CASE REPORT

Airway management concerns in patient with gastric banding procedures

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SUMMARY

Laparoscopic adjustable gastric band (LAGB) is considered a relatively safe and effective treatment for obesity. Even after weight loss patients with LAGB are at increased risk of pulmonary aspiration during induction of general anaesthesia, possibly due to LAGB-induced anatomical and functional changes. We present a case of aspiration in a patient with LAGB following significant weight loss and 14 h of preoperative fasting and review the literature. In the presence of LAGB we propose specific anaesthesia management at least consisting of anti-Trendelenburg positioning; avoidance of mask-ventilation; use of the local rapid sequence induction strategy with endotracheal intubation and fully awake extubation.

BACKGROUND

The number of people with obesity is increasing rapidly, as are the number of bariatric surgeries.¹ A popular technique for treating obesity is the laparoscopic adjustable gastric band (LAGB).^{2,3} This band is placed around the cardia and creates a small pouch just distal of the lower esophageal sphincter (LES) (figure 1). A catheter connects the LAGB to a subcutaneous port, allowing a saline injection to adjust the passage lumen.

How the LAGB induces weight loss is not fully understood.⁴ Initially, weight loss was attributed to eating in small proportions since the pouch fills rapidly and passage to the distal stomach is limited.^{4,5} Although unable to identify specific changes, Dixon *et al*⁶ emphasised that the band compresses the cardia, altering neuronal and hormonal-induced satiety and decreasing appetite.

The LAGB has been implicated in long-term complications,⁷ including LES dysfunction and gastro-esophageal dysmotility.⁸ Initiation, worsening, but also resolution of reflux symptoms have been associated with LAGB.⁸ Reflux during induction leading to pulmonary aspiration, with its significant morbidity and mortality,^{9,10} in direct relationship to the LAGB has received little attention as the focus has typically been on the causal relationship with weight and reflux, not on the band.^{11,12} Overall, extreme weight loss following bariatric surgery is associated with a 66-fold increased risk of pulmonary aspiration during induction of anaesthesia.¹³ No specific management or fasting guidelines exist as yet for patients with LAGB.^{14–17}

We present a case involving a patient with LAGB, who aspirated during induction of general anaesthesia. We review the literature and discuss indications for more specific care for patients with

LAGB, based on the pathophysiology induced by the LAGB.

CASE PRESENTATION

A 46-year-old woman presented for lumbar hernia (herniated nucleus pulposus (HNP)) correction. On the day of surgery, she was transferred from another hospital as 'nil per os (NPO) after midnight'. Preoperative assessment followed her admission. Her history showed an LAGB in 2000 after which she lost 50 kg. Her current weight was 105 kg (171 cm height, BMI 35.9 kg/m²). Further history showed a uterus extirpation, knee surgery and benign thyroid neoplasm resection. Most recently, 18 months previously, she had undergone uncomplicated urgent lumbar surgery under general anaesthesia following a 6-h fasting period. She had no cardiopulmonary symptoms and a limited exercise tolerance. There was no history of diabetes. She reported gradually increasing regurgitation, leading to her not receiving oral premedication. Her chronic medication consisted of oxycodone, pregabalin, naproxen and diazepam last administered the morning of the transfer. Assessment of heart, lungs and airway showed no abnormalities, nor did blood

Figure 1 Laparoscopic adjustable gastric band (LAGB) in place on the cardia of the stomach just distal from the lower esophageal sphincter. E, esophagus; L, lower esophageal sphincter (LES); Gp, gastric pouch; Gb, laparoscopic adjustable gastric band; St, stomach; C, catheter between LAGB and subcutaneous port for LAGB lumen alteration by altering the amount of saline in the band its stoma. Adapted from: 'Gastric Banding' by James P Gray.

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examinations besides slightly elevated C reactive protein and leucocytes count. She was classified ASA 2.

Premedication given 60 min before surgery consisted of acetaminophen 1000 mg Supp. and atropine 0.5 mg intramuscularly. Anaesthesia was induced at 14:00 using intravenous lidocaine 40 mg, sufentanil 15 µg, propofol 200 mg and rocuronium 45 mg. Prior to laryngoscopy, yellowish fluid with solid components filled the oro-pharynx and mouth. Cricoid pressure was applied and immediate suction performed. After rapid intubation, deep tracheal suction through the endotracheal tube showed some regurgitated material. A naso-gastric tube was passed. Prophylactic amoxicillin/clavulanic acid (2000/200 mg) and dexamethasone (4 mg) intravenously were administered. The procedure was allowed to continue and the operation concluded with fully awake extubation without further complications. She was monitored in the Medium Care for one night, returned to the ward and discharged in good condition. Five weeks later she returned for revision HNP surgery. Although she was 'NPO after midnight', anaesthesia was induced via rapid sequence induction in anti-Trendelenburg position and extubation was once again carried out fully awake. The perioperative course was uneventful.

