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INTEGRATED STUDY MASTER'S THESIS

Long-Term Results (10 and More Years) After Adjustable Gastric Banding Operation for Treatment of Obesity

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Outline

1. Abstract

This paper provides an in-depth analysis of the long-term outcomes of Laparoscopic Adjustable Gastric Banding (LAGB) as a treatment option for obesity based on a comprehensive review of clinical data and patient follow-ups spanning several years. LAGB, known for its minimally invasive approach and adjustability, presents itself as an option of bariatric surgery for weight management.

The primary focus of this systemic review lies in the significant differences in outcomes of the analyzed papers. Excess weight loss percentages of 16.9 to 68.1% are extensive margins that should be analyzed regarding their differences in the clinical setting. Due to the variability in the weight loss outcomes, with some patients experiencing weight regain over extended follow-up periods, it is essential to highlight the various outcomes.

This systemic review also examines the procedure's complications, which vary from case to case. Band slippage, dilations, and the need for revisional surgeries were noted as significant concerns. These complications will be discussed, as well as the surgery techniques and comprehensive postoperative care used.
In recent years, laparoscopic adjustable gastric banding has become less popular and has received less recent research than other bariatric procedures.

LAGB has advantages and disadvantages and can be a viable weight loss option for certain patients, though it is mainly praised in shorter terms. It does require a committed approach to postoperative care and lifestyle changes from the patient. After careful patient selection and management of potential complications, it might be a viable option to optimize long-term success, not just the short-term, when given the right circumstances.

2. Keywords

Laparoscopic adjustable gastric banding, Review, Long term, 10 and more years

3. Abbreviations

LAGB - Laparoscopic Adjustable Gastric Banding
EWL - Excess weight loss
FU - Follow-up
NR - No results were presented in the study
% - percent
Pts. - patients
Yrs. - years
Kg/m^2 - kg per meter squared

4. Introduction

Laparoscopic adjustable gastric banding (LAGB) is a surgical option that has been used in the management of the obesity pandemic, which is a fast-growing epidemic globally. This paper is a systematic review that examines the role of laparoscopic adjustable gastric banding as a potential treatment option for obesity in the clinical setting and with a more extended follow-up period of 10 or more years. This study is intended to thoroughly compare laparoscopic adjustable gastric banding (LAGB) as a therapy for obesity outcomes from various studies.

The consequences of obesity nowadays have a high impact on society as those affected not only have higher prevalences of type 2 diabetes, hypertension, cardiovascular diseases, and cancer [1] but also have to worry about their quality of life. The World Health Organization (WHO) has recognized obesity as a significant public health problem and a global health challenge [2], affecting millions worldwide. ''Obesity is a chronic complex disease defined by excessive fat deposits that can impair health,'' which arises, among other things, from genetic, environmental, and lifestyle factors [3]. Often, doctors suggest that patients try conventional treatment strategies such as lifestyle modification, diet, and exercise for weight management in highly obese patients [3]. These means may not be sufficient for everybody, so more effective actions may be required. Bariatric surgery is a more drastic but, at the same time, promising method of losing weight.

One of these methods is laparoscopic adjustable gastric banding, which has gained attention due to its minimally invasive nature and adjustability. The LAGB technique was first introduced in 1978 before becoming more widespread in the early 1990s [4]. It involves the placement of an adjustable

inflatable band around the stomach's upper part that helps reduce food intake. The personalization of band adjustments helps doctors optimize therapy and ensure that the patient's side effects from weight loss don't go beyond the accepted standards [5].

The methodological part of this paper will look at the side effects and method of installing the band. It will also discuss the studies, selection, criteria, and postoperative care. The paper mainly covers the weight loss differences that varied in different studies. It will analyze the operation techniques' differences, efficacy, adjustments, and side effects and try to find the answer.
This was done by reviewing several studies conducted during the past 20+ years and their clinical trials.
The main question aimed to solve is: ''Which treatment approach maximizes the weight loss outcome in Laparoscopic adjustable gastric banding in the long-term setting (10 and more years)?''

Despite its benefits, LAGB can have complications and difficulties, such as band slippage, erosion, infection, and removal. Long-term management, including adjustments and follow-up, will also be covered.

In conclusion, this review will focus on a descriptive analysis of the surgical laparoscopic adjustable gastric banding technique against obesity. This paper aims to contribute valuable insights to the medical community, considering laparoscopic adjustable gastric banding as a treatment option for obesity.

5. PRISMA analysis

The preferred reporting items for systematic reviews and meta-analysis (PRISMA) framework is a methodology for conducting and reporting systematic reviews [6].
This paper uses the PRISMA guidelines to examine the current literature about the long-term consequences of laparoscopic adjustable gastric banding as a treatment for obesity. The objective is to help present unbiased and comprehensive information.

Following the PRISMA model, a systematic literature search was conducted across major databases, particularly PubMed. The focus was on studies published about laparoscopic adjustable gastric banding, looking at the long-term results. The keywords used were ''Laparoscopic Adjustable Gastric Banding'', ''long-term results'', and ''treatment obesity''. Besides that, other

inclusion criteria were the patient′s follow-up for at least ten years, the percentage of follow-up exceeding 70%, at least 60 patients included in the study, and the publication after 2010. Studies discarded in the review were non-English, short-term, and less than 70% of patients followed.

The search initially brought in 2006 articles, which were screened through the titles and abstracts. Additional searches used factors like long-term studies and 10 or more years. The preliminary screening eliminated non-relevant studies and left seven sources that could be used as a basis for this review. Finally, seven more studies were found by taking other steps, e.g., through related papers' sources. Figure 1 documents the number of studies identified, included and rejected at each stage of the screening process.

Data was taken from the eligible studies, including the type of study, the country the study was performed in, the number of patients included, follow-up percentages as well as duration, 10-year excess weight loss, and reoperation percentage study. The changes in BMI were observed as well. Other data included the side effects determined in different studies, including band removal, malfunction, infection, migration, leakage, slippage, dilation, and intolerance. The operation technique, band, and fixation method were evaluated, including the follow-up and adjustment. The data was used to monitor the long-term efficacy and safety of LAGB and seek explanations for the diversity of weight loss percentages in the studies.

The PRISMA analysis provided a structured and comprehensive overview of the long-term outcomes. The review will examine the consequences of sustained weight loss surgery and highlight the variability in complications and the need for further surgeries.
Limitations of the PRISMA analysis included potential publication bias and heterogeneity of the study design. These limitations might affect the Independence of the findings.
The PRISMA review of LAGB as a long-term solution for obesity provides beneficial information on the treatment's effectiveness.

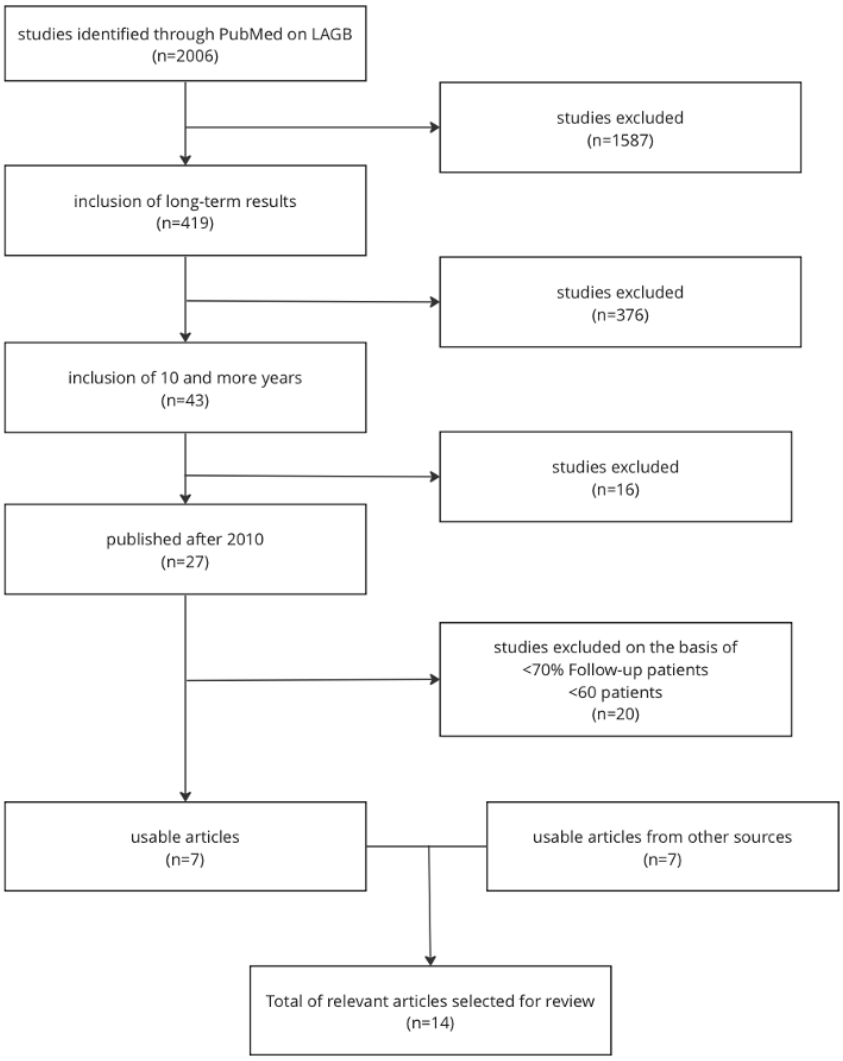

Figure 1: The flow diagram based on the PRIMA analysis when researching relevant sources.

5.1. Measures of evaluation

When the study evaluated results for several periods (e.g., 5, 10, 15 years), only the 10-year results were mentioned.

