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METABOLIC CHANGES AFTER BARIATRIC SURGERIES

(A REVIEW ARTICLE)

By

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ABSTRACT

Background: Obese persons may suffer from peripheral obesity with joint disease and venous stasis or central obesity that predisposes to a number of mortality-related problems due to the metabolic syndrome. Obesity is classified into: overweight, obesity class one, moderate obesity class two, morbid obesity, and super morbid obesity according to the body mass index (BMI). Extensive metabolic changes accompany bariatric surgery-based treatment of obesity. Consequently, the term "metabolic" surgery is being increasingly adopted in relation to the beneficial effects these procedures have on chronic diseases like type 2 diabetes.

Objectives: Discussing metabolic changes that occur in the body after bariatric surgeries.

Conclusion: Metabolic surgery achieves and sustains improvements in metabolic dysfunction secondary to obesity. Further mechanistic studies are essential to assess the true potential of metabolic surgery to treat the myriad other disorders of metabolism and their consequences in terms of cardiovascular disease and cancer.

Keywords: Obesity; Metabolic syndrome; Bariatric surgery; Post-operative metabolic changes

INTRODUCTION

Obesity is a major health problem worldwide and has reached an epidemic proportion in the western society. Evidence continues to accumulate that obesity is a major risk factor for many diseases and is associated with significant morbidity and mortality *(Abdelaal et al., 2017)*.

Obesity is a medical condition in which excess body fat has accumulated to the extent that it may cause numerous and serious chronic and fatal diseases. When exposed to overnutrition, humans are susceptible to develop diabetes, hypertension, cardio-pulmonary failure and various malignant neoplasms, all of which contribute to diminished life span *(Tzoulaki et al., 2018)*.

So, major efforts were done for the proper management of obesity. Non-surgical methods as dietary changes, exercise, behavioral changes and weight-loss medications are used, but are of limited role in long-term maintenance of weight loss or in morbidly obese patients *(Montesi et al., 2016)*.

In contrast to the minimal and largely unsustained weight loss of medical management, bariatric surgery has been shown to durably and effectively reduce excess body weight, obesity- related co-morbidities and mortality over the long term *(Pontiroli et al., 2018)*.

During treatment of obesity, it was found that bariatric surgery results in a decrease or resolution of many obesity related comorbid conditions. The metabolic syndrome (abdominal obesity, atherogenic dyslipidemia, hypertension, insulin resistance or glucose intolerance) comprises a constellation of serious cardiovascular risk factors. Bariatric surgery improves or leads to resolution of all of these factors in over 80% of patients and decreases the risk for cardiovascular disease. Similarly, diabetes also improves dramatically after bariatric surgery. Buchwald's meta-analysis showed that diabetes resolved in 99% of patients after biliopancreatic diversion, 84% after gastric bypass, 72% after gastroplasty, and 48% after gastric banding. About half of morbidly obese patients are hypertensive, and 80% of patients undergoing bariatric surgery will have resolution or improvement in their hypertension and their lipid profile after bariatric surgery. Sleep apnea, obesity hypoventilation syndrome (Pickwickian Syndrome), and asthma improve or resolve in the majority of patients after massive weight loss *(Kang and Le, 2017)*.

DISCUSSION

The metabolic syndrome has several synonymous syndromes including insulin resistance syndrome and dysmetabolic syndrome. More important than giving a name is providing a definition for the syndrome *(Rippe & Angelopoulos, 2012* and *Nilsson et al., 2019)*.

On light to overcome controversies on the limitations in the current definitions, the International Diabetes Federation (IDF) has proposed a new more practical definition which would be applicable globally for the identification of people at high risk of cardiovascular disease and diabetes. The IDF Group recognized that central obesity was an important determinant of the metabolic syndrome *(Kassi et al., 2011)*.

Visceral fat accumulation determined by CT scan or ultrasound has been demonstrated to have a strong correlation with the development of metabolic and cardiovascular disease. The consensus group placed particular emphasis on developing criteria for central obesity which would be appropriate for a wide variation of populations *(Woldemariam et al., 2018)*.

Definition of the metabolic syndrome:

Central obesity: Waist circumference ≥ 102 cm (M), ≥88 cm (F),

Plus any two of the following;

- Raised triglycerides: ≥150 mg/dL.
- Reduced HDL: <40 mg/dL (males), <50 mg/dL (females).
- Raised blood pressure: ≥130 (systolic) or ≥85 mm HG (diastolic).
- Fasting plasma glucose ≥100 mg/dL or previously diagnosed type 2 diabetes.
- A modification of the definition was also developed by the Ameri¬can Association of Clinical Endocrinologists (AACE) based on

the belief that insulin resistance is the core feature *(Scmhrd, 2018)*.

Obesity is quantified by body mass index (BMI) which is weight in kilograms divided by height in meters squared (kg/m2). Obesity is classified according to BMI to 5 categories **(Table 1)**.

