World Bulletin of Public Health (WBPH)
Available Online at: https://www.scholarexpress.net
Volume-22, May 2023
ISSN: 2749-3644

ANESTHETIC CHALLENGES IN THE OBESE PATIENTS: A CASE-CONTROL STUDY

Naser Mahdi Naser[1], Hayder Ali Ismael[2]
[1]*Imam Al_Hussein Teaching Hospital , Karbalaa, Iraq; alnajmnaser3@gmail.com*
[2]*Imam Al_Hassan Al_Mojtaba Teaching Hospital, Karbalaa, Iraq; haiderismael73@gmail.com*

Article history:

Received: March 1st 2023
Accepted: April 4th 2023
Published: May 6th 2023

Abstract:

The fat accumulation around the organs have tremendous impact on its fuctions, and secretion if any. Inturn, it affected by general anaesthesia and surgery. The current study aim to estimate the effect of anaesthesia in obese and non-obese individuals. The research design was employed in this work as case-control study type (n=20). It was accompanied at Al_Hussein Teaching Hospital, Karbalaa between Jun 2022 to January 2023. They were divided into two groups, *i.e.* non-obese patients treated with anesthesia group (OPT, n = 10) and obese patients treated with anesthesia group (NOPT, n = 10). The grouping was based on their body mass index (BMI). Kown lung and heart disease history patients were excluded from study. Also, patients admitted for the above mension two surgery were not enrolled. For BMI calculation, women height and weight were measured. Heart rate, stroke volume (ml/beat), cardiac output (L/min), mean arterial pressure (mmHg), systolic (mmHg) and diastolic (mmHg) blood pressure were evaluated. For respiratory parameters, tidal volume, respiratory rate, expiratory reserve volume and vital capacity of lungs were assessed.

The OPT group (41.8± 7.4 kg/m^2) showed increase ($p \leq 0.01$) in the body mass index as compared to NOPT group (27.3±28 kg/m^2). In the OPT group individuals (95.7 ± 1.42) showed increase ($p<0.01$) in the heart rate as compared to NOPT group (71.6 ± 5.39). The stroke volume was found to be decrease in the OPT group individuals (64.82 ± 3.16 ml/beat) as compare to NOPT group individuals (95.4 ± 3.91 ml/beat). The cardiac output were also significantly increased in the OPT group individuals (9.3 ±0.42 L/min) as compare to NOPT group individuals (5.6 ± 1.38 L/min). Systolic and diastolic blood pressure were unchanged in the NOPT group and decrease in OPT group. OPT and NOPT groups showed increase in the tidal volume and respiratory rate. In the OPT group individuals vital capacity was found to be unchages while in the NOPT group it showed decrease trend. Expiratory reserve volume was decreased in both the groups. Obese patients showed less PO2 and high amount of PCO2 in the blood as compared to healthy individuals. Fortunatly, non of the patients from both the groups were expire to due operative provcedure or its complications. About 32.1 % and 9.36% individuals required ICU after operative procedure from OPT and NOPT group, respectively. Around 8 and 2 individuals showed ICU readmission in OPT and NOPT group, respectively. More percentage of individuals were required mechanical ventilation in OPT group as compare to NOPT group. OPT group individuals required more hospital stay then NOPT group individuals.

Keywords: Respiratory system parameters, Obesity, Body mass index, Cardiovascular system, Anesthesia management

1. INTRODUCTION

Concurring to the World Health Organization (WHO), the predominance of prevalence has essentially expanded since 1975. It was estimated that in 2016, roughly 13% of the world's populace were labeled as obese (Edmond and Chau, 2013). Excessive fat accumulation in the various area of body is refered to as obesity (WHO, 2021). This accumulated fats showed direct or indirect impact on the persons mental and/or physical health, individuals life expectancy and its quality then the individual is called as obese. As perr the World Health Organization (WHO) guidelines, obesity can be measure or define as an body weight (BMI) indicator. It would be more then 30 kg per square meter of body area (BMI 30 kg / m^2) (Edmond and Chau, 2013).