The term ‚Long-term' refers to > 10 years since the operation.

In Figure 16, the Symbol ± indicates that the values behind the symbol reflect the Standard deviation before the symbol indicates the mean.

6. Method and advantages/disadvantages of the procedure

Many patients cannot lose (enough) weight by themselves through diet and exercise.
Laparoscopic adjustable gastric banding is a minimally invasive bariatric surgery technique used for the treatment of obesity. The mechanism of this procedure revolves around the restriction of food intake and satiety of the patient. [7]
This is achieved by placing an adjustable band around the upper portion of the stomach. [5]
Different operation techniques and fixations are used. During the research, almost all papers agreed that the Perigastric approach was first used. Later, the preferred method was the pars flaccida approach. One study even showed that the pars flaccida technique was used before it was even named as such.

6.1. Why LAGB is performed

Patients will undergo a full assessment before LAGB to ensure they are good candidates for this procedure. This evaluation includes medical history, physical examination, and psychological assessment. To ensure the success of an uncomplicated health procedure, patients must follow a specific diet before the surgery [8].

The primary purpose of LAGB is to induce a substantial degree of weight reduction and ''treat severe obesity'' [8]. Significant weight loss achieved through LAGB can improve or resolve obesity-related comorbidities[9, Abstract in English], such as type 2 diabetes, hypertension, cardiovascular diseases, and cancer [1], extending time and quality of life.

The laparoscopic approach allows quicker recovery, shorter hospital stays, and faster healing. Its minimally invasive character makes it the preferable alternative for patients and specialist doctors [10]. The individual therapy of gastric band is what makes it stand out. The weight loss ensured through the band wearing is possible due to the policy of adjusting the band's tightness without causing poor nutrition and excessive discomfort. [11] This adjustability also allows for reversibility. [12]
Losing weight encourages patients to adopt a healthier lifestyle, including better dietary habits and regular physical activity, contributing to long-term weight management [13]. Therefore, LAGB significantly contributes to coping with the global obesity problem as well as decreasing long-term risk factors for certain types of cancer, stroke, and heart disease [1].

6.2. Preparation

LAGB surgery requires extensive preparation to enhance its safety and efficiency.
Before the LAGB surgery, patients undergo standard medical check-ups and comprehensive evaluations. The medical condition assessment includes checking the medical history, physical examination, and possibly blood tests, imaging scans, and ECG tests to evaluate the overall health and identify the risk. Also, the patients usually have nutritional counseling before and after Laparoscopic Adjustable Gastric Band (LAGB) surgery [8]. This counseling helps them understand dietary changes they must make after the procedure and how to maintain proper nutrition to support weight loss and overall health. With the surgery, the patient receives extra motivation to keep a healthy lifestyle, but the long-term result (following a strict diet) is up to them. It is recommended to ″eat slowly and chew each bite very slowly and completely […]. [14]
The most frequent contributing factor to underwhelming post-surgical outcomes is smoking. Often, patients who smoke are recommended to stop before the operation. ''Smoking slows recovery and increases the risk for problems after surgery.'' [11]

Usually, patients must fit some predetermined criteria for acceptable health outcomes. Some healthcare providers suggest losing some weight before receiving the LAGB surgery, and ″many insurance companies require patients to participate in a medical weight loss program before surgery. [15] This preoperative weight loss can help reduce the size of the liver, making the surgery easier and safer to perform [16].
Suppose a patient is approved for laparoscopic adjustable gastric banding surgery. In that case, the patient will be given specific guidelines on what they should and should not do in the days preceding their operation. That may involve a recommended diet, drinking habits, medication to avoid, and instructions for preoperative bowel preparation if necessary. Some days before the surgery, patients provide informed consent to the surgery after receiving education about what to expect before, during, and after LAGB surgery. For instance, this can cover the surgical operation details, potential associated risks and possible complications, anticipated results, and postoperative care instructions [11].
Many patients may find approaching LAGB surgery intimidating. However, it is helpful for them to familiarize themselves with the steps and cooperate with their healthcare team to properly prepare for the surgery and improve their chances of a good outcome.

6.3. Risks

Generally, it is possible to conclude that laparoscopic adjustable gastric banding is considered a relatively safe procedure. Still, like any surgical intervention, it carries certain risks and potential complications. Table 4 provides a detailed description of the problems encountered during the reviewed procedures.

In the study of Arapis et al. [46], it was mentioned that ''38.3% developed at least one major complication'' [46].

As with any procedure under anesthesia, before the band is placed, some potential complications, such as allergic reactions, respiratory issues, and cardiovascular events, can occur [17].

Malfunctioning includes band slippage, erosion, leakage, and others. They can occur when there are issues with the band itself or the access port used for adjustments [18].

Another risk is a port infection or an abscess. The infection may appear at the access port site as pain, redness, swelling, or discharge [19]. An abscess may form in severe cases, needing to be drained and treated with antibiotics. This risk can be minimized by adhering to proper protocols during the operation and following the surgeon's instructions regarding the use of antibiotics [20].

Multiple articles address slippage or band erosion. In the long run, the gastric band may slip out of the designated area, reducing its effects or causing blockage in the stomach or intestines. This can happen if the clamp is not correctly positioned during the procedure or becomes loose over time. Sometimes, the gastric band could also [19].

One of LAGB's objectives is to assist patients before and after surgery. If the patient is not able to stop overeating or consuming foods that are not well tolerated, it can cause stretching of the small upper stomach pouch created by the gastric band. This can result in much-reduced weight loss or even weight regain that may require band adjustment or removal [21].

LAGB surgery can sometimes worsen symptoms of GERD, including heartburn and regurgitation [22]. Patients with pre-existing reflux conditions might require other treatments or follow-ups besides the surgery.

Lack of food intake can result in deficiencies of vitamins and minerals, particularly vitamin B12, iron, calcium, and folate. Affected people frequently rely on lifelong supplementation to avoid those deficiencies [8].

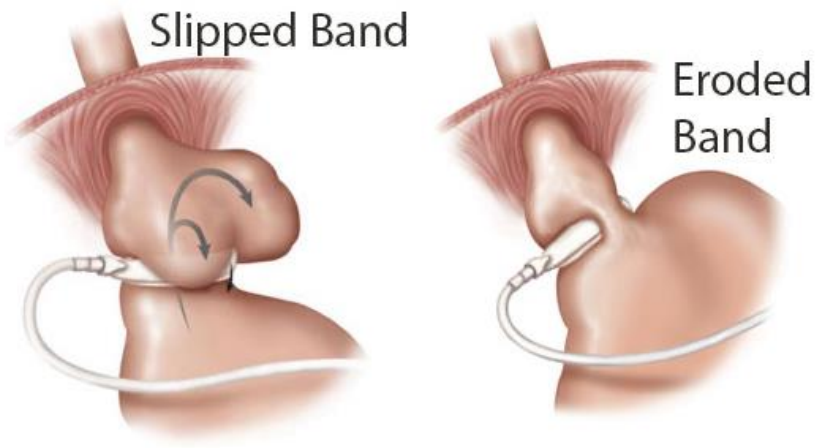

Figure 2: Slippage and Erosion in LAGB, Graphic from [23]

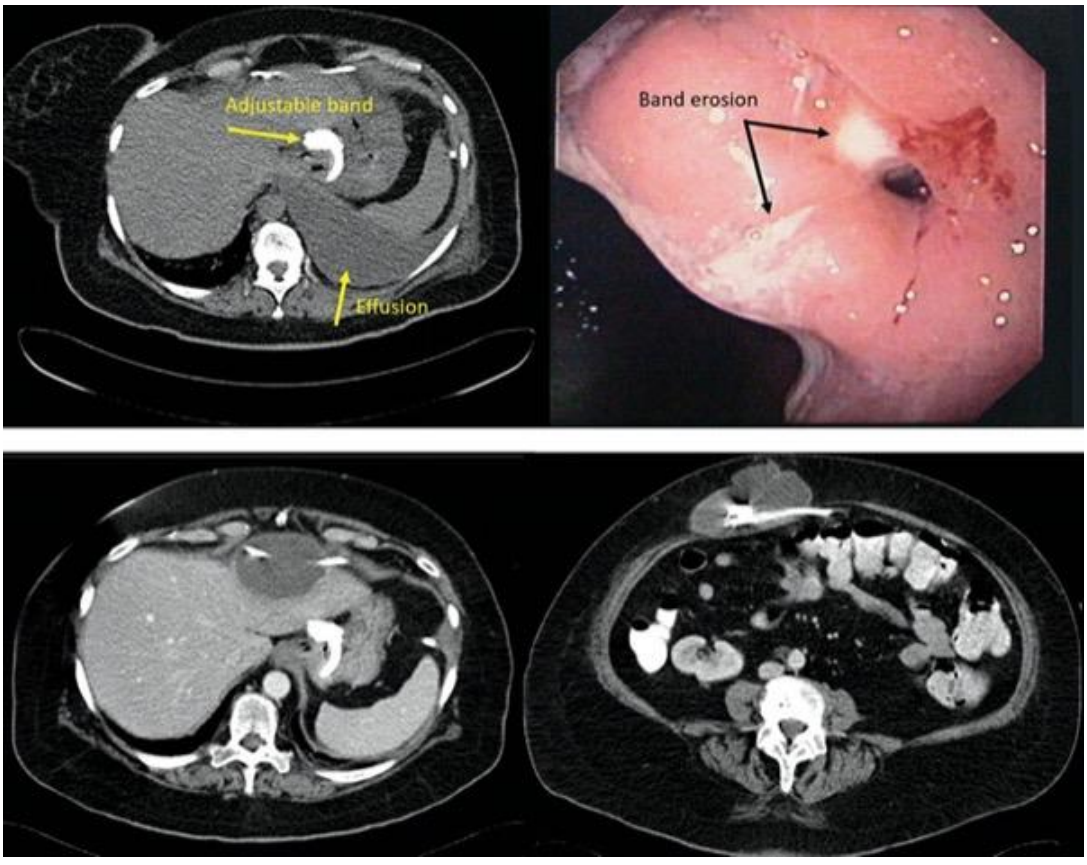

Figure 3: Top left: CT abdomen pelvis showing the adjustable band and associated left pleural effusion.
Top right: Endoscopic view of partially eroded gastric band.
Bottom left: CT arterial portography showing fluid collection in left liver lobe along course of gastric band tubing system.
Bottom right: Soft tissue collection around gastric band port system.
Graphic and description from [24]

6.4. Operation methods

Laparoscopic adjustable gastric banding involves placing an adjustable band around the upper portion of the stomach to create a smaller stomach pouch. This limits the amount of food consumed at one time, helping to promote weight loss. [5]

Many healthcare providers require candidates for LAGB to undergo a thorough preoperative evaluation, including a multidisciplinary assessment covering nutritional, psychological, and medical aspects to ensure suitability for bariatric surgery [8]. Preoperative guidelines may also include shrinkage diets. Some sources state patients should meet specific weightless goals before surgery [16].

