Routine postoperative upper gastrointestinal fluoroscopy after laparoscopic sleeve gastrectomy: Is there still a utility?

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Abstract

Purpose: To assess the performance of routine esophagogastric transit studies (OGT) performed between day 2 (D2) and day 4 (D4) following sleeve gastrectomy for the diagnosis of gastric fistula.

Patients and methods: Single center study including 736 patients undergoing surgery for sleeve gastrectomy including 32 of whom developed gastric fistula. Seven hundred and twenty OGT on D2 and 86 abdominal and pelvic CT scans were performed to investigate for a fistula and whether or not a blood collection was present. Sensitivity, specificity, positive and negative predictive values, Youden index (YI) and dosimetry were calculated for both investigations.

Results: The sensitivity and specificity of OGT for the diagnosis of fistula were 7% and 98% respectively with a PPV of 18%, an NPV of 96% and YI of 0.06. The mean DSP was 5500 μGy.m². Sensitivity, specificity, positive and negative predictive values and Youden index for CT were 55%, 100%, 100%, 81%, 0.55, respectively for the presence of a fistula; and 96%, 86%, 78%, 98%, 0.83 for the presence of a non-blood collection and; 100%, 86%, 78%, 100%, 0.86 for the presence of a non-blood collection and/or fistula. The mean DLP was 3700 mGy.cm.

Conclusion: Because of its very poor sensitivity for the diagnosis of gastric fistula, the OGT on D2 needs to be reconsidered. CT performed on clinical suspicion appears to be a better diagnostic tool.

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The medical and surgical management of patients suffering from massive obesity is multidisciplinary and not without its complications. It may be considered in patients with a body mass index of >40 kg/m\(^2\) or with a BMI of >35 kg/m\(^2\) associated with comorbidities (hypertension, sleep apnea syndrome, diabetes) or second line after failure of medical treatments [1–3].

Sleeve gastrectomy is a method approved by the French National Health Authority (February 2008) [4–7]. It is a restrictive technique which involves removing approximately 2/3 of the stomach, and in particular the part containing the cells which secrete the appetite hormone: ghrelin [8,9]. The stomach is then reduced to a vertical tube. This technique does not interfere with food digestion [10]. The mortality from the technique is estimated to be approximately 0.2%. Apart from the risk of early postoperative hematoma and hemorrhage, anastomotic fistula is the most common complication and the most difficult and long to treat [11–15]. It is often responsible for surgical revision and a large increase in the length of stay in hospital [16,17].

The French National Health Authority (HAS) recommends that a routine esophagogastroduodenal transit study (OGT) is performed between day 2 (D2) and day 4 (D4) after sleeve gastrectomy to investigate for a gastric fistula [18].

To our knowledge, very few studies have assessed the utility and performance of routine OGT at D2 to D4 in the diagnosis of post sleeve gastrectomy fistula [15,19].

The aim of our study was to assess the utility of routine OGT on D2 to D4 following surgery compared to CT performed on a clinical basis to investigate for a gastric fistula.

Patients and methods

The study was performed in the Saint-Éloi Hospital Radiology Department, Montpellier University Hospital between February 2005 and June 2011. It was a single center retrospective observational study which obtained agreement from the local ethics committee. Seven hundred and thirty-six sleeve gastrectomies were performed during this period; 552 women (75%) and 184 men (25%), of average age 43 years old ([18–76]).

Mean BMI was 46.14 kg/m\(^2\) [31–81] and 183 (25%) patients were super obese (BMI >50 kg/m\(^2\)).

The diagnosis of fistula was proven by surgery and/or endoscopy and/or opacification of the perigastric collection after ingestion of contrast medium on a CT scan.

All patients who underwent sleeve gastrectomy and OGT between D2 and D4 were included in the study.

OGT methods

A routine OGT was performed between D2 and D4 consistent with HAS recommendations.

