


**Research Article**

## Use of Indocyanine Green Imaging in Gastroyeyunal Reconstruction For Recalcitrant Gastroparesis - Case Report

Adolfo Leyva Alvizo\*, Cristina Villar-Canton, Giovanna Yazmin Arteaga-Müller, Meri Yeghiazaryan

### Abstract

Diagnosis of diabetic gastroparesis relies on identifying delayed gastric emptying in ulcers or obstruction absence, with associated gastrointestinal symptoms. Regarding a clinical case presentation, the article provides an overview of diabetic gastroparesis and its implications. Discussion includes surgical management as the treatment of choice from the clinical perspective.

**Keywords:** Gastroparesis; Indocyanine green; Gastrojejunal anastomosis; Antrectomy

### Overview/Introduction

Gastroparesis is a common complication in poorly controlled diabetic patients, characterized by delayed gastric emptying without apparent mechanical obstruction. Clinical presentation includes upper abdominal pain, nausea, vomiting, postprandial fullness, and early satiety due to the increased sensitivity caused by hyperglycemia in the gastrointestinal tract. Diabetic Gastroparesis (DG) diagnosis, according to the American College of Gastroenterology guidelines, require gastrointestinal symptoms and gastroparesis criteria. [1,9,10,12]. The stomach plays a fundamental role in digestion by producing hydrochloric acid and pepsinogen and performing digestion first steps. As part of the stomach's normal function, food is mixed, stored, and delivered through chemical and mechanical processes. The stomach expands to accommodate food, triggering digestion by delivering or storing food according to need, followed by trituration and emptying of chyme towards the duodenum. The ability to perform any of the previous tasks requires adequate gastric motility. In patients with impaired muscular contractions or relaxation of the smooth muscular layers of the stomach, gastrointestinal symptoms and gastroparesis may be present [1,4].

The physiopathology of hyperglycemia in neuropathy supports the main theories about delayed gastric emptying secondary to diabetes. During diabetic gastroparesis, the major motility control centers (the autonomic and enteric nervous systems) malfunction, causing altered emptying patterns. A coordinated fundal tone and antral contraction, with inhibitions of the duodenum and pyloric contractions, are necessary for gastric emptying. The exchange of nerve signals between the enteric and autonomic nervous systems allows synchronization of the stomach's smooth muscle layers and specialized pacemakers (Interstitial Cells of Cajal). Also, the vagus nerve regulates the accommodation of the fundus, along with antral contraction and pyloric relaxation. DG high glucose levels in the serum cause a proinflammatory state, resulting in neuronal injury (neuropathy) and improper vagus nerve neurotransmission with defective pacemakers and smooth muscle cells. When nerves are damaged, fewer antral contractions are visible, and pyloric spasms accompany uncoordinated antro-duodenal contractions, causing

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delayed gastric emptying [1,8,11,12]. The treatment options vary from patient to patient. Dietary changes for glycemic control and prokinetic drugs are the first line of treatment. However, surgical management is necessary in some cases, especially in patients with refractory gastroparesis [8]. Antrectomy with reconstruction is one of the surgical options for gastroparesis treatment; this procedure removes the lower third of the stomach, the antrum, followed by an anastomosis that controls the flow of chyme from the stomach to the duodenum or jejunum [3,5,7]. Antrectomy complications include insufficient perfusion and leakage of the gastric remnant to be anastomosed. The use of Indocyanine green helps reduce the risk of this complication. Indocyanine green is a tricyanobenzene molecule with water-soluble properties and high molecular weight, allowing it to bind to plasma proteins quickly and leak as minimally as possible. The method involves a non-invasive image study in which Indocyanine green becomes fluorescent and allows a time-varying recording of blood dilation. Results show a clearly defined vasculature, which helps spot low blood perfusion or leakage into the interstitial space, in this case, after an antrectomy [2,6,13].