Before the procedure, the patient is informed about the surgical procedure, potential risks and complications, expected outcomes, and postoperative care instructions [11].

The patient has to consent to the procedure and the anesthesia. Anesthesia is usually performed under general endotracheal anesthesia, ensuring the patient remains hemodynamically stable and unconscious during the operation.

At the beginning of the operation, the surgeon creates a pneumoperitoneum by insufflating carbon dioxide (CO2) into the abdominal cavity. The insertion of trochars follows this to act as portals for the laparoscopic instruments. The number and placement of trochars can vary based on surgeon preference but generally include a central port for the laparoscope and additional ports for operative instruments [25].

Ponce (2012) states that in their technique,'' A 5mm optical trocar is used to access the abdominal cavity in the left subcostal region. The position of the trocars is as follows: Trocar 1 is inserted subxiphoid in a mid-epigastric position; trocar 2, used for liver retraction, is inserted at the patient′s right subcostal margin in the mid-clavicular line; trocars 3 and 4, in an arc extending from trocar 2 toward the patient′s left; and trocar 5, laterally on the left subcostal margin.'' [26]

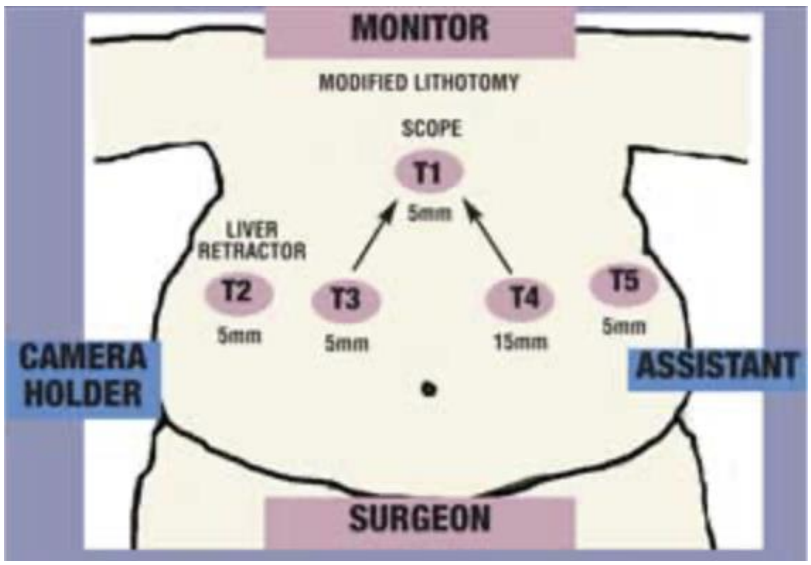

Figure 4: Patient position and trocar placement, Graphic and description from [26]

Using laparoscopic instruments, the surgeon navigates to the gastrogastric junction. A silicone gastric band is introduced and wrapped around the upper stomach, just below the gastroesophageal junction, to create a small proximal gastric pouch [27].

Some studies analyzed in this paper use the REALIZE Band by Ethicon Endo-Surgery. Generally speaking, the gastric band comprises three main components: a silicone band, an access port, and a connecting tube [28].

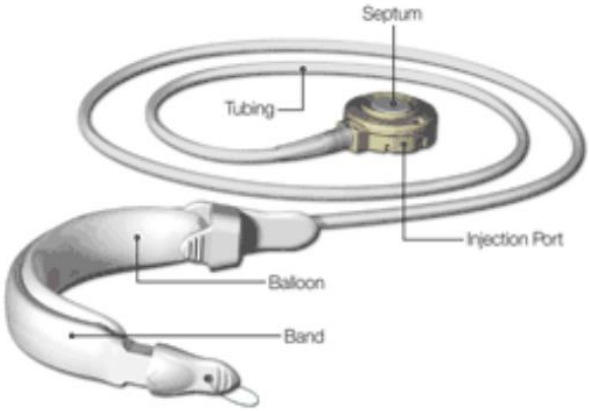

Figure 5: REALIZE Band by Ethicon Endo-Surgery, Graphic from [29]

In the pars flaccida method, firstly, dissection at the angle of His is done. For this ''the omentum covering the angle of His is gently swept to the side to facilitate exposure during the creation of a small incision lateral on the left side of the gastroesophageal junction within the gastrophrenic ligament; this small "window" initiates the plane of dissection for the pericardial tunnel.'' [26]

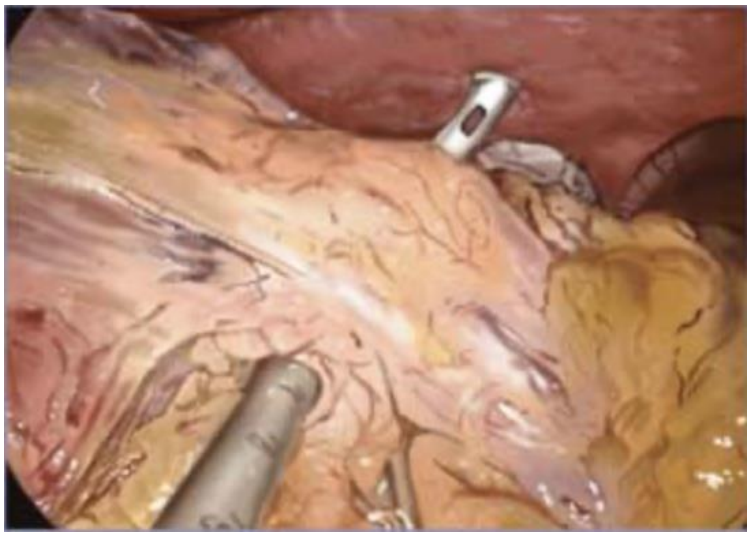

Figure 6: Articulating blunt dissector through the pars flaccida dissection, emerging in the angle of His, Graphic and description from [26]

The perigastric and pars flaccida techniques are two different surgical approaches used in laparoscopic adjustable gastric banding. Most studies first used the perigastric treatment, where a gastric band is placed by creating a tunnel behind the stomach. The band is positioned close to the gastroesophageal junction. This approach involves navigating around the stomach's greater curvature [28].

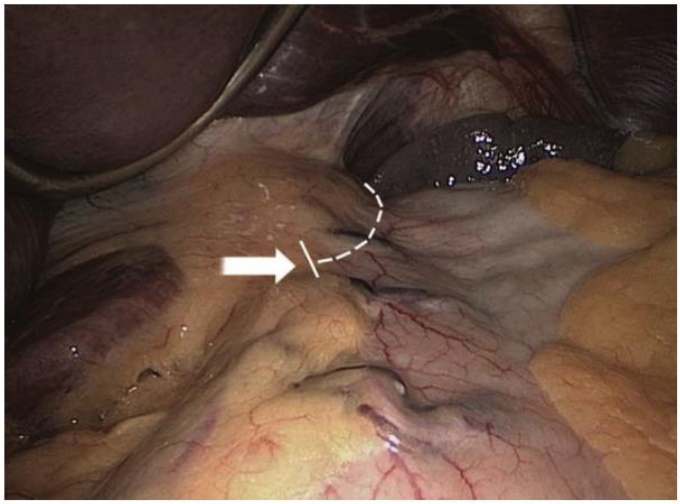

Figure 7: Perigastric technique. Dissection is performed near the gastric wall 3 cm below the gastroesophageal junction. White arrow: entry point, dotted line: route of retrogastric tunnel., Graphic and description from [28]

On the other hand, the pars flaccida technique is more recent. It evolved from the perigastric technique '' due to the complications of perigastric technique''[28]. The band is placed through a smaller tunnel created in the pars flaccida. This approach avoids the larger retrogastric space, reducing the risk of slippage or gastric prolapse like in the perigastric technique. It also allows for more precise placement of the band [28].
Overall, the pars flaccida technique is preferred in more recent LAGB procedures.

