in the lungs at the end of passive expiration.
- An expiratory reserve volume (ERV) is the amount of air that can be breathed out after a normal exhalation.
- **FRC may be sufficiently reduced such as small airways and alveoli remain closed during spontaneous ventilation, leading to ventilation-perfusion mismatch and right to left shunting.**
- **Tendency to also rapidly develop atelectasis , hypercapnia, increased expiratory resistance, wheezing, and tachypnea.**

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Respiratory Physiology

- **Combination of increase in O_2 consumption and a decrease in FRC, leads to a rapid decrease in oxygen saturation during apneic periods**. (A very short desaturation time at the induction of anesthesia with a short safe apnea time).
- **Lung volumes and intrapulmonary shunt worsen with the induction of general anesthesia in all patients, but to a much greater degree in obese patients.**
- **Supine position and obstructive sleep apnea (OSA) increase the extent of these effects.**

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Cardiovascular Physiology

- **Increased circulating blood volume**, although it is a lower proportion of total weight (50 mL/kg as compared with 75 mL/kg) compared with patients with normal body mass index (BMI).
- **Decreased systemic vascular resistance (SVR).**
- **Increased cardiac output (CO)** by 20 to 30 mL per kilogram of excess body fat.
  - The increased cardiac output occurs by means of expanded stroke volume(the amount of blood ejected from the ventricle with each cardiac cycle). Even though, stroke index, cardiac index, and heart rate remain normal.

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Cardiovascular Physiology

- **Left ventricular hypertrophy is related to the duration of obesity.** It is associated with an enhanced incidence of heart failure, ventricular arrhythmias, and death following ACS.
- The increased cardiac output can lead to **either right heart failure** (especially when associated with the hypoxia and hypercapnia of OSA) **or left ventricular failure** (especially when associated with hypertension).
- **Hypertension and cardiovascular disease** are more predominant in obese patients and when present may produce structural and hemodynamic changes.

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Comorbidities Affecting Perioperative Care

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Metabolic Syndrome (MetS)

- Also called **insulin resistance syndrome or syndrome X).**
- **Abdominal fat plays a part in a prothrombic and pro-inflammatory cascade that affects fatty acid metabolism and contributes to development of insulin resistance.**
- Central obesity is associated with insulin resistance and several metabolic and hemodynamic disorders, including hyperinsulinemia, atherogenic blood lipid changes, hypertension, and type 2 diabetes.

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Metabolic Syndrome (MetS)

- Defined by the criteria **of at least three of the following five:**
  - Glucose intolerance
  - Abdominal obesity
  - Increased blood pressure
  - Low high-density lipoprotein (HDL) levels
  - Increased triglyceride (TG) level

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Metabolic Syndrome (MetS)

- **Obesity and MetS cause significant increases in postoperative mortality in all classes of obesity, with greater risks of:** (Hebden 2020)
  - Postoperative cardiac complications **(2-3 x risk)**
  - Pulmonary complications **(1.5 -2.5 x risk)**
  - Acute kidney injury
  - Stroke/CHD **(3 x risk)**
  - Sepsis

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Obstructive Sleep Apnea (OSA)

- The risk of OSA correlates well with the body mass index (BMI).
- There is a linear correlation between obesity and OSA. In obese people, fat deposits in the upper respiratory tract narrow the airway; leading to hypoxic and apneic episodes, ultimately resulting in sleep apnea.
- The decreased oxygenation causes tissue hypoxia, which is the main contributing factor to atherosclerosis, the main risk factor for Cardiovascular Diseases (CVD).

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Obstructive Sleep Apnea (OSA)

- OSA can lead to collapse of the upper airway airways resulting in airway obstruction.
- Patients with severe undiagnosed OSA are at risk of respiratory depression during the postoperative period, especially with administration of opiates.
- **Patients suffering from OSA who are not adequately maintained with a CPAP could then present episodes of significant desaturation**.
- Treatment of moderate to severe OSA with CPAP reduces the risk of cardiovascular complications in the long term.

