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TECHNICAL STANDARDIZATION OF LAPAROSCOPIC VERTICAL GASTRECTOMY (SLEEVE GASTRECTOMY)

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Abstract: Morbid Obesity is considered a current epidemic by the World Obesity Federation. It is related to a series of comorbidities, and therefore it is important to adopt an adequate treatment to reduce the deleterious effects on the individual's health. The laparoscopic sleeve gastrectomy (LSG) technique, known as gastric sleeve, has been shown to be advantageous when compared to other surgical techniques. However, there are several technical details that are not a consensus among surgeons, in addition to additional measures that aim to prevent the main complications in the postoperative period. **Objective:** to develop a standardization in the surgical technique and postoperative follow-up aimed at reducing complications and minimizing pain. **Methods:** Detailed technical systematization that involves: The preparation and positioning of the patient; as the ideal method of securing the patient to the operating table, positioning the table and passing the trocars to improve surgical ergonomics. The details of the operative technique; such as the calibration of the gastric tube with the fouchet probe, *Downsizing* of loads for stapling the gastric tube, reinforcement of the staple line with continuous suture with fixation of the omentum and the final test with methylene blue. In addition to additional measures such as; Analgesia by videolaparoscopic tap-block and infusion of intraperitoneal analgesic solution, thromboembolic prophylaxis with the use of elastic stockings and use of prophylactic Clexane intraoperatively. **Results**: During 21 months, 202 patients who underwent GVL were included according to the technique described here. **Conclusion:** The proposed surgical technique facilitates the surgical procedure, improves the surgeon's ergonomics, reduces bleeding rates and fistulas, reduces the need for postoperative analgesics and reduces thromboembolic complications when compared to the literature.

Keywords: Vertical Gastrectomy; Sleeve Gastrectomy; Bariatric surgery.

INTRODUCTION

Since the definition of morbid obesity as a disease in the early 1950s, the epidemic of Morbid Obesity has been advancing around the world. Therefore, it must reach almost 30% of the adult population in Brazil by 2030. This is estimated by the World Obesity Atlas 2022, published by the World Obesity Federation. Grade III obesity is defined as the excessive accumulation of fat in the body, characterized by a body mass index (BMI) > 40 kg/m². It is related to a series of comorbidities, therefore, it is important to adopt an adequate treatment to reduce the deleterious effects on the individual's health (LOBSTEIN, 2022).

The laparoscopic sleeve gastrectomy (LSG) technique known as *sleeve* gástrico, it is the most commonly performed bariatric procedure in the world, representing more than 50% of all procedures in this segment (PALERMO, 2020). It presents weight loss and long-term morbidity results comparable to the Roux-en-Y technique, which is the second most used bariatric technique today (ROCHA, 2020). In Brazil, GVL has been gaining space and surgical indications in the bariatric surgery scenario, in addition to satisfactory results, presenting less technical complexity. Mainly, because it addresses only the stomach in the surgical procedure, dispensing with intestinal anastomoses and the involvement of the infrasocolic floor of the abdomen, which avoids the risk of internal hernias or other complications, such as a severe deficiency of micronutrients and proteins. This does not make it a technique that can be considered easy to learn, which is why the standardization of its steps is important (PALERMO, 2020).

There are several technical details that are not consensus among surgeons, in addition to additional measures, which aim to prevent the main complications in the postoperative period, such as fistula of the staple line, bleeding, pulmonary thromboembolism and system thrombosis. porto-mesenteric (RAMOS, 2015). In this work, we describe the technical and clinical aspects to perform the GVL procedure with maximum safety, in a way that can be replicated in other bariatric surgery services.

OBJECTIVE

To develop the standardization of the GVL surgical technique and the hospital follow-up of patients, in order to facilitate the surgeon's work and contribute to improvements in immediate results, reduction of complications and minimization of pain.

THEORETICAL REFERENCE

GVL is a safe option when compared to other bariatric surgery techniques, with serious complication rates on average equal to or less than 5%. In addition to satisfactory weight loss, several factors contribute to the wide acceptance of GVL in the world. It is considered a technically easier operation, as it does not require anastomoses and is clinically beneficial for the patient, as it rarely generates nutritional problems and facilitates long-term vitamin and mineral replacement, since there is no intestinal bypass (BERGER, 2016).

