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Laparoscopic adjustable gastric banding

Effects, side effects and challenges

Background

The laparoscopic adjustable gastric band is a useful tool in the treatment of severe obesity. It is a safe and durably effective procedure, however, optimal results depend upon the patient participating in a process of lifelong care.

Objective

This article discusses the procedure, follow up, and late complications for laparoscopic adjustable gastric banding. It also provides the general practitioner with 'alert' symptoms and signs of when to contact the treating surgeon.

Discussion

Lifelong care involves counselling about food choices and eating patterns, as well as adjustment of the device. The delivery of this care usually involves a multidisciplinary team. Patients should not be offered surgery unless a process for continuing care is in place. Late complications of laparoscopic adjustable gastric banding are relatively common; however, they can be readily treated in most cases, with weight loss continuing. Symptoms of volume reflux, nocturnal aspiration, dysphagia, regular regurgitation and vomiting may alert the primary care GP to complications. Abdominal pain along with any of these symptoms may suggest an acute complication, but other causes of abdominal pain should also be considered, depending on the clinical scenario.

■ **Obesity is a common and significant health problem in Australia. In 2008, an estimated 3.71 million (17.5%) Australians were obese – 1.76 million (16.5%) males and 1.95 million (18.5%) females.¹ These estimates were 14.5% higher than 2005 estimates.**

Obesity is now second only to smoking as a preventable cause of death, accounting for 14% of all deaths in the United States of America.^{2,3} Sustained weight loss of 10% reduces obesity related mortality, in particular deaths caused by ischaemic heart disease and diabetes,^{4,5} therefore weight loss has the potential to be one of the most powerful therapeutic interventions available in clinical medicine today.

Obesity is a result of caloric intake in excess of energy expenditure, and in simple terms, any effective treatment only needs to reverse this equation. Yet obesity is proving difficult to treat and to prevent, with most programs resulting in little or no weight loss.⁶

Laparoscopic adjustable gastric banding (LAGB) is currently the most popular surgical treatment for obesity in Australia. It leads to weight loss in excess of conservative programs with significant improvement in health and quality of life.^{7,8} Medium term results are equivalent to other more morbid bariatric procedures (*Table 1*), and the procedure appears to be cost effective.⁹ More than 13 000 LAGBs were placed in Australia in 2008, a 10-fold increase since 2000.¹⁰

Operative procedure

The LAGB is an adjustable silicone band that is placed laparoscopically around the upper stomach (*Figure 1*). Laparoscopic access is improved by preoperative weight loss reducing central adiposity.¹¹ Patients are in hospital for the day or overnight, and time off work is typically 5–10 days.

Laparoscopic adjustable gastric band placement is a safe procedure. The Centre for Bariatric Surgery in Melbourne, Victoria, has treated



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Figure 1. The normal appearance and position of the LAGB. The laparoscopic adjustable gastric band is placed 1 cm below the oesophago-gastric junction. It is lined by a balloon that is connected via tubing to a subcutaneous port that allows the amount of fluid within the band to be easily changed



over 5000 patients without a death, and a systematic review of all the published literature has confirmed a very low risk of perioperative death (0.05%) or complications (2.6%), one-tenth of the risk of gastric bypass.¹²

Follow up

Laparoscopic adjustable gastric banding appears to work by inducing satiety.¹³ The precise mechanisms underlying this effect are not yet well delineated. It does not appear that food is simply held up in the upper stomach, rather, it is more likely that complex neural and humoral pathways of satiety are modified by the presence of the band. Typically, patients can expect to lose 50–60% of their excess weight, usually over a 12–24 month period.¹⁴ At the Centre for Bariatric Surgery we aim for a rate of weight loss of 0.5–1.0 kg/week.

The stoma of the band is adjusted by injecting saline into a subcutaneous port (*Figure 2*). This is a simple procedure that is most often performed in the office. The decision to adjust the band is based upon the patient's sensation of satiety and rate of weight loss (*Figure 3*). When the band has the appropriate amount of fluid within it, the patient will be satisfied by small amounts of food and weight loss occurs.

