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FEASIBILITY AND ANALGESIC EFFICACY OF ULTRASOUND GUIDED TRANSVERSUS ABDOMINIS PLANE BLOCK IN LAPARSCOPIC BARIATRIC SURGERY

a Thesis
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List of Abbreviations

AGB: Adjustable gastric banding

ASA: American society of anesthesia

BMI: Body mass index

CPB: Cardiopulmonary bypass

CVD: Coronary vascular disease

ECG: Electrocardiogram

EtCO2: End tidal carbon dioxide

FDA: Food and Drug Administration

GA: General anesthesia

HRQOL: Health related quality of life

IV: Intravenous

LAST: Local anesthetic systemic toxicity

LBW: Lean body weight

LCD: Low calorie diet

MBP: Mean blood pressure

NAFLD: Non alcoholic fatty liver disease

NASH: Non alcoholic steatohepatitis

NHLBI: National health, lung and blood institute

NIBP: Non invasive blood pressure

OHS: Obesity hypoventilation syndrome

OSA: Obstructive sleep apnea

PABA: Para amino benzoic acid

PACU: Post anesthetic care unit

QOL: Quality of life

RA: Rectus abdominis muscle,

RSS: Ramsy sedation score

RYGB: Roux-en-y gastric banding

SBP: Systolic blood pressure

SPO2: Pulse-oximetry

TAP: Transversus abdominis plane

T2DM: Type 2 diabetes mellitus

WHO: World health organization

VAS: Visual analogue score

VGB: Vertical gastric banding

VLCD: Very low calorie diet

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INTRODUCTION

According to the National Institutes of Health, obesity can be defined as a medical condition in which excess fat has been accumulated to an extent that it might have a negative impact on health. It's a major health problem with clearly established health implications, including an increased risk for coronary artery diseases, hypertension, dyslipidemia, diabetes mellitus, gall bladder diseases, obstructive sleep apnea and socioeconomic and psychological impairment. The risk of developing one or more of these obesity- related conditions is based on body mass index (BMI). BMI uses a simple calculation based on the ratio of someone's height and weight (BMI = kg/m2), with 25-30 kg/m2 being low risk and > 40 kg/m2being very high risk ***(Bray et al., 2000)***.

Non surgical management can effectively induce 5%-10% weight loss and improve health in severely obese individuals resulting in cardio-metabolic benefit. Bariatric surgery procedures are indicated for patients with clinically severe obesity; currently, these procedures are the most successful and durable management of obesity. The best choice for any bariatric procedure depends on the individualized goals of the therapy (e.g. weight loss or/and glycemic control), available local expertise (surgeon and institution), patient preference and personalized risk satisfaction. At this time, there is still insufficient evidence to generalize in favor of one bariatric surgery for the obese population. In general, laparscopic bariatric surgical procedures are preferred over open bariatric procedures due to lower early postoperative morbidity and mortality ***(Jeffry et al., 2013).***

In the obese patient, the goal of postoperative pain management is provision of comfort, early mobilization and improved respiratory function without causing sedation and respiratory compromise. The pathophysiology of obesity, typical co- morbidities and the high prevalence of obstructive sleep apnea (OSA) amongst obese patients make safe analgesic management difficult and challenging. Although several reviews covering anesthesia and analgesia for obese patients are published, there is expert opinion and a paucity of evidence- based recommendations. Advice on general management includes multimodal analgesic therapy, preference for regional techniques, avoidance of sedatives, non-invasive ventilation with supplemental oxygen and early mobilization ***(Schung and Raymann, 2011)***.

The transversus abdominis plane (TAP) block is a relatively new regional anesthetic technique that targets the sensory supply of the anterior-lateral abdominal wall. First described by Rafi et al in 2001, the block is performed by injecting local anesthetic into the plane between the internal oblique and the transversus abdominis muscle using the triangle of Petit as a landmark. This TAP plane is infiltrated with local anesthetic to target the T7-T12 intercostal nerves, the ilioinguinal, iliohypogastric, and the lateral cutaneous branches of the dorsal rami of L1-L3 ***(Farrell et al, 2009)***.

Hebbard et al. have subsequently described an ultrasound-guided approach to the TAP block. This technique is more time-consuming than the landmark approach, due to preparation of ultrasound equipment. However it can be recommended due to the benefit of viewing the needle during insertion, therefore ensuring that the needle is placed correctly and that no other structures are injured. It must be emphasised that the needle should be continuously seen during insertion ***(Hebbard et al.2007)***.

TAP blocks have been successfully implemented for pain control after laparoscopic surgery in non obese patients undergoing diverse procedure ranging from appendectomy to neurostimulator implants. The resulting analgesia may be especially beneficial in morbidly obese patients after abdominal surgery due to their higher risk for postoperative pulmonary complications thus reducing the need for postoperative analgesics ***(McGraw-Hill, 2007)***.

Aim of the work

To determine the feasibility and analgesic efficacy of ultrasound-guided TAP blocks in morbidly obese patients during laparoscopic bariatric surgery and in early postoperative period regarding pain relief, early mobilization and improved respiratory function.

