INTRODUCTION

Bariatric surgery means 'the medicine and surgery of weight' (from the Greek words "baros," meaning "weight," and "iatrikos," meaning "medicine") ***(Buchwald et al., 2004).***

Obesity is defined as, a body mass index (BMI) of 30 kg/m^2 or more. Morbid obesity is defined as a body mass index (BMI) of > 40 kg/m^2 or BMI > 35 kg/m^2 together with obesity-related disease ***(National Institute of Health, 1991).***

Bariatric surgery is the only effective means of achieving long-term weight loss in the morbidly obese. A burgeoning medical and surgical literature supports its rapid adoption (***Buchwald et al., 2004).***

Non-surgical approaches to treatment of clinically severe obesity include various combinations of low- or very low-calorie diets, behavioral modification, exercise, and pharmacologic agents. In addition to weight reduction regimens, co-morbid factors such as diabetes mellitus, hypertension and dyslipidaemia, can be treated by usual medical methods. Non-surgical treatment of clinically severe obesity aims to create a caloric deficit sufficient to result in both permanent weight loss and reduction of weight-related risk factors or co-morbidity. These methods have limited success in achieving sustained weight loss. Therefore the National Institutes of Health established guidelines for the surgical therapy of morbid obesity, now referred to as bariatric surgery (***National Institute of Health, 1991).***

Bariatric surgical procedures reduce caloric intake by modifying the anatomy of the gastrointestinal tract. These operations are classified as either restrictive or malabsorptive. Restrictive procedures (e.g. vertical banded gastroplasty, or vertical sleeve gastrectomy) limit intake by creating a small gastric reservoir with a narrow outlet to delay emptying. Malabsorptive procedures (e.g. biliopancreatic diversion with duodenal switch) bypass varying portions of the small intestine where nutrient absorption occurs. Roux-en-Y gastric bypass is often referred to as a combination restriction–malabsorption procedure. Open and laparoscopic techniques, have been described ***(DeMaria et al., 2005).***

Co-morbidities including diabetes mellitus, hypertension, dyslipidaemia, obstructive sleep apnoea and the quality of life improve in the vast majority of patients at 1-2 years following Roux-en-Y gastric bypass, gastric banding and biliopancreatic diversion with duodenal switch ***(Angrisani et al., 2007).***

Surprisingly, found that Roux-en-Y gastric bypass leads to long-term remission of type 2 diabetes (no treatment, normal HbA_{1c} levels). Typically, type 2 diabetes mellitus improves within days after surgery for Roux-en-Y gastric bypass and biliopancreatic diversion with duodenal switch, long before significant weight loss has occurred. With gastric banding, improvement is proportional to weight loss and is, therefore, slower ***(Dixon et al., 2005).***

Remission rates for type 2 diabetes mellitus at 2 years were 83 % for roux-en-Y gastric bypass and 47 % for banding (***Buchwald et al., 2004).***

The mechanism of remission of type 2 diabetes mellitus is being keenly researched. Improvement in insulin resistance may be due to weight loss *per se* and production of incretins including GLP-1 (increasing insulin secretion), or changes in gut hormones due to foregut bypass ***(Hickey et al., 1998).***

The debate about which operation is best will continue for some years and other operations are likely to evolve. Choice of procedure seems to be driven by local culture, surgeon and patient preference and knowledge of risk versus benefit (***Courcoulas, 2005).***

A decision for surgical therapy should be reached only after assessment of the probability that the patient will be able to tolerate surgery without excessive risk and to comply adequately with the postoperative regimen. The operation should be carried out by a surgeon substantially experienced with the appropriate procedures and working in a clinical setting with adequate support for all aspects of perioperative management and assessment to have a reasonable chance of being both safe and successful ***(McMahon et al., 2006).***

The mortality rate associated with bariatric surgery is about 0.1% to 2.0%. Nonfatal perioperative complications include venous thromboembolism, anastomotic leaks, wound infections, bleeding, incidental splenectomy, incisional and internal hernias, and early small-bowel obstruction ***(Sjostrom et al., 2004).***

Postoperative gastrointestinal complications of bariatric surgery are common. Nausea and vomiting occur in more than 50% of patients undergoing restrictive procedures. Dumping syndrome, Deficiencies of iron, calcium, folate, vitamin B_{12}, and other nutrients occur after procedures with a component of malabsorption ***(McMahon et al., 2006)*****.**

AIM OF THE WORK

Aims at discussing the history and the aim of weight reduction surgery, and the different types of bariatric surgery operations.

