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## Gastrointestinal stromal tumor of the excluded stomach after Roux-en-Y gastric bypass: A case report and literature review

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## ABSTRACT

**BACKGROUND:** Gastric cancer is an extremely rare condition to occur after bariatric surgery, and most of the reported cases are adenocarcinomas. Regarding gastrointestinal stromal tumors (GISTs), there are only two reported cases occurring after bariatric surgery (one after gastric banding and the other following Roux-en-Y gastric bypass (RYGB)).

**CASE PRESENTATION:** A 48-year-old woman with previous history of obesity and type 2 diabetes, treated with a Roux-en-Y gastric bypass 2 years earlier, was referred to our center due to complains of diffuse abdominal pain and distension associated with asthenia. Magnetic resonance imaging showed a cystic-solid mass located in the right hypochondrium, measuring 19.5 × 13.5 × 16 cm, suggesting the diagnosis of a retroperitoneal tumor. Based on these findings, a laparotomy, evidencing that the larger cystic-solid tumor was originating from the excluded stomach post-RYGB. The gastrectomy of the excluded stomach was performed aside with a conventional cholecystectomy. Histopathology and immunohistochemistry confirmed to be a gastric GIST with epithelioid cells. Currently, 12 months after surgery, the patient presents no signs of recurrence.

**CONCLUSION:** This is the second case of gastric GIST occurring after RYGB to be reported in the literature.

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## 1. Introduction

In the last decades, the prevalence of obesity has reached levels higher than a third of the global population. Besides this high prevalence, the morbimortality is also alarming, as it was estimated that obesity and overweight were responsible for 3.4 million deaths in 2010 [1].

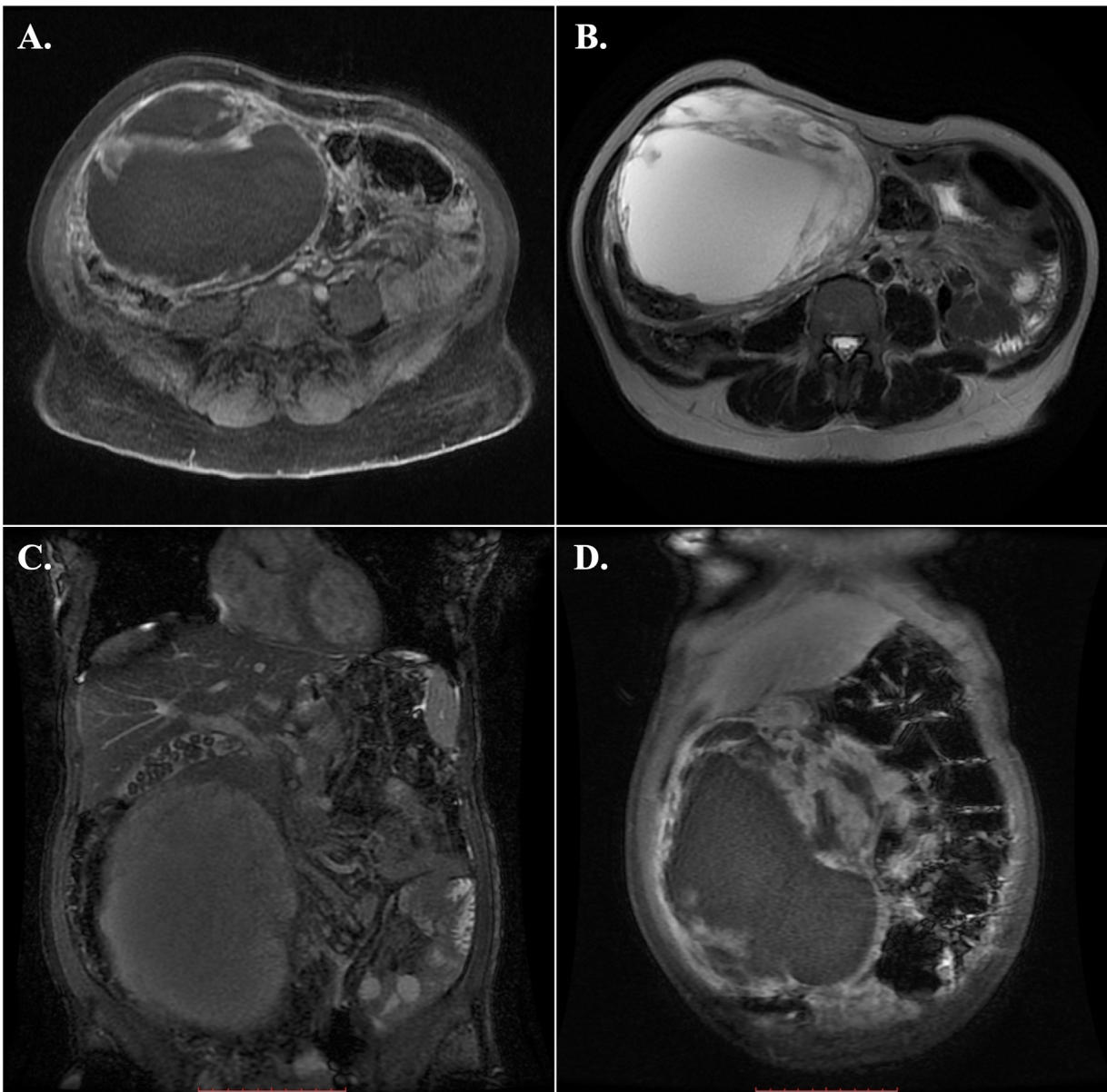
Apart from the cardiovascular, endocrine and other pathologies caused by obesity, it is known that patients with this condition are at an increased risk of developing cancer [2]. It is even estimated that almost 20% of cancer cases are intimately related to overweight and obesity. The mechanisms involving carcinogenesis and overweight are related to various factors, such as hyperinsulinemia and insulin resistance, oxidative stress and activity of IGF and its binding proteins [3,4].