The investigation was performed standing in fasting patients before they had started eating anything again. An unprepared film was performed firstly followed by a dynamic radiocopy study of contrast medium ingestion (Xenetix\(^{®}\), lobitrilid 350 mg) with at least two views (anterolateral and 3/4).

The diagnosis of fistula was made if any contrast medium had leaked outside of the gastrointestinal system on at least one view.

Methods for abdominal and pelvic computer tomography (CT)

An abdominal and pelvic CT was performed if any doubt was present after the OGT or if a clinical suspicion was present. No CT scans were performed routinely. All patients undergoing bariatric surgery followed the same protocol: a portal phased abdominal and pelvic image and a late image centered only on the region of interest after swallowing diluted Omnipaque 350. A fistula was suspected on CT if contrast medium leaked outside of the staple line.

Statistics

Sensitivity (Sn), specificity (Sp), positive PPV (PPV) and negative (NPV) predictive values were calculated for the diagnosis of gastric fistula for the OGT and CT. The Youden index which is the addition of two test qualities test (sensitivity + specificity) was calculated routinely. The diagnostic value of the test increased as the Youden index approached 1.

Dosimetry was reported for each of the investigations performed (DSP for the OGT and DLP for the CT). A P value of < 0.05 was deemed to be significant. All analyses were performed on Medcalc software 9.4.2.0 (Mariakerke, The Netherlands).

Results

Diagnosis of fistula

Thirty-two of the 736 patients undergoing surgery (4.4%) developed a gastric fistula within the year after surgery. Six fistulae developed before D3 postoperatively, nine between D4 and D7, seven between D8 and six weeks, and ten fistulae after six weeks. Five of the 32 patients who had a fistula did not have an OGT: four patients underwent revision surgery before D2 (two cases of postoperative peritonitis and two cases of fall in hemoglobin). One of whom weighed over 240 kg (above the maximum weight supported by the table) could not tolerate standing up. Three of the 32 patients with fistulae did not have CT scans as two underwent surgical revision for peritonitis in the immediate postoperative period and one patient underwent revision surgery for a fistula with massive peritoneal contamination seen on OGT.

OGT results

Seventy hundred and twenty of the 736 surgical patients had an OGT.

Five of the sixteen patients who did not have one developed a fistula (cf. above). Of the remaining eleven patients, four underwent revision surgery before D2 for a fall in hemoglobin, seven had a CT scan with oral opacification before D2 pre-empting the routine OGT on D2: four for suspected pulmonary embolism, two for assessment of a splenic
Routine postoperative upper gastrointestinal fluoroscopy

Figure 1. a: Pseudodiverticular image in contact with the superior staple line on OGT (arrow); b: Pseudodiverticular appearance in contact with the superior staple line on CT (arrow); c: Fistula on OGT (arrow).

and liver tumour diagnosed peroperatively and one for perioperative splenic decapsulation.

A total of 720 OGT were performed on D2 post-sleeve gastrectomy (27/32 patients with a fistula and 693/704 patients without a fistula).

The fistula could be visualized for an OGT in only two of the twenty-seven patients who developed one; conversely there were nine false positives (Fig. 1). Twenty-five fistulae which were confirmed by CT were not visualized on OGT. The sensitivity and specificity of OGT for the diagnosis of fistula were 7% and 99% respectively with PPV and NPV of 18% and 96% respectively (YI = 0.06). The mean DSP was 5500 μGy.m² (381 μGy.m² − 7149 μGy.m²).

CT results

Eighty-six CT were performed on a clinical and laboratory basis suspicious of fistula. Of the thirty-two fistulae, twenty-nine patients had a CT (two cases underwent surgical revision for immediate postoperative peritonitis and one patient underwent revision for a fistula with massive contamination of the peritoneal cavity seen on OGT). Fifty-seven patients had a negative CT scan despite clinical and laboratory features suspicious of a fistula.

Amongst those patients with the fistula, twenty-eight collections were seen, including fifteen cases in which the fistula tract feeding the collection was seen (Figs. 2 and 3). No collection suggested a hematoma in these patients. Only one fistula was isolated with no related collection.