Chapter 1:

ANATOMY OF THE STOMACH AND SMALL INTESTINE

ANATOMY

1-The stomach:

The stomach is the most dilated part of the digestive tube, and is situated between the end of the esophagus and the beginning of the small intestine ***(Mc Minn, 2003).***

The shape and position of the stomach are so greatly modified by changes within itself and in the surrounding viscera that no one form can be described as typical (Fig 1) ***(Susan et al., 2008)***.

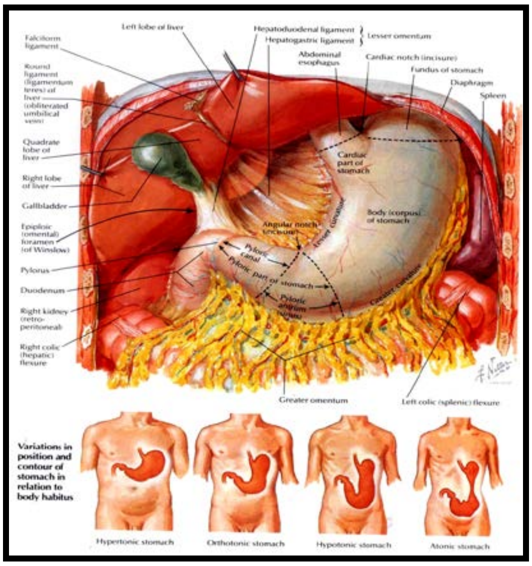

Figure (1): Stomach in Situ (***Netter, 2002).***

The lesser curvature gives attachment to the two layers of the hepatogastric ligament, and between these two layers are the left gastric artery and the right gastric branch of the hepatic artery ***(Snell et al., 2004).***

The main parts of the stomach are the fundus, body and pyloric part, with the greater and lesser curvatures forming the left and right borders respectively. The stomach is completely invested by peritoneum, which passes in a double layer from the lesser curvature to the liver as the lesser omentum, and hangs down from the fundus and greater curvature as the greater omentum ***(Chummy, 2010).***

The fundus is the part which projects upwards above the level of the cardia, and is in contact with the left dome of the diaphragm. It is usually full of swallowed air ***(Chummy, 2010).***

The largest part of the stomach is the body, extending from the fundus to the notch, the angular incisures, on the lower part of the lesser curvature. Variable amounts of the body will be above and below the costal margin, in contact with the diaphragm and anterior abdominal wall. Likewise the lowest part of the greater curvature may be above or below umbilical level ***(Chummy, 2010).***

Relations of the stomach

Antero-superior Surface, The left half is in contact with the diaphragm, which separates it from the base of the left lung, the pericardium, and the seventh, eighth, and ninth ribs, and intercostal spaces of the left side. The right half is in relation with the left and quadrate lobes of the liver and with the anterior abdominal wall. When the stomach is empty, the transverse colon may lie on the front part of this surface. The whole surface is covered by peritoneum ***(Neil Borley, 2005)***.

The Postero-inferior Surface is in relation with the diaphragm, the spleen, the left suprarenal gland, the upper part of the front of the left kidney, the anterior surface of the pancreas, the left colic flexure, and the upper layer of the transverse mesocolon. These structures form a shallow bed, the stomach bed, on which the viscus rests. The transverse mesocolon separates the stomach from the duodenojejunal flexure and small intestine. The postero-inferior surface is covered by peritoneum, except over a small area close to the cardiac orifice; this area is limited by the lines of attachment of the gastrophrenic ligament, and lies in apposition with the diaphragm, and frequently with the upper portion of the left suprarenal gland ***(Snell, 2004)***.

