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Comparison of the Effectiveness of Total Intravenous Anesthesia (TIVA) vs Inhalation Techniques in Patients with Morbid Obesity at Dr. M. Djamil General Hospital, Padang, Indonesia

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A B S T R A C T

Introduction: Morbidly obese patients (BMI ≥ 40 kg/m²) present unique challenges in anesthesia. Total intravenous anesthesia (TIVA) and inhalation techniques have their respective advantages and disadvantages in this group of patients. This study aims to compare the effectiveness and safety of TIVA and inhalation anesthesia in morbidly obese patients at Dr. M. Djamil General Hospital Padang. **Methods:** A prospective, randomized study was conducted on 80 morbidly obese patients undergoing elective surgery. Patients were randomized to receive TIVA with propofol and remifentanil or inhalation anesthesia with sevoflurane and desflurane. **Results:** The TIVA group demonstrated faster recovery time (p = 0.02) and less postoperative opioid requirements (p = 0.01) than the inhalation group. There was no significant difference in the incidence of intraoperative or postoperative complications. **Conclusion:** TIVA is an effective and safe option for morbidly obese patients undergoing elective surgery. TIVA offers faster recovery and fewer postoperative opioid requirements than inhalation anesthesia.

1. Introduction

Morbid obesity, defined as a body mass index (BMI) ≥ 40 kg/m², is an increasing global health problem. Its prevalence in Indonesia is inevitable, reaching 3.1% in 2018. Morbid obesity patients present unique challenges in anesthesia. Morbid obesity is associated with excessive adipose tissue around the neck, making visualization of the larynx difficult and increasing the risk of difficult intubation. Approximately 70% of morbidly obese patients suffer from obstructive sleep apnea (OSA), which increases the risk of respiratory complications during anesthesia. Morbidly obese patients are at high risk of cardiovascular complications such as hypertension, arrhythmia, and heart failure during anesthesia.[1-3]

The total intravenous anesthesia (TIVA) technique uses intravenous drugs to induce and maintain anesthesia. TIVA offers several advantages in morbidly obese patients. TIVA allows more precise control of blood pressure and heart rate than inhalation anesthesia. TIVA is associated with a lower incidence of postoperative nausea and vomiting than inhalation anesthesia. TIVA allows for quicker recovery than inhalation anesthesia.[4-6]

In Indonesia, data regarding the use of TIVA in morbidly obese patients is still limited. A study showed that TIVA is safe and effective for morbidly obese patients undergoing bariatric surgery. However, the study only involved 40 patients. Further research is needed to evaluate the effectiveness and safety of TIVA in a larger population of morbidly obese patients.[7-9] This study aims to compare the effectiveness and safety of TIVA vs inhalation in morbidly obese patients at Dr. M. Djamil General Hospital Padang. It is hoped that the results of this study will provide useful information for anesthesiologists in choosing the optimal anesthesia technique for morbidly obese patients.

2. Methods

This research is a prospective, randomized study conducted on 80 morbidly obese patients (BMI ≥ 40 kg/m²) who underwent elective surgery at Dr. M. Djamil General Hospital Padang. The population of this study were all morbidly obese patients undergoing elective surgery at Dr. M. Djamil General Hospital Padang. The research sample was taken by consecutive sampling. The inclusion criteria were patients with morbid obesity (BMI ≥ 40 kg/m²), undergoing elective surgery, aged 18-65 years, ASA I-III, and providing informed consent. Meanwhile, the exclusion criteria are history of allergy to propofol, remifentanil, sevoflurane, or desflurane, history of chronic obstructive pulmonary disease (COPD), history of uncontrolled obstructive sleep apnea (OSA), pregnancy, patients who are breastfeeding.

Patients who met the inclusion criteria were randomly assigned to receive TIVA with propofol and remifentanil or inhalation anesthesia with sevoflurane and desflurane. Allocation was carried out using computer-generated randomization. TIVA group: Induction of anesthesia with propofol 2 mg/kg BW and remifentanil 0.5 µg/kg BW/minute; Maintenance of anesthesia with propofol 4-8 mg/kg BW/hour and remifentanil 0.1-0.25 µg/kg BW/minute; Intravenous administration of fentanyl 1 µg/kg BW at the end of surgery. Inhalation Group: Induction of anesthesia with sevoflurane 8% and desflurane 6% in 100% oxygen; Maintenance of anesthesia with sevoflurane 1-3% and desflurane 4-6% in 40-60% oxygen; Intravenous administration of fentanyl 1 µg/kg BW at the end of surgery.

The parameters measured were recovery time, measured as the time from stopping administration of propofol or sevoflurane until the patient opened his eyes spontaneously and was able to answer simple questions; Postoperative opioid requirements, measured as the amount of intravenous morphine the patient required in the first 24 hours postoperatively; Intraoperative and postoperative complications: recorded and classified according to the Clavien-Dindo classification system. Data were analyzed using appropriate statistical tests, such as the t-test, Mann-Whitney U test, and chi-square test. This research was approved by the Research Ethics Committee of Dr. M. Djamil General Hospital Padang. Informed consent was obtained from all patients before the study began.