Patients who have an optimally adjusted band should be able to eat a good variety of foods, as long as they chew well and eat slowly. They should avoid foods such as doughy bread and dry meats as these textures pass with difficulty through the band. Most patients will only feel like eating 2–3 times a day, and we encourage patients to only eat when they are genuinely hungry. The ability to eat a good variety of foods, with no malabsorption, means that there are few nutritional problems following this surgery, however multivitamin and iron supplementation is recommended. A detailed educational program including a comprehensive patient information book¹⁵ should be provided to each patient.

Figure 2. Adjustability of the LAGB. The gastric band is adjusted by injecting saline into a port with a non-coring (Huber) needle. The stoma size can be increased or decreased according to symptoms and satiety

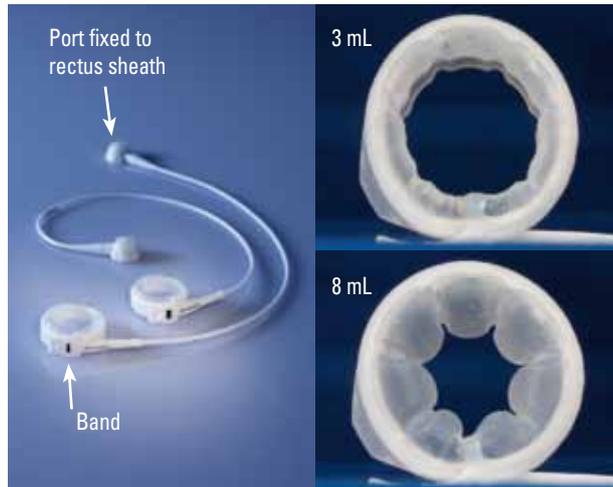
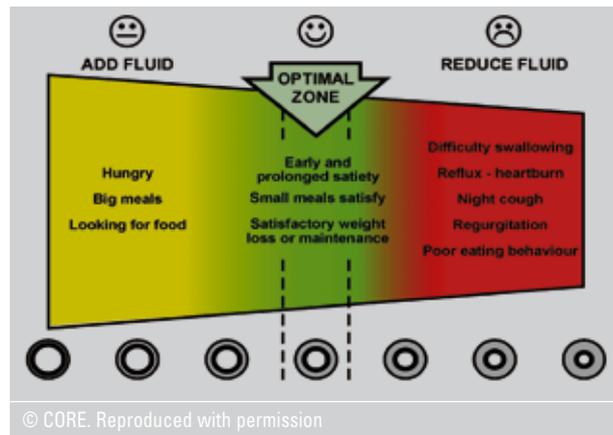


Figure 3. When to adjust the LAGB

- When there is inadequate fluid within the band the patient is hungry and seeking food (yellow). Fluid needs to be added
- When there is too much fluid within the band the patient has heartburn, reflux and is unable to tolerate a solid diet (red). Fluid needs to be removed
- When the band is optimally adjusted the patient is satisfied with 2–3 small meals a day, eating good solid food and maintains good weight loss without adverse symptoms



The need for device adjustment, education about food choices, exercise and eating style, as well as the need to monitor for nutritional and device related complications, makes the LAGB a process, not just a procedure. A multidisciplinary approach is the most practical way to meet all these patient needs, both in terms of skill set and work load management.

The multidisciplinary team includes the surgeon, general practitioner, nurse, dietician and psychologist. It is imperative that these health professionals are trained in the special needs of the LAGB patient as there are unique aspects to the post LAGB patient's care which requires specific training. Long term contact must be maintained, as there is a foreign body in situ with potential for future complication and failure.