A plane passing through the incisura angularis on the lesser curvature and the left limit of the opposed dilatation on the greater curvature divides the stomach into a left portion or body and a right or pyloric portion. The left portion of the body is known as the funds, and is marked off from the remainder of the body by a plane passing horizontally through the cardiac orifice. The pyloric portion is divided by a plane through the sulcus intermedius at right angles to the long axis of this portion; the part to the right of this plane is the pyloric antrum ***(Neil Borley, 2005).***

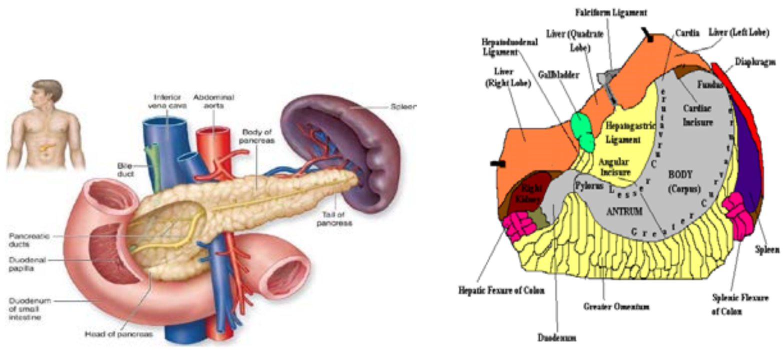

Figure (2): Relations of the stomach

The angle of His is the acute angle created between the cardia at the entrance to the stomach, and the esophagus. It forms a valve, preventing reflux of duodenal bile, enzymes and stomach acid from entering the esophagus, where they can cause inflammation. The angle is created by the collar sling fibers and the circular muscles around this (gastro-esophageal) junction ***(Chummy, 2010).***

The gastric glands are lined with different types of epithelial cells, depending upon their location in the stomach. There are also endocrine cells present in the gastric glands. Throughout the stomach, the carpet consists primarily of mucus-secreting surface epithelial cells (SECs) that extend down into the gland pits for variable distances. These cells also secrete bicarbonate and play an important role in protecting the stomach from injury due to acid, pepsin, and/or ingested irritants. In fact, all epithelial cells of the stomach (except the endocrine cells) contain carbonic anhydrase and are capable of producing bicarbonate ***(Bloom et al., 1975).***

In the cardia, the gastric glands are branched and secrete primarily mucus and bicarbonate, but not much acid. In the fundus and body, the glands are more tubular and the pits are deep. Parietal and chief cells are common in these glands. Histamine-secreting enterochromaffin-like (ECL) cells and somatostatin-secreting D cells are also found. Parietal cells secrete acid and intrinsic factor into the gastric lumen, and bicarbonate into the intercellular space. Arguably, parietal cells produce the only truly essential substance produced by the stomach (i.e., intrinsic factor). Parietal cells tend to occupy the midportion of the gastric glands found in the corpus of the stomach ***(Bloom et al., 1975).***

Chief cells (also called *zymogenic cells*) secrete pepsinogen I, which is maximally activated at a pH of 2.5. They tend to be clustered toward the base of the gastric glands and have a low columnar shape. When stimulated, the chief cells produce two immunologically distinct proenzyme forms of pepsinogen: predominantly pepsinogen I and some pepsinogen II, most of which is produced by SECs. These proenzymes are activated in an acidic luminal environment ***(Bloom et al., 1975).***

In the antrum, the gastric glands are again more branched and shallow, parietal cells are rare, and gastrin-secreting G cells and somatostatin-secreting D cells are present. A variety of hormone-secreting cells are present in various proportions throughout the gastric mucosa. Histologic analysis suggests that in the normal stomach, 13% of the epithelial cells are oxyntic (parietal) cells, 44% are chief (zymogenic) cells, 40% are mucous cells, and 3% are endocrine cells. In general, the antrum produces gastrin but not acid, and the proximal stomach produces acid but not gastrin ***(Bloom et al., 1975).***