Among all therapeutic strategies, bariatric surgery seems to be the most effective in treating obesity and its related comorbidities within short and long-term. Bariatric Surgery is one of the most

commonly performed gastrointestinal surgeries worldwide. The literature shows that patients undergoing bariatric surgery present a higher incidence of gastrointestinal stromal tumors (GISTs), approximately 0.8% – and generally diagnosed as an incidental finding at the bariatric procedure –, in comparison to the rest of the population, that present an estimated incidence of 14.5 per million and prevalence of 129 per million [5,6]. Although there are some conflicting results about the relationship between bariatric surgery and cancer development, most studies have reported a reduction of the cancer risk in patients who underwent bariatric surgery, especially those obesity related cancers. There are only a few cases of gastric cancer following bariatric surgery and there is still a lack of evidence linking gastric cancer and Bariatric Surgery [7–9].

Gastrointestinal Stromal Tumors (GIST) are the most common mesenchymal tumors of the gastrointestinal tract, usually expressing the KIT protein and harboring mutations of a gene that encodes a type III tyrosine kinase receptor. It is believed that GIST arises from the interstitial cell of Cajal, the pacemaker cells of the gastrointestinal tract. Both GIST and Cajal cells exhibit neuronal and smooth muscle cell features in immunohistochemistry and electron microscopy [11,12]. Most of the patients are symptomatic, and these symptoms are usually related to the tumor size. The most fre-

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**Fig. 1.** Magnetic resonance imaging showing a solid-cystic lesion (A), measuring  $19.5 \times 13.5 \times 16$  cm, with thick and irregular walls (D), multiple septa interspersed with solid areas (B), peripheral contrast-enhancement (A, B and D), located in the right hypochondrium, bulging the gallbladder superiorly (C).

quent site of these tumors is the stomach, with a prevalence of 50% [10–13].

Herein, we describe a rare case of GIST of the excluded stomach two years after Roux-en-Y gastric bypass (RYGB), the second case reported in english language literature until now. This work has been reported in line with the SCARE criteria [14].