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Obesity Hypoventilation Syndrome (OHS)

- Is defined as the presence of **awake** alveolar hypoventilation in an obese individual **which cannot be attributed to other conditions associated with alveolar hypoventilation.**
- OHS is associated with increased cardiovascular morbidity and mortality.
- The clinical manifestations of OHS are nonspecific and reflect the manifestations of obesity, **coexistent obstructive sleep apnea (OSA is present in 90 percent of OHS)** or of OHS-related complications (eg, pulmonary hypertension). (Piper 2021)

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Obesity Hypoventilation Syndrome

- Consistent with the phenomenon of hypoventilation, all patients with OHS have hypercapnia on arterial blood gas analysis when awake and on room air.
- **Although most patients with OHS present with chronic elevations in the $PaCO_2$, about one-third have acute-on-chronic respiratory failure** .
- A raised bicarbonate (>27 mmol/L) or base excess (>3 mmol/L) in the absence of another cause for a metabolic alkalosis in an obese individual with a $PaCO_2$ <45 mmHg **may be an early indicator of OHS, necessitating closer investigation**.

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Obesity Hypoventilation Syndrome

- Most patients with OHS have OSA, and up to two-thirds have pulmonary hypertension.
- Hypertension, congestive heart failure, and insulin resistance are more common in patients with eucapnic obesity.
- Patients with OHS are sensitive to the respiratory-depressant effects of sedatives and opioids, and supplemental oxygen may increase hypercapnia unless administered with noninvasive positive airway pressure therapy.

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Hypertension

- **Strongly associated with excess body weight (both overweight and obesity).**
- **Poorly controlled hypertension is associated with liable blood pressure (BP) during general anesthesia and increased cardiac, neurologic and renal complications.**
- Baseline BP measurements should be recorded prior to surgery to assess the level of control, and non urgent surgery postponed to improve management of poorly controlled hypertension (systolic > 170 mmHg: diastolic > 110 mmHg).

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Cardiovascular Disease

- Obesity is associated with **increased risks** for :
  - Coronary heart disease (CHD)
  - Cerebrovascular disease
  - Heart failure
  - Atrial fibrillation
- **The AHA advisory recommends that patients with severe obesity and at least one risk factor for CHD (diabetes, smoking, hypertension, or hyperlipidemia) or poor exercise tolerance should have a 12-lead EKG and chest X-ray prior to surgery.**
- Further cardiac work-up may be indicated based on results of these tests.

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Diabetes Mellitus

- **Type 2 diabetes is strongly associated with obesity.**
- For elective major surgery preoperative glycosylated hemoglobin (HbA1C) assessment is indicated in patients with obesity.
- **Elevated preoperative (HbA1C) levels are associated with an increased risk of perioperative morbidity, although not specific to patients with obesity alone.**

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Chronic Kidney Disease

- The risk is **increased (relative risk 2.3, 95% confidence interval 1.1-4.9) in patients with severe obesity (BMI of ≥ 35 kg/m^2)** compared with persons with normal BMI.
- However, it is unclear whether obesity is an independent risk factor of CKD.
- Data suggests that physical inactivity, smoking, and **morbid obesity contribute to risk of CKD**.

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OLDER AGE

- The combination of increasing age and severe obesity increase perioperative morbidity and mortality more significantly than either alone.
- Overall mortality was **increased more than three-fold in those aged ≥ 55 years** compared with those aged ≤ 55 years; suggesting that the older group were less able to recover from complications. (Wynn-Hebden 2020)

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OLDER AGE

- **The combination of the two is associated with:**
  - **Delayed discharge**
  - **Increased complications**
  - **Readmission**
  - **Early postoperative mortality**
- Older age and severe obesity each decrease cardiovascular reserve and musculoskeletal fitness, which increase perioperative risk.

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Sarcopenic Obesity

- **Characterized by reduced muscle mass and functionality in the presence of obesity, and there are trends towards adverse outcomes, particularly with age.**
- Varying diagnostic criteria result in the exact risk being unclear. The presence of sarcopenic obesity is suggested by:
  - **Poor grip strength**
  - **History of immobility**
  - **Slow gait**

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Sarcopenic Obesity

- **The prevalence of obesity in middle-aged and older adults has doubled since 1980, and it continues to increase worldwide.**
- **The major age-related changes in body composition include an increase in body fat and a decline in skeletal muscle, although BMI may remain relatively unchanged**.
- The complex interplay of common pathophysiological mechanisms, such as increased proinflammatory cytokines, oxidative stress, insulin resistance, and hormonal changes and decreased physical activity, underlie the close relationship between sarcopenia and obesity.

