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REVIEW ON DIFFERENT BARIATRIC PROCEDURE WITH POST OPERATIVE PROBLEM AND NUTRITIONAL COMPLICATION IN RATS

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ABSTRACT

Obesity is a progressive metabolic disease that decrease life span of human and associated with a wide range of problems ranging from heart disease and diabetes to infertility and cancer. Loss of weight can significantly help to cure and reduce the chances of future health problems. Approximately nearly 10% body weight loss occur through anti-obesity drugs, but it not confer clinically benefit in patients with a body mass index exceeding 40 kg/m2, for whom bariatric surgery is indicated. The number of bariatric operations increase worldwide in recent few years with the Roux-en-Y gastric bypass (gastric bypass) is the most commonly performed operation. It is important to understand the physiological mechanisms by which gastric bypass induces and maintains body weight loss. The bariatric operations in rat model have not only mimic time profile as well as magnitude of human weight loss but also allow researchers to control post operative critical physiological factors and associated complications. The aim of this article is to summarize and discuss the technical, experimental aspect as well as etiology associated with the risk and benefit of bariatric surgery.

KEYWORDS: Diabetes, bariatric surgery, duodenal switch, gastric banding, obesity.

INTRODUCTION

The aim of this review literature is to focus on bariatric surgery procedure with their pre and postoperative systematic complication for the treatment of diabetes and obesity in adolescents and adults. This study is mainly focused to provide evidence for efficacy, cost- effectiveness, safety and successfully establishment for bariatric technique in relation to current standard therapy for people suffering with obesity and Type 2 diabetes [1].

Obesity is a public health problem and led to the medicalisation. It has been growing over the last 20 to 30 years. It is simply defined as an excess amount of body fat, that is not easily measured due to the large variation in human body composition and their shape [2]. According to the WHO survey report (2006) approximately 2.5 million deaths worldwide reported per year with obesity.

Now a day diabetes especially Type 2 (T2DM) is a major health challenge problem. This is a currently sixth leading death causing agent in developed countries and its prevalence has doubled in the last 20 years. In France its prevalence has increased by 5.7% per year since 2000 and 3.6% of the total population were treated for diabetes in 2005[3]. Prevalence in other European countries is nearly 10%, in the USA it is nearly 14-20%, WHO foresees that nearly 350 million people in all Asian regions suffer world widely with diabetes by 2030.

American Diabetes Association suggest that diabetes mellitus (DM) is a group of metabolic disorder caused by hyperglycemia occurs when defection in insulin action, secretion or both. Type I DM or juvenile-onset is mainly characterized by autoimmune destruction of pancreatic beta cells resulting no production of insulin. Type II DM or adult onset diabetes caused by reduced insulin production with increased cell insulin resistance. The type III DM is known as gestational DM, which caused mainly during pregnancy [4].

When medicalisation, educational, psychological lifestyle and pharmaceutical interventions fail to treat then bariatric surgery term (used to describe the various methods used in weight loss surgery) may be used as a 'last option'[5]. All surgical method work by restricting the food volume intake.

National Health Service (NHS) approves bariatric surgery for obesity and T2D, when all medicinal interventions have failed, similar criteria to the US. The effectiveness of weight loss surgery shown promising results in initial weight loss, further maintenance of weight loss

and health benefits[6-7]. Bariatric surgery requires adjustment in eating practices before and after surgery. After surgery the patient initially takes liquid diet, but when solids food diet begins they must completely chew and slow down to avoid vomiting or discomfort. Patients experience initial rapid weight loss after by slower weight loss [8]. Patients feel early satiety (meaning that they feel full earlier than they would have prior to surgery), and a loss of appetite. In this article, we aim to describe the commonly performed bariatric procedures in terms of basic surgical technique, reported outcomes and complications.

Obesity Statistics

- > 50% overweight = double mortality
- > 50% overweight + DM = 5x mortality [9]

Measurements of Obesity

- Body mass index (BMI) = body weight (g)/length^2 (cm^2). (Rats)
- Body Mass Index = weight / height^2 in kg/m^2). (human)

Based on food and caloric intake, the following nutritional parameters were calculated [10]:

- Energy intake (kJ/day) = mean food consumption × dietary metabolizable energy

Surgical Techniques

Restrictive Procedures Include

- Laparoscopic sleeve gastrectomy (LSG)
- Laparoscopic adjustable gastric band (LAGB)
- Laparoscopic Roux-en-Y Gastric Bypass
- Vertical banded gastroplasty (VBG)