Initially, GVL was proposed as a procedure with important indication limits. It was reserved for severe cases, of super-obese patients, with a BMI above 40kg/m², with the intention of reducing the surgical risk, as a step in the biliopancreatic diversion technique with *duodenal switch*. These limits were quickly extended, especially in patients where Roux-en-Y gastric bypass was controversial, such as in patients with inflammatory bowel diseases, with previous abdominal operations, and candidates for organ transplants, such as liver and kidney (NASSIF 2013; RAMOS,

2015). On the other hand, some indications for GV remain relative, such as the presence of GERD and in obese patients with advanced metabolic syndrome (CARTER, 2011; LAFFIN, 2013).

Of the analyzed articles, the only consensual aspect is that SG must preferably be performed laparoscopically, since the dissection of the greater gastric curvature close to the spleen is greatly facilitated by the direct view that only laparoscopy can provide, avoiding iatrogenic splenic injuries. also, the correct positioning of the stapler next to the esophagogastric transition can only be performed through laparoscopic vision (BERGER, 2016). The laparoscopic release of the greater curvature and the gastric fundus is faster and safer with the use of ultrasonic energy, which through mechanical vibration energy makes it possible to seal the tissue by protein denaturation, resulting in fast and reliable hemostasis (PALERMO, 2020).

The diameter of the remaining stomach is one of the divergences between the GVL techniques, especially in the gastric body region. In theory, the less caliber gastric tube provides greater weight loss, at least in the initial postoperative period. However, this narrowing can also cause greater difficulty in feeding, in addition to generating increased intragastric pressure, with a greater risk of fistulas in the staple line. Another complication directly related to the reduction in stomach caliber is stenosis, with consequent gastric stasis, which generates recurrent episodes of vomiting, compromising the patient's quality of life, and increasing the risk of nutritional disorders (AURORA, 2012; LAFFIN, 2013).

In order to minimize these complications, surgeons agree on the need to use the *Fouchet* probe as an intragastric "template" to guide the calibration of the remaining stomach. Although the ideal size of this probe is controversial. Several studies have analyzed the outcome of surgery with different gastric tube calibration standards, from 28-French (Fr) to more than 50-Fr. Calibrations above 40-Fr have been associated with poor weight loss or significant regain. However, there are comparative studies with probes of different calibers that have not shown changes in weight loss results in the first postoperative year. Larger tubes may decrease the incidence of fistulas, probably because it allows the creation of a gastric tube with lower luminal pressure (BERGER, 2016; RAMOS, 2015).

However, there is evidence to support that making a very tight tube has minimal short-term weight loss advantages. Meanwhile, it risks significant postoperative complications, mainly fistula of the esophagogastric transition and clinically symptomatic strictures. Over time, the angle of His fistula, which seemed to be related to local problems of fragility of the esophagogastric transition, began to establish much more relationship with stapling too close to the esophagus. In general, it is advisable not to adjust the calibration to less than 32-Fr (10.7 mm) (RAMOS, 2015; PALERMO, 2020).

Staplers allow for faster and safer resections, and are indispensable devices in GVL. At the time of stapling, the point that marks the division of the pylorus with the antrum remains controversial. Most surgeons start the division 2-5 cm from the pylorus, to avoid increasing the antrum postoperatively. It is standardized by manufacturers to start with the highest stapler load at the level of the antrum and gradually use lower stop loads as stapling continues proximally. The thickness of the stomach decreases from the antrum to the fundus and from the greater to the lesser curvature. Based on the use of the Ethicon®️ stapler, it is suggested to start with the black or green load, continue with the gold and finish with the blue. But, with Medtronic®, you must start with one or two black charges and finish with the purple charge (DUPREE, 2014;

RAMOS, 2015; PALERMO, 2020).