The circular pyloric constriction on the surface of the stomach usually indicates the location of the pyloric sphincter and is often marked by a prepyloric vein of Mayo crossing the anterior surface vertically downwards. Proximally, it merges into the gastric antrum without a definite external boundary; distally, it ends abruptly at the thin-walled duodenum ***(Skandalakis et al., 2006).***

Blood supply:

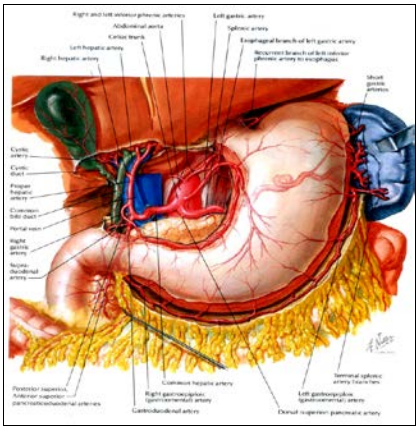

Figure (3): The stomach and its arterial supply ***(Netter, 2002).***

Left Gastric Artery:

In approximately 90% of individuals, the left gastric artery is a branch of the celiac axis. However, it may arise as an independent unit from the common hepatic artery, splenic artery, aorta, or superior mesenteric artery. In 4% of individuals, it arises from a splenic artery; in 3%, it has a direct aortic origin; in 2%, the left gastric is a branch of a hepatic artery**.** The left gastric artery travels up and to the left retroperitoneally to the proximal one-third of the lesser curvature of the stomach. Here, in approximately 95% of cases, it provides esophageal branches. It may give origin (in 24% of cases) to an aberrant left hepatic branch from which the esophageal and cardioesophageal arteries often arise ***(Skandalakis et al., 2004).***

Along the lesser curvature, it anastomoses with the right gastric artery forming arcade. This arcade gives off delicate branches to the lesser curve but most of its bigger branches pierce the seromuscular coat anteriorly and posteriorly to join the submucous vascular plexus of the stomach ***(Cuschieri, 2002)*****.**

Right Gastric Artery:

The right gastric artery is a small branch that arises most commonly from the proper hepatic artery (50% to 68%), left hepatic artery (28.8% to 40.5%), common hepatic (3.2%), or other, less frequent, sources. It gives origin to one or more suprapyloric branches. Anterior and posterior branches from these anastomose with infrapyloric vessels, and, with the supraduodenal artery, supply the distal gastric unit (e.g., the antrum, pyloric canal, and the first inch of the first part of the duodenum). The right gastric artery passes along the lesser curvature for approximately 4 to 6 cm before anastomosing with the left gastric artery ***(Skandalakis et al., 2004).***

Right Gastroepiploic Artery:

The right gastroepiploic artery originates from the gastroduodenal artery behind the first part of the duodenum, anterior to the head of the pancreas. It passes inferiorly towards the midline between the layers of the gastrocolic omentum. It lies inferior to the pylorus and then runs laterally along the greater curvature. It ends by anastomosing with the left gastroepiploic artery. It is adjacent to the pylorus but, more distally, lies 2 cm from the greater curvature of the stomach. Gastric branches ascend onto the anterior and posterior surfaces of the antrum and lower body of the stomach while epiploic branches descend into the greater omentum. It also contributes to the supply of the inferior aspect of the first part of the duodenum ***(Susan et al., 2008).***

It occasionally arises from the superior mesenteric artery or from the anterior superior pancreaticoduodenal artery. Before entering the gastrocolic ligament it gives off infrapyloric branch. For omental viability during distal gastrectomy, the right gastro-omental artery should be preserved by one of the following methods: ligating its gastric branches close to the stomach wall, ligating the anterior omental, or ligating the right gastro-omental distal and close to the origin of the right omental ***(Skandalakis et al., 2004).***