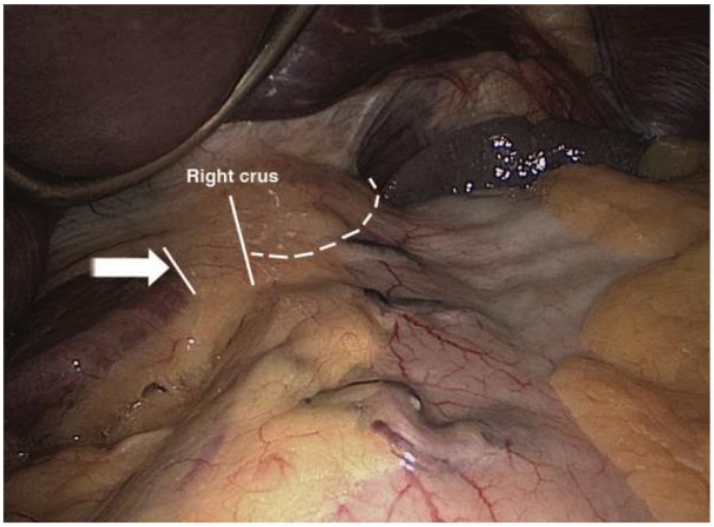

Figure 8: Pars flaccida technique. After dividing gastro-hepatic ligament, the dissection continues anterior to the right crus. Opening pars. White arrow: entry point, dotted line: route of retrogastric tunnel., Graphic and description from [28]

In more detail, ’’the thin area of the gastrohepatic ligament (pars flaccida) over the caudate lobe is divided. After the identification of right crus, peritoneum at the border of the crus is incised. The grasper is passed behind the gastro-esophageal junction to the angle of His (Figure 8). The band is introduced into the abdomen through the port. The end of the band is grasped with the grasper and passed through the created tunnel. A calibration bougie is passed to the stomach through the oral route. The balloon at the end of the bougie is filled with 15 cc saline.’’ [28]

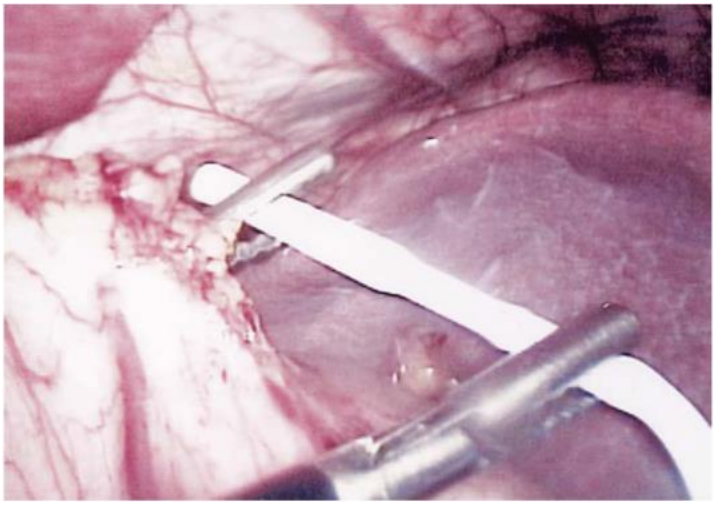

Figure 9: The end-tag of the band is brought up to meet the now retrogastric grasper and is pulled through, encircling the stomach,
Graphic and description from [30]

The band is locked, ensuring it encircles the stomach without slippage. A subcutaneous port is connected to the band via tubing. This port is secured to the fascia of the abdominal wall, enabling future non-surgical adjustments of the band's tightness by injecting or withdrawing saline solution through the port [30].
Banli says,’’ To avoid band slippage, gastric plication is created by putting, generally, three to five anterior sutures between the greater curvature and gastric pouch. Connecting tube is pulled outside the abdomen through a trocar and is connected and linked to the port after trocar removal. The port is fixed to the abdominal fascia with non-absorbable sutures.’’ [28]

After the band and port are secured, the trochars are removed, and the incisions are closed with sutures, staples, or surgical adhesives. Care is taken to ensure a sterile technique throughout the closure process to minimize the risk of postoperative infections [30].

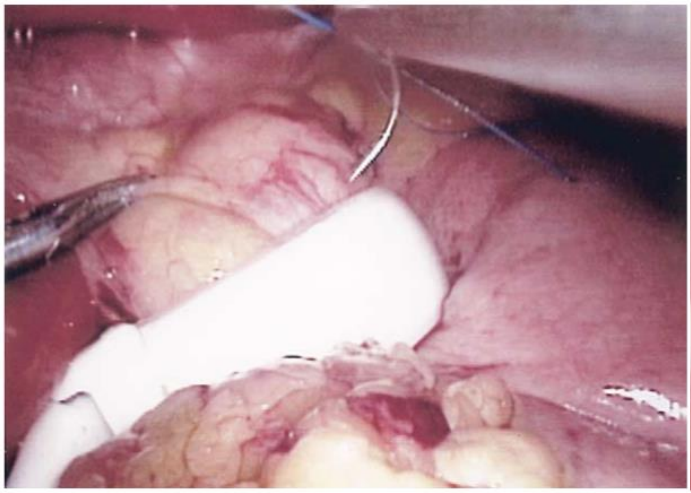

Figure 10: Gastric-to-gastric sutures are used. These should be placed so that the stomach above and below the band are approximated, but without undue tension.,
Graphic and description from [30]

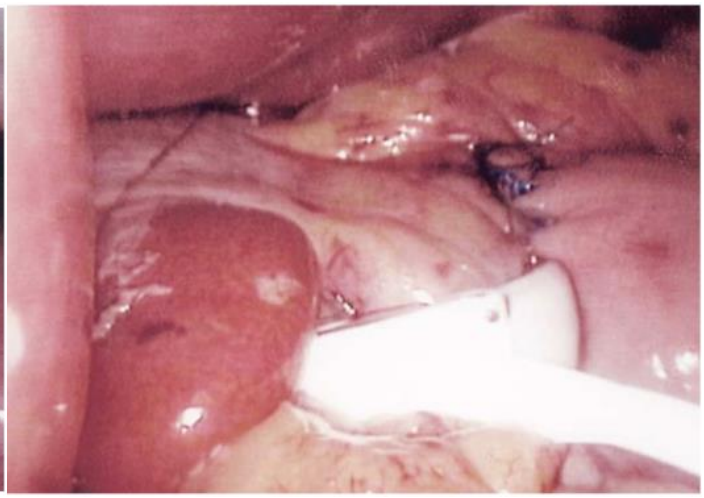

Figure 11: Properly positioned gastric band.,
Graphic and description from [30]

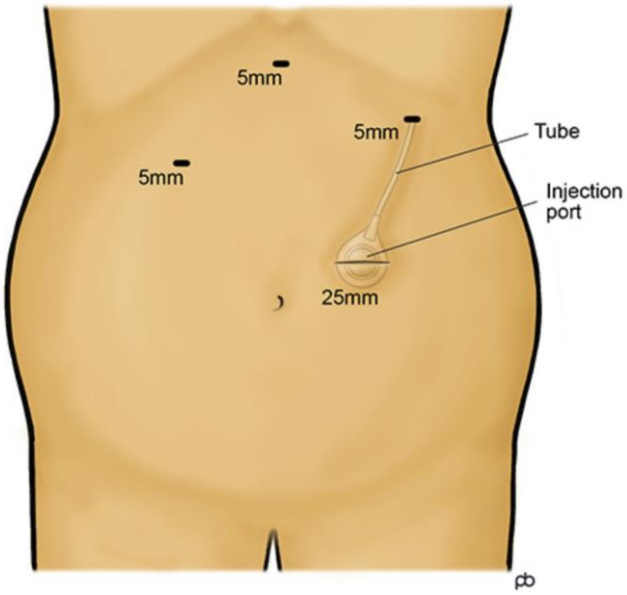

Figure 12: Position of the port for filling,
Graphic from [31]

6.5. After the operation

Several stages of the postoperative period and recovery after LAGB surgery include both phases of healing and adjustment. Later, the review will talk about the adjustments made to the band in more detail.
Postoperative care may vary between hospitals, but generally, the patients are discharged on the same day of the surgery or in no more than two days [11]. The duration of this also depends on the advice of the healthcare team members [8].
After the surgery, some patients may also experience discomfort in the incisions and abdomen regions. Painkillers are typically given out to alleviate some of the pain [32].

At the beginning of this treatment, patients are supplied with a liquid diet for the following days so the stomach can return to its normal status. This way, they begin with everything mashed, get the soft food, and finally go on with the solid food consistency [11].
Moreover, most of the studies published agree on the frequency of initial follow-up appointments, which are around 3, 6, 9, and 12 months, with twice in the second year and then yearly follow-up appointments. These appointments become less frequent as the patient's weight stabilizes [Table 5]. Follow-up appointments are the norm for patients who have had surgery, and they often come back with the surgical team to check on the progress and make any changes to the gastric band if they are needed. The tightening or loosening of the band can be altered as necessary to attain the precise amount of food intake restriction. Changes are achieved by using a needle to inject or remove saline solution via the access port implanted in the skin with the band [29]. Many sources agree that the first adjustment is done at around six weeks post-surgery [Table 5]. Next, within a few working days, the patient needs nutritional training to make excellent food choices, avoid nutrient deficiencies, and maintain hydration [11].

Adopting a healthy lifestyle after gastric bypass surgery is crucial. This includes eating nutritious foods, regular exercise, addressing emotional eating, or any behavior related to an unhealthy lifestyle [33]. Some patients may benefit from psychological support or counseling to help them adjust to the physical and emotional changes associated with LAGB surgery and to address any underlying issues related to body image, self-esteem, or emotional eating [34]. This approach is required for long-term success.

Shortly after the operation, the patients are monitored for any potential complications related to the gastric band and receive adjustments as needed [8].

In summary, this immediate and long-term postoperative period requires the healthcare team to continue supporting the patients after LAGB surgery to assist them in adjusting to their new lifestyle and reaching their weight loss goals with maximum safety.

6.6. Adjustments

Most studies agree that the band's first filling is done 4-6 weeks after surgery. No adjustments and filling are done before that or at the time of operation. The first filling is based on the patient's operations/band tolerance, weight loss, and food-fluid tolerance [28].

