Comparison Between Volume Controlled Ventilation And Pressure Controlled Ventilation In Morbidly Obese Patients Undergoing Laparoscopic Gastric sleeve Surgery

Thesis

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List of Abbreviations

Abb.	Full term
ADA	American Diabetes Association
ASA	American Society OfAnesthesiology
BMI	Body Mass Index
CBC	Complete Blood Count
CL	Drug Clearance
CPAP	Continuous positive airway pressure
DLCO	Carbon Monoxide Diffusion Capacity
ECG	Electrocardiogram
ETCO2	End tidal Carbon dioxide
IDF	International Diabetes Federation
OHS	Obesity hypoventilation syndrome
OSA	Obstructive sleep apnea
PEEP	Positive End Expiratory pressure.
PT	Prothrombin Time.
PVC	Pressure Controlled Ventilation
RR	Respiratory Rate
SPO2	Arterial Oxygen Saturation.
VCV	Volume Controlled Ventilation.
VD	Volume of distribution
WHO	World Health Organization.

INTRODUCTION

The management of oxygenation in a morbid obese patient undergoing laparoscopic procedures presents many challenging aspects to the anesthetist. Despite numerous recent studies, until now; there is no single guideline that provides optimum anesthetic ventilatory condition for this complex group of patients.

To facilitate Laparoscopic surgeries, the patient must be positioned in steep (40°) Trendelenburg position for some time. When combined with pneumoperitoneum, it can result in unfavorable respiratory and hemodynamic consequences such as decreased lung compliance, higher airway pressures, hypercarbia, hypotension and increased central venous pressure ***(Marino et al., 2007).***

Morbid obesity causes a physiological derangement of the respiratory system, which presents a challenge to achieving safe mechanical ventilation. The development of atelectasis after induction of anesthesia is exaggerated in patients with morbid obesity, and it is the main contributor to respiratory dysfunction ***(Eichenberger et al., 2009).***

In order to enhance intraoperative ventilation, anesthesiologists habitually increase tidal volume (VT). However, this maneuver increases airway pressure, which may result in ventilator-associated lung injury (VALI) ***(Matthay et al., 2002).***

The most common ventilation mode that is generally used is volume controlled ventilation. VCV is a mode of mechanical ventilation at which the ventilator delivers a preset volume waveform; the resultant airway pressure waveform depends on the shape of the flow waveform and respiratory system resistance and compliance ***(Campbell et al., 2002).***

Volume controlled ventilation (VCV) offers the safety of a pre-set tidal volume and minute ventilation but requires the clinician to appropriately set the inspiratory flow, flow waveform, and inspiratory time. During VCV, airway pressure increases in response to reduced compliance, increased resistance, or active exhalation and may increase the risk of ventilator-induced lung injury and pneumoperitoneum. PCV, limits the maximum airway pressure that is delivered to the lung, but may cause variable tidal and minute volume delivered to the patient ***(Farlex, 2012).***

Pressure controlled ventilation (PCV) is the alternative mode of ventilation. It utilizes a decelerating flow at which the flow rate reaches the greatest possible value at the beginning of inspiration, and diminishes throughout inspiration according to the pressure target. The resulting V_T depends on the pressure limit and the respiratory system compliance and resistance. In addition, the restriction of pressure levels has a positive effect on the patient's hemodynamic and might even decrease the risk of barotrauma ***(Wang et al., 2015).***

AIM OF THE WORK

The aim of this work is to compare between pressure controlled ventilation and volume controlled ventilation effect on respiratory parameters and post operative complications in morbidly obese patients undergoing laparascopic gastric sleeve surgery.

Chapter 1

PATHOPHYSIOLOGY OF OBESITY

Physiology:

Obesity is a medical condition at which excess body fat have accumulated to the extent that it has a negative effect on body health, including decreased life expectancy and/or increased health problems ***(Mullen et al., 2009).***

Obesity is an exaggeration of normal adiposity and is a central player in the pathophysiology of diabetes mellitus, insulin resistance, dyslipidemia, hypertension, and atherosclerosis, largely due to its secretion of excessive adipokines ***(Mullen et al., 2009).***

Obesity is a major contributor to the metabolic dysfunction involving lipid and glucose, but on a broader scale, it influences organ dysfunction involving cardiac, liver, intestinal, pulmonary, endocrine, and reproductive functions ***(Campos et al., 2006).***

Inflammatory, insulin-resistant, hypertensive, and thrombotic-promotingadipokines, which are atherogenic, are counterbalanced by anti-inflammatory and anti-atherogenic adipocyte hormones such as adiponectin, visfatin, and acylation-stimulating protein, whereas certain actions of leptin and resistin are pro-atherogenic ***(Campos et al., 2006)***

Obesity contributes to immune dysfunction from the effects of its inflammatory adipokine secretion and is a major risk factor for many cancers, including hepatocellular, esophageal, and colon ***(Evans et al., 2004).***

Classification of Obesity

Obesity is defined by body mass index (BMI) and further evaluated in terms of fat distribution via the waist–hip ratio and total cardiovascular risk factors. BMI is closely related to both percentage body fat and total body fat ***(Gray and Fujioka, 1991).***