Malabsorptive Procedures Include

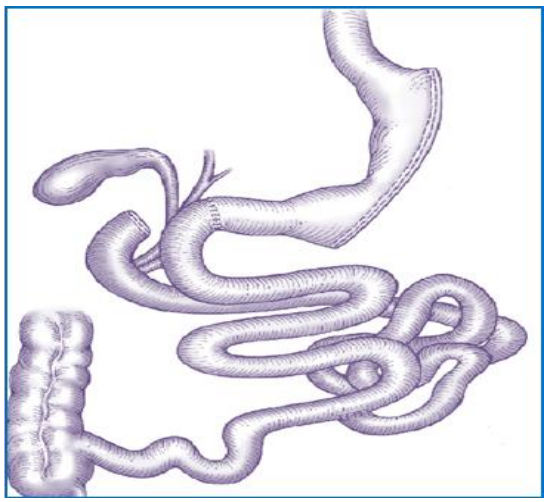
- Bilio-pancreatic diversion (BPD)
- Bilio-pancreatic diversion with duodenal switch (BPD-DS

Bariatric Surgical Preparations

Animals foods were withdraw before 4 to 6 hours prior to the operation. Rats were anesthetized and maintained throughout the procedure with suitable anesthetic agent (isoflurane 2-3% with O2). Midline incisions were performed to get exposure to the gastrointestinal tract. At the end of the bariatric operation, the midline incisions were closed and the mice were recovered on a water-circulated heating pad.[11]

Sleeve Gastrectomy

This is a modified technique of Magen strasse and Mill for rats surgery. Before 4-6 hr to operation Foods were withdrawn. Anesthesia (isoflurane) were given to obese rats the (5% for induction and 3% for maintenance) by rodent surgical mask using a veterinary anesthesia machine containing 100% oxygen tank. Abdomen hairs were completely removed using Trimer machine fallowed by razor. A vertically 4cm midline incision was done in Epigastria region. Rat stomach anatomy is something different from human. The rat esophagus enters a thin walled non-glandular fore stomach, limited from a second thick walled glandular corpus compartment with a fold of tissue forming a limiting ridge (margoplicatus). A sterile tonsil clamp was fix to the greater curvature from the antrum to fundus across the Glandular and fore stomach. The greater curvature approximately 90% of the fore stomach and 70% of the glandular stomach were removed using scalpels. After dividation stomach were closed with 3-0 silk suture (Ethicon, Piscataway, NJ) in three layers making gastric sleeve. The first layer was a running u-stitch under the clamp, the clamp was then removed and a running locked stitch was placed over the u-stitch, followed with a third layer of a simple running stitch over the previous sutures. Sutured areas were washed with 30 mL of normal saline. Abdominal wall were closed in two layers, peritoneum and fascia were closed with 3-0 Vicryl suture (Ethicon, Piscataway, NJ) and the skin were closed with 3-0 Ethilon nylon suture (Ethicon, Piscataway, NJ). To prevent the animals to open their sutures a tissue adhesive (Vetbond, 3M) is used over the outer suture line. Control rats were undergoing to the laparotomy, the stomach were elevated and replaced in position and the abdominal wall then closed as above [12].



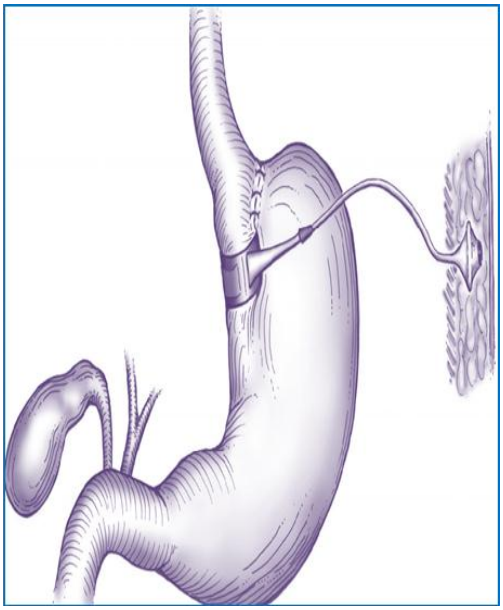
Complications

SG	%
Early	
Leak	3.4[13]
Bleeding	2.4
Stricture	2.4
Death	0.08
Late	
Reflux	23
% EWL<50	33

Adjustable Gastric Band (AGB)

Bioenteric modify the LAP-BAND system in Europe, also they improve this technique to get affordable outcome[14-15]. AGB is medup of a 12 mm wide soft silicone band with a elastic balloon that can be inflated by injection according to the patient condition. Band is fixed at the upper part of the stomach, it dividing into two sections, smaller portion where band form a capacity of about 15–20 ml (pouch), the larger remaining part below the band.