Banli described the fluid filling as necessary when ''the patient has insufficient weight loss (less than 0.5 kg per week) and insufficient restriction of solid food.''. He continues by saying that if ''the patient has obstructive symptoms (vomiting, heartburn), the fluid must be removed from the port.'' [28]

Adjustments are made by accessing the subcutaneous port with a fine needle, either adding saline to tighten the band and restrict food intake or removing saline to loosen the band.

Manufacturer recommendations of the REALIZE Band by Ethicon Endo-Surgery describe that the amount of fills varies between patients. Still, on average, there are four fills during the first year, two during the second year, and two during the third year [29].

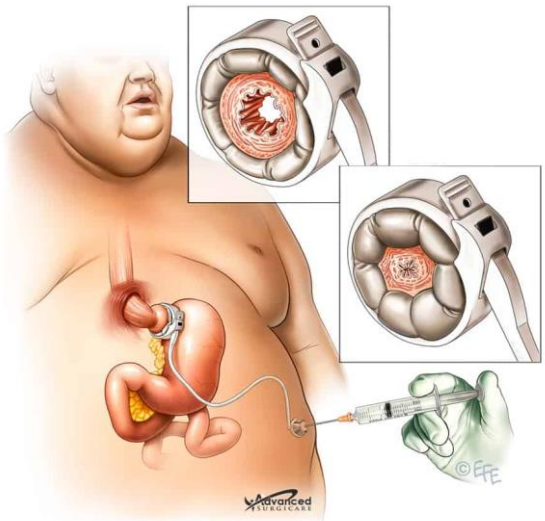

Figure 13: Adjustment of the Lap Band ,
Graphic from [35]

The goal is for the patient not to feel any hunger cues, be able to exercise portion control, feel satisfied, and achieve good weight loss.

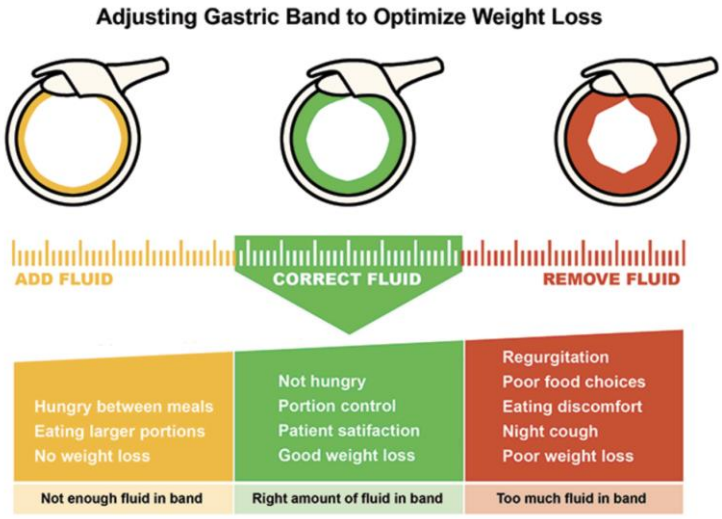

Figure 14: Optimal Fluid level in Lap Band,
Graphic from [31]

6.7. Outlook

The effects of laparoscopic adjustable gastric banding (LABG) surgery, in the long term, can differ from one individual to another. One of the main objectives of this review is maximizing weightloss outcomes in the long-term setting.

Generally speaking, it is possible to determine that LAGB surgery mainly results in significant weight loss in the first 12 to 18 months following the procedure. In the studies analyzed, on average, patients may lose 40% to 50% of excess body weight at some point during the treatment [Table 2]. The long-term weight loss outcomes and the end EWL will be further examined later.

Many patients have health issues because of obesity, and the weight loss achieved by LAGB leads to improving or resolving such conditions [9, Abstract in English]. These include type 2 diabetes, hypertension, cardiovascular diseases, and cancer [1]. This can thus result in better overall health conditions and the quality of life. The quality of life includes increased physical abilities, figure, self-esteem, and social functioning. Many patients report increased energy levels and a greater ability to participate in physical activities they were unable to do before surgery [36].

Long-term success with LAGB surgery is driven by multiple aspects, including strict adherence to dietary and lifestyle recommendations [13], routine care and checkups with the surgical team, and addressing any mental or behavioral issues regarding food and eating behavior [34]. Following Laparoscopic Adjustable Gastric Band surgery, patients should adhere to a dietary regimen that prevents nutritional deficits and guarantees a balanced diet. This may include the provision of vitamins and minerals regularly and screening for the presence of malnutrition [13]. The patient is involved and remains active in weight loss maintenance. The patient must be encouraged to stay motivated to realize the target. For example, Aarts et al. [44] stated that '' most patients were well motivated to come in for follow-up visits during the initial years after surgery (…). As the years after surgery passed, it was harder for patients to motivate themselves (…)'' [44].

Aside from lifestyle changes, LAGB can also bring about physical and psychological complications. Possible physical problems may include leakage, erosion, band slippage, port-related issues, and inadequate weight loss [18]. Some patients may require re-operation to address these complications or to remove the gastric band altogether [Table 3]. Long-term results of LAGB surgery are not only determined by physical factors. They are also affected by psychological and emotional factors, which may result in overeating or unhealthy eating habits. For instance, some patients will require continuous psychological support or counseling to maintain healthy lifestyles and overcome all the obstacles or setbacks [34].

Overall, LAGB surgery can be an effective tool for weight loss and the resolution of obesity-related health problems in the long term. Still, patients must be devoted to dietary and lifestyle changes alongside the healthcare providers support [11]. The Outlook per se can be positive if the patient cooperates closely with the healthcare provider and is motivated in the long term.

6.8. Advantages and Disadvantages of the procedure

Looking at the mechanism overall, LAGB is performed laparoscopically. This approach causes less tissue damage and quicker recovery than open surgeries [10] since the pouch developed is a small one using a silicon band [27]. It has specific features, such as adjustability and reversibility. Through the port placed under the skin of the abdomen, it is possible to inject or remove saline solution and to set the band's tightness [30]. It has this flexibility feature that allows for personalized control of the rate of weight loss, and it also tailors the procedure to the patient individually. Primarily, LAGB focuses on restriction. For instance, the band operates via the

production of a pouch that provokes a sensation of satiety following the intake of small quantities of food [27]. Therefore, it allows for reducing calorie intake as well. Naef et al. [39] explained that in their study, a ''rather slow gastric restriction (was used, that made) weight loss quite smooth and still ongoing beyond 2 years'' [39].

Being a form of obesity treatment, LAGB may provide improvement from comorbid conditions such as diabetes, cardiovascular disease, and some cancers [1]. Bariatric surgery is seen as accomplishing the task of improving obesity-related obstacles.

Weight loss has often been associated with health and psychological improvements. LAGB-operated patients usually found remarkable improvement in their day-to-day lives due to enhanced mobility, better self-esteem, and a more prosperous social and personal life [36]. Reducing obesity-related health issues can contribute to the patient's well-being.

In summary, the mechanisms of laparoscopic adjustable gastric banding can lead to a limited food intake and modulate satiety [7]. LAGB provides a minimally invasive treatment with a broader scope, thus suitable for long-term obesity management.
Consequently, although laparoscopic adjustable gastric banding has many advantages, it has some downsides and restrictions.

Success is a motivator for patients; failure is discouraging. A possibility for every bariatric surgery is weight regain or unsatisfactory weight loss results. Some patients may regain over time, particularly if they do not adhere to the dietary and lifestyle changes after the doctor recommends a specific post-surgery lifestyle change. It may trigger further interventions, band removal, and even more surgeries [21]. Medical follow-ups are needed to keep the negative impact of LAGB limited and to achieve long-term success. That is why the follow-up of at least 70% of patients was necessary for this review to grasp the picture entirely during such an extended period [Table 1]. LAGB efficacy stems from the fact that there have to be follow-up appointments regularly to make necessary adjustments and track a patient's progress. Such a necessity, however, might be inconvenient for some patients and cause compliance issues, consequently lowering the efficiency of treatment results. Victorzon reported that ''one patient had only 10% EWL (…), but she did not want to travel to the clinic for band adjustments'' [43].

Furthermore, LAGB does not guarantee success for all patients. Outcomes can vary significantly, with some individuals achieving excellent results while others struggle with minimal weight loss or

complications. The research has various results, with some facilities having more successful outcomes than others [Table 2]. This paper explains the variability that makes predicting the individual patient's outcome challenging.

As with any medical procedure, LAGB has complications and risks. Although LAGB poses the lowest risk of complications among other forms of bariatric surgery, it is not free from it. The patient may suffer a band's slippage, erosion, infection, or other problems [18]. Gastric pouch enlargement is another possibility. Patients who have experienced these complications may require additional surgeries or interventions at a later stage.

The operation, besides physical, could have a psychological influence. The psychological effect of laparoscopic adjustable gastric banding operation and its role in changing eating habits is complex. It is also common among patients to develop disordered eating patterns after the procedure or even face psychological challenges associated with the surgery, as patients are expected to adhere to strict diets and lifestyles [34]. They may starve and suffer the repercussions of nutritional deficiency. The diminished list of foods consumed and absorbed may bring about vitamin and mineral deficiencies [8]. LAGB represents a lifetime commitment to strict dietary modification, continuous physical activities, and periodic medical check-ups. These lifelong commitments are challenging for many patients [11]. However, failure to adhere to these changes can lead to sub-optimal results or complications.

It is also essential to look at the cost of medical care and follow-ups in the different countries where the studies were done. They can be prohibitive for some patients due to other healthcare systems and the motivations of countries for their inhabitants to live healthy lives that can not be found everywhere on the planet. The studies could have involved insurance companies paying for whole procedures or a small part of the treatment process and follow-ups. This might lead to different results in other countries as there is a chance that the patient may not be able to pay for it out of pocket [37].