## 2. Case presentation

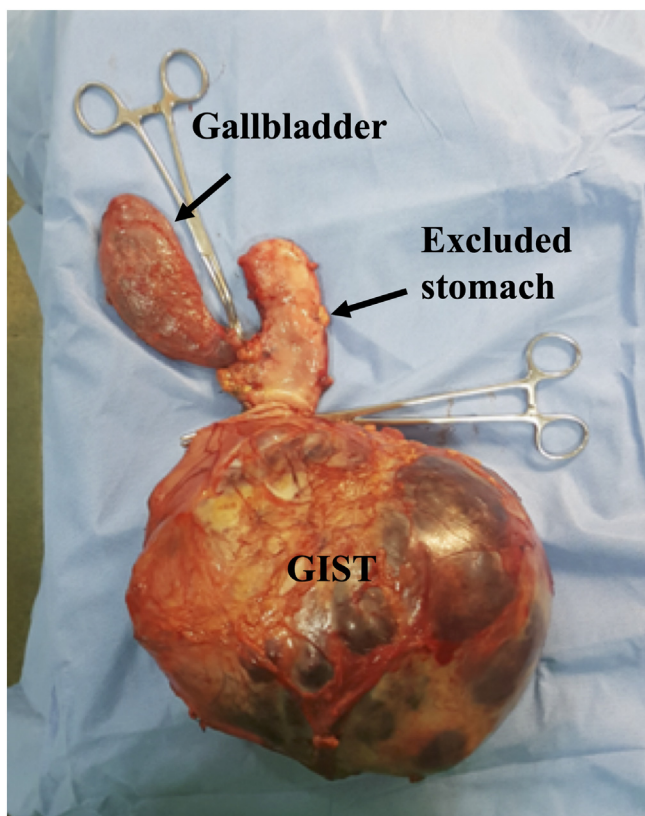
A 48-year old woman presenting moderate abdominal pain, distension, asthenia and weight loss (> 6 kg in one month) attended to a consultation in a secondary local hospital where an abdominal CT was requested. The scans showed a cystic-solid heterogenous complex mass located in the right hypochondrium/mesogastrum, measuring  $20 \times 14.1 \times 12.6$  cm. The patient was then referred to our center.

At admission, the patient persisted with the complains of diffuse abdominal pain and distension associated with asthenia.

The patient reported a previous history of obesity and Type 2 diabetes treated with Roux-en-Y gastric bypass (RYGB) 2 years before. Denied personal or familial history of cancer. At physical examination, there was periumbilical abdominal tenderness, and a moveable fibroelastic mass of approximately  $25 \times 18$  cm was palpated on the right hypochondrium.

Laboratory tests indicated the following values: hemoglobin (9.1 g/dL), hematocrit (30.2%), leucocytes ( $6750/\text{mm}^3$ ), platelets ( $339000/\text{mm}^3$ ), INR (1.15), PPT (27.1 s), fibrinogen (533 mg/dL),  $\text{Na}^+$  (137.9 mmol/L),  $\text{K}^+$  (5.1 mmol/L),  $\text{Cl}^-$  (101.3 mmol/L), creatinine (0.6 mg/dL), urea (23.1 mg/dL).

Magnetic resonance imaging (MRI) confirmed to be a cystic-solid mass of approximately  $19.5 \times 13.5 \times 16$  cm in right anterolateral situation, located between the liver, gallbladder, pancreas head and ascending colon, with thick and irregular walls and multiple septa interspersed with solid areas (Fig. 1-B and C). Furthermore, it showed peripheral contrast-enhancement (Fig. 1-A and D) and multiple cholelithiasis in the gallbladder (Fig. 1-C). The



**Fig. 2.** Surgical specimen. A large cystic-solid mass arising from the excluded stomach, and the gallbladder without morphological alterations.

MRI report suggested the diagnosis of an undetermined retroperitoneal tumor.

Based on these findings, an exploratory laparotomy was indicated in December 27<sup>th</sup> 2018. Intraoperative findings were a large cystic-solid and hypervascular tumor, fulfilling the entire mesogastrium within the peritoneal cavity, with epicenter and origin in the excluded stomach (post-RYGB) (Fig. 2). A gastrectomy of the excluded stomach was performed aside with a conventional cholecystectomy and lymphadenectomy (7 lymph nodes for pathology). The postoperative course was uneventful and the patient got discharged at the 3<sup>rd</sup> day after surgery.

