ANASTOMOTIC LEAK TEST USING INDOCYANINE GREEN DURING LAPAROSCOPIC ROUX-EN-Y GASTRIC BYPASS

RUNNING HEADS: Indocyanine green test for evaluation of perfusion of gastro-jejunal anastomosis during laparoscopic Roux-en-Y Gastric Bypass

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ABSTRACT

BACKGROUND: Indocyanine green (ICG) can be injected into the human bloodstream and it allows us to show stomach vascularity in real time. The aim of our study is to observe the preliminary results of the application of indocyanine green fluorescence (IGF) during laparoscopic Roux-en-Y Gastric Bypass (RYGB in our center and how the perfusion of the gastro-jejunal anastomosis affects the onset of fistula.

MATERIALS AND METHODS: 30 consecutive patients underwent RYGB with ICG fluorescence angiography at our center from January 2020 to December 2021. 5 ml of ICG were then injected intravenously to identify the blood supply of the stomach and the gastro-jejunal anastomosis.

RESULTS: In the RYGB tested with ICG, we all have adequate perfusion but despite this a methylene blue test was positive and allowed us to reinforce the suture of the gastro-jejunal anastomosis.
CONCLUSION: Intraoperative ICG testing during laparoscopic RYGB may be helpful in determining which patients are at an increased risk for leakage but multiple factors concur to the pathophysiology and the incidence of gastric fistula not only the perfusion.

Key words: laparoscopic Roux-en-Y gastric bypass, Indocyanine green test, anastomotic fistula, gastro-jejunal leak.

INTRODUCTION

Morbid obesity has become a major global health threat that leads to severe morbidity including diabetes, hypertension, obstructive sleep apnea, degenerative joint dis- ease and cardiovascular diseases [1].

Bariatric surgery is recognized as the most effective treatment for morbid obesity, maintaining a stable weight reduction in the long term and reducing comorbidities, with a favorable impact on mortality [2-4].

Gastric Bypass is a common operation for weight loss in patients with severe obesity. The procedure was developed in the 1960s by Drs. Mason and Ito who observed significant weight loss in a patient undergoing partial gastrectomy for peptic ulcer disease.

As expected, any increase in the frequency of a procedure usually unveils a significant number of related complications. Most of the complications of bariatric surgery are usually observed in the postoperative period.

Ninety-day mortality is very low (less than 0.5%). The morbidity of the procedure is classified into early complications and late complications. [5]

Early complications (0-30 days):

- Venous thromboembolism (VTE)
- Anastomotic leak
- Infection
- Intestinal blockage
- Stenosis Gastro-Jejunal

Late complications

- Intestinal blockage
- Dumping syndrome
- Marginal ulcer
- Gastrointestinal fistula
- Gallstones
- Incisional hernia
- Nutritional deficiencies

More information on complications after gastrectomy is beyond the scope of this review article. These are very complex pathological processes with specific etiologies, pathophysiology and treatments.

Gastric fistulas are the most common complication observed after gastric sleeve surgery. A meta-analysis of almost 10,000 sleeve gastrectomies conducted by Parikh et al. revealed that 2.2% of these procedures were posteriorly complicated by fistula development. In regards to Roux-en-Y gastric bypass (RYGB), anastomotic leaks are their most common complications with an incidence of 0-8% [6,7].

Indocyanine green fluorescence angiography (AF) (ICG) is an emerging technology that has been used in an attempt to reduce the incidence of anastomotic leaks. ICG is a water-

soluble tricarbocyanine dye that remains in the intravascular compartment until excretion and has a plasma half-life of between 3 and 5 minutes [8]. Importantly, the ICG absorbs light at a wavelength of excitation between 750 and 800 nm while emitting light at emission wavelengths greater than 830 nm or more [9]. Using near-infrared imaging systems, vascular perfusion to the gastro-jejunal anastomosis can be assessed intraoperatively, allowing surgeons to anastomose a well perfused bowel or to reshape a poorly perfused anastomosis. 5 ml of ICG were then injected intravenously to identify the blood supply of the stomach and the gastro-jejunal anastomosis.

The aim of our study is to observe the preliminary results of the application of indocyanine green fluorescence (IGF) during laparoscopic Roux-en-Y Gastric Bypass (RYGB in our center and how the perfusion of the gastro-jejunal anastomosis affects the onset of fistula.

MATERIALS AND METHODS

30 consecutive patients underwent RYGB with ICG fluorescence angiography at our center from January 2020 to December 2021.

During the period of interest, 10 male and 20 female patients underwent RYGB by the same surgical team with the same standardized technique.

The mean age was 43.6 in the male group and 37.6 in the female group (mean 39.18).