### Case report

A 33-year-old female was admitted to the hospital after suffering from stomach pain and vomiting over a period of 3 days. Symptoms are similar to those seen during previous admissions. Our patient had a prior medical history of type 1 diabetes mellitus treated with insulin Lantus, for more than 15 years, with bilateral retinal detachment, and finally requiring renal transplantation 5 years ago. 4 years before admission she became infected with *Clostridium difficile* and treated with fecal transplantation. 3 years prior to admission, our team performed a laparoscopic cholecystectomy on her with atypical upper GI symptoms and biliary sludge, with poor resolution of her symptoms, which prompted further studies until an official diagnosis of diabetic gastroparesis was achieved. In her admission through the Emergency Room, she weighed 92 kilograms with 1.56 meters height (BMI 37.8). The physical examination showed abdominal distention with normal peristalsis and tympanic percussions. According to a 99m Tc-Sulfur colloid nuclear MRI scan, gastric emptying was calculated at 831.92 minutes and 3% excretion in 60 minutes, leading to Severely Prolonged Gastric Emptying (figure 1). Endoscopy revealed biliary content in the stomach, and biopsies indicate reactive/chemical gastropathy (figure 2).

### Surgical procedure

We performed a laparoscopic antrectomy with Gastrojejunal Billroth 2 reconstruction. Once the antrum was removed, and the loop of bowel was carefully measured using a 10 cm mark on our intestinal clamps, the patient received

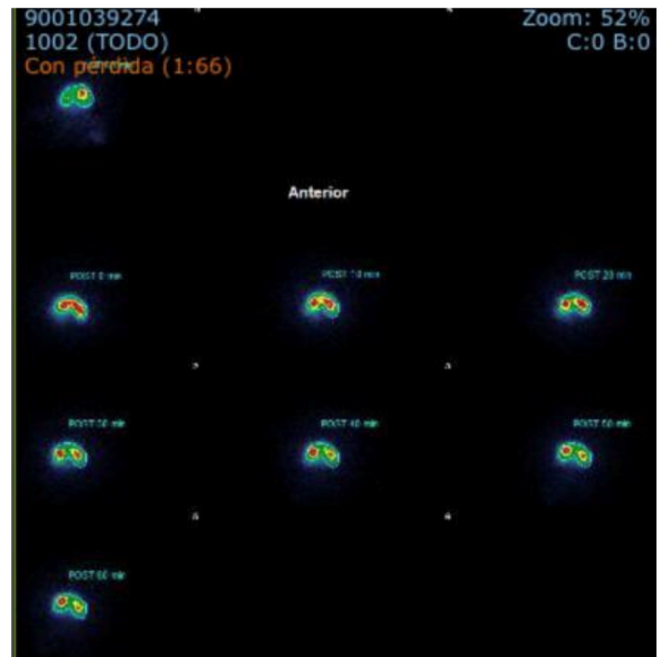


Figure 1: Gastric Emptying Nuclear Scan

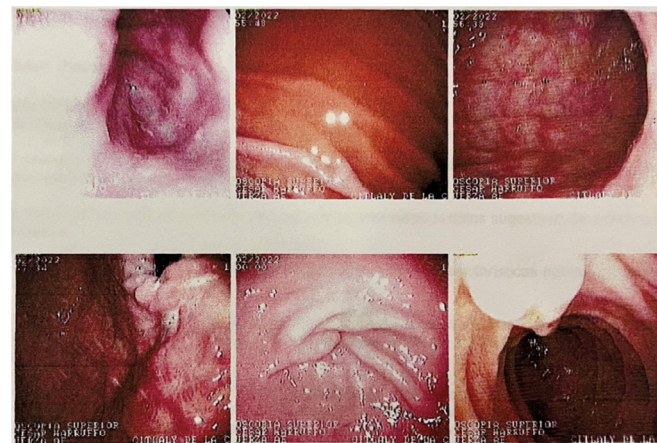


Figure 2: Endoscopy showing erosive gastritis as well as biliary reflux.