The main complication in the immediate postoperative period of GVL is the fistula in the staple line, since it is mainly detected within the first 10 postoperative days (DAKWAR, 2013). They occur in about 2% of patients and, preferably, are located in the upper third of the tubular gastric body, especially close to the esophagogastric transition. In addition, fistulas resulting from GVL are generally associated with greater morbidity, requiring the surgeon to be aware of the different therapeutic modalities available, such as percutaneous surgical drainage, endoscopic therapy with clips, dilation and stents, simple suture of the fistulous orifice, anastomosis between the fistulous orifice and a jejunal loop and, more radically, reserved for well-selected cases and experienced surgeons, total gastrectomy with esophagojejunal Roux-en-Y anastomosis (AURORA, 2012; PALERMO, 2020).

Another feared complication is postoperative bleeding in the stapling line, both externally to the abdominal cavity and internally, which can cause episodes of upper digestive hemorrhage. For prevention, studies suggest performing a continuous suture in a single total plane, with absorbable thread. The barbed suture has been shown to be a good option for this type of reinforcement. However, it has a high cost, which makes the procedure more expensive. Together, there are conflicting results in other studies, which did not show advantages in relation to over-suture with surgical thread and stapling without any reinforcement technique. The methylene blue test is routinely performed in the analyzed studies, although surgeons rarely report the test result as positive (PALERMO, 2020).

MATERIAL AND METHODS

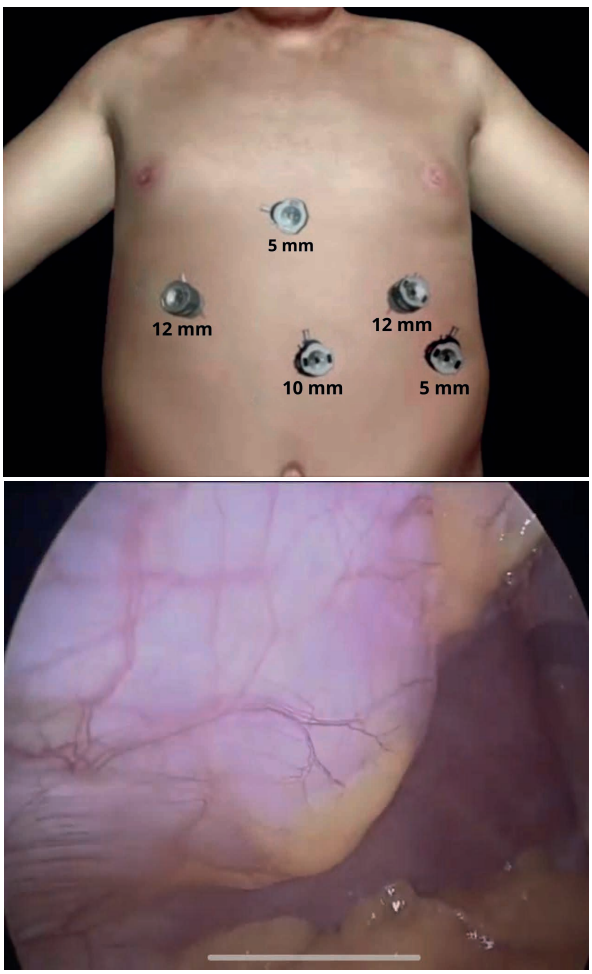
The study was carried out based on the technical analysis of the medical records of Dr. Marcelo Gomes Girundi and Dr. Rodrigo Faria Cardoso, and a wide review of the literature on the subject. The inclusion criterion was having undergone the GVL procedure at the General Surgery Service of Hospital Felício Rocho. Among the patients who met the inclusion criteria, there were no exclusion criteria.

This is a longitudinal retrospective study, based on the review of the medical records of selected patients. Thus, the Informed Consent Form (ICF) was unnecessary. The medical records of 202 patients who underwent GVL were analyzed, according to the technique described here, for 21 months, from December 2020 to May 2022.

The standardization of the surgical technique starts with positioning the patient, who is placed in a supine position with legs apart at 30°, with the surgeon between the patient's legs, to improve surgical ergonomics. First helper on the right and second helper on the left. Of the non-surgical measures, elastic compression stockings are first placed and the patient is subsequently triple-fixed to the surgical table. A bandage is positioned on the hip and adequate bandaging of the ankle with a sheet, in order to avoid internal rotation of the limbs and displacement of the patient in the maximum reverse Trendelenburg maneuver. We also use heaters on upper limbs and coverage of the exposed body area (PALERMO, 2020) [Fig 1 and 2].

