Robotic Ileal Interposition Surgery with Duodenal Exclusion and Sleeve Gastrectomy For Diabetes: The First Case Report and 1-Year Follow-Up

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1. Introduction

Responsible for more than one hundred billion in direct public spending on their treatment and controls, diabetes mellitus and obesity are public health problems, both correlated with each other [1]. Despite the therapeutic advances, these two conditions do not have a definitive cure by conservative treatment and require strict continuous clinical control [2]. In this context, ileal interposition with duodenal exclusion and sleeve gastrectomy, also known as metabolic surgery, is increasingly used as an effective measure for treating type 2 diabetes (DM2) [3]. Despite robotic surgery is a great advance, this surgical procedure is usually performed by laparoscopy [4]. Up to the time of this surgery (July 20, 2021), the authors have not identified in the scientific literature (Pubmed/Medline Database, BVS) any description of this technique using robotics, presenting here what appears to be the first case report and with a one-year follow-up. The authors show the feasibility of this complex surgical procedure performed for the first time through robotic surgery. This is a patient with type 2 diabetes diagnosed in 2003, who underwent ileal interposition with sleeve gastrectomy using the robotic technique. The work was approved by the Research Ethics Committee of PUCPR (CEP-PUCPR), under opinion number: 5,356,486.

2. Case Presentation

E.R., male, 61 years old, married, a former smoker, and a former alcoholic. DM2 since 2004 when he started with an oral hypoglycemic agent (metformin). In 2009, due to clinical worsening, insulinization was necessary, and, in 2021, with dyslipidemia, systemic arterial hypertension (SAH), and obesity, it was proposed to perform ileal interposition surgery with duodenal exclusion and sleeve gastrectomy (IIDESG) as a treatment for diabetes. Preoperatively, E.R was using dapagliflozin, metformin hydrochloride, pioglitazone hydrochloride, insulin aspart, insulin glargine, and losartan. On physical examination: 1.68 m, 93.9 kg, and a BMI of 33.3 kg/m² (grade 1 obesity).

He had frequent episodes of hyperglycemia, reporting measured capillary blood glucose values of around 400 mg/dl, with glycated hemoglobin of 7.3%, fasting glucose of 149 (mg/dL), and insulin of 11.7 (micro UI/mL).

The patient underwent the surgical procedure in July of the same year, using the ileal interposition technique with duodenal exclusion and robotic sleeve gastrectomy.

3. Surgical Procedure

The procedure was started with robotic sleeve gastrectomy (da Vinci, Strattner®), where part of the fundus, body, and antrum of the stomach was removed to reduce the ability of this organ to store the ingested food, as well as reduce the production of ghrelin, easy food control in the postoperative period. The stomach was left with approximately 100 mL, and the staple line was sutured to
prevent bleeding with PDS 3.0 thread, absorbable with continuous stitches. The duodenum was then excluded 4.0cm from the pylorus per staple filler Medtronic Blue with 3 stapling lines. Afterward, an over-suture with PDS 3.0 continuous stitches was performed. At 30 cm from the ileocecal valve, 1.6 m of the terminal ileum was sectioned with a white load stapler (45 mm, USA-Medtronic®). This ileum was interposed between the duodenum and the jejunum at 50 cm from the angle of Trietz. Reconstruction ileo-ileal látero-lateral was performed using manual 3–0 absorbable monofilament suture and breaches were closed with 3–0 non-absorbable monofilament suture. The ileum was interposed with end-to-side anastomosis with the duodenum (3–0 absorbable monofilament continuous suture). The distal part of the interposed ileum was anastomosed laterally to the jejunum at 50 cm from the angle of Trietz. In the end, the gaps were closed with single stitches (non-absorbable 3–0 monofilament thread). It was a surgery with great technical difficulty, lasting 6 h, but with a total bleeding volume of only 150 ml and without any complications to the proposed objective. Postoperatively, the patient was referred to the infirmi-ry without any complications. The diet was started on the second postoperative day and the hospital discharge on the fifth day.

4. Progress

The surgery was uneventful, prophylactic antibiotics were administered on the first postoperative day (cefazolin, 1g intravenously every 8/8 hours). Recovery in the ICU was not required, nor was the subsequent use of antibiotics. Discharge was on the fifth post-operative day and there was no readmission. E.R reported pain in the immediate postoperative period, controlled with morphine and absent by the fourth day of recovery. The patient had difficulty adapting to the recommended diet in the 15 days following the operative discharge, with episodes of pain, vomiting, and Dumping syndrome, an intercurrence resolved in a clinical consultation with a nutritionist (M.R.R.C.), where the importance of following the diet was reinforced, not only in the immediate postoperative period but until complete healing of the stomach and intestine. Twenty days after the operation, a solid diet was started, reinforcing the importance of chewing and excluding foods rich in sugar and/or fat, carbonated drinks, and alcohol. The patient followed the diet and evolved without any symptoms.

