An-Najah National University

Faculty of Graduate Studies

The Relationship Between Body Mass Index and Difficult Tracheal Intubation Among Patients who have Elective Surgery Under General Anesthesia in Jenin Governmental Hospital – Palestine

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This Thesis is Submitted as Partial Fulfillment of the Requirements for the Degree Of Master Of Nursing Anesthesia, Faculty Of Graduate Studies, An-Najah National University, Nablus-Palestine

2018

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الاهداء

بسم الله الرحمن الرحيم

(قل اعملوا فسيرى الله عملكم ورسوله والمؤمنون) صدق الله العظيم

إلهي لا يطيب الليل إلا بشكرك ولا يطيب النهار إلى بطاعتك .. ولا تطيب اللحظات إلا بذكرك .. ولا تطيب الآخرة إلا بعفوك .. ولا تطيب الجنة إلا برؤيتك

الله جل جلاله

إلى من بلغ الرسالة وأدى الأمانة .. ونصح الأمة .. إلى نبي الرحمة ونور العالمين.. سيدنا (محمد صلى الله عليه وسلم)

الي من جرع الكأس فارغا الي من كلت انامله ليقدم لي لحظه سعادة الي من حصد الشوك عن دربي ليمهد لي طريق العلم الي روح أبي

الي من أرضعتني الحب والحنان الي رمز الحب وبلسم الشفاء الي القلب الناصع بالبياض (والدتي الحبيبة)

الي من حبهم يجري في عروقي ويلهج بذكراهم فؤادي الي أخواتي وأخوتي

إلى الأخوات اللواتي لم تلدهن أمي .. إلى من تحلو بالإخاء وتميزوا بالوفاء والعطاء إلى ينابيع الصدق الصافي إلى من معهم سعدت، وبرفقتهم في دروب الحياة الحلوة والحزينة سرت إلى من كانوا معي على طريق النجاح والخير إلى من عرفت كيف أجدهم وعلموني أن لا أضيعه (صديقاتي)

الي من علمونا حروفا من ذهب وكلمات من درر وعبارات من أسمي وأجلي عبارات في العلم الي من صاغو لنا علمهم حروفا ومن فكرهم مناره تنير لنا سيرة العلم والنجاح الي أساتذتنا الكرام

الي كل من مد لي يد العون لأخطو في طريقي نحو هدفي اهدي هذا البحث

Acknowledgment

For most I am grateful for God to finish my thesis, further more I would like to thank the all library media specialists for their participation in the survey who supported my work in this way and helped me get results of better quality.

I would like to thank my fellow doctoral Dr. Aidah Alkaissi , Dr.Mariam Al-Tall, and DR. Niji Nazall for their feedback, cooperation and of course friendship, continuous support to my thesis ,and their motivation and helped . In addition I would like to express my gratitude to the staff in Jenin Governmental hospital.

I would like to thank my friends for accepting nothing less than excellence from me. Last but not the least, I would like to thank my family: my parents and to my brothers and sister for supporting me spiritually throughout writing this thesis and my life in general. I am also grateful to the members of my committee for their patience and support in overcoming numerous obstacles I have been facing through my research.

I would like to thank the all library media specialists for their participation in the survey who supported my work in this way and helped me get results of better quality.

الإقرار

أنا الموقعة ادناه، مقدمة الرسالة التي تحمل العنوان:

The Relationship Between Body Mass Index and Difficult Tracheal Intubation Among Patients who have Elective Surgery Under General Anesthesia in Jenin Governmental Hospital - Palestine

أقر بأن ما اشتملت علية هذه الرسالة انما هو نتاج جهدي الخاص، باستثناء ما تمت الإشارة اليه حيثما ورد، وأن هذه الرسالة كاملة، أو أي جزء منها لم يقدم من قبل لنيل أي درجة أو لقب علمي أو بحثي لدى أي مؤسسة أو بحثية أخرى

Declaration

The work provided in this thesis, unless otherwise referenced, is the researcher's own work, and has not been submitted elsewhere for any other degree or qualification.

Student's Name: **إسم الطالب:**

Signature: **التوقيع**

Date: **التاريخ:**

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List of Abbreviations

IDS: Intubation Difficulty Scale

UK: United Kingdom

GA: General Anesthesia

BMI: Body Mass Index

ASAPS: American Society of Anesthesiologists physical status

IBW: Ideal Body Weight.

Wt: Weight

Kg: Kilograms

Ht: Height

IRB: Institutional Review Board

ASA: The American Society of Anesthesiologists

OR: Operation Room

DL: Difficult Laryngoscope

OR: Odds Ratio

ICU: Intensive Care Unit

OT: Operating Theatre

ADA: Anticipated Difficulty Airway

TMD: Thyromental Distance

SMD: Sternomental Distance

ETT: Endo Tracheal Tube

DMV: Difficult Mask Ventilation

CNS: Central Nervous System

N: The size of the Populations.

Z: Class standard corresponding to the level of significance (0.95) and is equal to (1.96)

Q: The error rate is equal to (0.05)

P: Ratio provides a neutral property and equal (0.50)

Definitions of some term

General anesthesia (GA): is the state produced when a patient receives medications for amnesia, analgesia, muscle paralysis, and sedation. An anesthetized patient can be thought of as being in a controlled, reversible state of unconsciousness, (Smeltzer &Bare, 2003).

Body mass index (BMI): Calculated as weight in kilograms divided by height in meters squared, rounded to the nearest tenth, (Flegal et al.2010).

Elective surgery: is a planned, non-emergency surgical procedure, that is subject to choice (election). The choice may be made by the patient or doctor, (Smeltzer &Bare, 2003).

Surgery: The branch of medicine that employs operations in the treatment of disease or injury. Surgery can involve abrading, suturing, cutting, or physically changing body tissues and organs, (Smeltzer &Bare, 2003).

Difficult intubation: defined as three or more laryngoscopic attempts to place the tracheal tube into the trachea, as lasting 10 min using conventional laryngoscopy, or both, (De Jong, 2014).

Morbid Obesity: is term applied to people who are more than two times of their (BMI) exceeds 30kg/m2, (Smeltzer &Bare,2003).

Weight (wt): a piece of metal of known heaviness that can be used to measure the heaviness of other objects ,(Weight,2015).

Height: The distance from the base of something to the top,(Height, 2015).

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Abstract

Introduction: Difficult tracheal intubation is a common source of mortality and morbidity in many setting include: Operation, Intensive Care Unit (ICU), and Emergency ward. The incidence reported of difficult tracheal intubation is 0.1%–13% and reaches 14% in the obese population. The objective of the study was to investigate and compare the utility of Body Mass Index (BMI) as indicator of difficult tracheal intubations in patients who underwent for elective surgery under general anesthesia.

Aim: To find out the relationship between BMI and difficult tracheal intubation among patients who went for elective surgery under general anesthesia.

Background: The study was done by using the intubation difficulty scale (IDS), Mallampati score, and Wilson score**,** to confirm that obese patients are more difficult intubation than lean patients.

Material and methods: Prospective observational descriptive design was used in this study to patients who underwent for elective surgery under general anesthesia. The sample was 100 patients. The study done in Jenin

governmental hospital; the following information was obtained from participants for analysis: gender, age, height, weight, BMI, past medical history, past surgical history .Assessment Mallampati score, IDS, Wilson score**,** and the American Society of Anesthesiologists classification assigned by the anesthesiologist and senior doctors provider performing the endotracheal intubation.

Result: The total number of IDS was (81%) of participants who underwent elective surgery under general anesthesia were categorized as slightly difficult intubation according to IDS score. And 2% of participants were classified as moderate to major degree of intubation difficulty. 17% of participants were labeled as easy degree of intubation difficulty. And there is correlation between the Mallampati class and Wilson score with BMI $\boldsymbol{p} < \mathbf{0.001}$ and $\boldsymbol{p} = \mathbf{0.008}$ respectively.

Conclusion and recommendation: In conclusion, data showed that BMI is a reliable indicator for difficult tracheal intubation in patients who underwent elective surgery under general anesthesia. Mallampati classification and Wilson score is a strong predictor of difficult tracheal intubation in patients who underwent elective surgery under general anesthesia in correlated to their BMI, age and gender are not predictor for difficult intubation according to IDS scale. Future prospective studies should aim to include controlled preoperative assessments and defined concept of difficult tracheal intubation

Chapter One
Introduction

Introduction

Difficult tracheal intubation is a common source of mortality and morbidity to many patients in hospitals, the procedures of tracheal intubation happened in many settings and mostly done in operation room, critical care, and emergency room, (Uribe et al., 2015). Several studies have been done and shown the complication relationship to difficult intubation and include: hypoxic brain injury, cardiopulmonary arrest, rescue tracheostomy, airway trauma, aspiration, damage to teeth, and may end with death as mentioned that death is the most frequent causes of anesthetic in the published analyses records in the United Kingdom (UK) medical defense society, (Henderson et al, 2004; Uribe et al., 2015).

Identifying situations and patients at risk for airway management problems is a key to optimal care and has been to focus of numerous publications, (Juvin etal., 2003).

Shiga et al. in (2005) reported that unanticipated difficult intubation can be challenging to anesthesiologists. Numerous investigators have attempted to predict difficult intubation by using a simple bedside physical examination. And in 1985 a currently well-known screening test that classifies visibility of the oropharyngeal structure. The distance from the thyroid notch to the mentum (thyromental distance), the distance from the upper border of the manubrium sterni to the mentum (sternomental

distance), and a simple summation of risk factors (Wilson risk sum score) are widely recognized as tools for predicting difficult intubation.

Gonzalez et al. in (2008) reviewed several studies related to endotracheal intubation, the majority of theses reviewed studies indicated that endotracheal intubation is more difficult in obese than in lean patients and so the obesity thought to increase risk of difficult tracheal intubation.

Some groups of patients such as obese patients have a higher probability of difficult intubation. Due to their anatomic and physiologic characteristics they develop oxygen desaturation faster than in non-obese patients especially in the supine position, reduction in pharyngeal space and narrowing of the airways due to deposit of fat tissue. Gastro esophageal reflux is more common in obese patients favoring regurgitation and bronchial aspiration, (Filho et al., 2011).

