Management of staple line reinforcement in patients undergoing vertical sleeve gastrectomy: a comparative study of postoperative bleeding that occurred with the use of the manual reinforcement technique vs. titanium clips

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Abstract

Introduction: Laparoscopic sleeve gastrectomy has become the bariatric technique of choice over others, due to its simplicity, safety and good results in the short, medium and long term in weight loss and prevention of morbidities associated with obesity, which affects a large part of the population worldwide. Like any surgical intervention, it has its complications and risks, one of the most frequent is postoperative bleeding from the staple line, there are various techniques to reinforce the staple line, among which are manual suture and the use of titanium clips, this study aims to establish a comparison of benefits between the two methods, in order to identify which of them offers more benefits for surgeons and patients. **Methods:** Descriptive, correlational and systematic study, based on an electronic bibliographic search in scientific databases, of articles published in high-impact journals, in the last 5 years, in English and Spanish, showing relevant information regarding the topic and meet the inclusion criteria, around 50 documents were analyzed, of which 20 were chosen for the writing of this work. **Results:** Various studies from various countries were found, among which systematic reviews, meta-analyses, prospective studies, surgical protocols and postgraduate theses were analyzed, which showed insignificant results for the specific comparison of staple line reinforcement materials, in instead they offered more information on the benefit of reinforcing, without more specificity of techniques or materials. **Discussion:** The reinforcement of the staple line is considered by some authors as a prevention technique against the risk of bleeding and leaks, presenting efficacy in a series of patients around some investigations; On the other hand, there are authors who do not consider the reinforcement of the staple line necessary, since no relevant statistics are found on its use, and identify that it is not a procedure that justifies the lengthening of the surgery and the cost of this intervention, something important in a way routine. **Conclusions:** The investigation of this subject is important to establish a consensus that

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compiles the largest number of opinions and experiences that allow consolidating an established technique in an operation with great acceptance and use, which will favor professionals and patients.

Keywords: bariatric surgery, vertical gastectomy, staple line reinforcement, hand suture, titanium clips, postoperative bleeding.

DOI Number: 10.14704/nq.2022.20.13.NQ88266 **Neuro Quantology 2022; 20(13):2132-2137**

Introduction

Obesity is a worldwide epidemic problem, affecting people of all ages and socioeconomic groups, and its incidence has tripled since 1975. According to data from the World Health Organization (WHO), almost 1.4 billion adults are overweight, and about 500 million already have obesity, and this in turn increases the rates of associated complications such as cardiovascular disease, diabetes, hypertension, among others. (Chávez Velásquez, Pedraza and Montiel, 2019).

Vertical gastrectomy also known as "sleeve gastrectomy" was initially performed in 1988, based on the duodenal crossing with biliopancreatic diversion proposed by Scopiano; (Aiolfi et al., 2022) it is currently favorably accepted as a primary bariatric operation by both surgeons and patients, and has obtained promising results showing reductions in body mass index at 6 to 12 months after surgery, along with the mitigation of comorbidities that accompany obesity.(Pacheco García et al., 2019) For his part Gagner, in 1988 transcended to the laparoscopic technique in high-risk patients, since then, it has become the most used bariatric technique worldwide, for concretizing lasting weight loss. (Aktokmakyan, Gungor and Sumer, 2020) According to the IFSO Global Registry in 2019, Laparoscopic Vertical Gastrectomy (LGV), or "LSG" for short, is the most used technique, at 58.6%, followed by Roux-en-Y gastric bypass at 31.2%, and finally with lower usage rates, 4.1%, single-anastomosis gastric bypass.(Pacheco and Mayo, 2017).

Laparoscopic Sleeve Gastrectomy (LSG), was recognized by the American Society for Metabolic and Bariatric Surgery, and the American College of Surgeons as a metabolic and bariatric surgical technique. (Morales Maza, 2021) Whereas, the thermal Laparoscopic Vertical Gastrectomy was accepted in 2010, by the Spanish Society of Obesity Surgery (SECO) and by the Royal Academy of Medicine of Spain, in contrast to other frequently used thermals such as "gastric sleeve" or "tubular gastrectomy", (Pacheco Garcia et al., 2019) for language purposes, in this study we will refer to the technique as Vertical Gastrectomy (VG).