Nineteen collections were seen in patients without a fistula, eleven of which were suggestive of hematomas (Fig. 4) as they were hyper dense or associated with active hemorrhage or hemoperitoneum: on surgical exploration of the eight non-bloodly collections, three were hematomas, one collection was not found and another was a mesenteric cyst. Three collections were abscesses (one surgically proven, two as a result of clinical and laboratory outcome on an antibiotic therapy).

The sensitivity, specificity, positive and negative predictive values, and Youden index of CT for the diagnosis of clinically suspected fistula are shown in Table 1.

The mean DLP was 3700 mGy.cm, after dividing by the conversion factor, and effective dose of 55 mSy.

Figure 2. Unenhanced abdominal and pelvic CT, axial view showing a fluid and air collection in contact with the pacified gastric sheath after oral injection of iodine corresponding to an abscess with a fistula tract (arrow).

The sensitivity, specificity, positive and negative predictive values and Youden index for OGT and CT are shown respectively in Table 1.

Discussion

Obesity is a public health problem in France, 46% of the French population being overweight or obese [20]. There has

Figure 3. Unenhanced abdominal and pelvic CT, coronal section showing a fluid and air collection in contact with the superior staple line (arrow).
been a continuing increase in the prevalence of obesity in France with 3 million more obese people between 1997 and 2009. Most patients treated with a diet gain more weight than they have lost within 5 years after treatment.

Bariatric surgery techniques are not a miracle treatment for morbid obesity although this type of medical and surgical management is the most effective current therapeutic option to assist patients with a BMI of > 40 kg/m² to achieve considerable and sustained weight loss. Based on the principles of gastric restriction, the procedures have changed considerably over time. Five current techniques are recognized by the HAS [18]: adjustable calibrated horizontal gastrostomy (ring), laparoscopic calibrated vertical gastrectomy, longitudinal gastrectomy, gastrointestinal bypass and biliary-pancreatic shunting with or without duodenal inversion.

Longitudinal gastrectomy or sleeve gastrectomy is now an entirely separate bariatric surgical technique [5,18]. It involves a laparoscopic vertical resection of more than two thirds of the stomach leaving 60 to 80 mL of tubular stomach in place. The integrity is checked routinely by rejection of methylene blue into the gastric cannula. Apart from the restrictive nature of the gastrectomy, parietal cells which secrete ghrelin (the hormone which stimulates appetite through the hypothalamus pituitary access) [8,9] are removed. The advantages of sleeve gastrectomy are maintaining normal gastrointestinal continuity and the lack of malabsorption. Its two most common complications are bleeding from the staple line and gastric fistula which is the most common and most difficult to treat [9–12,14,16,17].

The average post-sleeve gastrectomy fistula rate published in the literature is 2.65%; compared to 4.3% in our series due to the large number of sleeve gastrectomies performed second line on scarred stomachs which is a known risk factor for fistula formation [4,5,9].

More than half of the fistulae (53%, n = 17) in our series developed more than a week after surgery and only six fistulae (18%) occurred before D3. This partly explains the very poor sensitivity of OGT, which was performed routinely between D2 and D4 in our department, following the HAS recommendations. When it is performed so early in order to allow a short hospitalization, the examination appears to be falsely reassuring with very poor diagnostic efficacy (YI = 0.06) and significant irradiation in obese patients in whom the radioscopy uptake is not always sufficient. According to our PCXMC dose calculation software, in a patient modelled as 1.74 m and 100 kg, using the following imaging acquisition parameters: tube-sensor distance 115 cm; field 28 cm x 28 cm, window centered on the stomach, the patient input dose is approximately 156 mGy, the effective stomach dose is 58 mSv and the whole body dose is 10 mSv.