Many studies have been conducted to find out the relationship between Body Mask Index(BMI) and difficult tracheal intubation ,and the result proved that BMI is a predictor of difficult tracheal intubation , (Gonzalez et al., 2008; Juvin et al., 2003; & Ezri et al., 2003). The likelihood of difficult intubation was nearly four times higher in patients with a body-mass index 40 kg/m2 than in non obese patients,(Holmberg et al .,2011).

Other studies have been implemented at Arab countries aimed at finding the efficacy and accuracy of a multi parameter computer-based system to define difficult laryngoscopy, (Moustafa et al., 2016; Riad et al.,2018; Ejaimi, 2016).

Unfortunately and at the best of researcher knowledge there was no related studies done in Palestine. This study aimed at to find out the relationship between BMI and difficult tracheal intubation among patients who underwent for elective surgery under general anesthesia.

Problem statement

Difficult tracheal intubation is a global problem that faces anesthesia team during surgery over all countries in the world. However, the incidence of difficult intubation varies from 1.5% to 13% in the world, (Badheka et al., 2016). Difficult tracheal intubation has many effects on the patients who underwent for surgery under general anesthesia and lead to many complications, like: occlusion of the air way, laryngeal spasm, homodynamic alterations, edema in the air way, risk factor for cardiac arrest, tissue injury, bleeding, and brain damage and may be lead at the end to death.

So identifying sum of the factors that have an effect on difficult tracheal intubation will minimize the incidence and complications that result from difficult tracheal intubation during surgery.

Significant of the study

The findings of this study might be beneficial for many categories including policy makers, hospital, medical team, patients and their family. It will be a review to anesthesia and researcher in the future in Palestine especially in local area. It might help in developing a policy/protocol to anesthesia team and hospitals about patients who could be at risk for difficult tracheal intubation before the operation. Moreover, it will provide recommendations to increase focus on difficult tracheal intubation and their relationship with BMI.

Aim: To find out the relationship between BMI and difficult tracheal intubation among patients who went for elective surgery under general anesthesia.

Objective

1- To estimate the rate of difficult tracheal intubation to patients who went for elective surgery under general anesthesia.

2- To find out the relationship between BMI and difficult tracheal intubation to patients who went for elective surgery under general anesthesia

Research question

- What is the rate of difficult tracheal intubation among patients who went for elective surgery under general anesthesia?

- Is there any relationship between the difficult tracheal intubation and BMI for patients who went for elective surgery under general anesthesia?

- Are there any differences between the rates of difficult tracheal intubation among patients who underwent for elective surgery under general anesthesia in relation to their gender and age group?

Hypothesis

- There is significant differences at 0.05 level related to the incidence of difficult tracheal intubation between different categories of BMI among patients who underwent for elective surgery under general anesthesia

- There is a significant difference at 0.05 level related to the incidence of difficult tracheal intubation between male and female patients who undergo for elective surgery under general anesthesia.

- There is a significant difference at 0.05 level related to the incidence of difficult tracheal intubation between different categories at age group among patients who underwent for elective surgery under general anesthesia.

- There is a relationship between Mallampati classes and difficult tracheal intubation among patients who went for elective surgery under tracheal intubation.

- There is a relationship between Wilson scores and difficult tracheal intubation among patients who went for elective surgery under tracheal intubation.

Background

1- Anesthesia

Anesthesia is considered an American invention, although anyone who examines history understands that innovations of significances can hardly have arisen spontaneously. Externally, mankind has suffered pain of various kinds, but the individual's well-being was not genuinely considered until the need for surgical treatments of disease arose, attempts to reliving pain were hitherto sporadic, (Miller, 1986).

They are many types of anesthesia include

1-Regional anesthesia : is a form of local anesthesia in which an anesthetic agent is injected around nerves so that the area supplied by these nerves is anesthetized.**,**(Smeltzer & Bare, 2003).

2-Local anesthesia: numbs a small part of the body for minor procedures, (Smeltzer & Bare, 2003).

3-General anesthesia can be defined as drug-induced reversible depression of the Central Nervous System (CNS) resulting in the loss of response to and perceptions of all an external stimuli. General anesthesia uses

intravenous and inhaled agents to allow adequate surgical access to the operative site, (Barash, 2009).

2- Tracheal intubation

Endotracheal intubation is the trans-laryngeal placement of a tube into the trachea via the nose (nasotracheal intubation) or mouth (orotracheal intubation).the first endotracheal intubation was done in 1880 by Sir Wiliam Macewen and do endotracheal intubation without resorting to tracheostomy. In 1895, Kirstein became the first to perform endotracheal intubation with the aid of laryngoscope, (Miller,1986).

Endotracheal intubation is indicated to protect the air way and reduce the risks of pulmonary aspirations. It also offers pathway for patients who require prolonged positive pressure ventilation and frequent suctions .In addition, the ETT can be used to administer emergency medications when intravenous access is not available. Most frequently, endotracheal intubation enables the patients to undergo surgical procedures and allow delivery of inhalation anesthetic .Outside operation room , endotracheal intubation involves patients who are in respiratory failure, shock, and cardiopulmonary arrest, and most patients receives mechanical ventilations invasively via an ETT,(Mosenifar &Soo Hoo,2006).

3- Tracheal tube

A tracheal tube is a catheter that is inserted into the trachea for the primary purpose of establishing and maintaining a patent (open and unobstructed) airway. The place of endotracheal intubation put on the tip of the endotracheal tube is positioned above the carina (before the trachea divides to each lung) and sealed within the trachea so that the lungs can be ventilated equally. And the size of type use as following:

- child less than 10 years old: size = age/4 + 4

- A size 7.5-mm cuffed ETT is well tolerated by most adult female patients.

-A size 8.0-mm cuffed ETT is well tolerated by most adult male patients, (Miller, 1986).

4- Difficult tracheal intubation

Difficult intubations were defined as three or more laryngoscopic attempts to place the tracheal tube into the trachea, as lasting 10 min using conventional laryngoscopy, or both, (De Jong, 2014).

Difficult airway: A difficult airway can be defined as one where an experienced provider anticipates or encounters difficulty with any or all of face mask ventilation, direct or indirect (e.g., video) laryngoscopy, tracheal intubation, or surgical airway, (Law et al., 2013).

Many complex mechanisms were evolves and used in direct laryngoscopy and intubation and varied set of factors have been studied in different reports with variable incidences of difficult intubation. The purpose was to minimize this risk due to difficult intubations; the national anesthesia societies have developed guidelines for the management of expected and unexpected difficult intubations (figure1). The aim of the guidelines is to provide a structured response to a potentially life-threatening clinical problem. They take into account current practice and recent developments, (Barash et al, 2009).

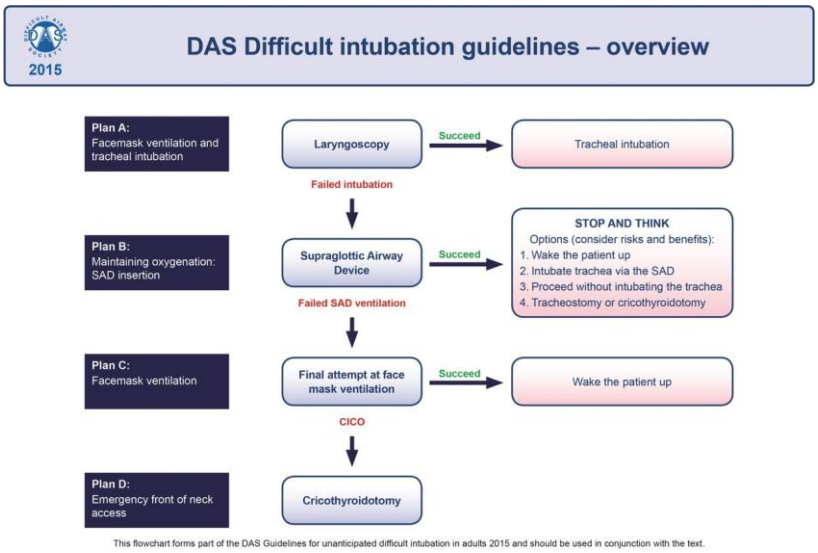

Figure (1): guidelines for the management of difficult intubations (Barash et al, 2009).

5- Operation and surgery

Surgery is a stressful complex event, approximately 60% of elective surgeries are now performed in an ambulatory or outpatients setting .the patients scheduled for elective surgery would be admitted to the hospitals at least one day before surgery for evaluation and preparations, these

activities are now completed before the patient admitted to the hospitals, (Smeltzer & Bare, 2006).

Operation: A medical procedure involving an incision with instruments; performed to repair damage or arrest disease in a living body; "they will schedule the operation as soon as operating room is available, (operation,2015).

Types of surgery

Surgical procedures are commonly categorized by urgency, body system involved, special instrumentation, timing, type of procedure, body part, degree of invasiveness of surgical procedures and purpose, (Smeltzer & Bare, 2006).

6- Body Mass Index

BMI is a ratio based on body weight and height, the patient who have BMI below than 24 are at increased risk for problems with poor nutritional status. In addition, a low BMI is associated with higher mortality rates in hospitalized patients and community –dwelling elderly. And it calculated as the following BMI = body weight (in kg) / height^2 (in metres), (Smeltzer & Bare, 2006).

Varying pathophysiologic consequences are associated with the anatomic distribution of body fat. Obesity, adipose tissue is located predominantly in the upper body (truncal distribution) and is associated with increased oxygen consumption and increased of cardiovascular disease. BMI

equations can be used to estimate ideal body weight by relating the "normal" BMI average of 22(normal =18 to 24.9) to known height, and rearranging the equations to read Ideal Body Weight =22*height ^{2} BMI is used to estimate the degree of obesity, (Barash et al, 2009).