BMI is defined as the subject's weight divided by the square of their height. BMI is usually expressed in kilograms per square meter, resulting when weight is measured in kilograms and height in meters. To convert from pounds per square inch multiply by 703 $(kg/m^2)/(lb/sq\ in)$ ***(Manson et al., 1995).***

According to the World Health Organization (WHO), obesity is classified as class I for a BMI between 30 and 34.9 kg/m^2, class II for a BMI between 35 and 39.9 kg/m^2, and class III for a BMI $\geq$ 40 kg/m^2,In turn, class I obesity is associated with a "moderate risk", class II with a "high risk", and class III with a "very high risk" of mortality ***(Abir and Bell, 2004).***

Table (1): Classification of obesity according to BMI ***(WHO, 2000).***

Classification	BMI	Risk of comorbidities
Under weight	<18.50	Low (but risk of other clinical problems increased)
Normal range	18.50 – 24.99	Average
Overweight:	≥ 25.00	
Pre-obese	25.00 – 29.99	Increased
Obese class I	30.00 – 34.99	Moderate
Obese class II	35.00 – 39.99	Severe
Obese class III	≥ 40.00	Very severe

Adapted from the WHO, 2004.

The committee on pediatric obesity at the maternal and child health bureau recommends that children with a body mass index (BMI) greater than or equal to the 85th percentile with complications of obesity or with a BMI greater than or equal to the 95th percentile, with or without complications, undergo evaluation and possible treatment ***(Dietz and Robinson,2005)***

Assessment of pediatric obesity can be made by plotting height and weight standard growth curves and BMI plotted on the revised growth curves.Despitemeasuringskinfold thickness can be unreliable and inaccurate, a triceps skinfold thickness higher than the 95th percentile, measured by an experienced observer, provides a strong evidence that the child has excess fat rather than increased lean body mass or large frame size ***(Dietz and Robinson, 2005).***

Assessment should include signs of the rare exogenous causes of obesity. This includes genetic syndromes, endocrinologic diseases, and psychologic disorders. Also

screening for complications of obesity should be done. Such as hypertension, dyslipidemias, orthopedic disorders, sleep disorders, gall bladder disease, and insulin resistance.Conditions that indicate consultation with a pediatric obesity specialist include pseudotumorcerebri, obesity-related sleep disorders, orthopedic problems, massive obesity, and obesity in children younger than 2 years of age ***(Krebs et al., 2007).***

Coexisting Diseases

Patients with clinically severe obesity have a higher incidence of comorbidities. Hypertension is the most common; affecting about 60% of the patients. Non-insulin dependent diabetes mellitus is also frequent. Among the cardiovascular diseases, patients may have heart failure, coronary ischemia, cardiomyopathy, cor- pulmonale, deep venous thrombosis (2.6% of the patients), arrhythmias, and sudden death ***(Bray, 2004).***

Gastroesophageal reflux, esophagitis, and increased incidence of aspiration during anesthesia (there is an increase in the secretion of gastric secretions) should always be remembered before the anesthetic induction of a patient with morbid obesity ***(Redinger, 2007).***

One of The main syndromes associated with morbid obesity is the metabolic syndrome which is characterized by visceral fat, dyslipidemia,hypertension, and insulin resistance. the World Health Organization established a more formal

description of metabolic syndrome, stressing the requirement of insulin resistance as a major factor for diagnosis (**Grundy et al.,2004),**

Table (2): Definition of metabolic syndrome ***(Alberti et al., 2005)***

WHO	NCEP ATP III	IDF
T2D or IFG or IGT or insulin resistance plus ≥ 2 of the following: • BMI > 30 kg/m² or WHR > 0.85 • HDL < 1.0 mmol/L (< 40 mg/dL) • TG ≥ 1.7 mmol/L (150 mg/dL) • BP ≥ 140/90 mmHg or use of blood pressure medication • microalbuminuria > 20 pg/min • Alb/Crea ratio ≥ 30 mg/g	≥ 3 of the following: • WC ≥ 88 cm • HDL < 1.3 mmol/L (< 50 mg/dL) • TG ≥ 1.7 mmol/L (150 mg/dL) • BP ≥ 135/85 mmHg or use of blood pressure medication	Central obesity defined as WC above the ethnicity-specific cut-off plus ≥ 2 of the following: • TG ≥ 1.7 mmol/L (150 mg/dL) or specific treatment • HDL < 1.3 mmol/L (< 50 mg/dL) or specific treatment • BP ≥ 135/85 mmHg or use of blood pressure medication • fasting plasma glucose ≥ 5.6 mmol/L (100 mg/dL) or previously diagnosed T2D

BP = blood pressure; HDL = high density lipoprotein cholesterol; IGT = impaired glucose tolerance; T2D = type 2 diabetes; TG = triglycerides; WC = waist circumference; WHR = waist to hip ratio.

The definition proposed by the National Cholesterol Education Program Adult Treatment Panel III (NCEP ATPIII) is the most commonly used for clinical and research purposes. The International Diabetes Federation (IDF) has proposed the most recent criteria, which resemble the NCEP one, with the exception that central obesity, assessed according to ethnicity-specific cut-offs, is an integral part of the IDF definition ***(Alberti et al., 2005).***

Often confused with metabolic syndrome, pre-diabetes is an intermediate condition between true diabetes mellitus and normoglycemia. The American Diabetes Association (ADA) defines pre-diabetes as a hemoglobin A1C ranging from 5.7%