It is also a poor quality investigation in obese patients who have difficulty drinking and remaining standing. The differential diagnosis between a small fistula and the image of a pseudo-diverticulum above the anastomosis is often difficult to make and resulted in false positives in our study, particularly as the location of the fistulae is preferentially in the upper part of the staple line (Fig. 1).

Because of the very low sensitivity of this investigation, its irradiation and the fact that it is performed too early, OGT does not appear to be a sufficiently high performance investigation in patient management.

CT cannot be performed routinely [21] although it is a very good diagnostic tool when used in suspected fistula based on clinical and laboratory findings [12,14,15].

If the CT is normal (no collection or fistula tract), there is not astomotic fistula and the sensitivity of CT is 100%.

The best test to diagnose fistula on a CT is visualization of the fistula and/or a collection (Figs. 2 and 3) if it is not a hematoma (YI 0.86) (Fig. 4).

Because of its very poor sensitivity to diagnose a gastric fistula, the role of the OGT on D2 should be reconsidered. We are considering abandoning the routine use of this

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**Table 1** Sensitivity (Sn), specificity (Sp), positive (PPV) and negative (NPV) predictive values of CT for the diagnosis of fistula.

<table>
<thead>
<tr>
<th>CT diagnosis</th>
<th>Patients with fistula [29]</th>
<th>Patients without fistula [57]</th>
<th>Sn (%)</th>
<th>Sp (%)</th>
<th>PPV (%)</th>
<th>NPV (%)</th>
<th>YI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blood or non-bloody collection and/or fistula</td>
<td>29</td>
<td>19</td>
<td>100</td>
<td>67</td>
<td>60</td>
<td>100</td>
<td>0.67</td>
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<tr>
<td>Non-bloody collection and/or fistula</td>
<td>29</td>
<td>8</td>
<td>100</td>
<td>86</td>
<td>78</td>
<td>100</td>
<td>0.86</td>
</tr>
<tr>
<td>Non-bloody collection</td>
<td>28</td>
<td>8</td>
<td>96</td>
<td>86</td>
<td>78</td>
<td>98</td>
<td>0.83</td>
</tr>
<tr>
<td>Fistula</td>
<td>16</td>
<td>0</td>
<td>55</td>
<td>100</td>
<td>100</td>
<td>81</td>
<td>0.55</td>
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</table>
investigation and performing a CT from the outset in sleeve gastrectomy in a patient with a past history of bariatric surgery which is a risk factor for fistula (ring or calibrated vertical gastrectomy) and for clinical or laboratory suspicion of pulmonary embolism or gastric fistula.

Our study has limitations which need to be discussed. Firstly, it is a retrospective study. In addition, for irradiation reasons, CT was only performed on the grounds of suspicion and not routinely. Finally, the formal diagnosis of fistula was not proven routinely by surgery, but in some cases by endoscopy and/or opacification of a perigastric collection after ingestion of a contrasting medium.

Routine OGT forty-eight hours after a sleeve gastrectomy is a relatively ineffective diagnostic investigation and falsely reassuring. Its role should be reconsidered in usual practice particularly, because of its significant irradiating nature in these patients. A CT performed on clinical or laboratory suspicion of a fistula is a good diagnostic tool looking for a non-bloodly collection. A lack of opacification of the collection after oral opacification should not cast doubt on the diagnosis of a fistula as this is only seen directly on CT in 50% of cases (Table 2).

Table 2 Results of OGT and CT respectively for the diagnosis of a fistula.

<table>
<thead>
<tr>
<th></th>
<th>Sn (%)</th>
<th>Sp (%)</th>
<th>PPV (%)</th>
<th>NVP (%)</th>
<th>YI</th>
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<tbody>
<tr>
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<td>99</td>
<td>18</td>
<td>96</td>
<td>0.06</td>
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<tr>
<td>CT</td>
<td>55</td>
<td>100</td>
<td>100</td>
<td>81</td>
<td>0.55</td>
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</table>

Disclosure of interest
The authors declare that they have no conflicts of interest concerning this article.

References