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Anesthetic Considerations

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RISK OF DIFFICULT AIRWAY

- Obesity is associated with morphological features that affect airway management.
- **Obese patients are at risk of a difficult airway.**
- Although this not necessarily mean difficult intubation. However, likely to present difficulties in face mask and supraglotic airway device (SAD) ventilation in a linear relationship to their BMI.

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RISK OF DIFFICULT AIRWAY

- Several related factors increase the risk of managing the airway:
  - Increased neck circumference (over 40 cm)
  - OSA
  - Limited cervical extension
  - Male gender
  - BMI > 30 kg/m ^{2}
- **These factors increase the risk classification of Difficult Mask Ventilation (DMV) and Difficult Intubation (DI).**

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RISK OF DIFFICULT AIRWAY

- In the case of a "can't oxygenate scenario, the obese patient's anatomy involves an increased risk of difficult cricothyroidotomy due to problems with landmark identification and pretracheal tissue thickness.
- **Therefore, in emergency surgery even more than elective surgery, the anesthesia provider must be prepared for a difficult airway and explore and identify predicting factors.**

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RISK OF DIFFICULT AIRWAY

- **In situations where there is a high risk of difficult ventilation and intubation, preparing an adequate airway management strategy is of utmost importance.**
- Adequate preoxygenation aiming for an EtO_2 > 90% with a patient in the ramped position is always imperative; depending on the clinical setting and time available.
- Positive pressure ventilation by face mask or a high flow nasal cannula can be used, considering that positive pressure oxygenation is the gold standard for obese patients.

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RISK OF DIFFICULT AIRWAY

- Apneic oxygenation during airway instrumentation (the so-called **NO-DESAT technique**), preferably with a high-flow nasal cannula, should be considered.
- **It has been shown in multiple studies that it significantly extends the time that the apneic patient maintains adequate oxygenation, allowing more time to safely intubate.**

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RISK OF DIFFICULT AIRWAY

- During the preoperative evaluation, the possibility of an awake fiber optic intubation may be discussed with the patient.
- **The final decision regarding airway management should be taken by the anesthesia provider on the day of surgery following optimal positioning on the operating table.**

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Positioning for Preoxygenation and Intubation

- The patient's position has a significant effect upon airway pressures.
- In the supine position the weight of the abdomen compresses the functional residual capacity (FRC) and even more when the patient has a paralyzed diaphragm.

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Positioning for Preoxygenation and Intubation

- **The ramp position improves the likelihood of successful airway management in obese patients.**
- **The reverse Trendelenburg position improves lung volume, oxygenation and respiratory mechanics, particularly during laparoscopic surgery.**

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Anesthetic Management

- Rapid sequence induction and intubation (RSII) is a technique commonly used to resist regurgitation of gastric contents and protect the airway.
- Securing the free airway quickly is of utmost importance, preferably by intubating as quickly as possible, using a modified RSI(mRSI) in the obese patient.

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Anesthetic Management

- **Modified RSI includes hemodynamic optimization and abolishes succinylcholine in favor of rocuronium**.
- Succinylcholine may reduce the safe apnea period and rocuronium followed by reversal with sugammadex may allow earlier re-establishment of spontaneous ventilation (compared with succinylcholine) if airway management is difficult.
- Optimal ventilation and oxygenation improve postoperative outcomes.

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Anesthetic Management

- **Protective intraoperative mechanical ventilation has been associated with a reduced incidence of postoperative complications, which can prolong hospital stay and increase mortality.**
- Protective intraoperative mechanical ventilation consists of the combination of :
  - Low tidal volume
  - Appropriate positive end-expiratory pressure (PEEP)
  - Low deriving pressure (airway plateau pressure minus PEEP)

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Anesthetic Management

- **Temporary hyperinflation of the lungs with recruitment maneuvers reverses atelectasis and improves intraoperative oxygenation and respiratory function**.
- These maneuvers are recommended after induction of anesthesia in hemodynamically stable obese patients. Also, whenever severe oxygen desaturation occurs, and they may reduce the risk of postoperative pulmonary complications.
- Limiting the fraction of inspired oxygen to below 0.8 is important, as higher levels can promote resorption atelectasis and worsen inflammatory lung injury.

