



# **Comparative Study Between DVT Incidence Among Anticoagulated Patients And Non Anticoagulated Patients After Laparoscopic Sleeve Gastrectomy**

*A Thesis*

*Submitted for Partial Fulfillment of Master Degree Of  
General Surgery*

*By*

**Mahmoud Saied Fadl Abd El Aziz**

*M.B.B.Ch.*

*Faculty of Medicine, Cairo University*

*Under supervision of*

**Prof.Dr. Ahmed Alaa El Din Abd El Mageed**

*Professor of General Surgery*

*Faculty of Medicine - Ain Shams University*

**Prof. Dr. Youhanna Shohdy Shafik**

*Assistant Professor of General Surgery*

*Faculty of Medicine - Ain Shams University*

**Dr. Mohab Gamal El Din Mostafa**

*Lecturer of General Surgery*

*Faculty of Medicine - Ain Shams University*

*Faculty of Medicine*

*Ain Shams University*

**2019**

بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

قالوا

سببنا انك لا تعلم لنا  
إلا ما علمتنا إنك أنت  
العليم العظيم

صدق الله العظيم

سورة البقرة الآية: ٣٢

# Acknowledgment

*First and foremost, I feel always indebted to **ALLAH**, the Most Kind and Most Merciful.*

*I'd like to express my respectful thanks and profound gratitude to **Prof. Dr. Ahmed Alaa El Din Abd El Mageed**, Professor of General Surgery Faculty of Medicine - Ain Shams University for his keen guidance, kind supervision, valuable advice and continuous encouragement, which made possible the completion of this work.*

*I am also delighted to express my deepest gratitude and thanks to **Prof. Dr. Youhanna Shohdy Shafik**, Assistant Professor of General Surgery Faculty of Medicine - Ain Shams University, for his kind care, continuous supervision, valuable instructions, constant help and great assistance throughout this work.*

*I am deeply thankful to **Dr. Mohab Gamal El Din Mostafa**, Lecturer of General Surgery Faculty of Medicine - Ain Shams University, for his great help, active participation and guidance.*

**Mahmoud Saied Fadl Abd El Aziz**

# *List of Contents*

Title	Page No.
List of Tables .....	5
List of Figures .....	6
List of Abbreviations .....	8
Introduction .....	1
Aim of the Work.....	13
Review of Literature	
▪ Overview on Laparoscopic Sleeve Gaastrectomy.....	14
▪ Aetiology & Risk Factors .....	26
▪ Pathophysiology of Deep Venous Thrombosis in Obesity .....	40
▪ Clinical Presentation and Diagnosis.....	49
▪ Current Guidelines for Deep Venous Thrombosis Prophylaxis During Laparoscopic Sleeve Gastrectomy.....	72
▪ Management of DVT and its Complications .....	84
Patients and Methods .....	117
Results .....	125
Discussion .....	142
Conclusion.....	146
Summary .....	147
References .....	148
Arabic Summary .....	—

## *List of Tables*

Table No.	Title	Page No.
<b>Table (1):</b>	Indications for bariatric surgery and patient selection .....	15
<b>Table (2):</b>	Wells score .....	55
<b>Table (3):</b>	Simplified pulmonary embolism severity index (PESI).....	63
<b>Table (4):</b>	Well's score for pulmonary embolism. ....	66
<b>Table (5):</b>	Simplified Well's score for pulmonary embolism. ....	67
<b>Table (6):</b>	Suggested VTE prophylaxis (SAGES). ....	83
<b>Table (7):</b>	Warfarin drug interactions. ....	92
<b>Table (8):</b>	Considerations prior to commencing dabigatran (Pradaxa®). ....	96
<b>Table (9):</b>	Considerations prior to commencing apixaban (Eliquis). ....	97
<b>Table (10):</b>	Considerations prior to commencing rivaroxaban (Xarelto®). ....	97
<b>Table (11):</b>	Comparative Properties of Warfarin, Dabigatran, Rivaroxaban, and Apixaban. ....	98
<b>Table (12):</b>	Effects of the New Oral Anticoagulants on Routine and Special Coagulation Assays, <sup>a</sup> .....	101
<b>Table (13):</b>	Demographic data. ....	126
<b>Table (14):</b>	Comparison between two groups in weight, BMI and operative time. ....	129
<b>Table (15):</b>	Previous medical history. ....	132
<b>Table (16):</b>	Peri-operative events in both groups. ....	136
<b>Table (17):</b>	Comparison of post operative LL pain or swelling and post operative dyspnea in both groups.....	137
<b>Table (18):</b>	Comparison of incidence of DVT in both groups.....	139