7. Results

Laparoscopic Adjustable Gastric Banding (LAGB) has been a widely adopted bariatric surgery technique for managing obesity. This section aims to provide a statistical analysis of weight loss outcomes following LAGB, examining its efficacy in the long term.

The analysis includes data from multiple clinical studies and trials starting when laparoscopic adjustable gastric banding was first introduced. Firstly, the type of study, the country where the study was done, the number of patients, and the duration and percentage of follow-up were examined.

7.1. (Table 1): general study information

Table 1:

References	Study type	Country	No. patients	Follow-up % (at 10 yrs)	Duration FU years at maximum
Naef, 2010[39]	retrospective	Switzerland	167	94	12
Stroh, 2010[40]	retrospective	Germany	200	84	12
Lanthaler, 2010[41]	retrospective	Austria	276	80	11
O'Brien, 2013[42]	Prospective, systemic review	Australia	3227	78	15
Victorzon, 2013[43]	retrospective	Finland	60	100	17
Aarts, 2014[44]	retrospective	Netherlands	201	99	18
Trujillo, 2015[45]	retrospective	Switzerland	100	73	13
Arapis, 2016[46]	retrospective	France	897	90	19
Carandina, 2017[47]	retrospective	France	301	80	16
Vinzens, 2017[48]	retrospective	Switzerland	405	85	18
Tammaro, 2017[49]	retrospective	France	794	90	19
Khoraki, 2017[50]	retrospective	USA	208	71	10
Froylich, 2017[51]	retrospective	Israel	92	80	14
Furbetta, 2018[52]	retrospective	Italy	3566	72	20

Figure 15 (Table 1): general study information,
partially copied from O'Brien et. al. [38]

In total, 14 papers were analyzed in this review. Only papers that were published after 2010 were used. Looking at Figure 15, most studies were retrospective, but some were initially done as a prospective study while still in progress. It also looked at the countries the studies were performed in, where many were done in some parts of Europe, one in the United States, one in Australia, and one in Israel. The number of patients varies from 60 to 3566, indicating a wide range of patients. All studies had a follow-up of at least 70%, some even 100%. The follow-up percentage does not correlate with the number of patients per study. Studies had a follow-up of at least ten years.

7.2. (Table 2): general patient data

Table 2:

References	Gender of operated patients	Mean Age in years	Mean % EWL >10 yrs	Mean BMI before LAGB in kg/m2
Naef, 2010[39]	120 female 47 male	40.1±5.2	48.8±6	44.2±4.6
Stroh, 2010[40]	159 female 41 male	41.5	31-16	47.9
Lanthaler, 2010[41]	230 female 46 male	38.6±10.5	64±32.1	44±6
O'Brien, 2013[42]	78% female	47	47	43.8
Victorzon, 2013[43]	44 female 16 male	45	49	45
Aarts, 2014[44]	154 female 47 male	37	41-21	45.6±6.2
Trujillo, 2015[45]	56 female 17 male	52.8±8.5	68.1±26.4	44.4±5.3
Arapis, 2016[46]	770 female 120 male	39.5	42	45.6
Carandina, 2017[47]	249 female	39.9±11	39-35	45.2±6.7
Vinzens, 2017[48]	268 female 75 male	41±10	50	44.3±6
Tammaro, 2017[49]	681 female 113 male	38.6±9.8	>50% EWL 32 % (10 years) 15 % (15 years)	46.1±7.3
Khoraki, 2017[50]	156 female 52 male	48.2±12.1	16.9	45.4±6.4
Froylich, 2017[51]	54 female 20 male	50.5±9.6	31.7±21	45.5±4.8
Furbetta, 2018[52]	2904 female 662 male	41.9	49	40.8

Figure 16 (Table 2): general patient data

In every study analyzed, a more significant number of females were operated on than males. The studies showed at least a 1:4 ratio of operated men to women. Mean ages range from mid-30s to over 50 years old, indicating various age groups undergoing this surgery.

As the research question is '' Which treatment approach maximizes the weight loss outcome in LAGB in the long-term setting (10+ years)?'', one significant factor for this review was the wide range of percentages of excess weight loss found in different studies.

Some only showed an EWL percentage of 16.9%, while others had up to 68.1%.

For a focused analysis on the percentage of excess weight loss, some key observations were that the study from Trujillo et al. [45], with 100 patients, reported the highest excess weight loss at 68.1%. The largest patient group from Italy in the study of Furbett et al. [52] reported an EWL of 49%, while the smallest cohort of 60 patients from Finland under Victorzon et al. [43] showed 49%.

The mean BMI before LAGB reported nearly consistent BMI results in the 40s. It describes that patients undergoing this procedure were typically classified as obese according to BMI classifications.

7.3. (Table 3): band survival

Table 3:

References	% Band removal with conversion to another method	% Band removal without conversion	% reoperation, revisional surgery	% Band survival	Difference in life span between perigastric and pars flaccida mentioned
Naef, 2010[39]	NR	NR	20.4	85	Only pars flaccida method
Stroh, 2010[40]	12		30.5	NR	”number of patients requiring reoperation was significantly higher in the open approach group”
Lanthaler, 2010[41]	28.6		52.9	53.6 (original band) 17.6 (band replaced with new one)	Only pars flaccida method
O’Brien, 2013[42]	5.6		43	NR	”Pars flaccida removed slippage but enlargements remained constant”
Victorzon, 2013[43]	21.7	26.6	63.3	50	Only pars flaccida method
Aarts, 2014[44]	46.6	7.7	67	46	”no … differences … were found between the 2 operative techniques”
Trujillo, 2015[45]	54.8		55	NR	Only pars flaccida method
Arapis, 2016[46]	23.7	14.7	61.7	NR	NR
Carandina, 2017[47]	37.5 (10 yrs) 49.9 (15 yrs)		59.8	65.8 (10 yrs.) 53.3 (15 yrs.)	”Not significantly different (p=0.55)”
Vinzens, 2017[48]	63	8	78	29	”With introduction of pars flaccida, significant reduction of slippage (p=0.021)”
Tammaro, 2017[49]	28.6	15.2	38.8	61.7	‘’No difference in removal by operative technique (p=0.7)”
Khoraki, 2017[50]	NR	NR	23.1	NR	Only pars flaccida method
Froylich, 2017[51]	29.7	29.7	29.7	40.6	Only pars flaccida method
Furbetta, 2018[52]	3.2	8.4	24.1	NR	NR

Figure 17 (Table 3): band survival

Figure 17 presents statistics on the removal of the band, additional surgeries required, the band's survival rate over a certain period, and observations about the different surgical techniques used.
In some studies, the percentage of band removal was described in terms of conversion to another method and without. Nevertheless, the band removal rates vary greatly, from 3.2% in Furbett et al. [52] to 59.4% when combining both methods indicated by Froylich et al. [51].
Thirdly, the reoperation and revisional surgery percentage is recounted. It ranges from the lowest 20.4% in Naef et al. [49] to 78% in Vinzens et al. [48].
The band survival percentage shows how often the band was still in use after a certain period. Six studies didn’t report any band survival percentages, though in the remaining eight studies, the highest was noted in Naef et al. [49] with 85%, and the lowest was in Vinzens et al. [48] with 29%. Generally speaking, it is essential to note that the results varied gravely.
This last column provides insights or findings from each study comparing two surgical techniques for band placement: perigastric and pars flaccida. Some studies report no significant differences in outcomes between the methods, while others, like Vinzens et al. [48], found that introducing the pars flaccida technique significantly reduced the rate of band slippage. Generally speaking, most scientific literature prefers and encourages using the pars flaccida method or even solely uses this method.

7.4. (Table 4): general complications

Table 4:

References	% Operative mortality	% Insufficient weight loss or weight regain	% Infection, dislocation band	% Infection, dislocation Port	% Intolerance	% Slippage	% Dilation pouch	% Esophagus dilation/ dysmotility	% Band leakage	% Migration, penetration	Other complications
Naef, 2010[39]	0	NR	1.8	1.8	1.2	1.2		23.9	6.6	1.2	Obstruction, severe solid food intolerance, nightly aspiration, vomiting
Stroh, 2010[40]	0	NR	0	NR	NR	2.5 (0 in pars flaccida)	9.5 (0 in pars flaccida)	NR	NR	5.5	Discomfort from normal diet, reflux symptoms
Lanthaler, 2010[41]	NR	NR	3.2	24.2	NR	NR	21.5	5.8	20.5	20.5	Heart burn, vomiting
O'Brien, 2013[42]	0	NR	NR	21	NR	NR	NR	NR	NR	NR	Reflux, heart burn
Victorzon, 2013[43]	0	NR	NR	NR	NR	13.3	18.3	NR	13.3	NR	Reflux disease
Aarts, 2014[44]	0	53 (or complications)	3	NR	NR	22		NR	17	6	Weight regain, severe reflux
Trujillo, 2015[45]	NR	12.3	NR	NR	NR	20.5	NR	NR	21.9	NR	Dysphagia, reflux, regurgitation, vomiting
Arapis, 2016[46]	0	8	2	NR	NR	11	19.5		15	NR	Solid food intolerance, reflux symptoms
Carandina, 2017[47]	0	42	NR	17.9	NR	12 (with pouch dilation)	NR	NR	NR	4.7	NR
Vinzens, 2017[48]	NR	23 (of those with revisional procedures)	NR	11.1	41.4	18.4	14.3	9.1	NR	0.6	Food intolerance, reflux, dysphagia, abdominal pain, band herniation
Tammaro, 2017[49]	NR	7.8	1	NR	NR	10.7	11.5	NR	NR	NR	Reflux oesophagitis, GERD
Khoraki, 2017[50]	NR	NR	NR	3.3	NR	7.7	NR	NR	NR	NR	Small bowel obstruction, deep vein thrombosis, aspiration pneumonia, upper extremity thrombophlebitis
Froylich, 2017[51]	NR	NR	NR	NR	17.5	4	NR	NR	NR	13.5	GERD, pouch dilation, dysphasia
Furbetta, 2018[52]	0	NR	NR	8.4	NR	NR	5.8	NR	NR	NR	NR

Figure 18 (Table 4): general complications

Figure 18 describes the complications mentioned in the different studies. It provides data on various complications and side effects associated with laparoscopic adjustable gastric banding across different studies. There are several critical points in the table. This systemic review considered the points of band removal, malfunction or porting, infection, migration, leakage, slippage, pouch or esophageal dilation, intolerance, and other general side effects to be the most important.