In expansion, over the past few years, the predominance of corpulence has been relentlessly

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Available Online at: https://www.scholarexpress.net
Volume-22, May 2023
ISSN: 2749-3644

expanding within the Joined together States (Flegal et al., 1998; 2016). The Centre for Disease Control and Prevention (CDC) pronounces that about 36% of grown-ups within the Joined together States are presently corpulent (McGuire et al., 2011). Weight is related to some other closely related health conditions such as hypertension, Type 2 diabetes mellitus, and heart and its artery diseases. Besides, obese or overweight individuals are repored to have obstructive sleep apnea (OSA), dyslipidemia, osteoarthritis, liver and gallbladder infections, cancers, regenerative and mental clutters, etc. It is additionally critical to note that weight may be a major hazard figure for asthma advancement and higher predominance of this malady is commonly seen in corpulent and overweight people as compared to non-obese people (Kim et al., 2014). Due to this bunch of concomitant maladies and complications that go with weight, the administration of corpulent patients, particularly those undertaking surgical procedures, is presently getting to be progressively challenging (Kopelman, 2000). The nearness of these conditions at a few point may require surgical mediation and so, anesthesiologists are habitually confronted with the challenge of viably overseeing corpulent patients beside their pre-existing comorbidities (Popkin and Doak, 1998).

In the body, accumulation of fats has very hazardous inpact. The fat accumulation around the organs has tremendous impact on its fuctions, and secretion if any. Inturn, it affected by general anaesthesia and surgery. The threat of anaesthesia in fat cases can be greatly reduced by the analgesic care platoon's logistical and specialized abilities, along with its precise cuts and knowledge (De Lorenzo et al, 2019). Preoperative procedure should be stickly follow for the obase individuals based on their history and physical examination. Ultramodern anaesthetics medicines such as sevoflurane or propofol, desflurane, and remifentanil, able the fast recovery (Schroder et al, 2001). According to the American Society of Anesthesiologists, around 45-50% individuals are morbidly fat (BMI> 35 kg/ m^2) amoung the operative cases. The incidence of post-operative mortality were also increased in obease individuals. Generally, cardiopulmonary damage was found to be associated with them. Around 20% obase individuals, delicate airway operation was observed. Hypoxia is constantly set up as a outcome of rapid-fire desaturation during anaesthesia induction (Schroder et al, 2001). Consideraing all the above mension facts, the current study aim to estimate the effect of anaesthesia in obese and non-obese individuals.

2. METHODOLOGY

2.1 Stady Design

The research design was employed in this work as case-control study type. It was accompanied at Al_Hussein Teaching Hospital,Karbalaa between June 2022 to January 2023. Patients (n = 20) come for the surgery were enrolled in the present study, after getting their oral concent.

2.2 Patient Enrollment

After getting concent from the patients, they were distributed into 2 groups. These groups were non-obese patients treated with anesthesia group (OPT, n = 10) and obese patients treated with anesthesia group (NOPT, n = 10). The grouping was based on their body mass index (BMI). All patients were operated after incorporation of spinal anesthesia. Kown lung and heart disease history patients were excluded from study. Also, patients admitted for the above mension two surgery were not enrolled.

2.3 Study Parameters

For BMI calculation, women height and weight were measured. Heart rate, stroke volume (ml/beat), cardiac output (L/min), mean arterial pressure (mmHg), systolic (mmHg) and diastolic (mmHg) blood pressure were evaluated. For respiratory parameters, tidal volume, respiratory rate, expiratory reserve volume and vital capacity of lungs were assessed. Serum PCO2 and PO2 levels were gauged in detailed. The postoperative parameters were also recorded.

2.4 Statistical Analysis

The collected data was analysed by the Graphpad prism (version 3) software. The results are represented as mean ±SD (standard deviation).

3. RESULTS

3.1 Body Mass Index Based Obesity Definition as per WHO and Enrolled Individuals

BMI could be a commonly utilized estimation of corpulence, its advantage being that it is simple to calculate. BMI does not depict the composition and conveyance of body tissue (muscle/adipose) or metabolic state. These are imperative variables in terms of pathophysiology, perioperative chance and administration. BMI can be valuable to caution groups and permit arranging and planning. The BMI may be a weight: tallness proportion. It is deliberate by isolating the weight (in kilograms) by the stature square (in meters). The body mass indexed is categorised in the six categorise based on weight definition as per world Helath organization (WHO). These categorise are underweightindividuals, normal, overweight individuals, obese class I, class II (Morbid obesity) and class III (Super morbid obesity) based on their BMI range under

World Bulletin of Public Health (WBPH)
Available Online at: https://www.scholarexpress.net
Volume-22, May 2023
ISSN: 2749-3644

18.5 kg/m^2, 18.5 to < 25 kg/m^2, 25 to < 30 kg/m^2, 30 to < 35 kg/m^2, 35 to < 40 kg/m^2 and 40 kg/m^2 and above, respectively.