## *List of Figures*

Fig. No.	Title	Page No.
<b>Figure (1):</b>	Completed sleeve gastrectomy demonstrating a tubularized stomach.....	16
<b>Figure (2):</b>	Trocar placement.....	17
<b>Figure (3):</b>	Dissecting in close proximity to the greater curvature of the stomach in a cephalad direction.....	18
<b>Figure (4):</b>	A 60-mm green load (4.8-mm staple height) Multifire Endo GIA stapler armed with bioabsorbable Seamguard material is placed vertically across the antrum to start the sleeve gastrectomy .....	19
<b>Figure (5):</b>	A diagrammatic representation the effect of antithrombin.....	32
<b>Figure (6):</b>	A simplified overview of the haemostatic cascade.....	41
<b>Figure (7):</b>	The coagulation cascade .....	42
<b>Figure (8):</b>	Overall diagnostic algorithm for evaluation of suspected deep vein thrombosis ( <i>DVT</i> ).....	62
<b>Figure (9):</b>	Findings of acute PE on CTPA.....	68
<b>Figure (10):</b>	Contrast-enhanced chest computed tomography demonstrating bilateral main pulmonary artery emboli ( <i>arrows</i> ) in a 60-year-old man with acute-onset shortness of breath and chest pain .....	69
<b>Figure (11):</b>	An integrated diagnostic algorithm for patients with suspected pulmonary embolism ( <i>PE</i> ). CT, computed tomography .....	71
<b>Figure (12):</b>	Pneumatic Compression .....	80
<b>Figure (13):</b>	The coagulation cascade and anticoagulants.....	85
<b>Figure (14):</b>	Clinical suspicion (VTE), Lower extremity DVT.....	108
<b>Figure (15):</b>	Clinical suspicion (VTE), Pulmonary Embolism (PE) .....	109

*List of Figures Cont...*

Fig. No.	Title	Page No.
<b>Figure (16):</b>	{BOX A}, Treatment of all VTE .....	109
<b>Figure (17):</b>	French position of the patient. ....	121
<b>Figure (18):</b>	Mean Age. In both groups .....	127
<b>Figure (19):</b>	Sex.....	127
<b>Figure (20):</b>	Sex in both groups.....	128
<b>Figure (21):</b>	Comparison between two groups in weight and BMI.....	130
<b>Figure (22):</b>	Mean Operative time in both groups .....	131
<b>Figure (23):</b>	Previous medical history. ....	133
<b>Figure (24):</b>	Previous medical history in both groups.....	134
<b>Figure (25):</b>	Incidence of post operative bleeding in both groups.....	137
<b>Figure (26):</b>	Post operative LL pain or swelling.....	138
<b>Figure (27):</b>	2 weeks post operative duplex LL. ....	140
<b>Figure (28):</b>	3 months post operative duplex LL.....	140
<b>Figure (29):</b>	6 months post operative duplex LL.....	141