Figures 1– Positioning the patient on the stretcher. 2 - Positioning of surgeons.

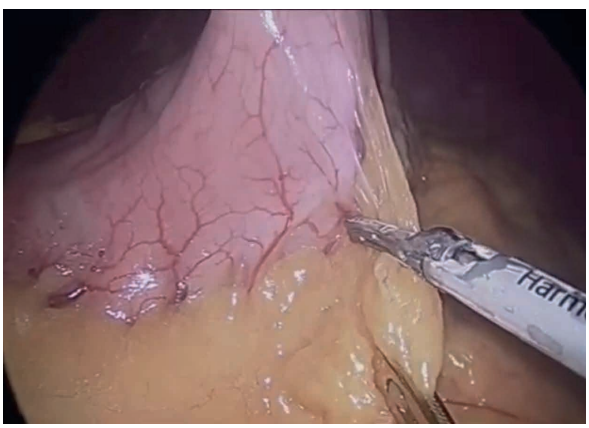
The technique of choice for performing pneumoperitoneum and accessing the peritoneal cavity is puncture with the Veress needle approximately 10 cm from the xiphoid process, immediately lateral to the left of the patient's midline, with the aim of deviating from the falciform ligament. CO is inflated to 15 mmHg. The puncture point of the Veress needle marks the positioning of the first 10mm trocar, for the optics. Before the incision of the other portals, analgesia is performed by videolaparoscopic tap-block, infusing 20 ml of analgesic solution in the topography of each incision (500 mg Hydrocortisone; 20 ml Lidocaine 2% with vasoconstrictor; 20 ml Bupivacaine 0.5%; 150 mg clonidine; 10 ml 8.4% sodium bicarbonate; 200 ml 0.9% saline solution. Subsequently, a 5-mm subxiphoid trocar is passed to retract the liver with a retractor. The surgeon uses a 12 mm pararectal trocar in the right upper quadrant, lateral and inferior to the falciform ligament. Another 12mm trocar is placed pararectally in the left upper quadrant. A 5mm trocar dedicated to the auxiliary is positioned on the left flank. In patients with severe visceral obesity, additional trocars can be added to the left auxiliary to retract the omentum, optimizing exposure when dissecting the left crus of the diaphragm(ROSENTHAL, 2012; SETHI, 2016; PALERMO, 2020) [Fig 3 e 4].

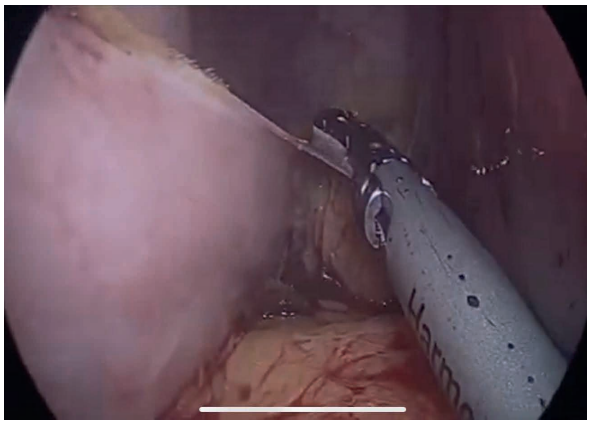


Figures 3– placement of the trocars. 4 - *Tap-block* videolaparoscopic.

The greater omentum is opened, using coagulating scissors, close to the stomach wall, in the middle portion of the greater curvature,

between the body and the antrum. The greater curvature must be completely detached from the stomach, preserving the gastro-epiploic vessels. The dissection begins close to the gastric body, in a distal direction, ending approximately 1-2 cm from the pylorus. It then ascends to the left pillar along the greater curvature. At this moment, the assistant performs the eversion maneuver of the body and antrum of the stomach, in order to clearly visualize the hiatus. Excellent exposure of the hiatus is necessary for construction of the ideal gastric tube. A possible incidental hiatal hernia must be inspected and the left crus of the diaphragm completely dissected to avoid residual gastric fundus. In the short term, it can lead to postoperative regurgitation and subsequent severe reflux. Due to the "refluxogenic" characteristic of GVL, this is an important step for the success of the procedure. Maintaining the gastric fundus can also lead to unsatisfactory weight loss in the long term(SILECHIA, 2015; CARTER, 2011; PALERMO, 2020; NOEL, 2013) [Fig 5 e 6].