This type of constriction is known as stoma. Main differences of this technique for gastric banding are: By means of a calibration balloon positioned in the stomach, the site of incision is determined at the small curvature. At this site, a 0.5 to 1cm window is placed closed to the cardia. Fenestrations were continued along the posterior wall of the gastro esophageal junction up to the angle of His. The adjustable gastric band makes it possible for the surgeon to alter the stoma diameter.

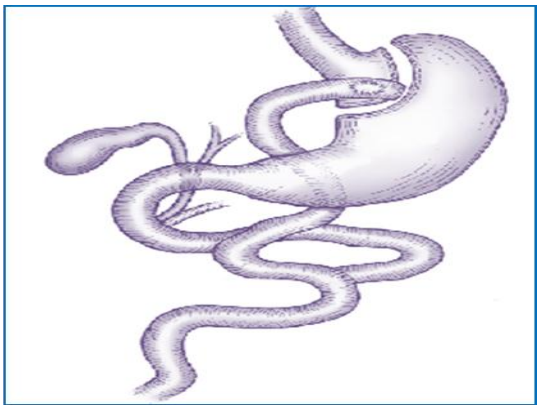


Complication With The Adjustable Gastric and	
Complication	Incidence %
Peri-operative complication	
Fatalities	0-2.1
Stomach wall lesion	0-3.5
Hemorrhage	0.5-2.0
Death	0
Late complication	
Pouch Dilation	
Erosion	0- 4.6
Port or band system complication	0.5-10.4
Wound infection	0-7.7
Ablation	60
Port	8.4
% EWL<50	50

Gastric Bypass (Rygbp)

The anatomy of upper gastrointestinal tract of animal does not allow the replication of the procedure that is used in humans. Scientist developed a new technique that is closely resembles to RYGB by ligating the stomach between the glandular portion and the gastric fundus (fore stomach). The site of Jejunum, 4 cm from the Ligament of Treitz and 6 cm from the site of gastroenterostomy, was transected. The distal portions were anastomosed to the fore stomach using 9-0 Ethilon in a side-to-side style. Gastrointestinal continuity is continued

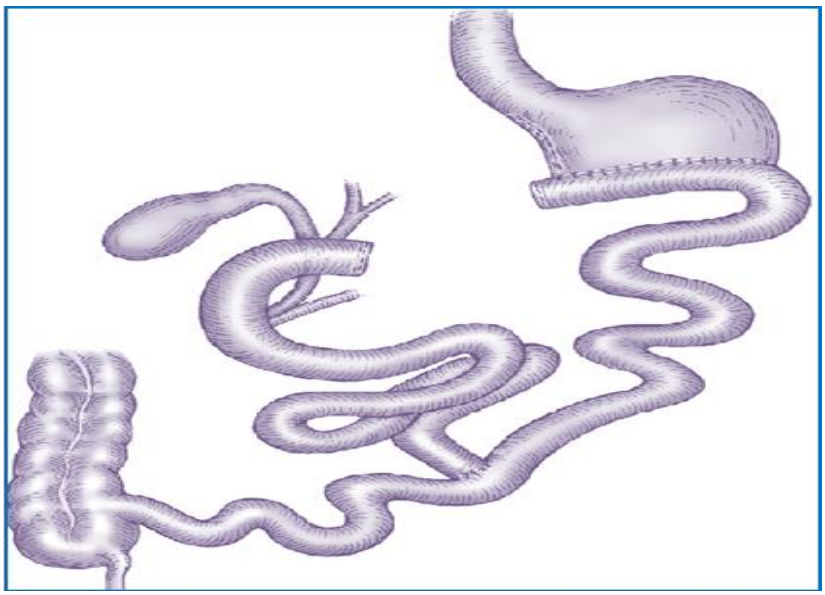
by performing a side-to-side jejuno-jejunostomy, the sham group involved mobilization of the fore stomach and proximal and distal jejunum and ileum without any intersection. [16]



GBP	%
Early	
Leak	3.6
Death	0.2
Late	
Obstruction	3.1
Dumping	13.3
Abdominal pain	9.8
% EWL<50	23