LGV consists of a procedure of vertical sectioning of the stomach, using staples, removal of the gastric fundus and proximal antrum, with the aim of creating a tubular shaped alimentary canal running along the lesser curvature of the stomach. The "gastric sleeve" would form a pouch with a capacity of approximately 150 ml, and its tubular shape is due to the stapling along the stomach.(Aktokmakyan, Gungor and Sumer, 2020) This stapling line can be covered or reinforced with different materials in order to reduce subsequent bleeding and prevent reoperation.

The process starts with the introduction of an orogastric calibration probe, through which a vertical gastrectomy is performed from approximately 6 to 8 cm from the pylorus to the angle of His, by means of continuous staples of sharp mechanical suture. After completion of the gastrectomy, the stomach is removed through one of the trocars wrapped in nylon to prevent contiguous wall contamination. As shown in Figure 1 (Quisiguiña et al., 2021).

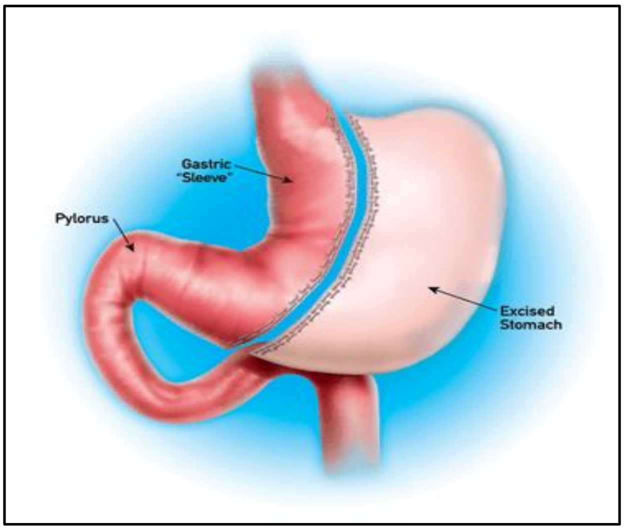

Figure 1: Vertical sleeve gastrectomy

Source: (World Laparoscopy Hospital, 2019)

Once this process has been performed, many surgeons resort to mechanical suture reinforcement and hydropneumatic testing to ensure that there are no leaks. For manual reinforcement, after having performed an adequate hemostasis control, a surget is made with 2/0 vicryl, through the entire route of the mechanical suture, thus preventing possible postoperative bleeding. (Pacheco and Mayo, 2017) Finally, the entrance holes of the trocars are closed with non-absorbable sutures to avoid hernias. (Quisiguiña et al., 2021).

Although GV is claimed to be a restrictive procedure, it also has neurohumoral effects, such as a decrease in the production of ghrelin, which is a hormone that stimulates appetite. In addition, the surgery induces a faster gastric emptying that transports food early into the small intestine.(Salazar Robalino, 2018).

From a technical point of view, laparoscopic GV is considered an optimal technique because of its simplicity and its results in terms of weight loss with its consequent resolution of comorbidities and low incidence of post-surgical complications; however to this it is necessary to know that despite its efficacy, there are important complications for the patient, such as leakage, fistulas, strictures, gastroesophageal reflux and the reason for the present study, bleeding from the stapling line. (Gagner and Kemmeter, 2020).

Most staple line leaks or bleeding have been seen proximally at 89%, and could be related to ischemic or mechanical problems such as excessive intraluminal pressure exceeding tissue and suture line strength. (Gagner and Kemmeter, 2020)

Several options have been used to mitigate this complication, this study focuses on comparing postoperative staple line bleeding rates through a systematic literature review, with the use of manual suture technique vs. the use of titanium clips.