Operational mortality was at 0% in all studies where it was a criterion. It supports the consensus that LAGB is a relatively safe method of bariatric surgery.

The percentage of insufficient weight loss needed to be sufficiently reported to draw necessary conclusions, though Arapis et al. [46] and Carandina et al. [47] describe differences of 8 to 42%. In the infection or dislocation of the band, the highest was reported at 3.2% by Lanthaler et al. [41] Port-related issues showed up in 24.2% of Lanthaler et al. [41] as well.

In some cases, an intolerance to the laparoscopic adjustable gastric band occurs, with specific percentages not always reported. Some studies showed unusually high results, like Vinzens et al. [48], compared to 1.8 percent in Naef et al. [39], often though an intolerance is not reported.
In some instances, slippage, pouch dilation, esophageal dilation, and dysmotility were explained together.
Generally speaking, all three complications were observed in different percentages.
Leakage from the gastric band caused a high percentage of complications, with results as low as 6.6% for Naef et al. [39] and up to 21.9% for Trujillo et al. [45].
Lanthaler et al. [41] noted the highest reported instance of the band migrating or penetrating the stomach, though the results were usually much lower, with the weakest for Vinzens et al. [48].
The reports showed further side effects, which included reflux disease, heartburn, vomiting, food intolerance, and aspiration problems.

This table highlights the variability in complication rates across different studies and the range of side effects experienced by patients following LAGB surgery. Considering that the side effects can significantly impact the patient's quality of life is crucial for patients and healthcare providers when choosing this treatment option.

7.5. (Table 5): operation techniques and follow-up

Figure 19 notes the different operation techniques, the fixation and band used, the follow-up appointments, and adjustments.
In the operation technique, the technique used initially was always noted first, followed by the one later used if there were different ones.

Most studies started with the perigastric operation technique before switching to pars flaccida.
O’Brien et al. [42] even tried conducting three different phases and determining the outcome of each one.
The fixation used for the band was not always reported, and it also doesn’t show as clear a trend as the technique used. Different methods were described, such as anterior fixation, gastrogastric fixation, and even more specific ones.

Table 5:

References	Operation technique (No. patients or %)	Fixation	Band used (No. of bands)	Follow-up	Adjustments
Naef, 2010[39]	All Pars flaccida	Anterior gastro-gastric tunnelling sutures	All Obtech, Ethicon Endo-Surgery	Band filling after 4 weeks	After 3, 6, 9, 12 months and yearly by operating surgeon in outpatient setting, indication: < 1kg weight loss/month
Stroh, 2010[40]	68.5% perigastric, 31.5% pars flaccida	gastrogastric stitches	11 SAGB (Obtech, Ethicon Endo-Surgery) 189 Lap-Band (INAMED Health)	First clinical examination after 6 weeks, then every 3 months for 2 years, after twice a year or when needed	< 2kg weight loss/month or <25% EBWL after 3 months
Lanthaler, 2010[41]	All Pars flaccida	Anterior fixation	12 Lap-Band (Bioenterics), 264 SAGB (Obtech)	Consultations once per month first 6 months, then every 3 months, after 1 year every 6 months, yearly after 2 years	After 1 month, band filled first time with 2ml iopamidol, after with 1-2 ml every month according to patient's comfort and weight loss, no more than 8 ml in band, filled and emptied at hospital
O'Brien, 2013[42]	931 Perigastric, 926 pars flaccida, 1370 Lap-Band AP system	Anterior fixation	NR	NR	Initially focused on ''fills'', then clinical consultation with adjustments
Victorzon, 2013[43]	All Pars flaccida (Tolonen technique)	NR	All SAGB (Obtech)	Filled after 6 weeks, visited at 3, 6, 9, 12 months in first year, then as needed but once a year, patients offered upper gastrointestinal endoscopy 3 years after surgery	Further adjustments at 3, 6, 9, 12 months in first year
Aarts, 2014[44]	41 Perigastric, 160 pars flaccida	NR	41 SAGB, 160 Lap-band (Inamed)	Followed up 6 times during first 2 years, then once a year	Adjusted when weight loss or lack of food restriction called for it
Trujillo, 2015[45]	Pars flaccida	Sutures between gastric pouch and gastric fundus	All SAGB (OBTech)	NR	Extra appointments, first choice in weight regain
Arapis, 2016[46]	376 Perigastric dissection, 521 pars flaccida	NR	All Lap-Band (Inamed/Allergan)	First consultation 1 months postoperatively, then every 3 months for 2 years, after twice a year or when needed	Performed by same surgical team, First adjustment 2 months after surgery then according to weight loss and food restriction
Carandina, 2017[47]	49.1 % (148) Perigastric, 50.9% Pars flaccida	NR	226 Lap-Band (Bioenterics), 75 Swedish Adjustable Gastric Band (Ethicon Endo-Surgery)	First year 1, 3, 6, and 12 months after surgery, every 6 months 2./3. Year, then annually	Outpatient basis by same surgeon under radiological guidance, filled during first month appointment and then as needed
Vinzens, 2017[48]	168 Perigastric, 15 pars flaccida with 9.75 cm Lap-Band 197 Pars flaccida with 11 cm Lap-Band 25 pars flaccida-to-perigastric	Sutures to gastric wall in perigastric, in pars flaccida on fatty tissue of lesser curvature band and gastric wall	168 Lap-Band (Inamed/Allergan), 9.75 cm Lap-Band and 11 cm Lap-Band	4,6,12 months after surgery, then every 6 months until fifth year, then annual follow-up	First after 6 weeks, according to weight loss
Tammaro, 2017[49]	376 Perigastric, 418 pars flaccida	NR	All Lap-Band (Inamed/Allergan)	Seen at 3, 6, 9, 12, 16, 20 and 24 months after surgery and then every 6 months	Began at 6 weeks postoperatively
Khoraki, 2017[50]	All Pars flaccida	Gastrigastric stitches	59 Lap-band 10 cm, 26 Vanguard band (Allergan), 18 Lap-Band AP Standard, 6 Lap-Band AP Large (Allergan), 99 Realize adjustable band (Realize)	Filled after 6 weeks, seen 2 and six weeks post-surgery, then 3, 6, 12, 18, 24 months and annually after	According to manufacturer guidelines
Froylich, 2017[51]	All Pars flaccida	Non-absorbable sutures to anterior rectus sheath and muscle	All Lap-Band (Bioenterics), SAGB (Ethicon Endo-Surgery)	Filled at first month appointment, referred to nutritionist	Outpatient, adjustments as needed
Furbetta, 2018[52]	79% Pars flaccida 19.4% Perigastric 1.6% Mix	Anchoring the port to fascia, later using mesh fixation, gastrogastric stitches	NR	First subjective, later at scheduled intervals or in case of need	First by surgeon and radiologist, based on band filling, later by surgeon with IDT (interdisciplinary team) based on band filling and IDT evaluation

Figure 19 (Table 5): operation techniques and follow-up

Many studies used different bands, showing the market the LAGB operation has in treating obesity. The most popular ones included the Swedish Adjustable Gastric Band by Obtech and the Lap-Band by Inamed, but Bands by Bioenterics and Ethicon also proved very popular. None of the studies reported any differences in outcome or higher wear and tear over time.

Essential factors in determining the procedure's outcome also include the attention to the follow-up used per study. Many studies had their first band filling after at least four weeks, most even after six weeks. It was also reported that some follow-ups occurred at three, six, nine, and 12 months after surgery. It was reported that follow-ups included appointments with nutritionists and other specialists. After some time, the follow-up appointments were less regular and mostly happened once a year.
Adjustments were also mostly reported on. Sometimes, they were yearly appointments for adjustments; in other studies, it was done according to the patient's needs. Not written in Figure 19, but in the study of O'Brien et al. [42], adjustments could also be made by the general physician, leading to a more straightforward approach for the patient, mostly though it was done by the same surgeon in an outpatient setting, that also performed the laparoscopic adjustable gastric banding operation.

This table highlights the variability in operation and follow-up approaches across different studies and the materials used following LAGB surgery. It is essential to consider the decade-long follow-up and adjustments when choosing this treatment option for obesity, as the time can significantly impact the patient's life and needs continuous commitment.

8. Discussion

The outcome of using Laparoscopic Adjustable Gastric Banding (LAGB) to treat obesity for a long time in this research, as shown in the results section, gives a multidimensional view of its efficacy and challenges. This discussion is devoted to considering the consequences of these findings and the overall procedure used.

One of the major effects of LAGB is weight loss, as shown by our study results. Notably, the percentage of excess weight loss (%EWL) aligns with the results of earlier studies, thereby presenting LAGB as an effective obesity therapy for selected people. Nevertheless, the fluctuation in the weight loss goal of patients supports the need for personalized approaches. Factors such as the patient's age, starting weight, and adherence to lifestyle changes are crucial aspects in patient selection. The patients' variability in response demonstrates the need for careful patient selection and continued monitoring.