Histopathological examination confirmed a mesenchymal neoplasm, comprised of atypical epithelioid cells surrounded by a partially hyalinized stroma, presenting 1 mitotic figure per 50 high power fields (Fig. 3). Surgical margins were clear and there were

no signs of neoplastic invasion in none of the excised lymph nodes. Immunohistochemistry (IHC) showed DOG1 (+), CD34 (+) and cKit (-) (Fig. 3). The proliferation index Ki-67 was 10%. These findings confirmed a gastrointestinal stromal tumor (GIST) with epithelioid cells.

Currently, around 12 months after surgery, the patient is free of disease, presenting no signs of recurrence nor metastasis, reporting a good quality of life, with no physical complains.

### 3. Discussion

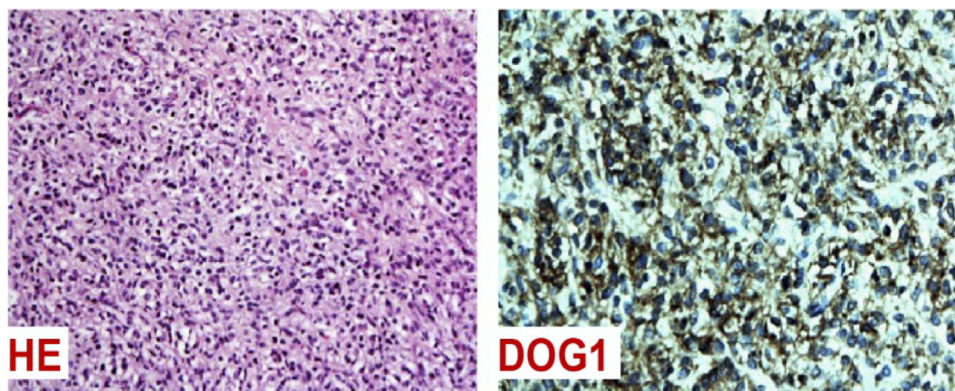
GISTs are rare malignant tumors, with only two case reported in the literature after bariatric surgery according to our knowledge: one after RYGB and one after gastrectomy banding (GB). The mean age at diagnosis of GIST after bariatric surgery among the two cases reported and ours is  $49.33 \pm 3.67$  years, and all of them occurred in women [13,15]. Contrastingly, the literature shows a major prevalence at the age of 60 s for GISTs in general (Table 1) [12].

There is a large spectrum in the symptomatology of GIST, and gastrointestinal bleeding appears to be the most prevalent one, followed by bowel obstruction. Overall, this bleeding lead to abdominal pain and anemia, as seen in the current case. GIST patients can also exhibit dysphagia as reported by DeRoover et al., or even asymptomatic and diagnosed incidentally, just as described by Aberllan [12,13,15,16].

The mainstay treatment of this neoplasm, when localized and resectable, is primarily surgery, aiming to resect the entire tumor with an intact pseudocapsule, taking special care to avoid tumor rupture, which is intimately related to poor prognosis [11]. Surgical treatment can be both curative or palliative. The curative surgery is the standard treatment, usually effective, but can be harder depending on the tumor location: gastro-esophageal junction, lesser curve, posterior wall, antrum and pylorus are considered unfavorable locations. Laparoscopy is as effective as open surgeries, especially in patients with tumors smaller than 8 cm [17,18].

On the other hand, for those patients where there is metastatic disease, surgery does not seem to be as effective. In these cases, and in unresectable GISTs, the use of Imatinib is the standard therapy. Imatinib is a tyrosine Kinase inhibitor of KIT and PDGRFA receptors that can also be used as adjuvant therapy to prevent tumor recurrence [11,19].