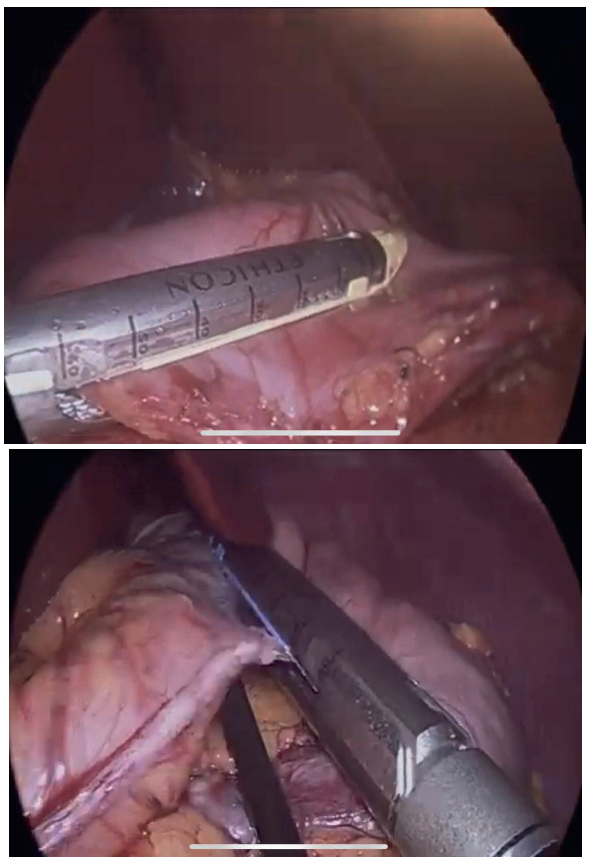
Figures 5– Dissection of the gastric body. 6 - Dissection of the left diaphragmatic pillar.

Next, the posterior adhesions are carefully dissected, with due attention to the left gastric artery, splenic vessels, spleen and pancreas. At this time, suboptimal exposure or excessive traction must be avoided to prevent vascular injury and bleeding. It is important not to release the entire posterior wall of the stomach in the vicinity of the lesser curvature, as some of these adhesions prevent twisting of the tube. Some patients may have a crossing of the posterior gastric artery close to the fundus, which must be ligated, without risk of gastric ischemia, to allow complete fundus resection, avoiding inadequate weight loss or weight regain due to incomplete fundus resection. Care must be taken when dissecting the fundus and angle of His, as short gastric vessels may be present, covered by a large amount of fat that makes it difficult to identify them (PALERMO, 2020; PARRIKH, 2013). Injury to these structures causes severe bleeding, and is challenging, as the vascular stump often retracts into the splenic perihilar fat, where blind use of coagulating scissors can result in catastrophic injuries. In addition, it can lead to direct or posterior esophageal or gastric thermal injury, which can result in postoperative fistulas. So in this step, if necessary, the surgeon can use titanium clips before sectioning the fat, preventing any chance of bleeding. The left

gastrophrenic ligament must be sectioned, to expose the angle of His and also improve the exposure of the hiatus and dissection of the left pillar (DUPREE, 2014; PALERMO, 2020).