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Anesthetic Management

- The superiority of inhalation or intravenous medications for maintaining anesthesia after induction has not been established in obese patients.
- **Among inhalational anesthetics, desflurane may be the best option, as its low lipophilicity and solubility limit distribution in adipose tissues, promoting faster emergence and recovery.**

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Anesthetic Management

- A meta-analysis reported that times to eye opening on command and tracheal extubation were decreased by 37 and 33.6 per cent respectively in patients receiving desflurane compared with sevoflurane. (Singh 2017)
- These advantages were confirmed for desflurane compared with propofol or isoflurane.

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Anesthetic Management

- **Furthermore, desflurane anesthesia has been associated with better early postoperative oxygenation and lung function than propofol anesthesia**.
- Compared with sevoflurane or desflurane, propofol anesthesia has a lower risk of PONV in the general population, but data are conflicting in obese patients, with some studies finding benefit and others reporting no benefit**. (Carrib 2020)**

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Analgesia

- **Multimodal analgesia strategies should be adopted in obese patients to reduce or eliminate use of opioids after surgery.**
- These strategies include use of non-opioid analgesics, such as intravenous acetaminophen and non-steroidal anti-inflammatory drugs, magnesium, and local and regional anesthesia.
- Intraperitoneal local anesthetic reduces postoperative pain and opioid consumption.

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Analgesia

- **If intraoperative opioids are required, a short-acting opioid (such as remifentanil) is preferred for obese patients**.
- Ultrasound-guided transverse abdominis plane (TAP) blocks have been used successfully.
- Ultrasound guidance is useful for regional techniques when the anatomy is unfavorable, as seen more often with obesity.
- The continuous use of ketorolac during the first 24 hours after surgery leads to a lower need for narcotics.

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Analgesia

- When facing severe pain, systemic adjuvants can reduce the need for narcotics.
  - Alpha-2 agonists have analgesic effects, with dexmedetomidine being more effective than clonidine.
  - Low dose ketamine is also an adjuvant to consider.
  - These agents both have an advantage in maintaining airway tone and respiratory drive.
- **Epidural blocks have the highest efficacy, and they have the potential to be used as the sole analgesic modality.**

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Weight Loss Surgeries

- **Sleeve Gastrectomy –restrictive classification**
  - These patients should routinely be intubated as there is a significant risk of reflux of gastric contents, regardless of the presence of symptoms.
- **Roux-en-Y Gastric Bypass or One Anastomosis Gastric Bypass- malabsorptive classification**
  - May affect bioavailability of oral medications as a result of shortening of the small bowel and loss of surface area (postoperative analgesia absorption).

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Postoperative Risks and Complications

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Rhabdomyolysis

- **Is a skeletal muscle disorder that involves releasing of toxic cell parts in the system circulation, with the potential risk of renal damage**.
- It occurs more commonly in severely obese patients during surgery.
- The excessive weight increases the compressive pressure on muscle, leading to muscular ischemic necrosis and release of muscle toxins into the systemic circulation.
- Male patients undergoing prolonged surgery (≥ 250 min) are at increased risk. (Trembly 2018)

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Rhabdomyolysis

- Muscles in the gluteal region are more commonly affected, although the shoulder girdle and upper arms can also be affected.
- Muscular pain is a predominant symptom, but this condition can be asymptomatic.
- Diagnosis involves measurement of serum creatine kinase (CK).
- **Patients with CK > 20,000 are at risk of developing acute renal failure.**
- **Early diagnosis and aggressive management with fluids and diuretics are essential to prevent kidney injury.**

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Thromboembolism

- **Obesity is a risk factor for deep venous thrombosis (DVT) and pulmonary embolism (PE) because of it induces an inflammatory state**.
- Prophylaxis against DVT/PE is needed, and use of pharmacological strategies must not exclude sequential compression devices , which is started in the OR.
- Every therapeutic effort must be made towards early postoperative mobilization.