5. Results

Eleven months after surgery, E.R. was using sertraline 20 mg and emapagliflozin 20 mg. He did not report major dietary restrictions, eating all types of food. Avoid only sweets, which you tolerate in small amounts, so as not to have the symptoms of Dumping syndrome. He complains of an increased flatus, also related to food abuse.

After 1 year of follow-up, he feels more energetic, and weighs 68 kg, with a BMI of 24.09 kg/m2. He had glycated hemoglobin of 6.4%, insulin of 2.6 micro IU/ml, and estimated mean glucose of 137 mg/dL. In clinical and nutritional follow-up.

6. Discussion

Robotic surgery is growing in medicine every day in all of the most complex procedures. In this surgery performed, there were advantages such as greater ergonomic comfort for the surgeon, 3D visualization of the structures, and greater mobility of the equipment/trocar since it allows rotations greater than 360° and access to planes that would be inaccessible by the laparoscopic route. Furthermore, with the use of the machine, manual tremor, typical of surgical evolution, does not occur due to the long procedure time. The surgical steps that benefited most from the use of the robotic technique, in this case, were those that required greater precision, such as carefully dissecting the duodenum to the gastro-duodenal artery and main bile duct, manual duodenal-ileal anastomosis, dissection of the mesentery and ileum and jejunum loops, and closure of the inter-mesenteric spaces. That is, techniques that would require more mental attention, body positioning of the surgeon’s trunk and limbs, and muscle fatigue when holding the video lapa-roscoy forceps. This type of procedure by conventional video laparoscopy takes an average of 3 h. This surgery, being the first of the team, lasted 6 h. However, due to the surgeon’s disposition on the robotic console, sitting relaxed with the support of the upper limbs in a fixed structure, with 3D visualization, it brought greater comfort and increased the surgeon’s ability in safety and precision, i.e., the surgeon’s comfort showed a significant difference.

Another benefit observed was the performance of the surgical stitches, which were more accurate, light, and easy, requiring less expertise than routine laparoscopic surgery.

A disadvantage of using the robotic technique was that the procedure took longer than that of laparoscopy, in this case, 2 times longer, largely due to the technical difficulty in moving the upper and lower abdomen. With more frequent use of this technology, a time similar to laparoscopic surgery can be achieved, as has occurred in the past in other procedures, such as gastroplasty [5]. The authors recommend, in these cases of longer surgical time, special anesthesiological attention so that the patient does not enter a state of hypoglycemia. In the postoperative period, the patient experienced more pain than in usual laparoscopic surgeries, probably due to the longer duration of surgery. He was hospitalized for 5 days, on average the discharge is performed in 2 to 3 postoperative days via laparoscopy.

Today, the main obstacle to the greater use of this technique is still the high cost, when compared to laparoscopy and laparotomy. The current cost difference is around 4,000 dollars. For the reader who is using the robotic technique for the first time, it is recommended to start with the simplest digestive surgery that requires less forces, less mobility, and less experience. Ileal interposition is technically more complex compared to other surgeries, such as bariatric ones.

For the more experienced reader who wants to reproduce this procedure, the key point is a duodenal ileal anastomosis, which should
be as wide as possible. Since stenosis is not estimated, good food drainage without the obstructive factor. Duodenal exclusion is the most relevant step for the control of metabolic diseases.

Ileal interposition with sleeve gastrectomy and duodenal exclusion has already been cited by other authors as a safe procedure with good results for the control of glycemia in diabetic patients using the laparoscopic technique [6]. However, until the completion of this surgery, the authors did not find in the literature any report of the execution of this surgical technique using the robotic approach. This technique, classified as minimally invasive, is seen as an evolution of the video laparoscopic technique, in which the surgeon commands the robot to perform the incisions and conduct the surgery. It is a recent technology, having been used as the first robotic platform in 1985 [7, 8]. Since then, great advances have taken place, and this surgical approach demonstrates numerous benefits. Among them, are rapid recovery, shorter hospital stays, and aesthetically favorable surgical scars [9]. Additionally, other benefits highlight this approach compared to others, such as better ergonomics for the surgeon, less bleeding, a better visual field for the surgeon (especially in hard-to-reach areas), and three-dimensional vision [7, 10]. This report corroborates the union of two advances in modern medicine, a new treatment in the fight against diabetes and obesity, in addition to the robotic surgical technique, which has been standing out in the current scenario. The surgery was successful in the peri and postoperative periods and it is concluded that it was safe for the procedure reported here II DESG led to a significant improvement in the DM2 condition, in addition to having helped in weight loss and maintenance of this patient’s ideal weight. This procedure is considered highly complex, with a longer mean surgical time compared to the usual bariatric and metabolic surgical procedures, however, with the help of a robot and technical standardization, it proved to be feasible for those who want to enter this procedure.

7. Declarations

This paper has no conflict of interest. The work was approved by the Research Ethics Committee of PUCPR (CEP-PUCPR), under opinion number: 5,356,486.

References

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