The incidence of obesity is increasing over the world, which was in 2014 more than 1.9 billion adults aged 18 years and older were overweight. Of these over 600 million adults were obese. Overall, about 13% of the world's adult population (11% of men and 15% of women) were obese in 2014.In 2014, 39% of adults aged 18 years and over (38% of men and 40% of women) were overweight, (WHO, October2017). n (2012) a study done by Abdeen et al. On an Urban Palestinian population to found 49% of women and 30% of men to be obese, and a later study including Palestinians in rural West Bank found 37% obesity levels for women and 18% amongst men. Among adolescents, a study taking place at the national level in both West Bank and Gaza found the prevalence of overweight for both genders (n = 1 2,847; 6,099 boys and 6,748 girls) was 16.5% (13.3% overweight; 3.2% obese); off these, 20.4% were boys and 13.0% were girls

Chapter Two
Literature review

Systematic review

Several international studies have been conducted in the world about the relationship between difficult tracheal intubation and BMI. To systematically review these studies the following databases were searched; Science Direct, Pub Med, Google Scholar, and Med Line using different keywords: (tracheal intubation, intubation, difficult tracheal intubation, BMI, obesity, obese, difficult airway, difficult intubation, Mallampati class, Wilson score, weight, and lean patients). Table (1) shows how these keywords were used in the research.

Table (1): Key words used in review

	Term	Combined with
1	Tracheal intubation **OR** difficult tracheal intubation **OR** intubation **OR** difficult intubation	And
2	BMI **OR** obesity **OR** obese patients **OR** lean patients	
3	Mallampati calss **OR** Wilson score **OR** weight **OR** difficult airway	

Inclusion and exclusion criteria of articles

After accessing 3023 articles the included articles were those published between 2004 and 2017 in English language. The following diagram (figure 2) show cases how this systematic review of the literature was conducted.

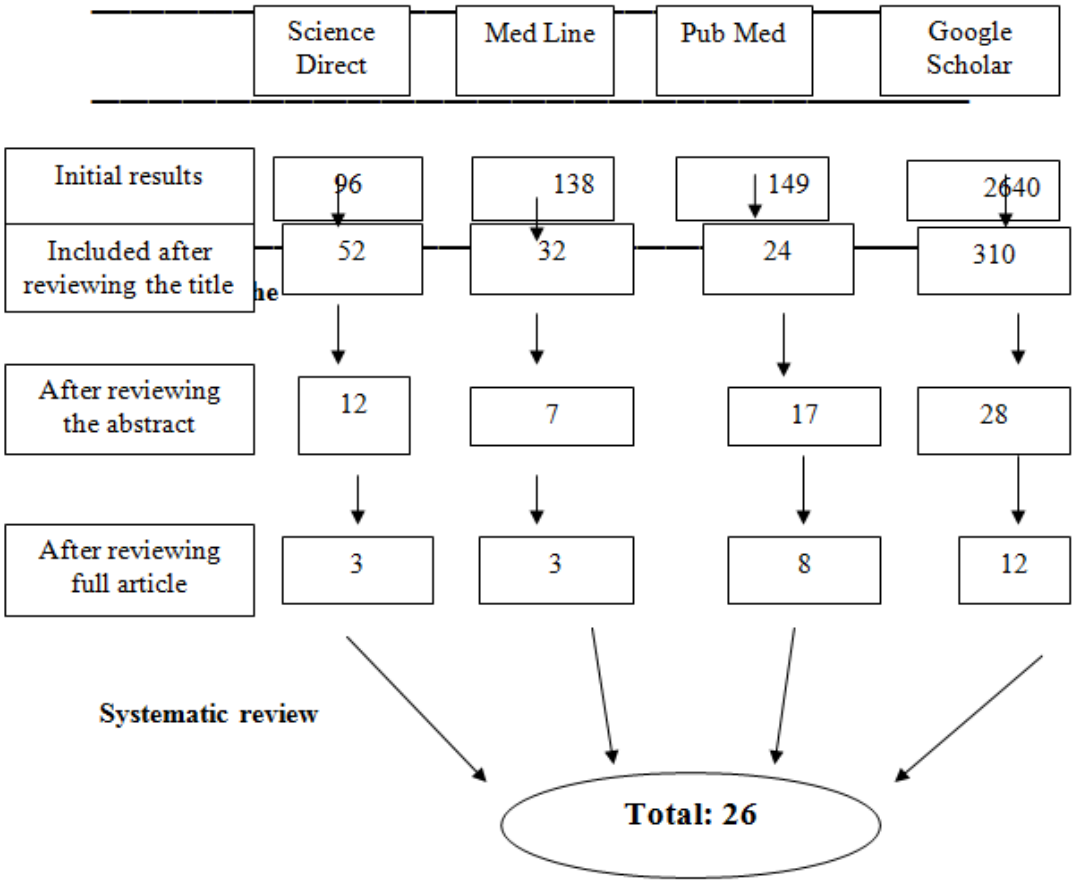

Figure 2: conducted of systematic review of the literature.

Problems with tracheal intubation were the most frequent causes of anesthetic death in the published analyses of records of the UK medical defense societies. The true number is likely to be substantially greater than those published, (Henderson, 2004).

A prospective study done in (2003) by Juvin et al. in Bichat Claude-Bernard Hospital in France, aimed at comparing the incidence of difficult tracheal intubation in obese and lean patients by using the intubation difficulty scale (IDS).The sample was 134 lean (body mass index, <30 kg/m2) and 129 obese (body mass index, >35 kg/m2), during a period of 10 month. Many variables were used to predict difficult intubation .The result

of the study showed that incidence of difficult intubation was more frequent in the obese than in the lean patients.

Another study done in (2008) in Paris by Ndoko et al. aimed at comparing tracheal intubation performance of standard Macintosh laryngoscope with the AirtraqTM laryngoscope in morbidly obese patients. The sample of study was one hundred and six from ASA I–III; morbidly obese (BMI >35 kg m22) consecutive adult patients. The patients underwent general, gynecological, and bariatric surgery. Randomization to intubation with the AirtraqTM or Macintosh laryngoscope was performed. The parameters that used included mallampati, thyromental distance, IDS, BMI, Inter incisor distance. The results showed that tracheal intubation was successfully carried out within 120seconed in all patients in the AirtraqTM laryngoscope group. Six patients in the Macintosh laryngoscope group required more than 2 min to complete tracheal intubation. These six patients were subsequently intubated with the AirtraqTM laryngoscope within a mean of 27(8) s.

In addition, a study done by Gonzalez et al. in (2008) aimed at comparing the incidence of difficult tracheal intubation, between lean and obese patients. The study assessed classical bedside tests and neck circumference by using of the IDS score. The sample size of study was 57 patients for each group, the result showed that difficult tracheal intubation was more frequent in obese than in lean patients (14.3% vs 3%;p=0.03). Similar results were found in a study done by Fox et al. (2008) which

confirmed the prevalence of difficult intubation in morbidly obese patients, ranging between 12% and 35%.

In contrast a cohort study done by Lundstrøm, et al. in (2009) aimed at assesseing whether obesity measured by BMI is associated with Difficult Tracheal Intubation (DTI). The sample included of 91,332 consecutive patients planned for intubation by direct laryngoscopy was retrieved from the Danish Anesthesia Database, the period was from 2005 and 25 in 2006–07. In this study a four-point scale to grade the tracheal intubation was used; Age, sex, American Society of Anesthesiologists physical status classification, priority of surgery, history of previous DTI, modified Mallampati-score, use of neuromuscular blocker, and BMI . At the end the conclusions was high BMI is a weak predictor but statistically significant predictor of difficult and failed intubation and may be more appropriate than weight in multivariate models of prediction of DTI

In (2010) a prospective study done by Gupta et al. in Kashmir aimed at comparing the efficiency of airway parameters to predict difficult intubation. The sample was 600 patients from ASAI and ASA II. The parameter was thyromental distance, mallampati, extention of the head, obesity; inter incisor gap and grading of prognathism. And intra-operative Cormack –lehane was used to predict difficult intubation. The result showed that glottic exposure on direct laryngoscopy was difficult in 20 patients. And the conclusion was thyromental distance, mallampati, extension of the head, obesity, inter incisor gap and grading of prognathism is best parameters for predict difficult intubation.

Myatt and Haire in (2010) reported that anesthesia in morbidly obese patients can present many challenges, and need more management, as traditionally; obese patients have been thought to be at greater risk of difficult airway and difficult intubation, when compared with the general population.

Additional study done in (2011) by Filho et al. about difficult intubation, the objective of the study was the reevaluation of the airways of obese patients undergone bariatric surgery after they reached a reduction of their BMI using the Mallampati classification, thyromental distance, inter incisor gap, neck circumference, and degree of Obstructive Sleep Apnea Syndrome (OSAS) and compare with the values observed in the preoperative period. The sample of the study was 52 patients of both genders with BMI higher than 35 kg/m-2 who underwent bariatric surgery under general anesthesia with tracheal intubation; the study was from April 01, 2004 and May 16, 2007. The result of the study showed a reduction in BMI and neck circumference, and an increase in both inter incisor gap and thyromental distance. Only one patient showed a reduction in Mallampati scale, and only 4 patients performed polysomnography.

Another retrospective study done in (2011) by Holmberg et al. in Seattle city , A review was performed of all patients ≥15 years of age who underwent pre hospital tracheal intubation by paramedics in the Seattle Medic One system over a 4-year period, and were transported to the regional level 1 trauma center (Harborview Medical Center). The sample was 80,501 patient contacts in which 4114 tracheal intubations (TIs) were

attempted during the 4-year study period, 823 met study entry criteria (including a calculable BMI). The result showed that the overall TI success rate was 98.5% (811 out of 823), with 6.8% (56 out of 823) meeting the predetermined definition for difficult TI. And in comparison with the lean patient subgroup (BMI <30 kg/m (2)), patients with class III obesity (BMI >40 kg/m(2)) there was a significant association with difficult tracheal intubation.

Budde et al. in (2013) reported the incidence of difficult intubation in the obese population with a BMI of greater than 30 has been reported in a large meta-analysis to be 15.8% compared to 5.8% in the general population. Unfortunately, the classical predictors of difficult intubation have been shown to be even less reliable in the obese with only increasing neck circumference of more than 43 cm measured at the level of the thyroid cartilage and Mallampati score being reproducible risk factors in the obese population and not BMI.