Table (1): Classification of obesity *(Kang and Le, 2017)*

Severity	BMI
Overweight	25.0 – 29.9
Obesity (class 1)	30.0 –34.9
Moderate obesity (class 2)	35.0 – 39.9
Morbid obesity (class 3)	40.0 – 49.9
Super morbid obesity	>50

The goal of bariatric surgery is to improve health in morbidly obese patients by achieving long-term, durable weight loss. It involves reducing caloric intake and/or absorption of calories from food, and may modify eating behavior by promoting slow ingestion of small boluses of food. Restrictive operations restrict the amount of food intake by reducing the quantity of food that can be consumed at one time, which results in a reduction in caloric intake. Malabsorptive procedures limit the absorption of nutrients and calories from ingested food by bypassing the duodenum and pre-determined lengths of small intestine *(Cummings and Cohen, 2016)*.

Patients with a BMI ≥40 kg/m2 or a BMI ≥35 kg/m2 with significant obesity-related comorbidities are candidates for bariatric surgery based on the 1991 Consensus Guidelines *(Kang and Le, 2017)*.

Bariatric procedures:

The bariatric procedures are classified: (Bland, 2012; Kang and Le, 2017) into:

Restrictive procedures
- a- Adjustable gastric banding.
- b- Sleeve gastrectomy.
- c- Vertical banded gastroplasty.

Malabsorptive procedures
- d- Biliopancreatic diversion.
- e- Biliopancreatic diversion with duodenal switch.

Combination procedures
- f- Roux-en-Y gastric bypass.

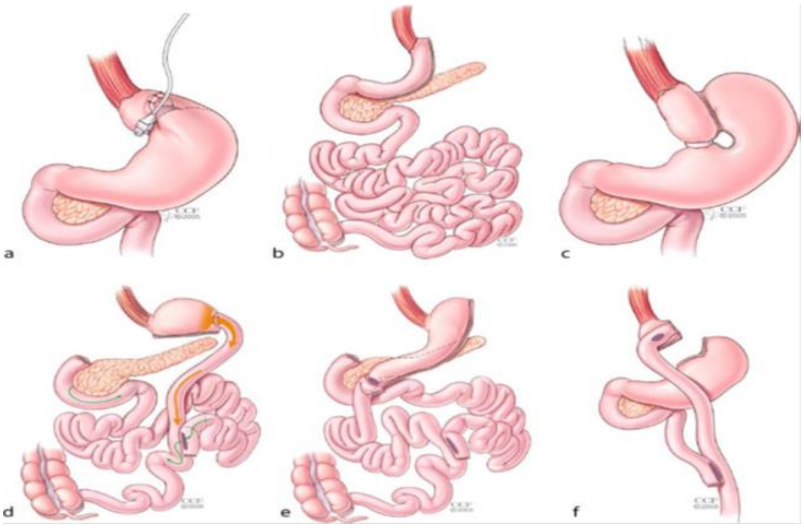

Figure (1): Different bariatric surgical procedures *(Bland, 2012)*.

Bariatric surgery improves glucose and lipid metabolism and attenuates endothelial dysfunction and sympathetic over activity. These changes are interrelated, since reduction of sympathetic over activity, improvement of endothelial dysfunction, and decrease of insulin resistance correlate each other, and with decreases of body weight and of visceral fat. In addition, bariatric surgery has been shown to prevent arterial hypertension and diabetes mellitus *(Kuno et al., 2019).*

Bariatric surgery has been reported to reduce left ventricular mass LVM indices in a number of studies, and has beneficial effects on virtually all sections of electrocardiogram (ECG). It is possible that weight loss is effective in reducing LVM (left ventricular mass) if accompanied by decrease of blood pressure. LVM correlates with circulating leptin levels, and with insulin resistance, and decreases of LVM and of leptin levels are correlated in obese normotensive subjects *(Di Bello et al., 2013).*

CONCLUSION

Bariatric surgery is the branch that studies weight loss surgical procedures. Bariatric surgical procedures are restrictive operations that restrict the amount of food intake by reducing the quantity of food that can be consumed at one time, malabsorptive procedures that limit the absorption of nutrients and calories from ingested food, or combination of both.

Bariatric surgery is indicated in patients with a BMI ≥40 kg/m2 or a BMI ≥35 kg/m2 with significant obesity-related comorbidities.

All the bariatric surgical procedures can be done laparoscopically as well as by laparotomy with the advantage of safety and minimal trauma. The amount of weight loss is greater with malabsorptive than with restrictive bariatric procedures.

Bariatric surgeries, including Roux-en-Y gastric bypass, are the most effective methods of curing type 2 diabetes and the other major components of the metabolic syndrome.

Bariatric surgeries decrease serum LDL-C and triglyceride concentrations, whereas increase serum HDL-C. Bariatric surgery decreases both systolic and diastolic blood pressure and also has a great effect on improvement of cardiac function and reduction of the risk of heart failure in obese patients.

