



Role of Laparoscopic Gastric Bypass as a Surgical Technique for Treatment of Morbid Obesity

Thesis

Submitted for partial fulfillment of MD degree in
General Surgery

By

Fady Makram Benjamine

Master degree in general surgery
Ain Shams University

Under supervision of

Prof. Dr. Mohamed Emad Saleh Hussein

Professor of general surgery
Faculty of medicine-Ain shams university

Prof. Dr. Ahmed Mohamed Ibrahim Khalil

Professor of general surgery
Faculty of medicine-Ain shams university

Dr. Inas Mohamed Sabry

Assistant professor of Endocrinology
Faculty of medicine-Ain shams university

Dr. Ahmed Hussein Tawfeek Al-korashy

Lecturer of general surgery
Faculty of medicine-Ain shams university

**Faculty of Medicine
Ain Shams University**

2010

ACKNOWLEDGMENT

After giving all thanks to God, The most kind and most merciful, who helped me to achieve this work,

*I am greatly honored to express my greatest gratitude & thanks to **Prof. Dr. Mohammed Emad Saleh**, Professor of General surgery, Faculty of Medicine, Ain-Shams University for undertaking the main supervision of this thesis, his precious advice, gentle guidance & kind support throughout the entire work, which were of unlimited value.*

*I would like to express my deepest sincere thanks to **Prof. Dr. Ahmed Mohamed Ibrahim**, Professor of General surgery, Faculty of Medicine, Ain-Shams University for his very great valuable help, generosity & unlimited support in every detail of this work. He gave me much of his time and effort which have made it a rewarding experience.*

*I would also like to express my great thanks to **Dr. Inas Mohamed Sabry**, Assistant professor of Endocrinology, Faculty of medicine, Ain-Shams University for her kind help and encouraging assistance in performing this work.*

*Also, I'm very grateful to **Dr. Ahmed Hussein Tawfeek Al-korashy**, Lecturer of general surgery, Faculty of medicine, Ain-Shams University for his great support and valuable guidance during this study.*

*Special thanks, admiration & respect to **my family and all the staff members & residents** of the second unit of general surgery department Ain-Shams University for their kind help, guidance & support and i wish God to reward them.*

List of Contents

	Page
Introduction	1
Aim of the work	4
<i>Chapter 1 Definition and etiology of obesity</i>	
1 Definition of obesity	5
2 Physiology and regulation of food intake	6
a) Central regulation of food intake	7
b) Alimentary regulation of food intake	10
c) Environmental regulation of food intake	11
3 Etiology of obesity	12
4 Pathogenesis of obesity	20
<i>Chapter 2 Anthropometric indices</i>	
1 Body Mass Index	23
2 Body circumferences	25
3 Skin fold thickness	27
4 Measurements of body composition	30
a) Fat mass and fat free mass	30
b) Densitometry	32
c) Total body water	33
d) Dual energy X-ray absorptiometry	34
e) Bioelectrical impedance	35
5 Measurements of fat distribution	38
a) Computed tomography imaging	39

	b) Magnetic resonance imaging	39
	<i>Chapter 3 Associated diseases with Obesity</i>	
1	Associated diseases with Obesity	42
	a) Osteoarthritis	43
	b) Hypertension	44
	c) Non insulin dependent diabetes mellitus	45
	d) Dyslipidemia	45
	e) Coronary heart diseases	46
	f) Cardiovascular dysfunction	46
	g) Neurological disorders	47
	h) Thromboembolic diseases	47
	i) Respiratory problems	47
	j) Sleep apnea	48
	k) Genital disorders	49
	l) Gastrointestinal complications	51
	m) Endocrinal dysfunction	51
	n) Renal complications	52
	o) Cancers	53
	p) Hernias	54
	q) Skin infections	55
	r)Surgical risks	55
	s) Idiopathic intracranial hypertension	56
	t)Pregnancy	56
	u)Social and psychological effects	56
	v)Trauma	57
	w)Economics hazards of obesity	58
	x)Life expectancy	59

2	Assessment of obesity	60
	a) History and evaluation of obesity	60
	b) Clinical examination	66
	c) Screening investigations	69
	<i>Chapter 4 Management of Obesity</i>	
1	Prevention of obesity	73
2	Non surgical management of morbid obesity	77
	a) Diet therapy	77
	b) Physical activity	80
	c) Behavior modification	82
	d) Pharmacotherapy	83
	e) Active physical interventions	90
	➤ Gastric balloons	90
	➤ Acupuncture	92
	➤ Jaw wiring	93
	➤ Regional fat metabolism	94
	➤ Waist cord	94
3	Surgical management of morbid obesity	96
	a) Body contouring surgery	96
	➤ Non excisional body contouring	96
	➤ Excisional body contouring	98
	b) Bariatric surgery	101
	➤ Patient selection	102
	➤ Preoperative evaluation of the Patient	105
	➤ Gastroplasty	108
	➤ Gastric banding	115
	➤ Sleeve gastrectomy	120