Table 1. Summary of bariatric operations¹⁹

Operation	Mechanism of action	1 year % EWL	5 year % EWL
LAGB	<ul style="list-style-type: none"> • Induction satiety • Restriction 	43.0 (n=11)	57.9 (n=5)
Roux-en-Y gastric bypass	<ul style="list-style-type: none"> • Altering gut hormones • Restriction • Possibly malabsorption 	65.2 (n=7)	58.2 (n=3)
Biliopancreatic diversion	<ul style="list-style-type: none"> • Malabsorption 	71.8 (n=4)	73.3 (n=3)
Sleeve gastrectomy	<ul style="list-style-type: none"> • Restriction 	Insufficient data	Insufficient data

% EWL = % of excess weight lost; n = number of studies fulfilling criteria for meta-analysis at each time point

Table 2. Late complications of the LAGB procedure

Complication	Presenting symptoms	Investigation
<ul style="list-style-type: none"> • Anterior prolapse • Posterior prolapse • Symmetrical pouch dilatation 	<ul style="list-style-type: none"> • Vomiting • Regurgitation • Volume reflux especially when recumbent • Inability to tolerate a solid diet • Epigastric pain radiating to the back • Haematemesis 	Barium swallow
<ul style="list-style-type: none"> • Erosion 	<ul style="list-style-type: none"> • Loss of satiety • Increasing need for adjustment • Spontaneous port infections • Weight gain 	Gastroscopy
<ul style="list-style-type: none"> • Port complications 	<ul style="list-style-type: none"> • Loss of fluid from system • History of trauma 	Repeat checking of volume of fluid within system

Late complications

Late complications relate mainly to problems with the band becoming displaced (*Figure 4*). With modern surgical techniques the risk of the band slipping down the stomach (prolapse) is 1–3%, the proximal pouch dilating is 5–10%, and there is a 3% chance of the band eroding into the stomach.¹⁶ In addition, the port used to fill the band can leak or move and the tubing can break. Complications are summarised in *Table 2*. Problems can generally be managed laparoscopically with minimal effect on long term weight loss or morbidity.¹⁷

Many complications are thought to arise because of excessive pressures within the proximal pouch, which can approach 100 mmHg. If a patient eats too much food too quickly against a band that is too tight, the pressures in the proximal pouch place tension on the stomach wall and force on the band. It is imperative that patients learn to chew their food well and eat slowly. They should also be reviewed early if they are experiencing symptoms consistent with over adjustment.

'Alert' symptoms and signs for the GP

Given the number of LAGBs being placed and already in situ, there is an increasing need for GPs to be aware not only of the symptoms of complications of the device itself, but also the implications of LAGB on other medical conditions.

While most late complications run a relatively benign course, occasionally patients present acutely. The most common acute complication is food bolus obstruction at the level of the band. This results from a patient ingesting either too much food or difficult textured food too quickly. Patients will typically describe vomiting undigested food and saliva. Oesophageal spasm is common. Patients are advised initially to try drinking a carbonated beverage to dislodge the food. This is best done over the sink as the patient may vomit vigorously. If the food bolus does not move on, they should contact their bariatric clinic for removal of fluid from the system which will open the stoma.

The band can slip, inducing obstruction and ischaemia of the proximal pouch. In this situation, unlike the more chronic slips, patients describe upper abdominal pain that may radiate to the back or chest. This is typically accompanied by vomiting and an inability to tolerate any oral fluids. Often very little is found on examination other than dehydration. X-ray or barium meal confirms the diagnosis. In this situation, fluid must be removed as soon as possible from the device. With removal of fluid there is usually resolution of symptoms, and assessment and further management can then be determined. Rarely, if the symptoms do not resolve, surgical treatment may be needed urgently.

Erosion of the band into the stomach can occur and generally



Figure 4. The barium swallow appearance of LAGB complications

Anterior prolapse

- The lie of the band is horizontal
- There is asymmetrical dilatation of the pouch above the band
- The barium is slow to pass through the band
- Intra-oesophageal reflux

**Posterior prolapse**

- The lie of the band is vertical
- There is asymmetrical dilatation of the pouch above the band
- The barium is slow to pass through the band
- Intra-oesophageal reflux

**Symmetrical pouch dilatation**

- The lie of the band is normal (2–8 o'clock)
- There is symmetrical dilatation of the pouch above the band
- The barium is slow to pass through the band
- Intra-oesophageal reflux



presents as regain of appetite and weight gain. There may be some mild epigastric pain, but rarely are there any acute symptoms.