INVESTIGATIONS

Following recuperation from the revision HNP surgery, a barium swallow was performed to diagnose esophageal or epiphrenic diverticulum, dilation or achalasia as causal pathology. The dynamic series showed a gastric pouch (figures 2 and 3) created by the LAGB, with notably slow emptying into the residual stomach. Esophageal dysmotility was seen with tertiary contractions and esophageal dilation with achalasia 'bird's beak sign' (figure 3). Diverticulum, hiatal hernia or other pathology was not seen.

DISCUSSION

An LAGB seems to be an unrecognised independent risk factor for complications, particularly aspiration. We suggest, supported

by some indirect evidence, that multifactorial changes caused by the LAGB, not weight or obesity, should trigger specific risk management.

Regurgitation and aspiration are well-documented anaesthesia issues in the obese as well in obstetrics and trauma care among others.^{14–17} Substrates for this increased risk include lowered sphincter tone, delayed gastric emptying and increased intra-abdominal pressure.^{14–16} Nonetheless, the European Society of Anaesthesiology states that obese patients may follow general preoperative fasting guidelines.¹⁶ Others suggest that induction in the obese is safest using rapid sequence techniques.¹⁷ These substrates plus other causal effects further increases the risk in patients with LAGB. In addition, even when obesity is no longer the issue, the presence of an LAGB should cause awareness of strongly increased aspiration danger during preoperative assessment as opposed to patients with, for example, a gastric bypass.

The LAGB influences multiple aspects in the gastrointestinal (GI) tract. Alteration of esophageal motility with sequestration of solids and fluids, lowered effective LES pressure, volume retained in the pouch itself and the effect of the band on gastric motility and prokinetics are all at issue.^{8, 18} At least three of these factors played a demonstrable role in our patient.

The effects of LAGB on esophageal motility and LES function has been touched on by de Jong *et al.*⁸ Esophageal motility showed an increased number of defective propagations, LES relaxation was disturbed and resting pressure decreased. These synergistic factors promote esophageal and pouch dilation,^{7, 19} and larger overall esophageal diameter,²⁰ potentially leading to an epiphrenic diverticulum as a late complication with its own aspiration risk.^{21, 22} Such a reservoir was not found in our patient, while achalasia and protracted pouch emptying were.

Residual stomach emptying after LAGB has been suggested as an independent factor without uniform results. In order to regurgitate, volume from stomach must pass the band and both esophageal sphincters. Tiktinsky *et al.*¹⁸ studied gastric emptying of semisolids using labelled meals in persistently obese patients after LAGB. They showed a significant decrease in emptying rates after LAGB compared with before LAGB and controls.¹⁸ Other studies were unable to confirm a causal relationship between LAGB and gastric emptying of solids, semisolids and fluids^{23–25} (table 1).

While gastric emptying may be protracted for semisolids in patients with LAGB, a mean emptying of ± 37 min or even a $T_{1/2}$ of more than 60 min still suggests that 6 h should be a safe fasting period.^{18, 24} Our patient fasted for at least 14 h, leading to the supposition that the source of the fluid and solid matter was not the stomach, but the pouch and esophagus. We note that our patient did report of regurgitation both after as well as between meals. It seems clear that prolonged NPO for gastric emptying does not guarantee prevention of aspiration nor decrease the chance of solids being present in the stomach, gastric pouch or even esophagus. Studies have not described total upper GI emptying in patients with LAGB.

Multifactorial functional changes in patients with LAGB suggest the need for aggressive anaesthesia management with emphasis on case finding, risk management and risk limitation. Based on the limited literature and our experience in this case, preoperative workup should consist of a focused cardiopulmonary risk-assessment, assessment for diabetes for its potential synergy in decreased gastric emptying, GI tract symptoms, indications for 'difficult airway' scenarios and informing the patient about induction and extubation strategy. It should potentially include a barium meal if there is a history of regurgitation.