Methodology

Descriptive, correlational and systematic study, based on an electronic bibliographic search in databases such as PubMed, Science Direct, Google Scholar, Medline, among others; following search strategies by using keywords such as: "vertical gastrectomy", "staple line reinforcement", "post-surgical complications", "manual and mechanical suture", "vertical gastrectomy", obtaining research works of various designs both in Spanish and English language. The search included research conducted from 2017 onwards.

The results were thoroughly reviewed by each title to discard those studies that were duplicated; and the remaining records were analyzed by reading abstracts. Studies where the vertical sleeve gastrectomy technique was emphasized, those that included data on leaks and staple line reinforcement, as well as those that involved surgical techniques related to the topic were included. Studies involving animal experimentation, letters to the editor, studies with a focus other than bariatric surgery, articles not describing mechanical or manual forms of reinforcement, and papers of extensive antiquity were excluded from eligibility.

The data collection objectives focused on variables highly relevant to the research such as: previous abdominal surgery, age, associated comorbidities, sex, age, type of bracing, surgical technique, anthropometric measurements and general complications.

After the selection and reading of the documents, the writing of this article began, and the bibliographic manager Mendeley was used.

Results

In the bibliographic search, about 50 articles were identified in the different databases mentioned, of which 22 were excluded because they contained bias in the information or impartiality in the approach, and finally 18 were selected. In addition, it is important to highlight that the selection included postgraduate theses from the Universidad Central del Ecuador, 1 review article from the same institution and a surgical protocol presented in the HECAM journal for epidemiological and contextual purposes.

Obesity is a public health problem worldwide, studies report that in the last 10 years there are figures around 500 million adults and 100 million obese children in the world. It is estimated that by the year 2030 around 1 in 2 adults will be obese, establishing a prevalence that reaches 50% (Chica Burgos, 2021). On the other hand (Chávez-Velásquez, Pedraza and Montiel, 2019) reports that every year around 3 million people die from coronary pathologies, cerebrovascular accidents, diabetes or various types of cancers due to overweight and obesity.

Bariatric surgery has taken position in the last 10 years, increasing more and more procedures performed, based on the statistics and incidence of growing obesity, so that the International Federation for Surgery of Obesity and Metabolic Disorders (IFSO) has reported an approximate of 700 000 surgical procedures around the world.(Pacheco Garcia et al., 2019) In this context, it is indicated that bariatric surgery allows to massively help people in their weight loss process and in turn in the improvement of quality of life and decrease of obesity-related morbidities.

The safety of bariatric procedures is becoming increasingly important in research and practice, which is why multiple studies have been conducted over the years to obtain current data indicating perioperative complication and mortality rates, the latter ranging between 0.03% and 0.2%, considered low and continuously improving over the last two decades. While the complication rates range between 5.8 and 11.7%, mainly due to leakage and bleeding, taking into account the first 30 days post-surgery.(Iannelli et al., 2019).

The mechanical cause of postoperative staple line bleeding occurs when intraluminal pressure, in conjunction with low gastric sleeve distensibility, exceeds the staple line resistance.(Cosentino et al., 2021).

Regarding techniques (Bali and Singal, 2018) states that clips are applied only on bleeding foci, if any, by prior corroboration. Otherwise, no staple line reinforcement technique is used. On the other hand (Jung et al., 2022) in a study of 529 patients, reveals that no staple line reinforcement was used and patients had no complications such as bleeding or leakage. Another meta-analysis performed by (P. Jimenez et al., 2022) with more than 1000 patients, indicates that there were no significantly relevant statistics in the proportion of leaks and hemorrhages after the use of staple line reinforcement using the manual technique, only three cases of leaks were identified, two of which were detected in patients reoperated for revision, three bleedings and one stenosis were also detected; reason for which they conclude in the decision not to use any reinforcement method.