The OPT patients (41.8± 7.4 kg/m^2) showed increase (p≤0.01) in the body mass index as compared to NOPT patients (27.3±28 kg/m^2). The BMI of the obese and non-obese patient are represented in the Table 1.

Table 1: Body mass index (BMI) of enrolled patients*

Parameters	OPT group	NOPT group
BMI	41.8± 7.4 kg/m^2**	27.3±28 kg/m^2

*Results are represented as mean ± standard deviation. OPT: obese patient treatment group; NOPT group: Non-obese patient treatment group. OPT group showed **p<0.01 as compared to NOPT group (One way ANOVA, unpaired two-tailed test).*
**BMI = Wt (kg)/Ht (m^2)*

3.2 Physiologic changes on the cardiovascular system

In the OPT group individuals (95.7 ± 1.42) showed increase (p<0.01) in the heart rate as compared to NOPT group (71.6 ± 5.39). The stroke volume was found to be decrease in the OPT group individuals (64.82 ± 3.16 ml/beat) as compare to NOPT group individuals (95.4 ± 3.91 ml/beat). Cardiovascular system changes in the enrolled individuals are depicted in the Table 2. The cardiac output were also significantly increased in the OPT group individuals (9.3 ±0.42 L/min) as compare to NOPT group individuals (5.6 ± 1.38 L/min). Systolic and diastolic blood pressure were unchanged in the NOPT group and decrease in OPT group.

Table 2. Cardiovascular system changes in the enrolled individuals

Parameters	OPT group	NOPT group
Heart rate	95.7 ± 1.42**	71.6 ± 5.39
Stroke volume (ml/beat)	64.82 ± 3.16	95.4 ± 3.91
Cardiac output (L/min)	9.3 ±0.42**	5.6 ± 1.38
Mean arterial pressure (mmHg)	116.4 ± 2.71**	94.2 ± 2.94
Systolic (mmHg)	Decrease	unchanged
Diastolic (mmHg)	Decrease	unchanged

*Results are represented as mean ± standard deviation. OPT: obese patient treatment group; NOPT group: Non-obese patient treatment group. OPT group showed **p<0.01 as compared to NOPT group (One way ANOVA, unpaired two-tailed test).*

3.3 Physiologic changes to the respiratory system

Changes to the respiratory system parameters of enrolled individuals are depicted in the Table 3. OPT and NOPT groups showed increase in the tidal volume and respiratory rate. In the OPT group individuals vital capacity was found to be unchages while in the NOPT group it showed decrease trend. Expiratory reserve volume was decreased in both the groups.

Table 3. Changes to the respiratory system parameters of enrolled individuals

Parameters	OPT group	NOPT group
Tidal volume	+++	+++
Respiratory rate	+++	+++
Expiratory reserve volume	---	---
Vital capacity	=	---

+++ : Increased; --- : Decreased; = : unchaged. OPT: obese patient treatment group; NOPT group: Non-obese patient treatment group.

3.4 Blood PO2 and PCO2 parameters

In the obesity research, PO2 and PCO2 level are important. Obese patients showed less PO2 and high amount of PCO2 in the blood as compared to healthy individuals. The PO2 and PCO2 levels of obese and non-obese patients are depicted in the Table 4.

World Bulletin of Public Health (WBPH)
Available Online at: https://www.scholarexpress.net
Volume-22, May 2023
ISSN: 2749-3644

Table 4. PO2 and PCO2 parameters on enrolled patients

Parameters	OPT group	NOPT group
PO2	Less than 65 mmHg	More than 65 mmHg
PCO2	More then 45 mmHg	Less than 45 mmHg

OPT: obese patient treatment group; NOPT group: Non-obese patient treatment group.

3.5 Postoperative management

Fortunatly, non of the patients from both the groups were expire to due operative provcedure or its complications. About 32.1 % and 9.36% individuals required ICU after operative procedure from OPT and NOPT group, respectively. Around 8 and 2 individuals showed ICU readmission in OPT and NOPT group, respectively. More percentage of individuals were required mechanical ventilation in OPT group as compare to NOPT group. OPT group individuals required more hospital stay then NOPT group individuals.