Assessment of the airway and anticipation of the “difficult airway” are fundamental skills for an anesthesiologist (Budde, 2013). Anatomical characteristics such as cervical and occipital fat accumulation, tongue size, airway narrowing, limited neck extension, and limited mouth opening are factors that make tracheal intubation more difficult in obese patients than in those with a lower body mass index (Ranieri, 2014) .

The incidence of difficult intubation (DI) reported in the literature varies markedly between studies, ranging from 0.05 to 18 % as Khan in (2014) mentioned.

In addition Langeron et al. in (2014) reported that high BMI (>35 kg/ m2) is a weak but statistically significant predictor of DTI and may be more appropriate than weight in multivariate models for DTI prediction. This assertion that only high BMI were independently correlated to DTI was also previously reported, suggesting again a non linear interaction between BMI and DTI risk.

Another study done in USA by Govindarajan et al. in 2014 reported that the incidence of difficulty with endotracheal intubation (ETI) is higher in obstetric patients than in surgical patients and the incidence in parturient may approach 1 in 500 .Screening tests as Mallampatti oropharyngeal classification, thyromental distance, mouth opening and Wilson risk score yield possible sensitivity (20% - 62%) and moderate specificity (82% - 97%).One can encounter unanticipated difficult airway with direct laryngoscopy despite the availability of predictive tests.

In addition an observational study done in Britain by De Jong et al. in (2014) aimed at comparing the incidence of difficult intubation in intensive care unit (ICU) and operating theatre (OT) in obese patients and the use of difficult airway management techniques and severe life-threatening complications related to intubation in obese patients admitted to ICU and OT. The database were collected from two period and to place the

first period of collecting data was from 2011 to 2012 and the sample was 1400 patients, and second period was from 2006 to 2011 and the sample was 11035patients. All consecutive patients tracheal intubation were included. Among the 1400 patients of the ICU cohort and the 11 035 patients of the OT, 282 (20%) and 2103 (19%) were obese. The result showed that incidence of difficult intubation was significantly higher in ICU obese patients (46/282, 16.2%) than in OT obese patients (172/2103, 8.2%). And according to that in obese patients, difficult intubation incidence was twice higher in ICU than in the OT, while severe life-threatening complications related to intubation occurred 20 times more often in ICU than in the OT.

In (2015) a retrospective study done by Uribe et al. at the Ohio State University Wexner Medical Center during a period of 12 months, from January 1, 2007 to December 31, 2007.The objectives of study was to investigate and compare the utility of BMI as an indicator of difficult tracheal intubation in males and females and to determine whether it can be reliably used in clinical settings as a predictor of potential difficult intubation. The sample was 4303 adult patients, 1970 (45.8%) men and 2333 (54.2%) women who underwent abdominal surgeries and required general anesthesia. The used tool was Mallampati score, and demographic data and BMI. The results showed that Mallampati score was another strong predictor of difficult tracheal intubation with appositive linear correlation ($P<0.0001$; odds ratio =3.50; 95%CI2.87–4.28 for every score

increase by1).The correlations for male and female groups were almost equal with no significant gender-related difference (P=0.1697).

Another prospective observational study done in India, Mummbai in (2016) by Mathew and Gvalani .The aim of the study was to compare the incidence of difficult intubation between obese and non obese patients and compare three predictors of difficult intubation. The sample was 250 patients divided in two groups according to their BMI obese and non obese. All patients done to them preoperatively assessment include: thyromental distance, BMI, Mallampati classification, neck circumference and Wilson score. IDS use to assess intubation difficulty to patients. At the end no intubation failed in this study, and the incidence of difficult intubation determined by IDS >5 was more frequent in obese groups (88.6% in obese vs. 11.4% in non obese). thyromental distance, Mallampati score, neck circumference and Wilson score were compared in obese patients to predict difficulty intubation of the three variable, Wilson score was found to be statistically significant ($p < 0.005$).

A study done in (2016) in Turkey by Ayhan et al. the aim of the study was to evaluate difficult mask ventilation (DMV) and difficult laryngoscope (DL) in the group of adult obese patients with endometrial cancer. The sample of the study was a total of 600 files of patients operated for endometrial cancer were reviewed and only those patients with BMI ≥25 (N=427) were included in the study. These patients were further subdivided into overweight (≥25>30), obese (≥30>40), morbidly obese (≥40>50) and super-obese (≥50) groups. The result of the study shown that

total of 427 consecutive adult patients, mean age 57.93+11.78 years, were evaluated. The mean BMI value was 35.7+6.15 kg/m2 and the distribution was as follows: overweight 18 (4.2%); obese 320 (74.9%); morbidly obese 74 (17.3%); and super-obese 15 (3.6%). There were 140 patients with DMV, 123 with DL, and 61 with DMV in combination with DL.

In (2017) another study done by Volnov et al. aimed at finding association between morbid obesity and difficult intubation. The participants were 127 morbidly obese individuals (BMI≥40) and 739 non-morbidly obese individuals (BMI<40).each patients assessed preoperatively to the following parameters: obstructive sleep apnea, neck range of motion, neck circumference, thyromental distance (TM), sternomental distance (SM), inter incisor distance, upper lip bite test (ULBT), and Mallampati score. To detect for difficult intubation the IDS score was used. The result determined that BMI was not a predictor for difficult tracheal intubation, and it was only difficult with mask ventilation.

In Palestine at the best knowledge of researcher three articles about difficult tracheal intubation and BMI have been conducted, but unfortunately have no access to them.

Chapter Three
Methodology

This chapter reviewed in details the methodology that was used in the study. Include, design, setting, sample and population, inclusion and exclusion criteria, tools, reliability, procedure implementation, validity, ethical considerations.

1- Design

Prospective observational descriptive design was used in this study, to find out the frequency of difficult tracheal intubation and to find out the relate factors. This design was chosen, because it is easy, cheap, and most suitable to achieve the objectives and aims of study.

2- Site and Setting

The study was conducted in Jenin governmental hospital, in surgical ward, recovery room and operation ward.

Jenin government hospital provides medical service to all people located in Jenin governorate. Hospital includes 21 ward and 4 operation rooms, 250bed, 192 nurse and 86 doctors.

A total 5450 surgery (ear nose throat, colcystectomy, orthopedic surgery, mastectomy and other type of surgery) have been performed using different types of anesthesia include regional anesthesia, G/A (endo tracheal intubation (ETT), Laryngeal mask, and nasal tracheal tube) during 2016.

3- Sample and sampling method

Study Population

The population of this study was patients who have elective surgery under general anesthesia that performed using tracheal intubation. The total number of those patients was estimated to be 100-120 per month according to Jenin hospital registration.

Sample and sampling method

Sample size was calculated 92 patients, according to population 100-120 patients/month, and the equations were use the sample size was calculated based on the equation was to Steven Thampson including:

N: The size of the Populations.

Z: Class standard corresponding to the level of significance (0.95) and is equal to (1.96)

Q: The error rate is equal to (0.05)

P: Ratio provides a neutral property and equal (0.50)

$$n = \frac{N \times P(1-P)}{[\![N-1 \times (d^2 \div z^2) + P(1-P)]\!]}$$

4- Eligibility criteria

Inclusion criteria

- ✓ Patients in both gender male and female
- ✓ Patients at age group 18-64 years old.
- ✓ Patients have elective surgery, and were done under tracheal intubation.
- ✓ Patients include in I, II and III according to ASA classification

Exclusion criteria

The exclusion Patients of the study was as follow

- ✓ Patients scheduled for regional anesthesia.
- ✓ General anesthesia was performed without endotracheal intubation.
- ✓ Those with upper airway pathology (i.e., maxillofacial fractures, tumors, etc),
- ✓ Cervical spine fractures.
- ✓ Patients younger than 18 yr or >64.
- ✓ Female patients were undergoing Cesareans section and pregnant women.
- ✓ Patients have full stomach.
- ✓ Patients have hiatal hernia.

- ✓ Patients complain of gastro esophageal reflux.
- ✓ Patients have a history of difficult laryngoscope intubation.
- ✓ Surgery request of nasal intubation.

5- Data collecting tools

The tool consisted of the following parts. (annex1)

Part one: Demographic data which was developed and include: age, ID, date of Admission, occupation, income level and level of education, gender, marital Status.

Part two: Health status assessment: include: medical and surgical and difficult intubation, duration of fasting hours before the operation, allergy to any food or medication, and the current health status

Anthropometric measurement: measuring the height and weight of patients to calculate the BMI.

Part three: physical assessment aimed at assessing patients' pre operations and implemented by anesthesia doctor's and it include three sections:

Section one: **ASAPS** American Society of Anesthesiologists physical status (ASAPS), used to assess of physical status of patients

This assessment was developed in 1941 to evaluate the degree of a patient's "sickness" or "physical state". And it has to be done before

selecting the anesthetic or before performing surgery. It consists of 6 classes as table (2), (Doyle& Garmon, 20).

Table (2): ASAPS classification.

ASA classifications	Classifications	Example
ASA 1	**A normal healthy patient.**	**Fit, nonobese (BMI under 30), a nonsmoking patient with good exercise tolerance.**
ASA 2	A patient with a mild systemic disease.	**Patient with no functional limitations and a well-controlled disease (e.g., treated hypertension, obesity with BMI under 35, frequent social drinker or is a cigarette smoker).**
ASA 3	A patient with a severe systemic disease that is not life-threatening.	**Patient with some functional limitation as a result of disease (e.g., poorly treated hypertension or diabetes, morbid obesity, chronic renal failure, a bronchospastic disease with intermittent exacerbation, stable angina, implanted pacemaker).**
ASA 4	**A patient with a severe systemic disease that is a** constant threat to life.	**Patient with functional limitation from severe, life-threatening disease (e.g., unstable angina, , myocardial infarction or stroke.**
ASA 5	**A moribund patient who is not expected to survive without the operation. The patient is not expected to survive beyond the next 24 hours without surgery.**	**ruptured abdominal aortic aneurysm, massive trauma, and extensive intracranial hemorrhage with mass effect.**
ASA 6	**A brain-dead patient whose organs are being removed with the intention of transplanting them into another patient.**	

Section tow: A Mallampati scale

This scale was created by anesthesiologist Seshagiri Mallampati in (1985), it is used to predict the ease of endotracheal intubation according

to laryngoscope difficulty, to assess the oraopharyngeal structure, and Later Samson and Young added a fourth grade to the original classification. Mallampati scale includes four classes, and it classified according to oropharyngeal view as following graph (3); class I: soft palate, fauces, uvula, and pillars visible; class II: soft palate, fauces, and uvula visible; class III: soft palate and base of uvula visible; and class IV: soft palate not visible. In this scale they have three score according to the Mallampati class as in figure (3) (Rich, 2005).

