



FOCUS ON: BARIATRICS

Bariatric surgery: techniques, outcomes and complications

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S U M M A R Y

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Bariatric or weight loss surgery is the only treatment for morbid obesity that confers definitive weight loss at long-term follow-up. In addition to weight reduction there is a strong possibility of amelioration or even cure of various co-morbid conditions associated with obesity such as Type II diabetes mellitus, obstructive sleep apnoea, hypertension, asthma, osteoarthritis and gastro-oesophageal reflux disease.

Laparoscopic bariatric surgery is now the gold standard technique in weight loss surgery with the Roux-en-Y Gastric Bypass, Adjustable Gastric Band and Sleeve Gastrectomy being the commonly performed surgeries in Europe, United States and Australia.

This review aims to outline the technique, efficacy and complications of these procedures as well as outline the less commonly performed though highly efficacious Bilio-pancreatic Diversion and Duodenal Switch. For the maximal benefit of any of the above weight loss surgeries it is essential the management of these patients be within a multi-disciplinary team (MDT) setting. Indeed it is the vital contributions of the anaesthesiologists, dietitians, clinical psychologists and diabetologists as well as technically sound surgery that ensures a successful outcome from bariatric surgery.

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1. Introduction

Obesity is currently a major healthcare concern in the Western world, and is also increasingly affecting the populations of the developing world. The World Health Organisation (WHO) estimates that 1 billion people in the world are currently overweight (BMI 25–30 kg/m²) and another 300 million to be obese (BMI ≥30 kg/m²). Morbid obesity is defined as a BMI ≥40 kg/m².

Obesity has a well-known association with coronary heart disease (CHD), hypertension, diabetes mellitus (DM), dyslipidaemia, obstructive sleep apnoea (OSA) and cancer. The relationship of central obesity with the Metabolic Syndrome (Syndrome X) is recognised and well described. Patients seen in bariatric surgery clinics not only have Type II DM, hyperfibrinogenaemia and dyslipidaemia but may also have non-alcoholic steatotic hepatitis (NASH) which may progress to cirrhosis. Morbid obesity is also associated with polycystic ovary syndrome (PCOS) and hence subfertility. The raised intra-abdominal pressure associated with being morbidly obese may also contribute to gastro-oesophageal

reflux disease (GORD), genuine stress incontinence (GSI) and venous stasis.

The 2002 WHO report attributes 58% of cases of Type II DM, 21% of cases of CHD and up to 42% of certain cancers to the obesity epidemic.¹ In the United States, 20% of the population are obese and it is estimated that \$140 billion per annum is directed to managing obesity-related disease. Obesity is also increasingly affecting the adolescent population. Studies looking at long-term follow-up (>50 years) of these patients have shown an increased incidence of both cardiac and cerebrovascular disease, as well as an increase in colorectal cancer mortality.

Drug therapy along with various diet and exercise programmes targeted at reducing obesity, have not proved effective in achieving long-term weight reduction. Medical therapy is associated with only 10% weight loss and is limited not only by poor efficacy but also by drug side effects. These medications include the serotonin noradrenaline re-uptake inhibitor, Sibutramine (Reductil) which reduces appetite and the pancreatic lipase inhibitor, Orlistat (Xenical), which inhibits 30% of fat absorption resulting in oily stools and fat-soluble vitamin deficiencies.^{2–4} Rimonabant (Acomplia), an anorectic obesity drug that works by selective blockade of the cannabinoid receptor (CB-1), has been suspended from the UK market since October 2008, amid concerns over exacerbation of depression and increased suicide risk.⁵

Bariatric (obesity) surgery refers to the variety of surgical procedures employed for achieving weight loss. It involves modification of

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the gastrointestinal tract to either reduce volume and/or absorptive capacity. Bariatric surgery also affords dramatic long-term improvement or complete remission of any existing co-morbidity with a decrease in onset of new co-morbidity.^{6,7} Bariatric surgery has been shown in the Swedish Obesity Surgery (SOS) trial to improve quality of life and to decrease mortality compared to non-surgical controls.⁸

In 2007 in the USA, over 240,000 bariatric surgeries were performed compared to 18,000 in 1994. In the UK we are mirroring the obesity epidemic in the US and hence the increasing availability of bariatric surgery services. Indeed, it has been estimated that England will have the third highest rate of obesity by 2025 with over 50% of the population having a BMI >30 kg/m².⁹ Consequently, there is a need that as the obesity epidemic continues, surgeons acquire the necessary advanced laparoscopic skills to perform bariatric surgery and meticulous attention be paid to the pre-operative and post-operative care of the bariatric patient. Also, there is an increased need for dedicated health professionals such as anaesthetists to develop a specialist interest in bariatric surgery. In this article, we aim to describe the commonly performed bariatric procedures in terms of basic surgical technique, reported outcomes and complications.