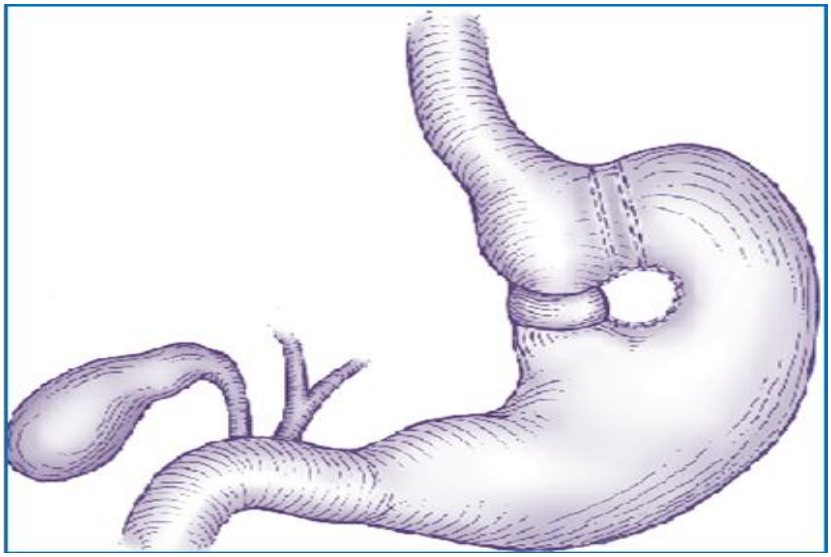
Biliopancreatic Diversion/Duodenal Switch (Bpd/Ds)

The site of jejunum, 4 cm from the Ligament of Treitz and 12 cm from the portion of gastroenterostomy, were transected. The GI distal segments were anastomosed to the greater curvature of the stomach using 10-0 Ethilon in a side-to-side style. GI tract establishments were done by performing side to- side Anastamosis. The results of this procedure are isolation of the duodenum and uppermost segment of the jejunum from the gastrointestinal tract. Unlike the human procedure, the proximal portion of duodenum is ligated at the pyloric-duodenal junction by 6-0 silk, but not to be transected [17].



Vertical Banded Gastroplasty (VBG)

This is a restrictive procedure. The upper part of stomach near the esophagus is vertically stapled for about 6 cm, to make a smaller stomach pouch. The pouch outlet is restricted by a ring or a band that slowing the emptying of food and creates the feeling of fullness[18].



Preliminary experiences are encouraging, but the VBG long term results were disappointing when assessed by the standard criteria.

Bariatric Surgery Model

Model	Number	Success %*	Mortality%**
Banding	12	100	25 (restriction)
Sleeve	14	100	0
RYGB	8	90	100 (obstruction)
BPD	10	90	80 (malnutrition)[19]

* Success, surgical success rate.

**Mortality, mice due to the restriction of banding, obstruction in the site of Anastamosis (RYGB) and severe malnutrition (RYGB, and BPD) two months post-surgery were euthanized.

Nutrition Requirement

Diet Progression

Stage 1: Clear liquids and protein supplement. (1 week)

Stage 2: No concentrated diet, low fat puree diet (3 weeks)

Stage 3: Regular texture weight reduction diet.

Common Post-Operative Nutritional Problems

Dehydration	Protein malnutrition	Food aversions/fears
Food intolerances	Dumping Syndrome	Loss of appetite
"Hibernation " Syndrome	Hair Loss	Food getting "stuck"
Diarrhea	Lactose intolerance	Vitamin/mineral deficiencies
Depression: often caused by frustration around inability to eat for comfort/stress[20]		

Measuring Parameter

Body weight	Liver weight
Oral Glucose Tolerance Test (OGTT)	Biochemistry
Oral d-xylose Loading Test	Food intake
Adipokines Leptin, Adiponectin	Lipid profile LDL, HDL, Cholestrol,TG and FFA
Glucose metabolism markers	
Gut hormones	Insulin level
Fecal Fat Measurement	Mixed-Meal Test
Fecal Energy Density	Plasma Levels of Cytokines[21]

CONCLUSION

Currently Bariatric surgery is only weight loss technique after medicalisation that provides sustained weight loss in morbidly obese and type 2 DM patients. The laparoscopic gastric band, open gastric bypass, sleeve gastrectomy and biliopancreatic diversion-duodenal switch are the main weight loss Surgical procedure currently used worldwide. Each Bariatric technique has its own complication and weight loss profile, but overall they show low mortality and morbidity rates. This observation supports the improvement of type 2 diabetes and obesity after bariatric operations.

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