Table 5. Postoperative management of both the groups

Sr no.	Parameters	OPT group	NOPT group
1	Mortality (%)	00.00	00.00
2	Need for ICU (%)	32.1	9.36
3	ICU readmission (number of patients)	8	2
4	Need for mechanical ventilation (%)	47.2	2.58
5	Hospital stay (number of days)	5-7	3-4

ICU: intensive care unit; OPT: obese patient treatment group; NOPT group: Non-obese patient treatment group.

4. DISCUSSION

Corpulence is related with haemodynamic overload (Alexander, 1993; Alpert, 2001). The expanded metabolic request forced by the extended fat tissue and expanded fat-free mass in corpulence comes about in a hyperdynamic circulation with expanded blood volume. In expansion to the expanded preload, cleared out ventricular (LV) afterload is additionally raised in stout people due to both expanded peripheral resistance and more noteworthy conduit supply route stiffness (Sutton-Tyrrell et al., 2001). Right ventricular afterload may be expanded, probably due to related rest disarranged breathing and LV changes (Alpert, 2001).

Various studies reported effect anaesthetic on the obesity (Covino, 1972; Askitopoulou et al, 2000; Domi and Laho, 2012; Edmond and Chau, 2013; De Lorenzo et al, 2019). DeMaria et al., (2007) reported that about 0.01/min increase in cardiac output for every kilogram of adipose tissue were observed. Many studies have been reported that the general anaesthetia is beneficial than another anaesthetia (Poirier et al, 2009). The postoperative management and recovery was very quick for the desflurane anesthesia. This was found to be more convenient for obese patients (Poirier et al, 2009). The intensive care admition after surgical procedure is completely depend on the consequential conditions and surgical requirements of morbidly obese individuals. Insufficient pulmonary gas exchange is the main reason. In morbidly obese individuals, this interdisciplinary methodology will minimize the anaesthesia danger and prevent difficulties (Schroder et al, 2001). Similar studies were also reported in child obesity (Sahoo et al, 2015; Chidambaran et al, 2018). Our study findings are accordance with these reports. In the obese individuals, regional anaesthetia was more noticeable. A localised anaesthetia used for less airway manipulation. The anaesthetic medicines which has effect of cardiopulmonary reduction, and postoperative nausea and vomiting should be avoided (Ingrande et al, 2009).

Unnessory increase in the weight and excess fat accumulation is a worldwide health issue. The morbid obesity showed a characteristic symptom i.e. hypoventilation pattern. The anesthesiologist should pay more attension towords this symptom (Edmond and Chau et al, 2013). Maternal obesity is a substantial threat factor for adverse gestation issues, and caesarean birth. It is also asscociate with many other adverse outcomes like deep venous thrombophlebitis, infection, etc. (Catalano, 2007). An anesthesiologist with the expertise, mindfulness of the pharmacologic and physiologic characteristics are highly recommendated in operative procedure for obese individuals (Ingrande etal., 2009).

In another study, fat cases (BMI 30 – 40 kg/ m 2) were aimlessly assigned to routinepre-oxygenation orpre-oxygenation plus " buccal " oxygenation. Buccal O 2 was administered via a modified3.5 mm Ring- Adair- Elwyn (RAE) tracheal tube placed inside the case's

World Bulletin of Public Health (WBPH)
Available Online at: https://www.scholarexpress.net
Volume-22, May 2023
ISSN: 2749-3644

impertinence. Cases entering buccal oxygenation were much less likely to parade an SpO2 of lower than 95 during 750 seconds of apnea. Median apnea times with an SpO2 of 95 or further were dragged in the buccal oxygenation group compared to thenon-buccal oxygenation group(Heard etal., 2017). therefore, clinically important extension of SAP in fat cases can be achieved by delivering buccal O2 during and after the induction of anesthesia. This approach to apneic oxygenation via an oral route requires lower O2 overflows and lower outfit than THRIVE while perfecting operation of the delicate airway and dragging SAP (Brodsky, 2018). Similar study was reported bymany authors (Gander et al, 2005; Catalano, 2007; Ingrande et al., 2009; Kristensen, 2010; Edmond and Chau et al, 2013).

5. CONCLUSIONS

A proper anesthesia operative management should be taken to treat obese cases during operations. Numerous anesthesiologists prefer to resuscitate the nerves at the operating table. There should be enough trained and endured staff in the operation theater to help with emptying the case snappily, if necessary during training.

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