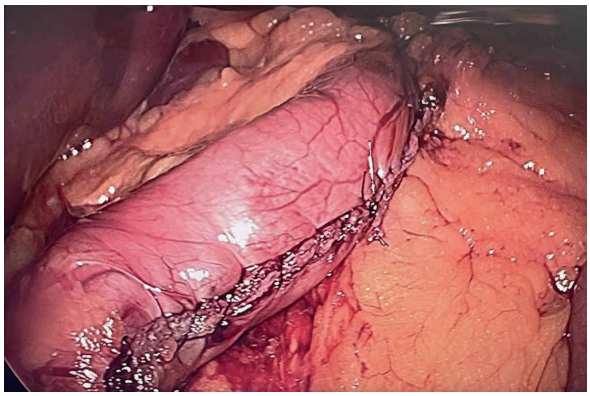
After this fundamental stage of the surgery, attention is turned to the resection of the stomach. The use of a 32-Fr Fouchet probe is mandatory for gastric tube calibration (CARTER, 2011; PALERMO, 2020). The Fouchet must be well positioned, post-pyloric and close to the lesser curvature, before any firing of the stapler occurs. Also, before releasing the clamp, it is important to ask the anesthesiologist to move the Fouchet, to make sure that the probe is free and that there is a good passage through the gastric tube, especially at the level of the angular notch. The stapler, regardless of its size, must never be placed against the Fouchet, which must only be used for guidance. The surgeon must palpate the distance between the stapler and the probe with the tip of an atraumatic forceps. As for the stapling, the starting point starts at the antrum, 2 cm from the pylorus, to avoid increasing the antrum postoperatively (DUPREE, 2014; PALERMO, 2020). Care must be taken to avoid kinking or stenosis of the tube at any level, particularly when approaching the angle of His. Our service has adopted gastric tube stapling with load downsizing, for better hemostasis. The thickness of the stomach decreases from the antrum to the fundus and from the greater to the lesser curvature. Thus, we choose the thickest stapler load for the antrum and gradually smaller loads as the stapler ascends proximally. We used the Ethicon Echelon Powered Plus® stapler and started the stapling with a gold load (1.8-3.0 mm) and later with blue loads (1.5-2.4 mm). The first stapling occurs 2 cm from the pylorus, ending 1-2 cm from the angle of His, to avoid involving esophageal tissue. We always check the posterior wall before shooting (DUPREE, 2014; PALERMO, 2020).

The stomach is fixed medially but free laterally, therefore, to avoid twisting during stapling, a slight lateral traction, just to balance the extension of the anterior and posterior walls, must be performed by the assistant. It is crucial to elevate tissues and inspect the posterior gastric wall prior to any stapling to ensure maximum tissue resection. The most critical step in stapling is the fundus, where a large volume of gastric tissue may be retained posteriorly despite appearing adequate previously. The left superolateral traction by the assistant allows correct exposure, which can be crucial at this surgical moment (PALERMO, 2020).



Figures 7 – Stapling of the gastric antrum.
8 - Stapling of the gastric fundus with superolateral traction by the auxiliary surgeon.

After complete stapling, the stapling line inspection is performed. We have always reinforced the line of staples with Capryl 2.0 wire. During the reinforcement, in the medial portion of the gastric tube, we performed one or more fixation points in the greater omentum, in order to keep the tube in an anatomical position (PALERMO, 2020) [Fig 9 and 10]. The continuous suture, in a single total plane with absorbable suture, is not intended to prevent the occurrence of fistulas, but to reduce the risk of postoperative bleeding in the stapling line (RAMOS, 2015). The methylene blue test is routinely performed. However, no patient in the study had a positive test result. The stomach is removed through the right 12-mm port. Finally, 100 ml of intraperitoneal analgesic solution is instilled, distributed in 30 ml in the staple line, 40 ml in the right costophrenic recess and 40 ml in the left costophrenic recess. Concomitantly, the use of clexane at a prophylactic dose starts intraoperatively, if there is usual surgical bleeding (PALERMO, 2020; ROCHA FILHO, 2020).



Figures 9– Staple line suture with Capryl 2.0 thread. 10 - Gastric tube attachment points on the greater omentum.

Regarding patient care during the hospital period, there is the standardization of the 2-day hospitalization period. The introduction to a sugar-free restricted liquid diet is performed on the 1st POD. Enoxaparin at a prophylactic dose is maintained for 12 days, starting intraoperatively. Venous hydration is maintained at 60ml/h in an infusion pump throughout the hospital period. Also, monitoring is performed with respiratory physiotherapy, using a respirometer. Furthermore, the compressive stockings are maintained until the outpatient return, on the 10th POD.