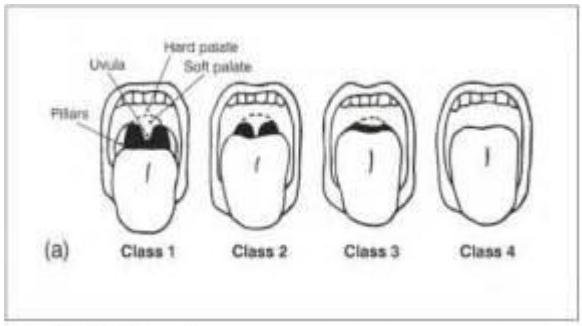

Figure 3: Mallampati Class (Rich, 2005**).**

Section three: Wilson score:

To assess physical characteristics of airway before anesthesia, it was developed by Wilson (1988) to predict difficult intubation. This score include five factors; weight, head and neck mobility, jaw movement, Receding mandible and buck teeth, (Wanderley et al, 2013).

1- Weight by (kg)

2- Head and neck movement, with differentiation of two groups: <90° and >90. The head and neck movement range will measure by making the

patient extend their neck as much as possible. Then, while holding a pen vertically to the patient's forehead, a notepad has held against the side of the patient's face next to the pen. Then, the patient's neck was flexed as much as possible. If the pencil was parallel to the bottom side of the notepad, it was recorded as 90o, if the pencil was lower than the bottom side of the notepad; it was recorded as more than 90o, (Wanderley et al, 2013).

3- Jaw movement

4- Receding mandible.

5- Buck teeth, the severity of buck teeth will consider normal if the patient put his teeth together, and the upper teeth closed on the lower teeth without space. If the upper teeth protruded 0-0.5 cm more than the lower teeth, it will considered moderate. If the upper teeth protruded more than 0.5 cm compared to the lower teeth, it will considered severe.

Part four: Intubation difficult score (IDS),

This scale used to assess and observe patients during operations based on anesthesiology doctors' assessment.

This scale is used to assess airway, and to validate difficult tracheal intubation after performance anesthesia, it created by Adnet et al. in (1997). It consists of seven part or parameters (N1-N7). Include number of intubation attempts, the number of additional procedures, the use of different intubation skills, Cormack and Lehane's classification of laryngeal

view, the lifting force when laryngoscopy is used, external laryngeal pressure maneuver, and the location of the vocal cord under laryngoscopic view, (Seo et al.,2012).

The evaluation method for IDS was as follows: for N_1, if intubation was successful on the first time, 0 points were given, and 1 point was added with additional intubation attempts. For N_2, 1 point was added with the increase of the number of doctors for endotracheal intubation. For N_3, 1 point was added with the repositioning of patients or with a change in intubation technique, such as a blade or a tube change. For N_4, grade 1 in Cormack and Lehane's classification on laryngeal view was 0 points, and 1 point was given with the increase in classification grade. For N_5, if the lifting force was normal with the use of laryngoscopy, 0 points were given. If a lot of force was needed, 1 point was added. For N_6, if external laryngeal pressure maneuver was needed to see the glottis better, 1 point was added. For N7, if the vocal cord under laryngoscopic view was abducted, 0 points were given. If the vocal cord was adducted, 1 point was added. The IDS score is the sum of N1 through N7. A score of 0 indicated intubation under ideal conditions. And it will be scoring as following:

IDS = 0: easy, $0 < IDS \leq 5$: slight difficulty, IDS > 5: moderate to severe difficulty.

6- Validity and Reliability

The tools were reviewed by three anesthesiologist doctors, tow specialist surgical and tow medical doctors. Comments were to add some disease in medical part, put the type of operation (current diagnosis), and delete the dose to drug which was use in operation in data collection tools. The pilot study was done after developing the tools on 10% of sample. And calculate crombachs alpha which was 0.65%.

Reliability to Mallampati classifications found a Sensitivity close to 100 % and a Specificity of 80 % for the test, (khan,2014).

7- Ethical considerations

1. Permission from Institutional Review Board IRB was taken from the university. (Annex2)

2. Consent form was taken from Jenin Government hospital. (Annex3)

3. Consent form was taken from each patient; Participants were assured that all data collected was confidential, voluntary and privacy to the patients. (Annex 4)

8- Data analysis plane

The statistical package of social sciences (SPSS) was used for data entry and in statistical analysis

9- Field work/ Procedure

After ensuring that the inclusion and exclusion criteria are met in selection of the subjects through reviewing the surgical list, the subjects were met and the aim of the study was explained to ensure their agreement to be included in the study.

Data collection took place at three sites:

Surgical word: where the demographic data and full medical and surgical history was collected from each patient in addition the height and weight were measured using the same weight scale.

1-Recovery room

In the recovery room the following assessment by anesthesiologist and senior doctors was performed (Tow anesthesiologist work more than 15yrs and tow senior Doctor work more than 12 yrs) ;

A- ASAPS this assessment was performed by doctors and the results was given to researcher who determine the inclusion of the patient in the study based on the classification of the ASAPS. The patients with (ASAI), (ASAII) and (ASAI II) only were included in the study, the other patients were excluded.

B- Mallampati scale: After performing the ASAPS, while the patient sitting up straight, mouth open and tongue maximally protruded, without speaking or saying “ahh the oropharengal structure was

assessed by the same doctor who determine the classes of the scale and provide them to the researcher.

C- Wilson score: this test continued by the same doctor, to assess the mobility of head, neck, jaw movement in addition receding mandible and buck teeth determine the score of the test 0, 1,2 score .

2- **Operation room**

In the operation room at the beginning patients were put in supine position on the bed, no pre operation medication was given. A multi-function monitor was used to continuously monitor the electrocardiogram (ECG), pulse oxygen saturation (SpO2) and non-invasive blood pressure. General anesthesia and tracheal intubation was inducing with propofol 2.0-2.5 mg/kg, non depolarizing muscle relaxants 0.5mg /kg (atracuronium). Adjunct drugs (fentanyl 100-200 mic and atropine 0.5 mg), and pre oxygenation 100% by face mask oxygen was delivered for minimum 3 minutes. Then direct tracheal laryngoscope was done by a Macintosh laryngoscope bearing a standard blade was inserted into the throat and with ETT size as protocol, and during intubation the doctor assesses patients for IDS.

10- Variable definitions

Dependent variable

Difficult intubation

Wilson score

Mallampati class

ASA classifications

Intubation Difficulty Scale

In dependent variable

Age of the patients

Gender of the patients

(BMI)

Table (3): Variables (Operational and conceptual) definitions.

Variables	Conceptual definitions	Operational definitions
Gender	A grammatical category, often designated as male, female, or neuter, used in the classification of nouns, pronouns, adjectives, and, in some languages verbs that may be arbitrary or based on characteristics such as sex or animacy and that determines agreement with or selection of modifiers,referents, or grammatical forms. (Gender,2015)	Male or Female.
Age	The length of time that a person or thing has existed (Age,2015)	Was measure by years, and was taken between 18-64years.
BMI	Was calculated as the weight in kilograms divided by the squared height in meters,(Flegal et al.2010).	Classification of BMI Underweight <18.5 Normal weight 18.5 to 24.9 Overweight 25 to 29.9 Obese >30
IDS	Is a function of seven parameters, resulting in a progressive, quantitative determination of intubation complexity.(Seo et al.,2012).	Was done by observation, contain seven parameters:- - (N1): number of intubation attempts. - (N2): number of additional procedures. - (N3): use of different intubation skills. - (N4): Cormack classification it classified to four grades. - (N5): Lifting force applied during laryngoscopy - (N6): Needed to apply external laryngeal pressure for optimized glottic exposure. - (N7): The last part, position of the vocal cords at intubation.
ASA Classifications	Is a system for assessing the fitness of patients before surgery, In 1963 the American Society of Anesthesiologists (ASA) adopted the five-category physical status classification system; was later added. (Doyle& Garmon,2017).	By questioner, assessment and interview And include a sixth category as the following: 1. Healthy person. 2. Mild systemic disease. 3. Severe systemic disease.

<table>
<tr><td></td><td></td><td>4. Severe systemic disease that is a constant threat to life.
5. A moribund person who is not expected to survive without the operation.
6. Declared brain-dead person whose organs are be for donor purposes</td></tr>
<tr><td>Mallampati class</td><td>Is used to predict the ease of endotracheal intubation. The test comprises a visual assessment of the distance from the tongue base to the roof of the mouth, and therefore the amount of space in which there is to work. (Rich, 2005).</td><td>By assessment and observations, and includes four classes, and it classified according to oropharyngeal view as following: class I: soft palate, fauces, uvula, and pillars visible; class II: soft palate, fauces, and uvula visible; class III: soft palate and base of uvula visible; and class IV: soft palate not visible.</td></tr>
<tr><td>Wilson score</td><td>To predict difficult endotracheal intubation before anesthesia, the criteria that assess physical characteristics.(Wanderley et al, 2013).</td><td>Will measured by assessment
And observation. Table (4)
<table>
<tr><th>Wilson factors/score</th><th>0</th><th>1</th><th>2</th></tr>
<tr><td>Weight (kg)</td><td><90</td><td>90-110</td><td>>110</td></tr>
<tr><td>Head and neck mobility (degrees)</td><td>>90</td><td>=90</td><td><90</td></tr>
<tr><td>Jaw movement</td><td>IG* >5 cm or subluxation† >0</td><td>IG * =5 cm or subluxation† =0</td><td>IG * <5 cm or subluxation† <0</td></tr>
<tr><td>Receding mandible</td><td>None</td><td>Moderate</td><td>Severe</td></tr>
<tr><td>Buck teeth</td><td>None</td><td>Moderate</td><td>Severe</td></tr>
<tr><td rowspan="3">Total score</td><td colspan="3"><5 -easy laryngoscopy</td></tr>
<tr><td colspan="3">6 to 7 -moderate difficulty</td></tr>
<tr><td colspan="3">>7- sever difficulty</td></tr>
</table></td></tr>
</table>

CHAPTER Four
RESULTS

Introductions

This chapter presents the results of the study, analysis of various demographic data to the participants, then characteristic of the anthropometrics properties to the participants. The relationship between demographic data (age, gender and BMI) with Mallampati, Wilson, and IDS scores scales. Finally, the relationship between Mallampati, Wilson, with IDS scores scales.