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Complications of Bariatric Surgical Operations

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Sleeve Gastrectomy(SG)

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Sleeve Gastrectomy (SG) (Vertical Sleeve Gastrectomy)

- Laparoscopic sleeve gastrectomy has become the most popular weight loss procedure in the United States over the last two decades.
- **The average excess weight loss after five years in a laparoscopic sleeve gastrectomy is reported to be around 60%, and the resolution of comorbidities is excellent.** (Lopez 2022)
- About 80% of the stomach is removed, leaving a tube-shaped stomach reduced to three or four ounces which is about the size and shape of a banana.

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Bleeding

- **Bleeding can occur from the gastric or short gastric vessels during dissection of the greater curve.**
- **Most of the bleeding problems occur from the staple line after transection of the stomach.**
- The bleeding is most likely a result of the large staples used for the thick tissue in the distal stomach.
- Large staples are not adequate to seal small vessels. This has led many surgeons to reinforce the staple line by over-sewing, buttressing, or both.

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Gastric Leak

- The Metabolic and Bariatric Surgery Accreditation and Quality Improvement Program (MBSAQIP) database shows **a leak rate of about 0.8 percent in over 93,000 patients who underwent laparoscopic sleeve gastrectomy.**
- The cause of the leak is increased pressure relayed on the staple line in the setting of relative ischemia. This is typically located just below the GE junction, where there is relative ischemia due to the dependence on the sacrificed short gastric vessels.

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Gastric Leak

- An increase in pressure may be due to :
  - A distal narrowing caused by a small-caliber bougie
  - Stricturing
  - Technical error of firing the stapler too close to the incisura angularis (small notch located on the lesser curvature of the stomach near the pyloric end).

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Gastric Leak

- **Patients may be asymptomatic but frequently present with fever, tachycardia, and tachypnea with elevated heart rate being the first sign**.
- The diagnostic test of choice is a CT scan with oral and IV contrast which demonstrates relatively high sensitivity and specificity.
- **In the acute, unstable patient, exploration with drainage of the leak and placement of a distal feeding tube until the leak is healed is the management of choice.**

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Gastric Leak

- Endoscopic therapy with the use of stents has been increasingly employed for management of leaks, but migration of the stents remains a problem.
- **Early diagnosis, adequate drainage, and gastric decompression are the mainstay of treatment for leaks**.

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Stricture

- **Narrowing or stenosis can create gastric outlet obstruction. The presentation varies depending on the severity of the obstruction.**
- The gastroesophageal junction and the incisura angularis are the two most common areas.
- The common symptoms are dysphagia, nausea, and vomiting, dehydration and inability to tolerate oral diet.
- The diagnostic image of choice is a UGI contrast study.
- Treatment of the acute stricture is conservative and only requires surgery in the setting of nonresolution.

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Gastroesophageal Reflux

- Patients present with classic symptoms such as burning pain, heartburn, and regurgitation.
- It can occur as an early and late complication. The first-line treatment is antireflux medical therapy.
- GERD unresponsive to antireflux medical therapy with no clear anatomic abnormalities, such as stoma stenosis or a hiatal hernia, can be effectively treated by conversion to RYGB (Roux-En-Y-Gastric Bypass).

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ROUX-EN-Y GASTRIC BYPASS (RYGB)

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ROUX-EN-Y GASTRIC BYPASS (RYGB)

- Involves the creation of a small gastric pouch and an anastomosis to a Roux limb of jejunum that bypasses 75 to 150 cm of small bowel, thereby restricting food and limiting absorption.
- **It works by restricting the amount of food one ingests (restriction) and by limiting the amount of nutrients absorbed from the ingested food (malabsorption).**
- In addition, it induces a multitude of physiologic and hormonal responses by bypassing the duodenum and excluding the fundus and body of the stomach. As examples, ghrelin levels are lower and leptin levels higher after RYGB, which results in decreased hunger and increased satisfied feeling, respectively.

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ROUX-EN-Y GASTRIC BYPASS (RYGB)

- **Because RYGB treats insulin resistance better than most other bariatric procedures, it may be preferred in patients with uncontrolled type 2 diabetes, nonalcoholic fatty liver disease, metabolic syndrome, or polycystic ovarian syndrome. These conditions are attributable to insulin resistance.**
- Additionally, while sleeve gastrectomy (SG) and RYGB are equally effective in improving diabetes in the short term, RYGB is associated with better long-term control of diabetes and lower rates of relapse.