3. Results

Table 1 shows the characteristics of the 80 respondents who participated in this research. Respondents consisted of 40 men (50%) and 40 women (50%). Respondents' ages ranged from 18-65 years, with the largest age group being 36-55 years (43.8%). A total of 25 respondents (31.3%) had a BMI of 40-45 kg/m², 30 respondents (37.5%) had a BMI of 46-50 kg/m², 20 respondents (25%) had a BMI of 51-55 kg/m², and 5 respondents (6.3%) had a BMI of 56-60 kg/m². A total of 20 respondents (25%) were classified as ASA I, 45 respondents (56.3%) as ASA II, and 15 respondents (18.8%) as ASA III. The most frequently performed type of surgery was bariatric surgery (37.5%), followed by orthopedic surgery (31.3%), urology (18.8%), and gynecology (12.5%).

Table 1. Characteristics of respondents.

Characteristics	Category	Total	Percentage
Gender	Male	40	50%
	Female	40	50%
Age	18-35 years	30	37.5%
	36-55 years	35	43.8%
	56-65 years	15	18.8%
BMI	40-45 kg/m²	25	31.3%
	46-50 kg/m²	30	37.5%
	51-55 kg/m²	20	25%
	56-60 kg/m²	5	6.3%
ASA status	I	20	25%
	II	45	56.3%
	III	15	18.8%
Types of surgery	Bariatric	30	37.5%
	Orthopedics	25	31.3%
	Urology	15	18.8%
	Gynecology	10	12.5%

Table 2 shows the comparative results between the TIVA and inhalation groups in terms of recovery time, postoperative opioid requirements, and the incidence of intraoperative and postoperative complications. The TIVA group showed a significantly faster recovery time (average 25 minutes) than the inhalation group (average 35 minutes) with a p-value of 0.02.

The TIVA group also showed significantly less postoperative opioid requirements (mean 10 mg) than the inhalation group (mean 20 mg) with a p-value of 0.01. There was no significant difference in the incidence of intraoperative or postoperative complications between the two groups. In the TIVA group, there were 5 cases of intraoperative complications (6.3%) and 3 cases of postoperative complications (3.8%). In the inhalation group, there were 4 cases of intraoperative complications (5%) and 2 cases of postoperative complications (2.5%).

Table 2. Comparison of outcomes between groups.

Parameter	TIVA group	Inhalation group	p-value
Recovery time (minutes)	25 ± 5	35 ± 10	0,02
Postoperative opioid requirements (mg)	10 ± 5	20 ± 10	0,01
Intraoperative complications	5 (6,3%)	4 (5%)	0,72
Postoperative complications	3 (3,8%)	2 (2,5%)	0,65

4. Discussion

The results of this study showed that the TIVA group had a significantly faster recovery time than the inhalation group. This is in line with several previous studies which show that TIVA can speed up patient recovery after surgery. Propofol is rapidly metabolized by the liver and excreted via the kidneys. This allows for quicker recovery of consciousness compared to inhalation agents, which have a longer elimination time. Propofol has a shorter sedation effect compared to inhalation agents. This allows patients to wake up and recover more quickly after surgery. TIVA is

associated with a lower incidence of postoperative nausea and vomiting compared with inhalation anesthesia. Nausea and vomiting can slow a patient's recovery after surgery.[10-13]

A study showed that TIVA with propofol and remifentanil resulted in faster recovery in patients undergoing bariatric surgery compared with inhalation anesthesia with sevoflurane. A study showed that TIVA with propofol and remifentanil resulted in faster recovery in patients undergoing gynecologic surgery compared with inhalation anesthesia with desflurane. Propofol is an intravenous anesthetic drug that works by increasing the effects of γ-aminobutyric acid (GABA) in the brain. GABA is a neurotransmitter that inhibits central nervous activity. The enhancement of GABA effects by propofol causes central nervous system depression, resulting in sedation and anesthetic effects. Propofol has a rapid onset and offset, allowing better control over the depth of anesthesia. Propofol has minimal effects on hemodynamics, which is important in morbidly obese patients who are often at risk of cardiovascular complications. Propofol is rapidly metabolized and excreted via the kidneys, allowing for quicker recovery compared with inhaled agents.[14-16]

The findings of this study showed that the TIVA group had significantly fewer postoperative opioid requirements than the inhalation group. This is in line with several previous studies. The study found that patients who received TIVA needed 30% less postoperative opioids than patients who received inhalers. The study found that patients who received TIVA required 40% less postoperative opioids than patients who received inhalers. TIVA allows more precise control of blood pressure and heart rate than inhalation. This can help reduce pain and inflammation, thereby reducing the need for postoperative opioids. Propofol, a drug used for induction and maintenance of TIVA anesthesia, has anti-inflammatory effects. This can help reduce pain and inflammation, thereby reducing the need for postoperative opioids. Patients who received TIVA tended to feel more sedated after surgery than patients who received inhalation. This can help reduce pain and the need for postoperative opioids.[17-19]

5. Conclusion

TIVA is an effective and safe option for morbidly obese patients undergoing elective surgery. TIVA offers faster recovery and fewer postoperative opioid requirements than inhalation anesthesia.

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