Not only GISTs are reported in patients after bariatric surgery. Most reports of post-bariatric gastric cancer cases are adenocarcinomas. However, Mackenzie et al., in a cohort study compared 8794 obese post bariatric surgery patients with the same number of patients who did not underwent surgery, and found that, in general,



**Fig. 3.** Hematoxylin-eosin (HE) staining showing mesenchymal neoplasm, comprised of atypical epithelioid cells surrounded by a partially hyalinized stroma. Immunohistochemistry (IHC) positive for DOG1 CD34 and negative cKit.

**Table 1**  
Previous reported cases of GISTs after bariatric surgery.

Author	Sex	Age	BS	Time <sup>a</sup>	Clinical presentation	Diagnosis	IHC	Treatment	Prognosis
Our case	F	48	RYGB	2 years	Abdominal tenderness + anemia	CT + MRI	DOG1 (+) CD34 (+) cKIT (–)	Gastrectomy (excluded stomach) + duodenal suture + cholecystectomy	Without signs of recurrence 12 months after surgery
De Roover et al. [13]	F	47	GB	12 years	Progressive dysphagia + vomiting	Endoscopy + exploratory laparotomy	CD117 (+) cKIT (+)	Total gastrectomy. Imatinib after recurrence.	Recurrence 3 years after the procedure. Good response to Imatinib
Abellan et al. [15]	F	53	RYGB	7 years	Asymptomatic	Incidental (at an appendectomy)	cKIT (+)	Gastrectomy of the residual stomach	Not reported

BS: bariatric surgery; RYGB: Roux-en-Y gastric bypass; GB: gastric banding; IHC: immunohistochemistry; CT: computed tomography; MRI: magnetic resonance imaging.

<sup>a</sup> Time between BS and GIST diagnosis.

there is a decrease in the cancer development rate in those patients who have undergone the procedure [9,20]. These findings are reinforced by De Siqueira et al., that reported a significant decrease in the expression of potential cancer proteins in obese patients after bariatric surgery [21].

The prognosis of patients with GIST is often favorable, with a 5-year survival rate after surgery of 65%. Nevertheless, several factors can interfere in the prognosis, such as age, tumor site, mitotic index, tumor size, occurrence of curative resection and postoperative imatinib. Alongside, there are some studies showing relation between immunohistochemistry and prognosis, such as c-Kit and CD-34 positivity as a potential good outcome. On the other hand, DOG1 positivity, found in our patient, seems to be a potential poor outcome marker [22–24].

Moreover, literature shows that GISTs showing large dimensions (over 9,5 cm), such as the current case, present higher chance of accelerate growth in a short period of time [25]. In those cases of GIST following bariatric surgery, there is still a lack of data in the literature due to the rarity of the condition. Notwithstanding, it is possible that our patient may require further interventions to treat an eventual recurrence or metastases, such as happened in the case described by DeRoover et al. [7,13].

The main limitation of our case is the fact that there are no details regarding the previous RYGB since it was performed in another state and the patient did not carry any exams nor the surgical report of this operation. Furthermore, the patient reported that she did not undergo an esophagogastroduodenoscopy before the RYGB, so it is not possible to determine whether the tumor was already in the stomach or not at that time.

#### 4. Conclusion

To sum up, among the three cases of GIST after bariatric surgery ever reported in the literature to date, only two cases were reportedly symptomatic. Our case stands as the first cKIT (–) GIST after bariatric surgery to be reported.

#### Declaration of Competing Interest

The authors report no declarations of interest.

#### Funding

The authors declare no financial support.

#### Ethical approval

This study was approved by the Ethics Committee of Federal University of Pernambuco, under the registration number CAAE 277734620.0.0000.8807.

#### Consent

Written informed consent was obtained from the patient for publication of this case report and accompanying images. A copy of the written consent is available for review by the Editor-in-Chief of this journal on request.

#### Author's contribution

Study concept and design: CESM, NSL, AABF.  
Data Collection: WAN, DTCS, MARCA.  
Data Analysis and interpretation: WAN, CESM, MARCA.  
Writing the paper: WAN, FSC, HGBC.  
Revision: CESM, NSL, AABF.

#### Registration of research studies

N/A.

#### Guarantor

Wagner A. Nascimento.

#### Provenance and peer review

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