Left Gastroepiploic Artery:

The left gastroepiploic artery arises from the splenic artery as its largest branch near the splenic hilum. It runs anteroinferiorly between the layers of the gastrosplenic ligament and into the upper gastrocolic omentum. It lies between the layers of peritoneum close to the greater curvature, running inferiorly to anastomose with the right gastro epiploic artery. It gives off gastric branches to the fundus of the stomach through the gastrosplenic ligament and to the body of the stomach through the gastrocolic omentum. These are necessarily longer than the gastric branches of the right gastroepiploic artery and may be 8-10 cm long. Epiploic (omental) branches arise along the course of the vessel and descend between the layers of the gastrocolic omentum into the greater omentum. A particularly large epiploic branch commonly originates close to the origin of the left gastroepiploic artery, descends in the lateral portion of the greater omentum and provides a large arterial supply to the lateral half of the omentum ***(Susan et al., 2008).***

Short Gastric Arteries:

Approximately five to seven short gastric arteries arise from the terminal branches of the splenic artery or from the left gastro-omental artery. They may appear to emerge from the substance of the spleen at its hilum, having arisen from terminal splenic branches within the organ. The short gastric vessels provide arterial blood supply of the fundus and upper part of the body of the stomach ***(Skandalakis et al., 2004).***

Posterior Gastric Artery:

A distinct posterior gastric artery may occur. When present, it arises from the splenic artery in its middle section posterior to the body of the stomach. It ascends behind the peritoneum of the lesser sac towards the fundus. It reaches the posterior surface of the stomach in the gastrophrenic fold ***(Susan et al., 2008).***

Venous drainage:

The gastric veins parallel the arteries in position and course. The right and left gastric veins drain into the portal vein; the short gastric veins and left gastro-omental veins drain into the splenic vein, which joins the superior mesenteric vein (SMV) to form the portal vein. The right gastro-omental vein empties in the SMV. A prepyloric vein ascends over the pylorus to the right gastric vein. Because this vein is obvious in living persons, surgeons use it for identifying the pylorus ***(Moore and Dalley, 2006).***

2– Duodenum:

The adult duodenum is C shaped, 20-25 cm long and is the shortest, widest and most predictably placed part of the small intestine. The head and uncinate process of the pancreas lie within the concavity of the C (Fig 4). The duodenum lies entirely above the level of the umbilicus and is described as having four parts ***(Susan et al., 2008).***

First Part (Superior):

About 5 cm long. The proximal half is mobile; the distal half is fixed. The duodenum passes upward from the pylorus to the neck of the gallbladder. The initial 2.5 cm is freely movable and is covered by the same two layers of peritoneum that invest the stomach. The hepatoduodenal portion of the lesser omentum attaches to the superior border of the duodenum; the greater omentum attaches to its inferior border. The distal 2.5 cm is covered with peritoneum only on the anterior surface of the organ, so that the posterior surface is in intimate contact with the bile duct, the portal vein, and the gastroduodenal artery ***(Skandalakis et al., 2004).***