REFERENCES

1. **Abdelaal M, le Roux CW and Docherty NG. (2017):** Morbidity and mortality associated with obesity. Annals of translational medicine, 5(7): 161-172.
2. **Bland KI, Sarr MG, Büchler MW, Csendes A, Garden OJ and Wong J. (2012):** General Surgery: Principles and International Practice 2nd Edition. Springer, USA, 2nd edition. 1.
3. **Cummings DE and Cohen RV. (2016):** Bariatric/Metabolic Surgery to Treat Type 2 Diabetes in Patients with a BMI <35 kg/m2. Diabetes Care, 39(6): 924–933.
4. **Di Bello V, Fabiani I, Conte L, Barletta V, Delle Donne MG, Cuono C, Leo LA, Dini FL, Marzilli M, Pinchera A and Santin F. (2013):** New Echocardiographic Techniques in the Evaluation of Left Ventricular Function in Obesity. Obesity, 21: 881-892.
5. **Kang JH and Le QA. (2017):** Effectiveness of bariatric surgical procedures: A systematic review and network meta-analysis of randomized controlled trials. Medicine, 96(46): e8632.
6. **Kassi E, Pervanidou P and Abd Kaltsas G. (2011):** Metabolic syndrome: definitions and controversies. BMC Med., 9: 48.
7. **Kuno T, Tanimoto E, Morita S and Shimada YJ. (2019):** Effects of Bariatric Surgery on Cardiovascular Disease: A Concise Update of Recent Advances. Frontiers in cardiovascular medicine, 6: 94.
8. **Montesi L, El Ghoch M, Brodosi L, Calugi S, Marchesini G and Dalle Grave R. (2016):** Long-term weight loss maintenance for obesity: a multidisciplinary approach. Diabetes, metabolic syndrome and obesity: targets and therapy, 9: 37–46.
9. **Nilsson PM, Tuomilehto J and Rydén L. (2019):** The metabolic syndrome – What is it and how should it be managed?. European Journal of Preventive Cardiology, 26(2): 33-46.
10. **Pontiroli AE, Zakaria AS and Fanchini, M. (2018):** A 23-year study of mortality and development of co-morbidities in patients with obesity undergoing bariatric surgery (laparoscopic gastric banding) in comparison with medical treatment of obesity. Cardiovasc Diabetol., 17: 161.
11. **Rippe JM and Angelopoulos TJ. (2012):** Obesity: Prevention and Treatment. CRC Press, 435.

12. **Scmhrd SN. (2018):** Metabolic Syndrome: Practice Essentials, Background, Pathophysiology. Journal of Heart and Stroke, 3: 1-4.

13. **Tzoulaki I, Iliou A and Mikros E. (2018):** Paul Elliott. An Overview of Metabolic Phenotyping in Blood Pressure Research. Curr Hypertens Rep., 20: 78.

14. **Woldemariam MM, Evans KD, Butwin AN, Pargeon RL, Volz KR and Spees C. (2018):** Measuring Abdominal Visceral Fat Thickness With Sonography: A Methodologic Approach. Journal of Diagnostic Medical Sonography, 34(2): 91–96.

التغيرات الحادثة في التمثيل الغذائى في الجسم بعد جراحات السمنة

(دراسة مرجعية)

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خلفية البحث: السمنة مشكلة صحية كبيرة تؤثر على الكثير من الناس في جميع أنحاء العالم. يكاد يؤثر على كل عضو في الجسم. قد يعاني الأشخاص الذين يعانون من السمنة المفرطة من السمنة الطرفية مع أمراض المفاصل والركود الوريدي أو السمنة المركزية التي تهيئ لعدد من المشاكل المتعلقة بالوفيات بسبب متلازمة التمثيل الغذائي. وتصنف السمنة إلى الوزن الزائد، والسمنة من الدرجة الأولى، والسمنة المتوسطة الفئة الثانية، والسمنة المرضية والسمنة المفرطة المرضية حسب مؤشر كتلة الجسم. وتصاحب تغييرات التمثيل الغذائي واسعة النطاق علاج السمنة القائم على الجراحة. وبالتالي، يتم إعتماد مصطلح "جراحة التمثيل الغذائي" بشكل متزايد فيما يتعلق بالآثار المفيدة لهذه الإجراءات على الأمراض المزمنة مثل مرض السكري من النوع 2.

الهدف من البحث: مناقشة التغيرات الأيضية التي تحدث في الجسم بعد جراحات السمنة.

الاستنتاج: تحقق جراحة التمثيل الغذائي وتحافظ على التحسينات في ضعف التمثيل الغذائي الثانوي للسمنة. المزيد من الدراسات الآلية ضرورية لتقييم الإمكانات الحقيقية لجراحة التمثيل الغذائي لعلاج عدد لا يحصى من الاضطرابات الأخرى في التمثيل الغذائي وعواقبها من حيث أمراض القلب والأوعية الدموية والسرطان.

الكلمات الدالة: السمنة المفرطة، جراحات السمنه، التغيرات الأيضيه ما بعد الجراحات.