Pathophysiology of Obesity and its Complications

Obesity is a common and serious disease of over nutrition and fat accumulation that affect about 25% to 40% of the adult population. Obesity would be of no significance if it were not a serious health hazard. Examination of the effect of body weight on death rate demonstrates that a deviation of 15% to 25% above the the average body weight causes a significant increase in mortality. Obesity is characterized by excess adipose tissue ***(Angel et al, 1990)***.

Adipose tissue is one of the largest organs of the human body. It represents about 10% to 15% of the body weight of a normal man and about 20% to 25% of a normal woman. While most of the adipose fat is subcutaneous, sizable amounts are found in the mesentery, the omentum and the retroperitoneal area. Fat tissue **(Figure 1)** is a specialized form of connective tissue which consists of fat cells embedded in a cartilaginous framework (stroma) that provides support to the cells, as well as blood capillaries and nerve fibers that permeate the tissue. Fat cells arise from more primitive primordial cells that are associated with the capillary network. Differentiation of these cells into fat-storing adipocytes depends on a variety of nutritional and hormonal factors. Fat cells are the largest cells in the body and they are unique of their capacity of storing and releasing fat according to the nutritional requirement of the host body. Over 90% of the fat cell mass is formed of a triglyceride which is the most efficient and compact way of storing calories ***(Angel et al, 1990).***

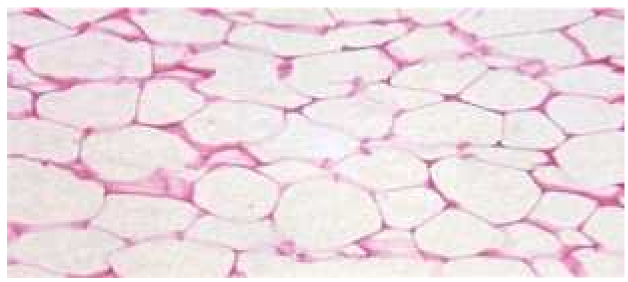

Figure 1

Under normal circumstances, the amount of fat in adipose tissue remains constant despite the continuous turnover. This means that the reactions controlling fat synthesis and storage are perfectly balanced with the reactions controlling fat breakdown and mobilization. Fat accumulate in adipose tissues by two mechanisms. The first and the most important is the transfer of plasma lipids to fat cells. Lipoprotein-bound triglyceride is converted by lipoprotein lipase enzymes into its constituents, fatty acids and glycerol. The second mechanism is responsible for fat storage which involves the uptake of glucose from the dietary carbohydrates and its conversion by fat cells into fatty acids, thence triglycerides. This is called the de novo synthesis pathway ***(Farkas, 1998)***.

Adolphe Quetelte **(Figure 2)** (1796-1874), a Belgian statistician, described the Quetelte index of relative body weight in 1832, which was the ratio of weight in kilograms divided by square the height in meters. Ancel Keys (1904-2004) later termed this ratio as body mass index (BMI) in1972. In 1982, BMI was adapted for evaluating overweight and obese patients by National Health institutes. Variables that limit BMI as a comparative tool include aging, sex, physical fitness, muscular built, weight loss with exercises, racial differences and clinical diseases. Despite these limitations, BMI is the predominant measure to gauge the severity of obesityand the key determinant of treatment indications and in current guidelines and algorithms of obesity management ***(Welbourne et al, 2005)***.

Figure 2: Adolphe Quetelte

In 1997, the WHO put forth a classification of the disease severity for overweight and obesity using the BMI as seen in **(Figure 3)**. Using the WHO classification as a foundation, NHLBI published clinical guidelines on the identification, evaluation of overweight and obesity in 2012 .In this algorithm (**Figure 4)**, the value of BMI is the indicator of lifestyle modification, medical or surgical interference without referring to the presence or the absence of obesity complications ***(Montori et al, 2009)***.

WHO classification of obesity

Classification	BMI (kg/m²)	Risk of co-morbidity
Underweight	Less than 18.5	
Normal	18.5 - 24.9	Not increased
Overweight or pre-obese	25.0 - 29.9	Increased
Obesity, further classified as:	≥30.0	Increased as follows:
– Class I	30.0 - 34.9	– Moderate
– Class II	35.0 - 39.9	– Severe
– Class III	≥40.0	– Very severe

Source: Adapted from WHO 1997

Figure 3: WHO classification of obesity (Montori et al, 2009)

Treatment	Body mass index (kg/m²)				
	25.0-26.9	27.0-29.9	30.0-34.9	35.0-39.9	>40
Dietary modification	+	+	+	+	+
Exercise	+	+	+	+	+
Behavioral modification	+	+	+	+	+
Pharmacotherapy		*	+	+	+
Bariatric surgery				x	+

+ indicated therapy

* with comorbidities

x with significant comorbidities, including obstructive sleep apnea, diabetes mellitus, coronary artery disease, and uncontrolled hypertension

Note. Adapted from American Heart Association. (2013). *2013 AHA/ACC/TOC guidelines for the management of overweight and obesity in adults.* Retrieved from http://circ.ahajournals.org/content/129/25_suppl_2/S102.full.pdf+html

Adapted from National Heart, Lung, and Blood Institute. (2012a). *How are overweight and obesity treated?* Retrieved from http://www.nhlbi.nih.gov/health/health-topics/topics/obe/treatment

Figure 4: NHLBI guidelines for management of obesity in adults (Montori et al, 2009)