Patients with LAGB retain the risk of other surgical and medical illnesses. It is important that patients are assessed and treated on their merits as there is a risk that their care could be compromised if the presence of the LAGB distracts treating physicians from following normal clinical logic.¹⁸

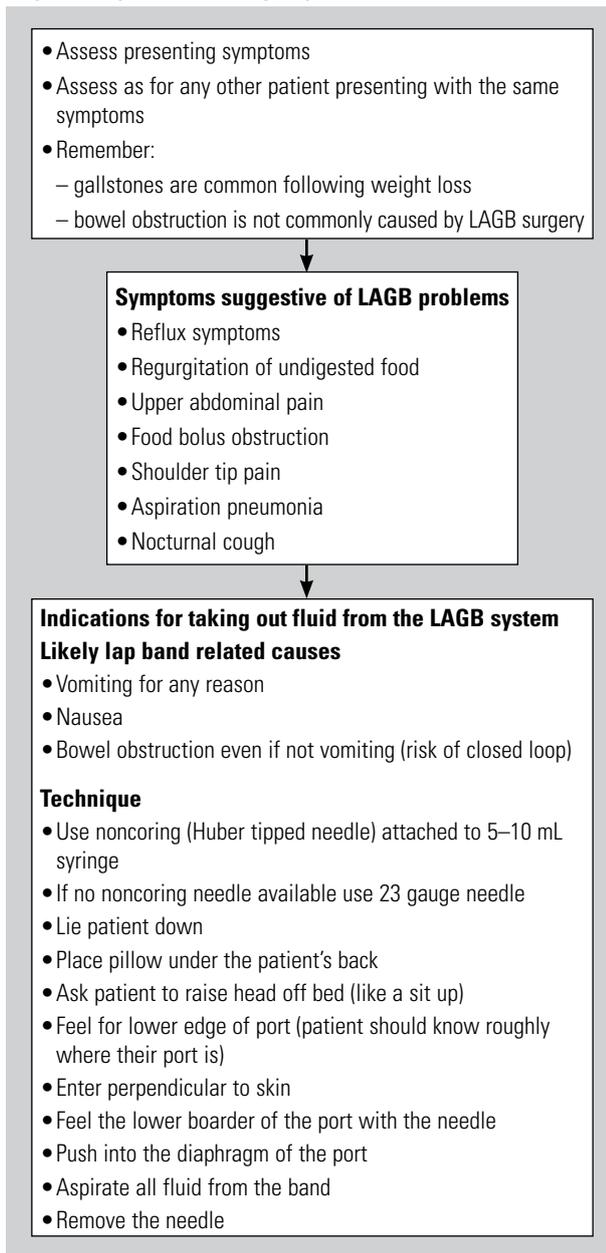
If there is any doubt as to the role of LAGB in a clinical scenario, the safest option is always to remove fluid from the system and to contact the treating bariatric surgeon. An algorithm for care in the emergency situation is outlined in *Figure 5*.

Conclusion

Laparoscopic adjustable gastric banding is a useful tool in the treatment of severe obesity. It is a safe and durably effective procedure, however, optimal results depend upon the patient participating in a lifelong process of care. It is hoped by optimising this care that late complications will be avoided.

General practitioners should be engaged in all stages of the LAGB process. They should be kept informed of weight change, as well as any emerging problems and can reinforce with the patient the ongoing nature of the weight loss and weight maintenance process. They are ideally positioned to monitor changes in health, and if indicated, can modify the dosages and use of medications for conditions likely to change with weight loss such as diabetes, hypertension or hypercholesterolaemia.

Figure 5. Algorithm for emergency care



Summary of important points

- LAGB is a safe and durably effective weight loss tool.
- Optimal results depend up on a process of life long care.
- The process following LAGB involves counselling about food choices and eating patterns as well as band adjustment.
- A multidisciplinary team is useful in optimising the long term program.
- Late complications include band slippage, migration and mechanical problems – most run a benign course.
- Acute presentations are rare and are characterised by abdominal pain.
- Removing fluid from the band alleviates most acute situations, at least temporarily.