Socio-Demographic Data

Table (4): The distribution of frequency (%) of participants according to their demographic data (N=100).

Variable		No.	%
Gender	Male	41	41.0
	Female	59	59.0
Age	18-30 years	17	17.0
	31-40 years	41	41.0
	41-50 years	22	22.0
	51-64 years	20	20.0
Marital Status	Married	78	78.0
	Single	10	10.0
	Divorced	5	5.0
	Widowed	7	7.0
Occupation	Non Worker	35	35.0
	Worker	65	65.0
Level of education	School First -Middle school High school	 30 35	 30 35
	Bachelor	26	26.0
	Master	9	9.0
Income	Less than 1500 NIS	27	27.0
	1600-3000 NIS	45	45.0
	More than 3000 NIS	28	28.0

Table (4) showed that (59%) of the participants were female and married (78%). 65% of the subject was worker, and 45% of them have income between 1600-3000 NIS per month. Unfortunately, 65% of the participants were illiterate-school.

Table 5: Distribution anthropometric characteristics of participants (n=100).

Variable	Mean ± SD	MIN		MAX			
Height (cm)	166.49 (9.41)	148.00		192			
Weight (kg)	72.16 (10.87)	49.00		100			
BMI	26.09 (3.88)	18.59		41.09			
		Total		**Male**		**Female**	
BMI Categories		**N**	**%**	**N**	**%**	**N**	**%**
	Normal	38	38.0	20	48.8	18	30.5
	Overweight	45	45.0	16	39.0	29	49.2
	Obese	17	17.0	5	12.2	12	20.3

SD: standard deviation; **BMI**: body mass index; **MIN**: minimum; **MAX**: maximum

Table (5) showed that the mean of the participants' height was 166.49 ± 9.41 ranged between 148cm to 192cm, and the mean of their weight was 72.16 ±10.8. Their BMI value ranged from 18.5 to 41, with mean 26.09 kg/m^2.

Table (6): distribution of percentage of participants medical and surgical past history.

Variable		No	%
Medical History	None	81	81.0
	CVD	5	5.0
	DM	8	8.0
	HTN	6	6.0
Medication history	No	81	81.0
	Yes	19	19.0
Allergy	No	99	99.0
	Yes	1	1.0
Surgical History	None	50.0	50.0
	Major	25.0	25.0
	Minor	25.0	25.0
Anesthesia surgery	None	50.0	50.0
	GA	42.0	40.0
	S A	3.0	3.0
	Another	5.0	5.0

CVD: Cardiovascular Disease; **DM**: Diabetes Mellitus; **HTN**: Hypertension; **GA**: General Anesthesia; **SA**: spinal anesthesia.

Table (6) showed that 73% of them have no medical history and 81% of them have no medications history, and just one participant has allergy. While 50% of the participants have no past surgical history, 25% of them had past major surgery and 25% had past minor surgery. 42% of participants have anesthesia history by using GA.

Table (7): Participants present history.

Variable		Frequency	Percentage
Present Surgery	Abdominal	68	68.0
	Urology	27	27.0
	Thoracic	5	5.0
NPO hours	8-10hrs	3	2.0
	11-12hrs	63	63.0
	13-14hrs	32	32.0
	>14hrs	2	2.0
ASA	1	78	78.0
	2	15	15.0
	3	7	7.0

ASA: American Society of Anesthesiologist; **NPO**: Nothing per Mouth.

The present history of the participants as shown in table (7) revealed that 68% of the participants underwent abdominal surgery while rest underwent either urologic surgery (27%) or thoracic surgery (5%). Most of them (95%) were NPO between 11 to 14 hours prior surgery.

Table (8): Cross tabulation for gender, age, and BMI with Wilson score classification for laryngoscope difficulty.

Variable		**Wilson Score Class/ Laryngoscope difficulty**					
		Easy	**Moderate**	**Sever**		X^2	**P value**
		n (%)	n (%)	n (%)			
Gender	Male	25(60.9)	16 (39.1)	0 (0.0)	**41**	2.3	0.31
	Female	40(67.8)	17 (28.8)	2 (3.4)	**59**		
	Total	**65**	**33**	**2**	**100**		
Age	18-30 years	9 (52.9)	8 (47.1)	0 (0.0)	**17**	13.0	0.042
	31-40 years	32(78.0)	9 (22.0)	0 (0.0)	**41**		
	41-50 years	14(63.6)	8 (36.4)	0 (0.0)	**22**		
	51-64 years	10(50.0)	8 (40.0)	2 10.0)	**20**		
	Total	**65**	**33**	**2**	**100**		
BMI category	Normal	32(84.2)	6 (15.8)	0 (0.0)	**38**	13.8	0.008
	Overweigh t	27(60.0)	17 (37.8)	1 (2.2)	**44**		
	Obese	6 (35.3)	10 (58.8)	1 (5.9)	**17**		
	Total	**65**	**33**	**2**	**100**		

Table 8 showed the correlation between the demographic data (gender, age and BMI) with Wilson scale classification. There is a statistically significant correlation (**X^2=13, p =0.042)** between age category and difficulty of intubation based on Wilson scale. All sever cases (10%) of laryngyscopic difficulty according to Wilson scale were among the elder age group (51-64 years). And 47.1% of moderate cases were between the ages of 18to 30 years.

There is a statistically significant correlation (**X^2=13.8, p =0.008)** between BMI category and the level of laryngical intubation difficulty based on Wilson scale. Over weight and obese participants have 8.1 % of them were considered as sever class of laryngoscope intubation difficulty based on Wilson scale.

Table (9): Cross tabulation for gender, age, and BMI with Mallampati score classification for laryngoscope difficulty.

Variable		**Mallampati Score difficulty**					
		Class 1	Class 2	Class 3		X^2	P value
		n %	n %	n %			
Gender	Male	31 (75.6)	8 (19.5)	2 (4.9)	**41**	4.1	0.12
	Female	33 (55.9)	22 (37.3)	4 (6.8)	**59**		
	Total	**64**	**30**	**6**	**100**		
Age	18-30 years	14 (82.4)	3 (17.6)	0 (0.0)	**17**	7.6	0.26
	31-40 years	27 (65.9)	13 (31.7)	1 (2.4)	**41**		
	41-50 years	12 (54.5)	8 (36.4)	2 (9.1)	**22**		
	51-64 years	11 (55.0)	6 (30.0)	3(15.0)	**20**		
	Total	**64**	**30**	**6**	**100**		
BMI category	Normal	31 (81.6)	7 (18.4)	0 (0.0)	**38**	25.5	<0.001
	Overweight	26 (57.8)	18 (40.0)	1 (2.2)	**45**		
	Obese	7 (41.2)	5 (29.4)	5 (29.4)	**17**		
	Total	**64**	**30**	**6**	**100**		

Table 9 showed the correlation between the demographic data (gender, age and BMI) with Mallampati score classification for laryngoscope difficulty. BMI category of participants has a statistically significant correlation (**X^2=25.5, p < 0.001)** with difficulty of intubation based on Mallampati score classification for laryngoscope difficulty. Normal body mass index participants have no any case as class 3 based on Mallampati score classification for laryngoscope difficulty. Over weight and obese participants have 2.2% and 29.4 % respectively of them were considered as class 3 of laryngoscope intubation difficulty based on Mallampati score classification for laryngoscope difficulty

Neither gender (**X^2=4.1, p < 0. 12)** nor age (**X^2=6.7, p < 0.26)** had a statistical correlation with the Mallampati score classification for laryngoscope difficulty. There is no correlation between gender and age with Mallampati score classification for laryngoscope difficulty.

Table (10): Cross tabulation for gender, age, and BMI with IDS score classification for laryngoscope difficulty.

Variable		**IDS class difficulty**				
		Easy	Slight	Moderate	X^2	P value
		n %	n %	n %		
Gender	Male	10 (24.4)	31 (75.6)	0 (0.0)	3.8	0.144
	Female	7 (11.9)	50 (84.7)	2 (3.4)		
Age	18-30 years	2 (11.8)	15 (88.2)	0 (0.0)	5.6	0.46
	31-40 years	10 (24.4)	30 (73.2)	1 (2.4)		
	41-50 years	4 (18.2)	18 (81.8)	0 (0.0)		
	51-64 years	1 (5.0)	18 (90.0)	1 (5.0)		
BMI category	Normal	12 (31.6)	26 (68.4)	0 (0.0)	19.2	0.001
	Overweight	3 (6.7)	42 (93.3)	0 (0.0)		
	Obese	2 (11.8)	13 (76.5)	2 (11.8)		

X^2**:** chi square; **BMI**: body mass index

Table 10 showed the correlation between the demographic data (gender, age and BMI) with IDS score classification for laryngoscope difficulty. Only BMI category of participants has a statistically significant correlation (**X^2=19.2, p = 0.001)** with difficulty of intubation based on IDS score classification for laryngoscope difficulty. Obese participants have 11.8% of them were considered as moderate to severe of laryngoscope intubation difficulty based on IDS score classification for laryngoscope difficulty.

Gender (**X^2 =3.8, p < 0. 144)** and age (**X^2=5.6, p < 0.46)** had no statistical correlation with the IDS score classification for laryngoscope difficulty. There is no correlation between gender and age with IDS score classification for laryngoscope difficulty p<**0.144.**

Table (11): Zero and Partial Correlation (control by participants' BMI) between Mallampai, Wilson, and IDS Scales (N=100).