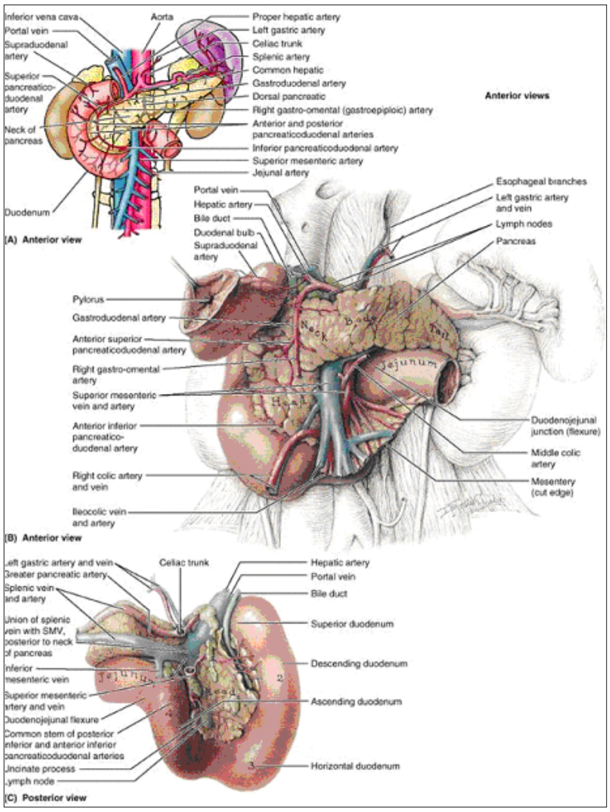

Figure (4): Duodenum; blood supply & relations (***Moore & Dalley, 2006).***

Second Part (Descending):

About 7.5 cm long. The parts above and below the attachment of the transverse colon are covered with visceral peritoneum. At about the midpoint of the second part of the duodenum, the pancreaticobiliary tract opens into its concave posteromedial side ***(Skandalakis et al., 2004).***

The terminal portion of the common bile duct passes through the duodenal wall; it is about 1.5 cm in length, and narrows from 1.0 cm extramurally to 0.5 cm at the papilla. The main pancreatic duct enters the duodenum caudal to the bile duct, also decreasing in diameter. The papilla of Vater is a nipple-like formation and projection of the duodenal mucosa through which the distal end of the ampulla of Vater passes into the duodenum. The ampulla of Vater, with its several formations, is the union of the pancreaticobiliary ducts. The major papilla is on the posteromedial wall of the second (descending) portion of the duodenum to the right of the second or third lumbar vertebra ***(Skandalakis et al., 2004).***

Third Part (horizontal):

The third part of the duodenum is about 10 cm long. Peritoneum covers the lower portion of the anterior aspect and is reflected anteriorly to form the posterior layer of the origin of the small bowel mesentery. The anterior surface of the left lateral end, close to the junction with the fourth part, is also covered with peritoneum ***(Susan et al., 2008).***

Fourth Part (Ascending):

About 2.5 cm long. It ends at the duodenojejunal junction to the left and at the level of the second lumbar vertebra at the root of the transverse mesocolon. The main trunk of the inferior mesenteric vein lies either posterior to the duodenojejunal flexure or beneath the adjacent peritoneal fold (The duodenojejunal flexure is a useful landmark to locate the vein radiologically or surgically). The duodenojejunal junction is suspended by the ligament of Treitz, a remnant of the dorsal mesentery, which extends from the duodenojejunal flexure to the right crus of the diaphragm ***(Skandalakis et al., 2004).***

The suspensory muscle (ligament) of Treitz is a fibromuscular band that arises from the right crus of the diaphragm and inserts on the upper surface of the duodenojejunal flexure. It passes posterior to the pancreas and the splenic vein, and anterior to the left renal vein ***(Skandalakis et al., 2004).***

Blood Supply of the duodenum:

The main vessels supplying the duodenum are the superior and inferior pancreaticoduodenal arteries. The first and second parts also receive contributions from several sources including the right gastric artery, the supraduodenal artery, the right gastroepiploic artery, the hepatic artery and the gastroduodenal artery. Branches of the superior pancreaticoduodenal artery may contribute to the supply of the pyloric canal, with some anastomosis in the muscular layer across the pyloroduodenal junction ***(Susan et al., 2008).***

Gastroduodenal artery:

The gastroduodenal artery arises from the common hepatic artery behind, or sometimes above, the first part of the duodenum. It descends between the first part of the duodenum and the neck of the pancreas, immediately to the right of the peritoneal reflection from the posterior surface of the first part. At the lower border of the first part of the duodenum it divides into the right gastroepiploic and superior pancreaticoduodenal arteries. Before its division the lowest part of the artery gives