	➤ Biliopancreatic diversion	124
	➤ Jejunioileal bypass	128
	➤ Jejunocolic bypass	132
	➤ Vertical sleeve gastrectomy with duodenal switch	133
	➤ Gastric bypass	137
	➤ Laparoscopic surgery for morbid obesity	149
	• Laparoscopic vertical banded gastroplasty	151
	• Laparoscopic adjustable silicon gastric banding	154
	• Laparoscopic sleeve gastrectomy ...	160
	• Laparoscopic malabsorption procedures	162
	• Laparoscopic gastric bypass	164
	➤ Emerging bariatric procedures	172
	• Mini-gastric bypass	172
	• Endoluminal procedures	173
	• Gastric pacing	174
4	Postoperative dietary management and follow up	177
5	Outcome of surgery	179
6	Complications of surgery for obesity	182
	<i>Patients & Methods</i>	
1	Inclusion criteria	201
2	Exclusion criteria	202
3	Procedure	206
4	Post operative care	216

5	Post operative follow up	218
6	Post operative diet regimen	218
7	Post operative drug therapy	219
8	Data collection	220

Results

1	Data Management and Analysis	222
2	Patients' characteristic clinical data	223
3	Preoperative assessment	224
4	Comorbidities	226
5	Intraoperative complications	227
6	Operative time and postoperative hospital stay	228
7	Follow up of the patients	229

	<i>Discussion</i>	255
--	--------------------------	-----

	<i>Summary and Conclusion</i>	270
--	--------------------------------------	-----

	<i>References</i>	275
--	--------------------------	-----

	<i>Arabic Summary</i>	
--	------------------------------	--



List of tables

	Page
Table 1 : Classification of weight status and comorbid risk in adults based on BMI	25
Table 2 : Comorbid risks of obesity according to waist circumference	27
Table 3 : The body composition of ‘reference man’ showing individual components	31
Table 4 : Classification of overweight and obesity by body mass index and waist circumference	67
Table 5 : Bariatric surgery for management of obesity	75
Table 6 : Drugs used to treat obesity	85
Table 7 : Distribution of cases according to personal characteristics of medical importance	224
Table 8 : Distribution of cases according to the preoperative anthropometric indices	225
Table 9 : Distribution of cases according to comorbidities	226
Table 10 : Distribution of cases according to conversion to open surgery	227
Table 11 : Distribution of cases according to operative time, postoperative hospital stay and pain score	228
Table 12 : Early postoperative complications	231
Table 13 : Late postoperative complications	232
Table 14 : Patients’ weight in different follow up measurements.	233
Table 15 : Comparison between patients according to weight at different follow ups	235

Table 16 :	Patients' excess weight loss in different follow up measurements	236
Table 17 :	Comparison between patients according to excess weight loss at different follow ups	238
Table 18 :	Description of the patient with poor weight loss	239
Table 19 :	Patients' body mass index in different follow up measurements	240
Table 20 :	Comparison between patients according to body mass index at different follow ups	242
Table 21 :	Patients' waist circumference in different follow up measurements	243
Table 22 :	Comparison between patients according to waist circumference at different follow ups	245
Table 23 :	Patients' hip circumference in different follow up measurements	246
Table 24 :	Comparison between patients according to hip circumference at different follow ups	248
Table 25 :	Patients' waist/hip ratio in different follow up measurements	249
Table 26 :	Comparison between patients according to waist/hip ratio at different follow ups	250
Table 27 :	Comparison between males and females regarding weight and BMI percent of change	251
Table 28 :	Comparison between sweet eaters and non sweet eaters regarding weight and BMI percent of change ...	251
Table 29 :	Comparison between patients with and without family history of obesity regarding weight and BMI percent of change	252
Table 30 :	Comparison between patients as regard operative time and hospital stay in relation to the BMI	253

Table 31 : Fate of different comorbidities after operation	253
Table 32 : Comparison between the operative time and conversion to open surgery for the present study and others	261
Table 33 : Comparison between the hospital stay for the present study and others	262
Table 34 : Comparison between the BMI decrease for the present study and others	263
Table 35 : Comparison between the percentage of anastomotic leakage in the present study and others	266
Table 36 : Comparison between the present study and other studies regarding the postoperative complications	269

List of figures

	Page
Fig. 1 : Cushing syndrome showing truncal obesity with a ‘buffalo hump’	16
Fig. 2 : Measuring waist circumference and hip circumference	26
Fig. 3 : Measuring subcutaneous skin fold thicknesses using skin fold calipers	29
Fig. 4 : Whole body DEXA scan of a woman with a BMI of 22 kg/m ²	35
Fig. 5 : Commercially available units for measurement of bioelectrical impedance	36
Fig. 6 : CT images of the abdomen (at L4/L5 level) of a man with central obesity	39
Fig. 7 : MRI whole body scans and fat maps of young adult women (24–30 y), each of whom has a BMI around 25 kg/m ²	41
Fig. 8 : Intragastric Balloon in place within the lumen of the stomach	91
Fig. 9 : Abdominoplasty	98
Fig. 10 : Gastroplasty with horizontal partial transaction	110
Fig. 11 : Vertical banded gastroplasty	111
Fig. 12 : Non adjustable gastric banding	116
Fig. 13 : Adjustable gastric banding	117
Fig. 14 : Completed sleeve gastrectomy demonstrating a tubularized stomach	121
Fig. 15 : Biliopancreatic diversion	125