The mean preoperative BMI was roughly the same in the two groups (45.16 in the male group vs 45.06) (in the female group).

At least one major comorbidity was found in all patients: the most represented was hypertension (19 patients, 63.33%), followed by diabetes (6 patients, 20%), COPD and / or OSAS (4 patients, 12 , 3%) and osteoarthritis (1 patient, 3.33%).

Five patients had previous sleeve gastrectomy surgeries.

Adequate perfusion was defined as “the direct and clear visualization of the fluorescence along the gastric tube, relative to the excised specimen, after an estimated time of 150-180 s after i.v. administration injection "(FIGURE 1a-1b).

In case of inadequate perfusion, our expected options were binding reinforcement with fibrin glue or with sutures.

A methylene blue test is routinely performed after fluorescence.
The procedure ended with the placement of an intra-abdominal drain along the suture line.
On the second postoperative day, a routine swallow test with Gastrografin is performed.
After the Gastrografin swallow test, if negative, patients were given a liquid diet for 1 day, then a semi-liquid diet and were discharged on the third postoperative day.
Our follow-up was performed routinely with blood tests and clinical examination at 3-6-12 months.

Figure 1a: Evaluation of perfusion of gastro-jejunal by using Indocyanine green test
Figure 1b: Intraoperative picture of the gastro-jejunal

RESULTS

The procedure was performed in all patients without ICG-related adverse events.
Blood supply was rated "satisfactory and adequate" in all patients.
The mean operative time was 123 min. No conversion to laparotomy was performed.
Despite this, the methylene blue test was positive in only one patient, a suture reinforcement of the gastro-jejunal anastomosis was performed with Vycril stitches.
Routine swallowing of Gastrografin on the second postoperative day was negative for leaks in all patients.
No patient showed signs or symptoms of leaks at the gastro-jejunal anastomosis.
Analyzing our database, we performed 26 RYGBs without ICG tests from 2017 to 2019; the total number of leakage was 0 and our leakage rate was 0%.
In the RYGB tested with ICG, we all have adequate perfusion but despite this a methylene blue test was positive and allowed us to reinforce the suture of the gastro-jejunal anastomosis.
Furthermore, our main objective was to evaluate whether this method could adequately estimate the ischemia of the gastro-jejunal anastomosis and help in the prevention of leakage: this is so far not confirmed by our preliminary results (the only case with methylene blue test positive was adequately perfused with the ICG test).

DISCUSSION

Anastomotic leaks following RYGB can be caused by a number of factors including those compromising healing such as mechanical tension and ischemia [10] but are also associated with other factors such as BMI, age and the postoperative course [11].

The reported incidence of gastro-jejunal leakages after LRYGB has been reported to range between 1 and 3% [12-13].

The diagnosis of gastrointestinal leak after bariatric surgery can be challenging. The patient's presentation varies according to the type and timing of the leak and the patient's systemic inflammatory response. Patients with morbid obesity may show uncertain presentations, leading to late diagnosis and potentially catastrophic consequences.

There is still uncertainty about the pathophysiology of anastomotic leak after RYGB : the cause may vary from person to person. It may be caused by a problem with the tool or materials used to close the anastomosis during surgery. It may be because of problems with the blood flow in the area after surgery. Or it may be linked to other reasons for poor wound healing, such as diabetes or smoking [14-17].

The use of routine intraoperative methylene blue leak testing is still discussed as it may be useful for identifying suture line rupture but not for identifying areas at increased risk of subsequent leakage [18-20].

Recently, much interest has been focused on the possibility of assessing blood supply during surgery with the use of ICG fluorescence angiography, which is a real-time, inexpensive and feasible method of establishing vascularity in an area. [21-24]. It has been fully and positively approved in most laparoscopic procedures [25-27] but there is still little literature on its usefulness in the bariatric procedure.

Therefore, our aim was to evaluate whether intraoperative ICG fluorescence angiography could lead to estimating the ischemic area [28].

From the first data, we did not find any ischemic segmental area at the gastro-jejunal anastomosis, despite a patient with a positive methylene blue test [29-30].

CONCLUSIONS

Although all patients underwent to the ICG test during RYGB showed optimal perfusion, one patient was positive to the intraoperative methylene blue test and this allowed us to reinforce the anastomosis with sutures. This information has led us to believe that multiple factors contribute to the pathophysiology and incidence of gastric fistula in the context of the RYGB operation. Therefore, intraoperative ICG testing may be helpful in determining which patients are at an increased risk for leakage, and if adjunctive measure is needed intraoperatively, but further testing is needed to determine if ICG will predict leakage due to ischemia.

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