RESULTS AND DISCUSSIONS

For 21 months, 202 patients who underwent GVL were included according to the technique described here, from December 2020 to May 2022. Of these 202 cases, 158 were women and 44 men. The mean age was 38.7 years (21-56) and the indications were: morbid obesity (70%) and metabolic syndrome (30%). The mean BMI of the patients was 40.2 kg/m² (34-46) and the mean operative time, calculated from the first incision to the last point on the skin, was 60 minutes (40-90). Notably, the surgical time was longer in the series in which the patients had a higher BMI. There were no reports of the need to pass an auxiliary trocar.

All patients were discharged on the third postoperative day. In no case was there a need for conversion to the laparotomy method and there were no perioperative complications. Patients who had complications returned in the late postoperative period to the emergency room. Of the observed postoperative complications, three patients had mesenteric portal thrombosis (1.48%) and three patients had gastric fistula (1.48%), a total complication rate of 2.97%. There were no deaths. None of the 196 patients, who had no complications, required more than 15 days off work.

Of the patients who had mesenteric portal thrombosis, two were women and one was a man. The initial symptoms that led patients to seek medical attention in the late postoperative period were mainly abdominal pain and vomiting. Contrast-enhanced abdominal CT scans were performed to clarify the diagnosis of portal thrombosis. The mean age was 38 years (36-40). The average BMI was 41.6 kg/m². One patient was undergoing hormonal contraceptive treatment. No patient had a history of smoking. All patients received anticoagulant treatment and none required surgery. The mean length of stay was eight days (8-9). All patients had complete or almost complete recanalization of the portal vein. No patient had a positive thrombophilia test. No endoscopic findings of portal hypertension were observed. In our series, we observed an increase in the incidence of venous thrombosis, especially in patients who did not follow the postoperative oral hydration recommendations. It is important to note that the cases coincided with the most critical period of the Covid19 pandemic, in which all three patients had a history of infection and/or vaccination in the lower interval six months before the thrombotic event. Therefore, one of our hypotheses, for this sequence of cases, would also be the thrombogenic effects of the SARS-CoV-2 infection itself, and/or its immunization schemes, which have been reported in other types of patients. We understand that all patients submitted to GVL were tested before the procedure and did not present the disease for a previous period of less than 3 months. Patients followed up with this complication responded positively to anticoagulation, with complete recanalization of the portal vein. Conservative treatment with anticoagulants was effective.

All three patients who presented gastric fistula were women. The initial symptoms that led patients to seek medical attention in the late postoperative period, on average on the 10th POD (6-13), were severe abdominal pain, fever, prostration and vomiting. Contrast-enhanced abdominal CT scans were performed to clarify the diagnosis of gastric fistula. The mean age was 38 years (25-45). The average BMI was 41.7 kg/m². Two patients had DMT2 and SAH. All patients underwent antibiotic therapy. Two patients underwent a new surgical approach via videolaparoscopy and one patient underwent laparotomy, with washing and drainage of the cavity. The length of stay was on average 25 days (8-38). In our series, we observed an increase in the incidence of fistulas in patients with more comorbidities. The patients followed up with this complication responded positively to the proposed treatment.

We emphasize that we did not present any case of bleeding, which is the main complication of GVL, in the 202 patients analyzed. We attribute this positive result to the *Downsizing* of loads and the suture in the stapling line. In a subjective satisfaction analysis, all were very satisfied with the results. They showed good tolerance to a sugar-free restricted liquid diet from the 1st POD, pain and emetic complaints were well treated with simple analgesia and antiemetics and without aesthetic complaints.

CONCLUSIONS

The surgical technique proposed here facilitates the surgeon's work in difficult points of sleeve gastrectomy and improves its ergonomics. It decreases the rates of bleeding and fistulas, of thromboembolic complications and the need for postoperative analgesics, when compared to the literature.

Finally, the standardization of all the care that encompasses the surgical act proves to be effective, feasible and safe, as long as its technical steps are observed. Minimizes possible errors throughout the surgical and hospital process, reproducibly in other bariatric surgery services.

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