## *List of Abbreviations*

<b>Abb.</b>	<b>Full term</b>
<i>ACCP</i> .....	<i>American College of Chest Physicians</i>
<i>AF</i> .....	<i>Atrial fibrillation</i>
<i>AIS</i> .....	<i>Acute ischemic stroke</i>
<i>APSAC</i> .....	<i>Anisoylated plasminogen streptokinase activator complex</i>
<i>aPTT</i> .....	<i>Activated partial thromboplastin time</i>
<i>ASMBS</i> .....	<i>American Society for Metabolic and Bariatric Surgery</i>
<i>BMI</i> .....	<i>Body mass index</i>
<i>BPD-DS</i> .....	<i>Biliopancreatic diversion with duodenal switch</i>
<i>CHF</i> .....	<i>Congestive heart failure</i>
<i>CI</i> .....	<i>Confidence interval</i>
<i>COPD</i> .....	<i>Chronic obstructive pulmonary disease</i>
<i>CT</i> .....	<i>Computed tomography</i>
<i>CTPA</i> .....	<i>Computed tomography pulmonary angiography</i>
<i>CTPH</i> .....	<i>Chronic thromboembolic pulmonary hypertension</i>
<i>CTV</i> .....	<i>Computed tomography venography</i>
<i>CVC</i> .....	<i>Central venous catheter</i>
<i>DS</i> .....	<i>Duodenal switch</i>
<i>DUS</i> .....	<i>Duplex ultrasonography</i>
<i>DVT</i> .....	<i>Deep vein thrombosis</i>
<i>ECG</i> .....	<i>Electrocardiography</i>
<i>HCSE</i> .....	<i>Horse chestnut seed extract</i>
<i>HIT</i> .....	<i>Heparin-induced thrombocytopenia</i>
<i>HRT</i> .....	<i>Hormone replacement therapy</i>
<i>IPC</i> .....	<i>Intermittent pneumatic compression</i>
<i>LGB</i> .....	<i>Laparoscopic gastric banding</i>



## *List of Abbreviations Cont...*

Abb.	Full term
LMWH.....	Low molecular weight heparin
LSG.....	Laparoscopic Sleeve Gastrectomy
MPFF.....	Micronized purified flavonoid fraction
MRI.....	Magnetic resonance imaging
NOAC.....	Non-Vitamin K antagonist oral anticoagulants
NPO .....	Nothing by mouth
PAI-1.....	Plasminogen activator inhibitor-1
PCD .....	Pneumatic compression devices
PE.....	Pulmonary embolism
PESI.....	Pulmonary embolism severity index
PIOPED.....	Prospective Investigation of Pulmonary Embolism Diagnosis
PPV .....	Positive predictive value
PTS .....	Post-thrombotic syndrome
PTS .....	Post-thrombotic syndrome
r-PA.....	Recombinant plasminogen activator
RYGB.....	Roux-en-Y gastric bypass
SAGES.....	Suggested VTE prophylaxis
SC .....	Subcutaneous
SD .....	Standard deviations
SG .....	Sleeve gastrectomy
SPSS.....	Statistical Package for Social Science
TF .....	Tissue factor
TFPI.....	Tissue factor pathway inhibitor
TGF- $\beta$ .....	Transforming growth factor- $\beta$
TNF- $\alpha$ .....	tumor necrosis factor- $\alpha$
TOS.....	The Obesity Society
tPA .....	Tissue plasminogen activator

## *List of Abbreviations Cont...*

---

---

Abb.	Full term
UFH.....	Unfractionated heparin
UH.....	Unfractionated heparin
V/Q scan .....	Ventilation / Perfusion scan
VBG .....	Vertical banded gastroplasty
VKAs.....	Vitamin K antagonists
VPX.....	VTE prophylaxis
VTE.....	Venous thromboembolism

---

## INTRODUCTION

Obesity is a medical condition in which excess body fat has accumulated to the extent that it may have an adverse effect on health, leading to reduced life expectancy and/or increased health problems (*Haslam and James, 2005*).

Surgical approaches to weight loss, bariatric surgeries, are commonly performed procedures for morbidly obese individuals; the estimated number of bariatric procedures in the USA alone was close to 180,000 in 2013. Bariatric surgery is effective in achieving weight loss and improving obesity-related complications (*Matthew et al., 2015*).

Laparoscopic Sleeve Gastrectomy (LSG) has increased in popularity and is currently very popular among laparoscopic surgeons involved in bariatric surgery. As LSG proved to be effective in achieving considerable weight loss in the short-term, it has been proposed by some as a sole bariatric procedure (*Iannelli et al., 2008*).

As a result of new technologies with lower risks and better long-term results, bariatric and metabolic surgeries have grown in popularity in recent years. The number of operations performed is rapidly increasing. However, bariatric surgery is associated with numerous peri- and postoperative complications (*Stroh et al., 2012*).