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ROUX-EN-Y GASTRIC BYPASS (RYGB)

- Patients with Barrett's esophagus, severe/complicated gastroesophageal reflux disease (GERD), or bile reflux may be better candidates for RYGB than for SG.
- Because RYGB involves two gastrointestinal anastomoses, it may be riskier for patients who chronically take glucocorticoid or nonsteroidal anti-inflammatory medications because of the risks of leaks or marginal ulceration.
- Crohn disease is a relative contraindication for RYGB due to the potential for strictures and leaks at the anastomoses. SG is a suitable procedure for such patients if bariatric surgery is indicated.

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Anastomotic Leak

- The MBSAQIP (The Metabolic and Bariatric Surgery Accreditation and Quality Improvement Program) database **shows a 1.6 percent leak rate in over 41,000 patients who underwent laparoscopic Roux-en-Y gastric bypass.**
- The clinical presentation of an anastomotic leak can be subtle and requires vigilance for signs such as low-grade fevers, respiratory compromise, and/or unexplained sustained tachycardia greater than 120 bpm.
- These signs may also be present in the setting of pulmonary embolism.

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Anastomotic Leak

- A leak may be radiographically confirmed by barium swallow or contrast computed tomography (CT).
- If a leak is suspected clinically, emergency surgical exploration should be performed, even if the imaging is negative, given the rapid progression to sepsis in the severely obese patient with comorbidities .
- **Any patient with unexplained but persistent tachycardia requires immediate exploration to rule out a leak.**

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Bleeding

- **It can also occur from an anastomosis; more commonly, intraluminal bleeding occurs**.
- **Patients frequently present with tachycardia, a decreased hematocrit, hematochezia, or melena**. Such bleeding typically resolves without surgical intervention but may require transfusion of blood products and reversal of anticoagulation.

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Bleeding

- Careful endoscopic examination and therapy is appropriate for ongoing bleeding with high transfusion requirements.
- Surgery is reserved for hemodynamic instability, intraluminal bleeding not amenable to endoscopic therapy (e.g., staple line of the excluded stomach), extraluminal bleeding, or continued bleeding despite restoration of normal coagulation status.

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Stomal Stenosis

- Is defined clinically as the inability to swallow liquids and usually occurs if the anastomosis narrows to a diameter of <10 mm.
- **Stomal stenosis occurs in 6 to 17 percent of patients undergoing LRYGB, typically in the early postoperative period.** (Lim 2021)
- The etiology is uncertain, although tissue ischemia, marginal ulcer, or increased tension on the gastrojejunal anastomosis is believed to have a role. The higher rate in LRYGB and may be related to the use of the small-diameter (21 mm) circular staplers.

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Stomal Stenosis

- Patients typically present several weeks after surgery with nausea, vomiting, dysphagia, gastroesophageal reflux, and eventually an inability to tolerate oral intake, including liquids .
- The diagnosis is usually established by endoscopy or with an upper gastrointestinal series.
- **Endoscopic balloon dilation is usually successful .**
- The stoma should be dilated to a diameter of approximately 15 mm; further dilation to 20 mm may reduce the restrictive effect of RYGB. The complication rate for dilation is approximately 3 percent. (Lim 2021)

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Marginal Ulcers

- Develop near the gastrojejunal (GJ) anastomosis. They have been reported in 0.6 to 16 percent of patients after RYGB. (Lim 2021)
- Causes of marginal ulcers include :
  - Poor tissue perfusion due to tension or ischemia at the anastomosis
  - Presence of foreign material, such as staples or nonabsorbable suture
  - Excess acid exposure in the gastric pouch due to gastrogastric fistulas
  - Nonsteroidal anti-inflammatory drug use
  - *Helicobacter pylori* infection
  - Smoking

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Marginal Ulcers

- Patients can present with nausea, abdominal pain, gastrointestinal bleeding, stomal stenosis, or perforation.
- The diagnosis is established by upper endoscopy.
- Initial medical treatment consists of gastric acid suppression with a six-week course of proton pump inhibitors, with or without the addition of sucralfate followed by a repeat endoscopy to ensure healing.