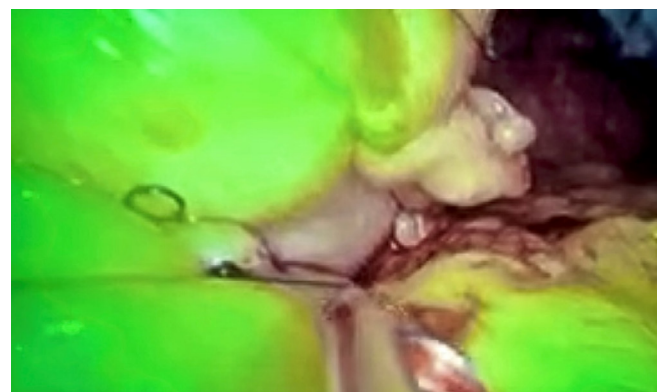
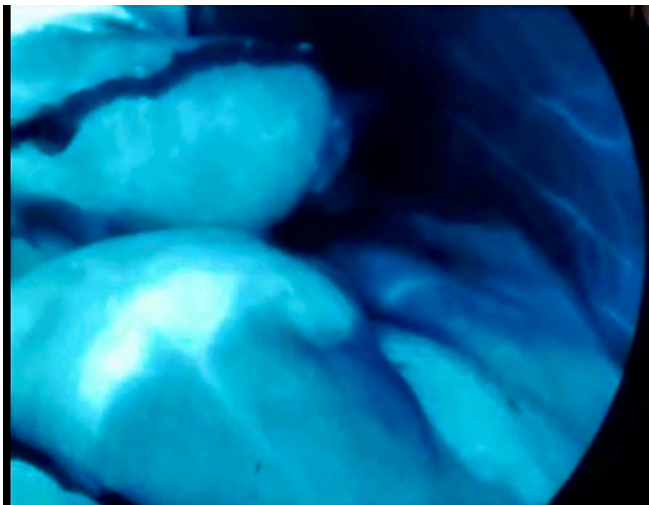


Figure 3: ICG injection with gastric stump in the upper segment, and jejunal loop on the bottom, a 2-0 silk suture can be seen between both segments.



**Figure 4:** Final ICG with the gastric stump (staple line of gastric resection visible as a black horizontal line) and jejunal stump perfectly perfused after completing the anastomosis.

2.5 mg of IV Indocyanine Green, to verify the optimal irrigation of both the gastric border of resection and the jejunal segment that was ascended in the loop configuration (figure 3). The gastric resection level was above the incisura angularis, resecting the antrum and segment of the body, leaving a horizontal gastric stump line (figure 4). We decided to perform the anastomosis bypassing 1.80 mts of jejunum, to help her achieve weight loss, after counting the distal small bowel in 470 cms distally to the anastomotic site. After optimal perfusion was verified, the G-J was performed using a stapled posterior anastomosis and a blue 40 mm load, closing the stapler defect with running 2-0 V-Loc suture. Total surgical time was 105 minutes, with minimal bleeding and no other findings reported. The procedure was well tolerated, starting clear liquids on PO day 1, and progressing slowly through 5 more days until discharged with a soft diet, with strict multidisciplinary management involving her Nephrologist, Gastroenterologist, and Registered Dietitian. She was seen a month later with good food intake and without abdominal pain and vomit. She underwent follow up with our RD and Psychologist according to our center standards. After 6 months she was asymptomatic regarding her gastric emptying, and lost 20 kilograms, making her metabolic control easier.

## Discussion

Gastroparesis is a challenging disease, both diagnosis and treatment are difficult to determine in the majority of the cases. Here we have the case of a young diabetic female who was initially operated on for a laparoscopic cholecystectomy years before being diagnosed officially with gastroparesis. The atypical symptoms persisted and she was evaluated deeply until we concluded her diagnosis. Considering the patient's weight, we considered performing an antrectomy

with small bowel reconstruction bypassing enough distance to help her achieve weight loss as well. Gastric bypass with or without gastric resection has been used and has resulted in both symptom reduction and decreased use of prokinetics [14]. Both nausea and vomiting have been improved in series of patients using gastric bypass in these patients [15,16]. The use of Indocyanine green angiography in bariatric operations has been reported to assess insufficient blood flow and hence increased risk of leakage [17]. In this patient we assessed optimal perfusion both from the gastric stump to be anastomosed and from the intestinal loop that was ascended. We had no evidence of leaks and the patient had a favorable resolution of her symptoms.

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