Variable		IDS score		IDS score	
		Zero Correlation		Partial Correlation†	
	Mean (Std. Deviation)	Correlation (r)	*P* Value	Correlation (r)	*P* Value
Mallampati Score	0.42 (0.60)	0.37**	< 0.001	0.26**	0.007
Wilson Score	1.37 (1.33)	0.44**	< 0.001	0.28**	0.005
IDS score	2.11 (1.83)				

†: correlation controlled by BMI variable **IDS:** Intubation Difficulty Score

**correlation is significant at the 0.01 level (2- tailed)

Table 11 revealed that there is a medium to high correlation(r = 0.37) and a statistically significant (p < 0.001) correlation between Mallampati scale and IDS score scale. When controlling the correlation between Mallampati scale and IDS score scale by participants' BMI, the correlation persist in significant (p=.007) but decrease its strength into medium to moderate(r = 0.26). Furthermore, that there is a medium to high correlation(r = 0.44) and a statistically significant (p < 0.001) correlation between Wilson Score Scale and IDS score scale. When controlling the correlation between Wilson Score Scale and IDS score scale by participants' BMI, the correlation persist in significant (p=.005) but decrease its strength into medium to moderate(r = 0.28).

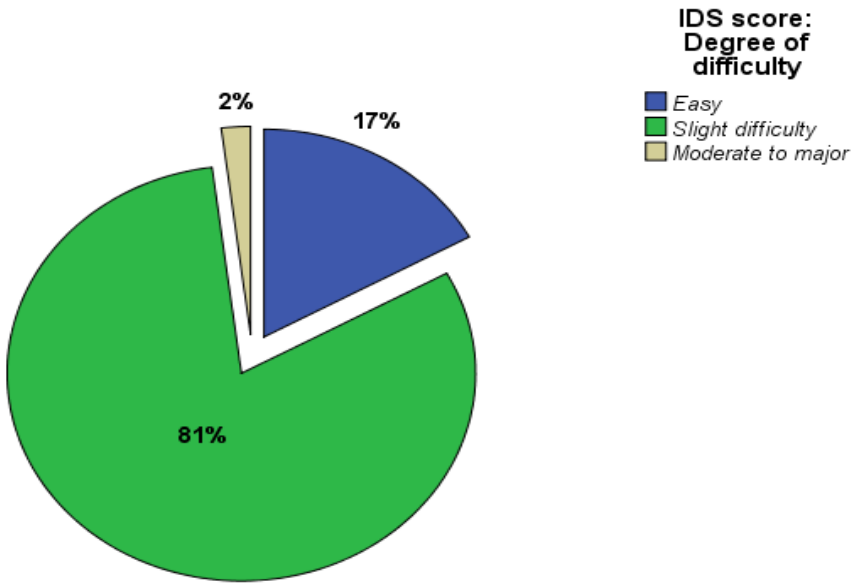

Figure 4: The rate of endotracheal intubation difficulty levels based IDS Scale.

Most of the present study participants (81%) who underwent elective surgery under general anesthesia were categorized as slightly difficult intubation according to IDS score. And 2% of participants were classified as moderate to major degree of intubation difficulty. 17% of participants were labeled as easy degree of intubation difficulty. (See figure 4).

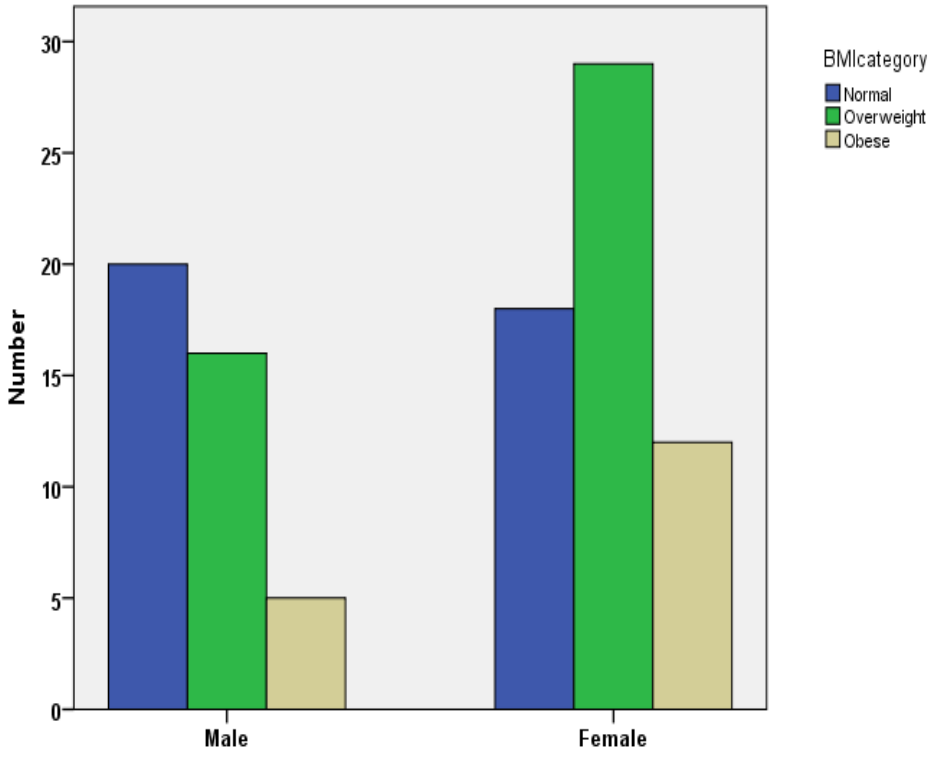

Figure 5: Distribution of participants' body mass index according to gender.

Figure 5 shows the distribution of participants' BMI according to their gender. (20) Participants from Male had normal BMI and (17) were overweight and (5) of them were obese. On the other hand, half of women participants (29) BMI were overweight and of (18) had normal BMI and (12) had obese BMI.

Chapter Five
Discussion

Discussion

This chapter discusses the main result which was found in the study. Based on findings of current study; it is likely that BMI has significant relation with factors evaluated include Wilson score, Mallampati classification, and IDS. But has no correlation to this factor with anthropometrics included age, gender with them, except age has relation with Wilson score.

Socio-demographic characteristic

The study results (table 4) revealed that more than half (59 %,) of participants were female which nearly as the study by Motemadi et al. in (2017) where the female rate was (51%). And in (2010) Uribe et al. 4303 adult patients were 1970 (45.8%) men and 2333 (54.2%) women.

According to anthropometrics parameters table (5) the finding of the study revealed that the mean of BMI was (26.09±3.88) and nearly half of the participants (45%) were overweight with nearly half of them (49.2%) were female, these findings were in the same line in Palestine which indicated that the percent of overweight people was 70% (67.8% male and 72.5% female),(Ma'an News Agency 2012).

.

Regarding medical history of the participant table(6) indicated that less than one tenth (6%) have HTN and 8% have DM and these result were similar to the annual report which showed that 4.4% and 6.6% of Palestinians have HTN, DM respectively. While the study by Alabed et al. (2014) reported the prevalence of (DM) among Palestinian refugees was estimated to be 12-15%.

According to participants table(7) the finding of our study shows that tow-third of participants 68% done to them abdominal surgery ,and most participants fast from 11-12hrs 63% before operation ,and most of them was included in ASA I which mean that 78% of participants healthy

The results of this study table (8), Wilson score have a significant relation with BMI P<0.008, our results thus confirm the work of Mathew and Gvalani in (2016) they showed that Wilson score have relation with BMI to detect laryngoscope difficulty. In another hand Kim et al., in 2011 reported that Wilson scores a poor-to-moderate sensitivity and a positive predictive value. Moreover, the clinical predictive value of the Wilson score may be reduced in obese patients as the jaw mobility is often limited by a mass effect.

Regarding to finding in this study table (9) there is relation between Mallampati classification and BMI, that Mallampati score is a risk factor for difficult intubation according to BMI, Similarly to Shailaja et al., 2014; Brodsky et al.; Motamedi etal .2017. As Filho et al in (2011) reported that in obesity, weight gain is followed by an increase in the size of the tongue

so that the proportion between the tongue and pharyngeal structures are altered; the possibility of difficult laryngoscopy exists. Incapability of visualizing the posterior pharyngeal wall in this population is two times higher than in non-obese patients.

And in our study found that there is no significant difference between the Mallampati subgroups in terms of age and gender distribution. In opposite of Motamedi etal.2017 recorded that there was a significant relationship found between Mallampati score and age and gender.

According to the result of the present study table (10), no significant relationship was found between gender of subjects and intra-tracheal intubation difficulty scoring systems, similarly the finding of Motamedi et al. in (2017), However, contrary to finding of present study, Uribe et al. in (2015) reported the impact of gender especially male in predicting the difficulty of intra-tracheal intubation.

And in this study, there is no significant relation found between age and IDS, in contrast to (Türkan et al., 2002; Basunia et al., 2013) recorded that with increase in age there is an increase probability of difficult intubation.

Another significant finding of this study was that BMI is a predictor for difficult tracheal intubation ,similarly to(Voyagis et al 1998; Uribe et al, 2015, Juvin et al,2003), in contrast to (Lundstrøm,rt al,2009; Ezri et al. ,2001, ayhan et al,2016) recorded that BMI not predictor of difficult tracheal intubation.

According to table(11) there is significant relation between Mallampati class and IDS in correlation when controlling with participants BMI, as in Ayhan et al. (2016) .And also there is significant between Wilson score and IDS in correlation when controlling with participants BMI .

Limitations of the study

There were several limitations to the current study. The data was collected from one hospital, and the result was on not all type of operation that has both advantages and disadvantages. In the study no patients were in underweight class according to BMI, and this leads for not having specific comparison between patients according to their distribution of BMI. Possible bias related to variability in intubation skills among the anesthesia doctors. It was not blinded completely; the IDS score could have been increased intentionally if the anesthesia doctors know the aimed of the study. The patient's initial position may have influenced the incidence of difficult intubation. Recent study reported that the appropriate initial position for intubation to obese patients is the ramped position rather than the sniff position. In present study adopted the sniff position initially for all subjects, and the incidence of difficult intubation may have been increased for obese patients. Furthermore, there was no actual failed intubation in the study.