Figure 2 X-ray showing the gastric pouch created by the laparoscopic adjustable gastric band (LAGB) between the lower esophageal sphincter (LES) and the LAGB in a gastric banding patient. Pouch empties into the rest of the stomach. Dilated esophagus present and LAGB with subcutaneous port in situ. E, esophagus; L, lower esophageal sphincter (LES); Gp, gastric pouch; Gb, laparoscopic adjustable gastric band; St, stomach; Sp, subcutaneous port; C, catheter between LAGB and subcutaneous port for LAGB lumen alteration by altering the amount of saline in the band its stoma.

Figure 3 Left: esophageal dysmotility demonstrated by tertiary contractions over the full esophagus in a gastric banding patient. Laparoscopic adjustable gastric band (LAGB) in situ. Right: X-ray showing esophageal dilation with 'bird's beak sign' near the lower esophageal sphincter pathognomonic for achalasia. LAGB in situ. E, esophagus; Gb, laparoscopic adjustable gastric band; St, stomach; Bs, 'bird's beak sign'.

Deflation of the LAGB cuff might be considered on an empirical basis in the absence of regurgitation; prokinetics and antacids might contribute. Classification should be as a high aspiration risk. The use of a prolonged fasting period, particularly for solids seems of limited relevance but may contribute a reduction in chance of solids, being present in the upper GI tract. An induction approach including actions such as anti-Trendelenburg position, generous preoxygenation, cricoid pressure to avoid

passive hydrostatic reflux and avoidance of mask-ventilation as part of local rapid sequence intubation strategies with endotracheal intubation, careful placement of a gastric tube and extubation when fully awake seems warranted.

We recognise that evidence-based guidelines or recommendations for the preoperative assessment, fasting periods and induction of anaesthesia in patients with LAGB cannot be generated by anecdotal reports, but recognition of the LAGB and not

Table 1 Comparison of four studies on gastric emptying before and after surgery of LAGB

First author and publication year (number of patients) test medium	Population and methods	Outcomes
de Jong <i>et al</i> ²³ (N=16) solids	Before and 6 months after LAGB surgery. Medication stopped 3 days prior. Radiolabelled solid meal was used following overnight fasting	<i>Preoperatively</i> : 42%/h—(23.3–59)* <i>Postoperatively</i> : 38%/h—(31–71)* NS
Tiktinsky <i>et al</i> ¹⁸ (N _{before} =11; N _{after} =16; N _{control} =10) semisolids	Healthy volunteers and patients before and after LAGB. Radiolabelled semisolid meal was used following overnight fasting	<i>Preoperatively</i> : 23.8±4.7 min† <i>Postoperatively</i> : 36.6±9.8 min† <i>Control</i> : 22.8±6.8 min† p<0.001
Burton <i>et al</i> ²⁴ (N=12) semisolids	Patients before and 12 months after LAGB surgery. Radiolabelled semisolid meal was used following overnight fasting in combination with scintigraphic imaging	<i>Preoperatively</i> : 63.5±34.1 min† <i>Postoperatively</i> : 73.3±26.8 min† NS
Unger <i>et al</i> ²⁵ (N=8) fluid	Patients before and 6 weeks after LAGB surgery. Serum acetaminophen concentration was used to determine gastric emptying	<i>Preoperatively</i> : 62±3pM‡; 98 ±6 min§; 11.1±0.6 nMx4h¶ <i>Postoperatively</i> : 61±3pM‡; 100 ±6 min§; 9.4±1.4 nMx4h¶ NS

*Fraction emptied per hour, median and IQR.

†Half emptying time in minutes, mean and SEM.

‡Peak concentration in pM, mean and SEM.

§Time to peak in minutes, mean and SEM.

¶AUC, mean and SEM.

AUC, area under the curve; LAGB, laparoscopic adjustable gastric band.

weight per se may lead to further reports and stimulate awareness. Although rapid intubation strategies introduce their own specific risks, we believe the relative morbidity in pulmonary aspiration is higher and therefore justifies consideration of aggressive techniques, as used in the local setting.

In conclusion, the presence of an LAGB should raise warning flags in the preoperative assessment especially if the BMI has decreased. Specific anaesthesia management, including a fasting policy and induction and extubation strategies, should target on limiting the increased risk of aspiration. A focus on fluid and solid sequestration in the upper GI tract is most relevant. Studies concerning preoperative risk stratification in this growing subgroup of patients are needed.

Learning points

- The presence of a laparoscopic adjustable gastric band should raise warning flags in the preoperative assessment, patients should be classified as high aspiration risk.
- The sequestration of fluids and solids in the upper gastrointestinal tract is most relevant.
- Anaesthesia management should target on limiting the increased risk of aspiration.

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