In a prospective study, conducted by (Vilallonga et al., 2020) where 920 patients undergoing LGV were included, the usefulness of hand suturing for staple line reinforcement with absorbable material was compared. The study was divided into 400 patients with manual reinforcement and 400 without it, obtaining 8 cases of postoperative bleeding in the group of patients without reinforcement and none in the group that did use it. All the surgeries were performed by the same team of experienced bariatric surgeons, which prevents relating variables such as professional criteria or the physician's experience to the result.

(Aktokmakyan, Gungor and Sumer, 2020) indicates that staple line reinforcement using clips is beneficial, showing reductions in operative time, limitation of postoperative gastric leakage and postoperative bleeding.

(Aiolfi et al., 2022) states that the use of hand suture with absorbable synthetic polymers as reinforcement has been shown to be feasible and is well tolerated, in a study of 160 patients undergoing LGV with hand suture as staple line reinforcement, 9.4% developed complications, showing that its use is associated with a higher rate of leakage and bleeding compared to other techniques used in this study but not mentioned here, as they do not include the use of titanium clips for the strict comparison performed in this work.

(Highet et al., 2021) in a cost-effectiveness analysis of routine staple line reinforcement suggests that, compared to standard stapling without reinforcement, reinforcement in any of its techniques and materials reduces minor post-surgical bleeding, but not major bleeding or leaks, so it is not considered cost-effective when used routinely in laparoscopic vertical sleeve gastrectomy.

Many studies have been published to evaluate the impact of various reinforcement techniques on the prevention of postoperative bleeding after laparoscopic vertical gastrectomy, however, the results have not been entirely conclusive due to the retrospective design of the investigations, insignificant sample sizes and low postoperative complication rates in the absence of staple line reinforcement. Therefore, a solidly supported consensus that comprehensively considers reinforcement techniques is needed in order to establish more specific results.

Discussion

The main objective of staple line reinforcement is to reduce hemorrhage rates and staple line leaks. However, despite the analysis performed, there is no current consensus in the recommendations on the use of staple line reinforcement, since there are variables such as surgeon criteria and surgeon experience when deciding whether to apply reinforcement or not, so this practice remains controversial.

Within the context of this research, no significant data were found in the literature comparing and strongly demonstrating the benefits in terms of postoperative bleeding with the use of manual suture vs. titanium clips. However, several studies have defined hand suturing with resorbable material as a way to prevent bleeding in the procedures performed.

On the other hand, due to the lack of specificity regarding the technique used in many studies comparing the benefit of reinforcing or not the staple line, the superiority of one method of reinforcement over another has not been accurately established.

This inconsistency has also been reflected in the articles selected for analysis due to various personal risk factors of the patient, making some more prone than others due to their circumstances to postoperative complications such as bleeding.

Given the aforementioned circumstances and limitations, there is a need for prospective trials to identify with specificity the most commonly used techniques for their cost-effectiveness and safety in the use of staple line reinforcement in vertical sleeve gastrectomy.

Conclusions

Standardizing the surgical technique in vertical sleeve gastrectomy is important for the homologation of team work and the establishment of results that allow identifying the greatest benefit for patients in a surgery that is increasingly used and chosen by surgeons due to its good results in the management of obesity and its complications, which afflicts a large part of the population.

Systematic reviews, conferences and consensus with long-term multicenter studies would help to clarify these inconsistencies in the choice of technique, material or simply the choice or not to make a reinforcement to the stapling line in vertical sleeve gastrectomy. Despite the fact that most surgeons perform additional reinforcement of staple lines, the need for it has not been established, nor has the ideal technique for doing so.

Regarding the studies analyzed that indicated results against the use of the manual suture technique for staple line reinforcement, it has been established that it offers an optimal rate of usefulness, presenting 0 cases of leaks or postoperative bleeding after its use; however, no studies have been found that establish it as the technique of choice for staple line reinforcement, due to the fact that it can sometimes increase intraluminal pressure.

Regarding the use of titanium clips for staple line reinforcement, no significant information has been found that would allow establishing an important comparison with the use of manual suture.

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