Conclusions of the study

- In conclusion, data showed that BMI is a reliable indicator for difficult tracheal intubation in patients who went elective surgery under general anesthesia.
- Difficult intubations defined by IDS scores, were more common in the obese patients group.
- Mallampati classification and Wilson score is a strong predictor of difficult tracheal intubation in patients who went elective surgery under general anesthesia in correlated to their BMI.
- Identifying the patients based on BMI assessment and Mallampati score, and Wilson score may prevent possible consequences of difficult tracheal intubation and help to adopt an alternative approach for these patients.

Recommendation

- Future prospective studies should aim to include controlled preoperative assessments and defined variables and factors effect on difficult tracheal intubation.
- Our results indicate that careful attention in the preoperative period may increase safety to patients, and decrease mortality and morbidity.

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Appendix

Annex (1)

بسم الله الرحمن الرحيم

موافقة للإشتراك في البحث العلمي

جامعة النجاح الوطنية –كلية الطب وعلوم الصحة اقسم التمريض

أخي/اختي المشاركه

السلام عليكم ورحمة الله وبركاته

أنت مدعو/ة للمشاركة ببحث علمي سيجرى في جنين في فلسطين. الرجاء أن تأخذ/ي الوقت الكافي لقراءة المعلومات التالية بتأن قبل أن تقرر/ي إذا كنت تريد/ين المشاركة أم لا. بإمكانك طلب إيضاحات أو معلومات إضافية عن أي شيء مذكور في هذه الإستمارة أو عن هذه الدراسة ككل من الباحث.

يقوم البحث بالأساس على دراسه العلاقة بين مؤشر كتله الجسم وصعوبة التنبيب الرغامي بين المرضى الذين لديهم عمليه جراحية اختياريه تحت التخدير العام في مستشفى جنين الحكومي– فلسطين.

Data collection tools

A. Demographic Data:

Part one:

ID: _____ Date of Admission: _____

Occupation: worker_____ non worker_____

Level of education: Illiterate_____ school_____

Bachelor degree_____ Master Degree_____

Income level: 1- <1500____ 2- 1600-3000 ____ 3- >3000_____

Part two:

Sex: male_____ female_____

Age: 18-30 yrs_____ 31-40yrs____ 41-50yrs____51-64yrs_____

Marital Status: Married_____ Single ____

Divorced _____ Separated____

Widowed ____ Other_____

Part three:

Height: _____Weight: _____

BMI: Below 18.5_____18.5 – 24.9_____25.0 – 29.9___30.0 and Above_____

B-Health assessment:

1- Do you have any diseases: 1-Yes_____ 2-No_____

If yes which: 1-Cardiovascular disease_____ 2-Diabetes mellitus_____

3- Hypertension_____4- another _____

Medication on use _____

Allergy to any food or medications: _____

2- Do you have any past surgical history: 1-Yes_____ 2-No _____

If yes, kind of surgery: a-Minor_____ b- Major: _____

What type of present surgery?
a- Abdominal _____ b-Urology_____ c-Cardiovascular_____
d- Orthopedic _____e- Respiratory _____ f-Thoracic_____

Current diagnosis:_____

Number of fasting hours until induction of the patient (hours of NPO):
a- 8-10 hrs: _____ b-11-13hrs_____ c-<14hrs_____

Do you have any type anesthesia before: 1-Yes_____ 2_No _____

If yes, which type: a- GA____ b- SA____ c-Another _____

C_ Assessment and observations pre operations based on anesthesiology doctors assessment:

1-ASA PS

ASA I	ASA II	ASA III
Normal healthy patient	Patient with mild systemic disease	Patient with sever systemic disease

2--**Mallampati classification:**

Class I	Class II	Class III	Class IV
Soft palate, fauces, uvula, and pillars visible	Soft palate, fauces, and uvula visible;	Soft palate and base of uvula visible	Soft palate not visible

3- Wilsons score and contain five parts:

a- Weight (kg).

1- <90_____ 2- 90-110_____ 3- >110_____

b- Head & neck movement:

1- >90_____ 2- 90_____3- <90_____

c- Jaw movement

1-Inter-incisor gap (cm): **(**Maximum interincisal opening)

1- > 5_____ 2- 5_____3- <5_____

2-SL: SLux: (Jaw subluxation and maximum forward protrusion of the lower incisors beyond the upper incisors).

1-> 0_____ 2-0_____3-<0_____

d- Receding mandible:

1-None_____ 2-Moderate_____3-Severe_____

e- Buck teeth:

1-None_____ 2-Moderate_____3-Severe_____

D- Assessment and observations during operations based on anesthesiology doctors' assessment: Assess Intubation difficult score (IDS) and contain 7 parts:

N1- The number of supplementary attempt:

1-One _____ 2-Tow _____3-Three _____4-More than three _____

N2- Operator :(represents the number of additional persons directly attempting)

1-One _____ 2-Tow _____ 3-Three _____ 4-More than three _____

N3- Use of any alternative technique: Yes____No____

If Yes which: 1- Repositioning of the patient_____ 2-change of materials_____

3-change in approach _____ 4-use of another technique_____

N4- Cormack–Lehane scale:

Grade I	Grade II	Grade III	Grade IV
Complete visualization of the vocal cords	Visualization of the inferior portion of the glottis	Visualization of the epiglottis only	Inability to visualize the epiglottis

N5-Lifting force during laryngoscopy:

1- Normal _____ 2- Increased _____

N6-External laryngeal pressure to improve glottis exposure:

1-No _____ 2- Yes _____

N7-Position of vocal cords during laryngoscopy :

1-abduction: _____ 2- adduction: _____

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&Health Sciences
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Studies

جامعة النجاح
الوطنية
كلية الطب وعلوم الصحة
دائرة الدراسات العليا

Approval Letter

Study Title:

The relationship between BMI and difficult tracheal intubation among patients who have elective surgery under General Anesthesia in Jenin governmental hospital- Palestine

Submitted by:

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Date Reviewed:

23/3/2017

Date Approved:

30/March/2017

Your Study titled: "The relationship between BMI and difficult tracheal intubation among patients who have elective surgery under General Anesthesia in Jenin governmental hospital- Palestine" with archived number (15) March was reviewed by An-Najah National University IRB committee and was approved on 30/March/2017

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جامعه النجاح الوطنيه

كليه الدراسات العليا

العلاقة بين مؤشر كتله الجسم وصعوبة التنبيب الرغامي بين المرضى الذين لديهم عمليه جراحية اختياريه تحت التخدير العام في مستشفى جنين الحكومي– فلسطين

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د. نجي نزال

قدمت هذه الأطروحة استكمالاً لمتطلبات الحصول علي درجه الماجستير في تمريض التخدير، بكلية الدراسات العليا، في جامعة النجاح الوطنية، نابلس– فلسطين.

2018

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الملخص

مقدمة: التنبيب الرغامي الصعب هو مصدر شائع للوفيات والمراضة في العديد من الأماكن بما في ذلك: الجراحة، وحدة العناية المركزة، وقسم الطوارئ. نسبة حدوث التنبيب الصعبة في القصبة الهوائية هي 0.1٪ - 13٪ وتصل إلى 14٪ في عدد البدناء. كان الهدف من الدراسة هو دراسة ومقارنة فائدة مؤشر كتلة الجسم كمؤشر على التنبيب القصبي الصعب في المرضى الذين ذهبوا إلى الجراحة الاختيارية تحت التخدير العام.

هدف الدراسة: تهدف هذه الدراسة الي معرفة العلاقة بين مؤشر كتله الجسم وصعوبه التنبيب الرغامي ،للمرضي الذين لديهم عملية جراحية اختياريه ،تحت التخدير العام.

الخلفية: أجريت الدراسة باستخدام مقياس الصعوبة في التنبيب الرغامي (IDS)، درجة Mallampati، ودرجة Wilson، لتأكيد أن المرضى البدناء هم أكثر صعوبة في التنبيب من المرضى الذين يصنفون تحت الوزن الطبيعي.

تصميم الدراسه وطريقتها: تم استخدام دراسة وصفية رصدية في هذه الدراسة، للمرضى الذين ذهبوا إلى الجراحة الاختيارية تحت التخدير العام. كانت العينة 100 مريض. تم اجراء الدراسة في مستشفى جنين الحكومي. تم الحصول على المعلومات التالية من المشاركين للتحليل: الجنس والعمر والطول والوزن ومؤشر كتلة الجسم، التاريخ الطبي الماضي، التاريخ الجراحي الماضي.

تقييم نقاط Mallampati، IDS، درجة Wilson، وتم تقييم المريض وفحصه من قبل أخصائي التخدير واطباء مقيمين تخدير.

النتائج :اظهرت النتائج ان هناك علاقه بين صعوبه التنبيب الرغامي ومؤشر كتله الجسم، تم تصنيف العدد الإجمالي لـ (81٪) من المشاركين الذين خضعوا لعملية جراحية اختيارية تحت التخدير العام على أنها تنبيب بسيط بعض الصعوبة وفقًا لدرجة IDS. وصنف 2٪ من المشاركين على أنها متوسطة إلى درجة كبيرة من صعوبة التنبيب. تم تصنيف 17٪ من المشاركين على أنها درجة سهلة من صعوبة التنبيب. وهناك ارتباط بين الطبقة Mallampati وWilson مع مؤشر كتلة الجسم P <0.001 و P = 0.008 على التوالي. في نهاية مؤشر كتلة الجسم هو التنبأ عن التنبيب الرغامي الصعبة.

الخاتمة والتوصيات: أظهرت البيانات أن مؤشر كتلة الجسم هو مؤشر موثوق للتنبيب الرغامي في المرضى الذين خضعوا لعملية جراحية اختيارية تحت التخدير العام. تصنيف Mallampati ودرجة Wilson هو مؤشر قوي على التنبيب الرغامي الصعب في المرضى الذين خضعوا لعملية جراحية اختيارية تحت التخدير العام في ارتباطهم بمؤشر كتلة الجسم. ينبغي أن تهدف الدراسات المستقبلية المستقبلية إلى تضمين تقييمات قبل الجراحة الخاضعة للرقابة ومفهوم محدد للتنبيب الرغامي الصعب.