Different Surgical Modalities in Management of Childhood Obesity

Thesis

Submitted For Partial Fulfillment of M.D degree in General Surgery

By

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2016

Abstract

Background: Obesity is a growing serious health problem in children and adolescents. The Management plan worldwide is a stepwise approach that involves lifestyle changes and bariatric surgery. Different surgical options are available for obese adolescents. Restrictive operations; Adjustable Gastric Banding (AGB), and Vertical-Banded Gastroplasty (VBG). Mal-absorptive operations; Biliopancreatic Diversion (BPD) with or without Duodenal Switch (DS), and combined; Gastric Bypass (RYGBP). Although all are valid in adults, there has been controversy among the scientific bodies to define the standard surgical treatment, because of the concerns surrounding bariatric surgery in this particular age group.

Methods: This is a prospective study conducted at Ain Shams university hospital in 40 obese adolescents allocated equally into 4 groups and offered randomly AGB, VBG, RYGBP or BPD/DS and followed-up for 1 year, after failure of conservative treatment and legalization has documented. Each patient's BMI was above the 99th percentile for age and sex. All patients had one or more comorbidities.

Results: The average age was 15.3 (13-18 years), The average BMI was 55.2 ± 8.4Kg/m2, and Excess Body Weight (EBW) was 84.8 ± 22.6 kg. Each type of surgery has induced significant weight loss. The average EBW loss was 93.1±5.6, 78.5±14.6, 66.9±24.1, and 51.7±23.1 kg for BPD, RYGBP. VBG, and AGB, respectively. BPD was the most powerful in reducing Body weight and resolution of comorbidities , but with higher complications rate**.**

Conclusions: RYGBP is the surgical treatment of choice for obese adolescents, because it has superior outcomes to VBG and AGB with acceptable complications rate, and comparable weight loss to BPD/DS. BPD should be preserved for patients with Prader-Willi Syndrome.

Keywords: Bariatric surgery, Weight loss surgery, Childhood and adolescents' obesity, Adolescents' bariatric surgery, Biliopancreatic diversion, Duodenal switch, Gastric Bypass, Vertical-banded gastroplasty, Adjustable gastric banding.

بسم الله الرحمن الرحيم

قالوا

سبحانك لا علم لنا
إلا ما علمتنا إنك أنت
العليم الحكيم

صدق الله العظيم

سورة البقرة الآية: ٣٢

Acknowledgement

First and foremost, I feel always indebted to **Allah**, *the most kind and most merciful.*

I am greatly honored to express my deep respect and gratitude to **Prof. Dr. Khaled Ali Gawdat** *, Professor of General Surgery, Faculty of Medicine, Ain Shams University, for his faithful step by step supervision, understanding, help and encouragement in initiating and completing this work.*

I am greatly indebted to **Prof. Dr. Ali Mohamed Elanwar,** *Assistant Professor of General Surgery, Faculty of Medicine, Ain Shams University, for his constructive ideas, support, great help and generous guidance.*

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List of Abbreviations

BMI	Body Mass Index
WHO	World Health Organization
HEN	Health Evidence Network
CDC	Center of Disease Control
STD	Standard Deviation
NIH	National Institutes of Health
POMC	Pre-Opio-Melano-Cortin
T2DM	Type 2 Diabetes Mellitus
NHANES	National Health and Nutrition Examination Survey
PWS	Prader- Willi Syndrome
GHS-R1a	Growth Hormone Secretory Receptor type 1a
IR	Insulin Resistance
HOMA-IR	Homeostatic Model Assessment -Insulin Resistance
NPY	Neuropeptide Y
ARC	Hypothalamic Arcuate Nuclei
ACTH	Adrenocorticotropic hormone
GH	Growth Hormone
AGRP	Agouti-Related Peptide
PYY	Peptide-YY
RMR	Resting Metabolic Rate
BBB	Blood Brain Barrier
OXM	Oxyntomodulin
GLP-1	Glucagon Like Peptide- 1
NAFLD	Non Alcoholic Fatty Liver Disease
NASH	Non-Alcoholic Steatosis/Hepatitis
OSAS	Obstructive Sleep Apnea Syndrome
SCFE	Slipped Capital Femoral Epiphysis
AOA	American Obesity Association
IGT	Impaired Glucose Tolerance
IDF	International Diabetes Federation
WC	Waist Circumference
FBG	Fasting Blood Glucose
RDA	Recommended Dietary Allowances
AAP	American Academy of Pediatrics

APSA	American Pediatric Surgical Association IPEG International Pediatric Endosurgery Group IFSO International Federation for Surgery of Obesity ANZ Australia and New Zealand
ASBMS	American Society of Bariatric and Metabolic Surgery
KID	Kid's Inpatient Database
FDA	Food and Drug Administration
PCOS	Polycystic Ovary Syndrome
WLS	Weight loss Surgery
BPD/DS	Biliopancreatic Diversion/ Duodenal Switch
RYGBP	Roux –En- Y Gastric Bypass
VBG	Vertical- Banded Gastroplasty
(L)AGB	(Laparoscopic) Adjustable Gastric Banding
(i)PTH	(intact) Parathormone Hormone
DVT	Deep Vein Thrombosis
PE	Pulmonary Embolism
GERD	Gastroesophageal Reflux Disease
LSG	Laparoscopic Sleeve Gastrectomy
DEXA	Dual-Energy X-ray Absorptiometry
QOL	Quality of Life
AHI	Apnea Hypopnea Index
CC	Common Channel
AL	Alimentary Limb
BPL	Biliopancreatic Limb
DIA	Duodeno-Ileal Anatomosis
EBW(L)	Excess Body Weight (Loss)
BW	Body Weight
PEM	Protein Energy Malnutrition
25(OH)D	25- Hydroxy Vitamin D
AMOS study	Adolescents Morbid Obesity Surgery study
FABS study	Follow-up of Adolescent Bariatric Surgery study
BMC (D)	Bone Mineral Content (Density)
CPAP	Continuous Positive Airway Pressure