- General practitioners should be kept involved at all stages of the LAGB process as they should be monitoring and managing changes in health with weight loss.

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References

1. Access Economics. The growing cost of obesity – three years on. In: Economics A, editor. Melbourne: Access Economics, 2008.
2. Mokdad A, Serdula M, Dietz W. The spread of the obesity epidemic in the United States. *JAMA* 1999;282:1519–22.
3. Ogden CL, Carroll MD, Curtin LR, McDowell MA, Tabak CJ, Flegal KM. Prevalence of overweight and obesity in the United States, 1999–2004. *JAMA* 2006;295:1549–55.
4. Adams TD, Gress RE, Smith SC, et al. Long-term mortality after gastric bypass surgery. *N Engl J Med* 2007;357:753–61.
5. Peeters A, O'Brien PE, Laurie C, et al. Substantial intentional weight loss and mortality in the severely obese. *Ann Surg* 2007;246:1028–33.
6. Bray GA. Medical therapy for obesity: Current status and future hopes. *Med Clin North Am* 2007;91:1225–53,xi.
7. O'Brien PE, Dixon JB, Laurie C, et al. Treatment of mild to moderate obesity with laparoscopic adjustable gastric banding or an intensive medical program: A randomized trial. *Ann Intern Med* 2006;144:625–33.
8. Dixon JB, O'Brien PE, Playfair J, et al. Adjustable gastric banding and conventional therapy for type 2 diabetes: A randomized controlled trial. *JAMA* 2008;299:316–23.
9. Keating CL, Dixon JB, Moodie ML, Peeters A, Playfair J, O'Brien PE. Cost-efficacy of surgically induced weight loss for the management of type 2 diabetes. *Diabetes Care* 2009;32:567–84.
10. Medicare Australia. Item number 30511. Available at www.medicareaustralia.gov.au/cgi-bin/broker.exe?_PROGRAM=sas.mbs_item_standard_report.sas&_SERVICE=default&DRILL=ag&_DEBUG=0&group=30511&VAR=services&STAT=count&RPT_FMT=by+time+period+and+state&PTYPE=calyear&START_DT=200001&END_DT=200812.
11. Colles SL, Dixon JB, Marks P, Strauss BJ, O'Brien PE. Preoperative weight loss with a very-low-energy diet: Quantitation of changes in liver and abdominal fat by serial imaging. *Am J Clin Nutr* 2006;84:304–11.
12. Chapman AE, Kiroff G, Game P, et al. Laparoscopic adjustable gastric banding in the treatment of obesity: A systematic literature review. *Surgery* 2004;135:326–51.
13. Dixon AF, Dixon JB, O'Brien PE. Laparoscopic adjustable gastric banding induces prolonged satiety: A randomized blind crossover study. *J Clin Endocrinol Metab* 2005;90:813–9.
14. O'Brien PE, Dixon JB, Brown W, et al. The laparoscopic adjustable gastric band (Lap-Band): A prospective study of medium-term effects on weight, health and quality of life. *Obes Surg* 2002;12:652–60.
15. O'Brien P. The LAP-BAND solution: A partnership in weight loss. 1st edn. Melbourne: Melbourne University Publishing, 2007.
16. Brown W, Burton P, Anderson M, et al. Symmetrical pouch dilatation after laparoscopic adjustable gastric banding: Incidence and management. *Obes Surg* 2008;18:1104–8.
17. O'Brien PE, Dixon JB. Lap-band: Outcomes and results. *Journal of Laparoendoscopic & Advanced Surgical Techniques* 2003;13:265–70.
18. Campbell N, Brown WA, Smith A, Skinner S, Nottle P. Small bowel obstruction creates a closed loop in patients with a laparoscopic adjustable gastric band. *Obes Surg* 2008;18:1346–9.
19. O'Brien PE, McPhail T, Chaston TB, Dixon JB. Systematic review of medium-term weight loss after bariatric operations. *Obes Surg* 2006;16:1032–40.