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Marginal Ulcers

- During the follow-up, nonsteroidal anti-inflammatory drugs should be discontinued, and patients should be encouraged to stop smoking.
- An upper gastrointestinal series or a computed tomography (CT) scan with oral contrast should be performed to rule out a gastrogastric fistula.

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Gastrogastric (CG) Fistula

- A gastrogastric (GG) fistula is a channel that develops between the gastric pouch and the excluded stomach remnant, allowing ingested food to enter the bypassed foregut (stomach and duodenum).
- **GG fistulas occur in approximately 1 to 2 percent of patients after RYGB and most commonly cause marginal ulcers or weight regain.** (Lim 2021)
- Patients diagnosed with a GG fistula who also have either significant weight regain or persistent symptoms from marginal ulcers (eg, abdominal pain, stomal stenosis, or gastrointestinal bleeding) are candidates for revision or repair.

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Dumping Syndrome

- **Occurs in up to 50 percent of post-gastric bypass patients when high levels of simple carbohydrates are ingested.**
- There are two types of dumping syndrome, early and late. Early dumping syndrome has a rapid onset, usually within 15 minutes. It is the result of rapid emptying of food into the small bowel.
- Due to the hyperosmolality of the food, rapid fluid shifts from the plasma into the bowel occur, resulting in hypotension and a sympathetic nervous system response.

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Dumping Syndrome

- Patients often present with colicky abdominal pain, diarrhea, nausea, and tachycardia
- Patients should avoid foods that are high in simple sugar content and replace them with a diet consisting of high-fiber, complex carbohydrate, and protein-rich foods.
- Behavioral modification, such as small, frequent meals and separating solids from liquid intake by 30 minutes, is also advocated.
- Usually, early dumping is self-limiting and resolves within 7 to 12 weeks

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Postoperative Care

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Postoperative Care

- **Issues specific to the patient with obesity in the post-anesthesia care unit (PACU) are largely respiratory and ventilatory**.
- The patient should be placed in a head elevated or semi seated position.
- As beneficial effects of protective intraoperative mechanical ventilation may be lost after extubation.
- **CPAP or NIV should be considered in high-risk obese patients.**

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Postoperative Care

- CPAP or NIV in the obese patient after surgery:
  - Counter act upper airway obstruction
  - Reduce hypoventilation and atelectasis
  - Improve gas exchange and respiratory function
  - Relieve dyspnea
  - Decrease breathing effort
- **They may therefore lower the risk of acute respiratory failure after surgery.**

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Postoperative Care

- **In the obese patients requiring opioids, CPAP in the early postoperative period improves sleep-disordered breathing and enhances the respiratory depressant effects of these drugs.**
- When intravenous opioids are required after surgery, PCAs are recommended. A longer than usual lock-out period between doses should be considered.
- Analgesia by the enteral route should be commenced as early as possible.

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Postoperative Care

- **Evidence regarding the optimal duration of postoperative monitoring for patients with severe obesity is lacking.**
- Prior to transfer of the patient to an unmonitored setting, oxygen saturation on room air should return to preoperative baseline, and when left undisturbed the patient should not develop clinical hypoxemia or airway obstruction.
- The decision to discharge patients with diagnosed or likely OSA should consider the ability to use CPAP, the need for opioid medication, and comorbid medical conditions.

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Summary

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Summary

- Appropriate airway management, careful anesthetic management and an adequate ventilation strategy (extending beyond the immediate postextubation period) may improve postoperative outcomes for obese patients.
- Additional perioperative precautions are necessary to reduce complications in patients with severe morbid obesity, metabolic syndrome, untreated or severe OSA, or obesity hypoventilation syndrome, and obese patients undergoing operations, long procedures or revisional surgery.

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Summary

- Obesity is a multisystem disease and obese patients may present a higher risk of complication in the perioperative setting. They pose significant challenges to the anesthesiologist and the nurse caring for these patients.
- **The perianesthesia nurse should understand the anesthetic approach, specific surgical procedures ,potential complications and plan for the post operative care of the obese patient.**

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