The long-term sustainability of weight loss post-LAGB is critical to its effectiveness. Performing multiple studies, the analysis found a trend of significant initial weight loss, followed by a degree of weight regain by patients over time, leading to good short-term results but significantly different ones long-term. This cycle demonstrates that although LAGB can achieve weight reduction, its success relies on continuing certain lifestyle changes. Nutritional counseling, physical activity, and psychological support would make it possible to achieve the goal of continued weight loss.
Often, many patients lose the band as not many report long-term good results. ''This technique has been abandoned in both Europe and the United States due to increasing band-associated complications and the emergence of more popular procedures. […] Only one large study, conducted in Australia presents acceptable long-term results […].'' (Vinzens et. al. [48]).

Looking at the data in Figure 19, it is often suggested that the pars flaccida operation technique shows better results than the perigastric one. This happens because, firstly, the perigastric operation technique was used, and after the switch to pars flaccida, pars flaccida showed better outcomes. Aarts et al. [44] supported this trend when writing,'' In the short term, this was also the case in this series, especially for the number of reoperations due to slippage''[44].

While LAGB is less invasive and has lower complication rates compared to other bariatric surgeries, the results revealed several problems such as band slippage and band dilation. These complications, alongside instances of insufficient weight loss, have led to high rates of revisions. This finding emphasizes the need for careful patient monitoring and the potential for surgical revisions or conversions to other bariatric procedures.

Moreover, Victorzon et al. [43] tried to explain the different outcomes after laparoscopic adjustable gastric banding by saying, '' One of the problems of gastric banding is of a logistic nature. The continuous and indefinite need for band adjustments is crucial for even moderate success in the longer run […]. This is also tiresome for the patient in the long run and may make the patient seek alternative solutions. […] [43]. The studies discussion follows by pointing out, that Australia has successfully involved general physicians in the process, leading to a more sustainable approach for the patient. Cultural differences between Europe, North America, and Australia may also play a role.

The initial research question was ''Which treatment approach maximizes the weight loss outcome in Laparoscopic adjustable gastric banding in the long-term setting (10 and more years)?''

Sadly, it is impossible to determine a clear trend when examining the outcomes of the different studies to explain why the percentage of excess weight loss varies significantly. Different suggestions can be made, but there is no definitive answer.

Having performed a post-operation assessment of the long-term outcomes of laparoscopic adjustable gastric banding, several important recommendations can be derived to improve this procedure. The studies described a comprehensive assessment, including psychological evaluations and physical health screenings. This process ensured that LAGB is offered to individuals most likely to benefit from it. It can optimize outcomes and reduce the risk of complications.

It was often noted that the patient received a comprehensive preoperative education. It is important to inform the patient about realistic expectations regarding weight loss, required lifestyle changes, and possible risks. Also, counseling sessions, informational material, and support groups can help the patient in the long term.

The integration of a multidisciplinary team was not noted in every study. The handling of obesity should be spelled out. The management of obesity should be a coordinated effort that involves several specialists such as a bariatric surgeon, dietitian, psychologist, nutritionist, primary care provider, etc. It is essential to approach obesity as a team and provide comprehensive patient care. Postoperative care, which covers nutrition, physical activity, and psychological care, could be a possible way for patients to have even more positive outcomes. These programs are critical in maintaining body weight and improving general health results.
Postoperative support is crucial for monitoring the patient's progress, managing the band adjustments, and identifying complications early. Continued support might help the patient cope with lifestyle changes and psychological challenges.

Unfortunately, nearly none of the papers talked about the time between the identification and management of complications. Healthcare workers must be very good at identifying and handling problems associated with this practice.

Another factor that is subject to healthcare systems in different countries is the public health initiative to increase public awareness about laparoscopic adjustable gastric banding as an obesity treatment of choice. Ongoing education campaigns could make the operation less mysterious, get more people exposed to it, and convey the advantages and disadvantages of this treatment.

While LAGB offers a viable option for weight loss, its long-term success hinges on careful patient selection today, comprehensive education, multidisciplinary care, and continuous support. Advancements in research and public health education are necessary to improve the outcomes and acceptance of the treatment option.

Laparoscopic adjustable gastric banding has proven to be a somewhat effective bariatric surgery option for treating obesity, but studies analyzing its long-term results come with certain limitations. Addressing these limitations and identifying future research directions is essential for enhancing our understanding and improving the outcomes of LAGB.

A significant limitation in current research is the variability in study designs. It is challenging to compare results across studies when different studies focus on different aspects. Differences, for example, in the follow-up duration, assessment, methodologies, and side effect documentation make it difficult to analyze and compare results between different studies easily. Standardizing these perimeters could lead to more reliable and generalizable findings, though it would also mean only seeing a specific type of study.

One of the most challenging issues in this paper is the selection of long-term data. Many studies focus on short-term outcomes, with few investigations extending beyond five years post-surgery. An explanation might be that many countries only require three to five years of follow-up. Given that obesity is a lifelong condition, more extended studies with more long-term data are crucial to better understand the efficiency and risks of LAGB.

The impact of patient complications and lifestyle changes after the procedure is often unreported. These factors play a crucial role in the long-term success of the surgery, as they can significantly affect the results.

The studies we have covered are hardly related to the psychological and behavioral consequences that people experience after the surgery. It was underreported if other complications like limited motivation, depression, etc occurred. This component is critical as obesity is not purely physical but involves several different variables, such as behavior and emotions.

Some of the papers detailed the complications present after the LAGB and other underreported complications or side effects. A comprehensive review would have been interesting for this systemic review.

LAGB is often not a preferred method in the treatment of obesity anymore, and no long-term research papers are being published as of data from 2024. An extended follow-up with more longitudinal studies, ideally beyond 10 years, could be interesting. It could provide a deeper insight

into the durability of weight loss, patient satisfaction, and long-term complications, as well as newer operation methods and their impact.

The studied research did not commonly include exhaustive patient profiling that would have included psychological, behavioral, and physical aspects. It would have been positive to include that and focus on mental health or social functioning, for example. That would better capture the overall impact of the surgery on patients' lives.
In most cases, weight loss was the only assessment regarding quality of life. Furthermore, it would have been better to specify that and make it about mental health or lifestyle. That way, it would also be possible to assess how the intervention affected patients' lives.
Studies on laparoscopic adjustable gastric banding are not recent. Assessing the effect of new surgical methods and technology on outcomes can be exciting. Researching new band materials or post-operative care will increase efficiency and reduce complications.

Nearly none of the papers provided any economic evaluations of the treatment in comparison to other procedures, especially for patients with long-term health costs who underwent the operation compared to those who did not.

Knowing the restrictions of the present-day research on LAGB is crucial in delivering a better understanding of its long-term efficacy and safety. Future studies can go beyond the what-if scenarios and look specifically into how the physical, psychological, and lifestyle factors influence obesity in terms of treatment.

9. Conclusion

While analyzing the long-term results of laparoscopic adjustable gastric banding (LAGB) as a treatment option for obesity, a view that embraces the physiological and psychological impact of the procedure is imperative. This article has analyzed and contrasted several outcomes, such as weight loss effectiveness, effects on obesity-related comorbidities, and possible complications of LAGB.

First and foremost, LAGB's efficiency in achieving weight loss is given. The outcomes vary depending on the study, but every clinical trial attained some sort of weight loss. The mark of 50% EWL is often nearly met or exceeded. On the other hand, the treatment with a laparoscopic

adjustable gastric band is not without its limitations and should be considered with careful deliberation. The duration of treatment varies from short-term to long-term, and the chances of regaining weight demonstrate the necessity for patients to undergo permanent lifestyle modifications after the procedure. It is clear from the evidence that the success of LAGB goes beyond the application of the procedure itself; it additionally depends on patients' ability to live a healthy lifestyle and adapt to alterations in eating habits.

Moreover, the complications associated with LAGB, such as band slippage, etc, present considerable challenges. These complications can cause a patient to develop more morbidity and a need for more surgery, both of which can have a physical and emotional effect on the patient. In contrast, evidence of patient screening, perfect operation techniques, and strict follow-up is emphasized.

With the development of other bariatric techniques with increased rates of weight loss and potentially fewer complications, the applicability of LAGB in obesity treatment has now shifted to be considered. In some cases, procedures such as gastric bypass and sleeve gastrectomy have proved to be more result-oriented in terms of weight loss than other weight reduction methods. This eventually contributed to the increasing tendency of bariatric operations, with the declared preference for alternatives over laparoscopic gastric band surgery.

Despite the concerns, LAGB still has several advantages that cannot be overlooked. It is minimally invasive, adjustable, and reversible. After careful consideration, these significant positives make it a preferred option for certain patients. Patient groups that LAGB is better for include those who are at high risk or who prefer a less invasive approach. In comparison to other methods, LAGB offers a technique that can be personalized to the individual’s needs better.

Considering the broader management of obesity, LAGB should be seen as one of the many choices available rather than the only remedy for the issue. Obesity is a multifaceted health concern that necessitates the engagement of a plan of strategies—lifestyle behavior therapy, nutritional support, and sometimes even pharmacotherapy. The decision to proceed with LAGB should be informed and involve a multidisciplinary team to receive the full spectrum of care.

Therefore, in the context of the previous discussion, in which it was pointed out that laparoscopic adjustable gastric banding efficiently treats obesity, this surgical procedure is recognized as an effective tool. However, patients can have more reliable alternatives in these cases. LAGB is a

procedure that should be addressed under an individual case rather than viewed generally, generalizing the individual′s medical history, personal tastes, and level of commitment. From this side, it is advantageous, but the result will be different if other conditions exist.

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