Fig. 16 :	Jejunioileal bypass	129
Fig. 17 :	Jejunocolic bypass	132
Fig. 18 :	Duodenal switch	134
Fig. 19 :	Gastric bypass with loop gastrojejunostomy as performed by Mason and Ito	138
Fig. 20 :	Roux-en-Y gastric bypass	139
Fig. 21 :	Radiogram showing anastomotic leak after gastric bypass	143
Fig. 22 :	Computed tomography showing severe distension of native stomach	144
Fig. 23 :	Upper GI contrast x-ray demonstrating a gastrogastic fistula	146
Fig. 24 :	Exposure of the angle of Hiss	156
Fig. 25 :	The tubing is threaded into the Lap-Band placer, which is then withdrawn across to the lesser curve side	157
Fig. 26 :	Completion of anterior fixation	158
Fig. 27 :	Laparoscopic sleeve gastrectomy	161
Fig. 28 :	Port placement for laparoscopic gastric bypass	165
Fig. 29 :	The gastric pouch is created using the linear stapler ...	166
Fig. 30 :	The jejunum is divided with a linear stapler	167
Fig. 31 :	Formation of the jejunojejunal anastomosis.....	168
Fig. 32 :	The linear stapler is fired to create the anastomosis....	169
Fig. 33 :	Mini-gastric bypass	172
Fig. 34 :	Gastric pacing	176
Fig. 35 :	Fluid collections in patients with leaks	189
Fig. 36 :	Endoscopic view of an anastomotic stricture	198



Fig. 37 :	Endoscopic view of a marginal ulcer at the gastrojejunal anastomosis of a gastric bypass	199
Fig. 38 :	Division of the jejunum 50-75 cm distal to the ligament of Treitz using a stapler	210
Fig. 39 :	The staple line of the divided jejunum	210
Fig. 40 :	Creation of the small bowel enterotomies by the Harmonic shear	211
Fig. 41 :	Fashioning of a side to side anastomosis between the two jejunal segments using a stapler	211
Fig. 42 :	Closure of the enterotomies	212
Fig. 43 :	Insertion of the stapler which first applied horizontally across the lesser curve of the stomach	213
Fig. 44 :	The staple line of the gastric pouch	214
Fig. 45 :	The created gastric pouch	214
Fig. 46 :	The completed gastrojejunostomy	215
Fig. 47 :	Closure of the mesenteric defect	216
Fig. 48 :	Mean weight in different follow up measurements	234
Fig. 49 :	Mean excess weight loss in different follow up measurements	237
Fig. 50 :	Mean body mass index in different follow up measurements	241
Fig. 51 :	Mean waist circumference in different follow up measurements	244
Fig. 52 :	Mean hip circumference in different follow up measurements	247
Fig. 53 :	Mean waist/hip ratio in different follow up measurements	249

List of Abbreviations (In Alphabetical Order)

BMC :	Bone mineral content
BMD :	Bone mineral density
BMI :	Body mass index
BPD :	Biliopancreatic diversion
BPD-DS :	Biliopancreatic diversion with duodenal switch
CHD :	Coronary heart diseases
CT :	Computed tomography
D₂O :	Deuterium oxide
DEXA :	Dual energy X-ray absorptiometry
DVT :	Deep venous thrombosis
ERCP :	Endoscopic retrograde cholangiopancreatogrpahy
EWL :	Expected weight loss
FFM :	Fat free mass
FM :	Fat mass
GBP :	Gastric bypass
GLP-1 :	Glucagon link peptide-1
HDL-C :	High density lipoprotein cholesterol
IGS :	Implantable gastric stimulator
LCD :	Low calorie diets
LDL-C :	Low density lipoprotein cholesterol
LRYGBP :	Laparoscopic Roux-en-Y gastric bypass
MRI :	Magnetic resonance imaging

NHLBI :	National Heart, Lung and Blood Institute
NIDDM :	Non insulin dependent diabetes mellitus
NOTES :	Natural orifice transluminal endoscopic surgery
NSAID :	Non steroidal anti inflammatory drugs
OGTT :	Oral glucose tolerance test
OSA :	Obstructive sleep apnea
PCOS :	Polycystic ovary syndrome
PVN :	Paraventricular nucleus
RYGBP :	Roux-en-Y gastric bypass
SFT :	Skinfold thickness
TBW :	Total body water
VAS :	Visual analogue scale
VBG :	Vertical banded gastroplasty
VLCD :	Very low calorie diets
VMN :	Ventromedial nucleus
WHO :	World health organization