Venous thromboembolism is the most common postoperative complication. Obesity needs to be considered as one of the most serious factors predisposing patients to the development of thrombosis and pulmonary embolism (*Stroh et al., 2012*).

Deep venous thrombosis may occur in up to 1.3% of patients after open or laparoscopic bariatric surgery. Despite the early mobility after laparoscopic surgery, the incidence of DVT may not be reduced as much as expected because the benefit of early motility may be offset by the tendency of pneumoperitoneum to promote DVT (*Becattini et al., 2012*).

Despite universal agreement on the need for thromboprophylaxis, no clear consensus has been reached regarding the best regimen and treatment duration. Current modalities of thromboprophylaxis include subcutaneous injection of unfractionated or low molecular weight heparin, pneumatic compression devices, elastic stockings, and inferior vena cava filters (*Magee et al., 2010*).

Most series evaluating prophylactic strategies for bariatric patients include some form of mechanical prophylaxis. Because of concerns of bleeding complications associated with chemoprophylaxis (2% incidence of bleeding complications in a recent systematic review when a standardized definition of hemorrhage was used), several studies have examined the use of mechanical compression only in bariatric surgery patients (*Becattini et al., 2012*).

## **AIM OF THE WORK**

To compare between incidence of developing deep venous thrombosis in patients receiving anticoagulation prophylaxis to those not receiving anticoagulation prophylaxis in Laparoscopic sleeve gastrectomy operations for treatment of morbid obesity.

## *Chapter 1*

# **OVERVIEW ON LAPAROSCOPIC SLEEVE GASTRECTOMY**

Obesity is a medical condition in which excess body fat has accumulated to the extent that it may have an adverse effect on health, leading to reduced life expectancy and/or increased health problems (*Haslam and James, 2005*).

Body mass index (BMI) is a widely and simple used method to estimate body fat mass. BMI is calculated by dividing the subject's mass in kg by the square of his or her height. Any BMI  $\geq 35$  is severe obesity, BMI of  $\geq 40$  is morbid obesity and BMI of  $\geq 45$  is super obese (*Sturm, 2007*).

Severe obesity is associated with a large number of comorbidities. These start at the head (stroke, diabetic retinopathy, pseudo tumor cerebri, tinnitus) and go to the toes (diabetic neuropathy, venous stasis disease, foot ulcers) and affect almost every organ in between: heart, lungs, liver, gall bladder, spleen, esophagus, intestines, colon, kidneys, bladder, ovaries, prostate, breast, legs, etc... (*Sugerman et al., 2003*).

Bariatric surgery has demonstrated to be the most effective and sustainable method for the regulation of morbid obesity, superior to both pharmaceuticals and combinations of diet and lifestyle regimens.

## Indications for Bariatric Surgery and Patient Selection:

In 1991 the National Institutes of Health published a consensus statement regarding bariatric surgery. Surgery was indicated in patients with a BMI  $\geq 40$  kg/m<sup>2</sup> and in patients with a BMI between 35 and 40 with other comorbidities (**Table 1**). Severe sleep apnea, obesity related cardiomyopathy, Pickwickian syndrome, severe diabetes mellitus and lifestyle limitations were all considered comorbidities that would allow the patient to pursue surgery (*National Institutes of Health, 2013*).

**Table (1):** Indications for bariatric surgery and patient selection (*Schirmer and Schauer, 2010*).

**Patient must:**

1. Have BMI of  $\geq 40$  with or without other co-morbid medical conditions associated with obesity.
2. Have BMI of 35–40 with other co-morbid medical conditions.

**In addition, patients:**

1. Have failed attempt of other weight loss treatments
2. Must be psychologically stable
3. Must be cooperative, motivated and agree for lifelong follow up.
4. Must be fit for surgery.
5. Aged 18 to 60 years.

*Sleeve gastrectomy (SG)* was introduced as a promising bariatric operation. SG involves removing the fundus and greater curvature portion of the stomach, leaving only a lesser curvature tube (*Deitel et al., 2007*).