2. Indications and contra-indications

The currently accepted indications for bariatric surgery in the UK, as recommended by the National Institute for Clinical Excellence (NICE), are based on the US 1991 National Institutes of Health (NIH) Consensus Statement.¹⁰ Bariatric surgery should be offered to patients with a BMI ≥40 kg/m² alone or ≥35 kg/m² if associated with serious co-morbid conditions such as DM, OSA or CHD, when 6 months of medical treatment or lifestyle change have failed to produce and sustain adequate weight loss. Surgery may be proposed in the first instance if patients are super-obese (BMI ≥50 kg/m²). The surgery should be performed in specialist centres by experienced surgeons in multi-disciplinary clinical settings. Pre-operative as well as comprehensive post-operative management with lifelong medical surveillance should be available. Contra-indications to bariatric surgery include patients considered very high or unacceptable anaesthetic risk, untreated major depression or psychosis, alcohol or drug abuse, advanced liver disease or inability to comply with post-operative medical, nutritional and psychological assessments. Age *per se* is not a contra-indication to surgery with evidence for good outcomes in patients over 60 years of age.¹¹

3. Bariatric surgical procedures

The field of bariatric surgery has developed quickly over the last 30 years with the laparoscopic technique evolving since the mid-1990s. The rationale for the laparoscopic approach exists as for other forms of surgery. There is a decreased incidence of post-operative wound infection, dehiscence and incisional hernia, reduced blood loss, faster recovery to daily activities and reduced hospital stay compared to the equivalent open procedure.¹²

Bariatric surgical techniques can be divided into restrictive, malabsorptive or combined restrictive/malabsorptive procedures.

Restrictive procedures include

- laparoscopic adjustable gastric band (LAGB),
- laparoscopic sleeve gastrectomy (LSG)
- vertical banded gastroplasty (VBG).

Malabsorptive procedures include

- bilio-pancreatic diversion (BPD)
- bilio-pancreatic diversion with duodenal switch (BPD-DS).

The laparoscopic Roux-en-Y gastric bypass (LRYGB) is considered a combination of both restriction and mild mal-absorption.

The choice of procedure for any given patient is made on an individual basis, and relates to patient BMI and desired excess weight loss (EWL), eating behaviour, co-morbidities and previous surgical history.

Thorough pre-operative preparation of the morbidly obese patient by the MDT is essential to achieve good outcomes from bariatric surgery. Co-morbid conditions such as hypertension, DM, OSA must be optimised prior to surgery. Further information on pre-operative assessment and work-up can be found in the article by O'Neill and Allam.¹³ Prior to surgery, patients may be assessed by a clinical psychologist and may require counselling, in addition to education on diet alteration and advice to stop smoking. Venous thrombo-embolism (VTE) accounts for the majority of deaths in patients undergoing bariatric surgery hence the importance of intermittent pneumatic compression stockings peri-operatively and prophylactic low molecular weight heparins (e.g. enoxaparin 40 mg SC bd) which should be continued for 2–4 weeks post-operatively depending on individual VTE risk. Patients must be prepared for frequent clinic follow-up, band adjustments in the case of LAGB surgery, the need for long-term vitamin and/or mineral supplementation (for LRYGB, BPD and BPD-DS patients), an alteration in eating habits and the possible need for re-operation.

4. Laparoscopic adjustable gastric band insertion

The laparoscopic adjustable gastric band (LAGB) has now superseded the VBG (also known as the Mason procedure or 'stomach stapling') as the favoured restrictive bariatric surgical technique. The LAGB is currently the most commonly performed bariatric procedure in Europe and Australia.

The gastric band is an implantable device made up of 2 parts; a round silicone band with an inflatable cuff that sits around the cardia and a reservoir that is placed over the fascia of the abdominal wall (Fig. 1). The components are connected by silicone tubing, to allow addition or removal of saline via the subcutaneous reservoir to adjust the cuff size and therefore the degree of gastric restriction.

Anatomically, the gastric band is placed just below the gastro-oesophageal junction (GOJ) around the gastric cardia, creating a 10–15 ml gastric pouch. The band forms a stoma of about 12 mm in diameter and works by reducing the rate of food entry, with stretching of the stomach wall leading to early satiety through signals transmitted via the nucleus tractus solitarius to the appetite centres in the hypothalamus thus reducing appetite. Maintenance of satiety is thought to be dependent on maintenance of the 15 ml gastric pouch and stoma restriction. The LAGB is fully reversible, as there is no anatomical alteration to the bowel. Average operating time is 45–60 min and it may be performed as a day case but usually involves overnight hospital stay. Most patients can return to work within 3–5 days.

4.1. Surgical technique

The technique of LAGB can be broadly divided into 5 key steps;

- i) Port placement
- ii) Division of the gastro-hepatic ligament (*pars flaccida*) and exposure of the right crus
- iii) Full mobilisation of the Angle of His
- iv) Reduction and repair of all hiatus hernia
- v) Insertion and fixation of the band

After appropriate port placement, the procedure is commenced by division of the *pars flaccida*, identification of the inferior part of

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