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Introduction

Overweight and obesity are defined as abnormal or excessive fat accumulation that may impair health. In 2010, it accounts for 43 million children problems. Overweight and obesity are now increasing in low- and middle- income countries, particularly in urban settings **(WHO, 2011).**

Obesity now affects 17% of all children and adolescents in the United States. The percentage of adolescents and children who are obese tripled from 1980 to 2008. In 2008 alone, more than 1/3 of U.S. children and adolescents were overweight or obese **(National Center For Health Statistics, 2011).**

For patients aged 2 through 19 years, weight status may be determined by plotting the BMI value on the CDC 2000 growth charts, which results in an age- and gender- specific percentiles **(Barlow, 2007).**

Overweight is defined as a BMI at or above the 85^{th} percentile on the CDC 2000 growth charts for children of the same age and sex, this replaces the previously used term " at risk of overweight" **(Barlow, 2007).**

Obesity is considered a BMI at or above the 95^{th} percentile or a BMI greater than 30 kg/m^2, whichever is smaller, this definition replaces the term "overweight" **(Ogden & Carroll, 2011).**

As the incidence of childhood obesity has increased, so has the identification of the consequences of childhood obesity, including Obstructive sleep apnea, orthopedic problems, hyperandrogenism, type 2 diabetes, hypertension, hyperlipidemia, fatty liver disease, and premature cardiovascular disease **(Korner et al., 2008).**

Over 50% of overweight adolescents meet the criteria for metabolic syndrome (insulin resistance, hypertension, hyperlipidemia and abdominal obesity) **(Gardner et al., 2008).**

The comorbidities of the obesity in children persist into adulthood, thus increasing the medical burden on society and the risk for early morbidity and mortality. Owing to the rising prevalence of both childhood obesity and its comorbidities, it is estimated that up to a third of the U.S and European populations will develop type 2 diabetes during their lifetimes **(Lobstein & Jackson, 2006).**

The cornerstone of the management for childhood obesity is modification of dietary and exercise habits. When caloric intake decreases, metabolism slows, resulting in decreases calorie utilization and difficulty achieving weight loss, typically resulting in a maximum weight loss of 5-10% which is unlikely to be sustained **(Hainer et al., 2008).**

For individuals suffering from complications associated with morbid obesity, bariatric surgery is recognized as an effective treatment to provide significant weight loss and long-term weight control. Gastric bypass surgery appears to overcome the compensatory responses of the body to decreased caloric intake, and results in long-term, clinically significant weight loss **(De Castro et al., 2008), (Del Genio et al., 2007).**

In view of the rise in the prevalence of childhood obesity-particularly of cases in which obesity related morbidity is already present at a very young age –implementation of this treatment modality in adolescents seems a reasonable and acceptable option **(August et al., 2008).**

Extremely obese diabetic adolescents experience significant weight loss and remission of type 2 diabetes mellitus after Roux-en-Y gastric bypass. Improvements in insulin resistance, B- cell function, and cardiovascular risk factors support Roux-en Y gastric bypass as an intervention that improves the health of these adolescents **(Inge et al., 2009).**

Aim of the work

To evaluate the results of different bariatric surgeries on childhood and adolescents obesity below 18 years and more than 13 years old in girls and 15 years in boys, trying to pick up the standard surgical treatment suitable for them.

Pathophysiology

Definition and Classification of Childhood Obesity:

Obesity means excess body fat, BMI is reasonably accurate method for predicting adiposity and can be easily used as screening tool **(Rome, 2011).**

The definition of pediatric obesity is not usually easy. Because directly measuring body fat is challenging and time consuming, the measurement of BMI is most commonly used. However, BMI does not always accurately reflect body composition. For example, athletes with high muscle mass and an extremely low body fat may have obese BMIs. The use of BMI as a predictor of body fat mass in pediatrics has been shown with variable accuracy, with correlation ranging between 0.5 and 0.94, depending on sex and age. Despite these limitations, BMI has been shown to be predictive of the cardiovascular risk factors in pediatric patients and considered the most relevant clinical parameter of childhood obesity **(Hsia et al., 2012).**

The continuing changes in body weight and built throughout childhood mean that overweight and obesity cannot be defined by the static BMI thresholds that are used by adults above 18 years (overweight = BMI 25−29.9 kg/m^2; obese = BMI ≥30 kg/m^2). Instead, the child's BMI is compared with the distribution of BMI in a reference population matched for age and sex. Conventionally, the reference data are expressed as percentiles: the 50th percentile represents the mean value for that age and sex, while the 85th and 95th percentiles respectively contain the highest 15% and 5% of values in the reference population **(Reilly, 2005), (Speiser, 2005).**

According to this system BMI for age and gender above 85th percentile is called over weight. BMI for age and gender above 95th percentile is obese. BMI for age and gender above 99th percentile is morbid obese. The 85th and 95th percentile of BMI