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LETTER TO EDITOR/LED REPLY

Invited Commentary to "The Gastric Migration Crisis in Obesity Surgery"

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We congratulate Dr. *Runkel* for the interesting report on the intrathoracic migration (ITM) of the stomach after bariatric surgery (BS) and the editor for the invitation to comment on this hot topic.

Bariatric surgery has increased dramatically over the last two decades worldwide in concomitance with the increase in the prevalence of obesity and the application of the laparoscopic techniques to this branch of surgery. While bariatric surgery has been proven to be effective in achieving a sustained weight loss and remission of obesity-related comorbidities [1], its wide use has generated new iatrogenic conditions including ITM of the stomach, either the gastric tube of the sleeve gastrectomy (SG) or the gastric pouch of the Roux-en-Y or omega gastric bypass (GB) as reported by *Runkel* in this issue of Obesity Surgery.

The mechanisms leading to the ITM in SG are disparate but at least some of them depend on the surgical technique as for example when the policy of an aggressive dissection of the hiatal region in search of a hiatal hernia is followed as advocated by some authors or when part of the gastric fundus is "missed" in the mediastinum.

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Interestingly, bariatric surgeons are focused on the role of crural diaphragm, which may be impaired after the SG, as a main mechanism responsible for GERD. However, although the crural diaphragm is of paramount importance in concomitance with increase in the intra-abdominal pressure and straining, other mechanisms are implicated in GERD after SG as in individuals with no history of BS. The transient lower esophageal sphincter relations (tLESRs) are currently considered as the most frequent mechanisms responsible for reflux during periods of normal LES pressure (> 10 mmHg); a hypotensive LES may be responsible for increased reflux during restful recumbency and after meals. Of note is also the fact that the harmful effects on the esophageal mucosa of these phenomena are additive, accounting for the increased rate of GERD-related clinical manifestations after SG, going from heartburn and regurgitation to histological changes including Barrett's esophagus. If one then adds the fact that sensibility of the esophageal mucosa varies widely among individuals going from absence of symptoms in patients with Barrett's esophagus [2], negative endoscopic reflux disease (NERD), and hypersensitive esophagus, the picture of SG and GERD, which the bariatric community is currently facing, appears as a far more complex issue [3].

This great complexity may also account for the variable results obtained when the crura is repaired at the time of SG or an anti-reflux valve is added to the procedure. Furthermore, the results in the literature are difficult to compare between studies as most of them refer to retrospective clinical charts analyses of symptoms without standardized questionnaires and only very few studies report endoscopic and/or pH-metry results.

Although SG is currently the most preferred bariatric procedure by surgeons and patients, it is far from being the "ideal procedure" and GERD is now recognized as the Achilles's heel of SG. However, most patients respond to proton pump inhibitor (PPIs) and only very few are converted to the RYGP for intractable GERD [4]. If GERD symptoms become resistant to PPIs, then the conversion becomes an easy procedure because of previous weight loss and can be done associating

the fixation of the hiatal hernia when present and fashioning a small and short, non-acid-producing gastric pouch.

The issue of Barrett's esophagus as a long-term complication of SG is currently a matter of debate. Indeed, we recently published a multicenter series of patients undergoing systematic endoscopy 5 years and more after the SG and found 18.8% of metaplasia [5]. However, it should be noticed that that only short Barrett's cases without dysplasia were found. Given the long time required for the sequence metaplasia to dysplasia and adenocarcinoma, and the low rate of transformation from dysplasia to adenocarcinoma (annual incidence of 0.43% in non-bariatric patients), the value of this study is limited to support the use of systematic endoscopy 5 years after the SG [6]. Whether patients with metaplasia should undergo conversion to RYGP or simple surveillance as in the general population remains at this stage unclear. Indeed, only four cases of adenocarcinoma of the esophagus have been reported so far while the SG is performed since many years [7, 8].

Interestingly, ITM occurs after procedures including an intestinal bypass but it is considered as an asymptomatic imaging report. However, although the Roux-en-Y gastric bypass pouch is considered as an anti-reflux procedure, long-term results indicate that the prevalence of GERD symptoms is reduced but a significant proportion of patients still complain of GERD symptoms after the RYGP as reported by Mehaffey et al [9]. This may be explained by the complexity of the GERD as outlined above but also by the variability in the surgical technique and the occurrence of ITM of the gastric pouch. Indeed, a large gastric pouch dilates more and produces more acid than a small, lesser curvature–based gastric pouch, and in the long-term it may participate in the occurrence of GERD symptoms in association with ITM.

If we come back to the concept of the "ideal" surgical procedure, the intestinal bypass is not without common side effects such as bacterial overgrowth, minerals and vitamins deficiencies, or bowel obstruction that may compromise patients' quality of life significantly.

In conclusion, ITM is certainly a complication of bariatric surgery and mainly of SG that may play a significant role in the occurrence of GERD and its complications. However, in case of GERD complicating the SG, PPIs are effective in most of the cases and when these fail the RYGP conversion is still possible as a parachute option. By the time being, no bariatric procedure can be considered as "ideal" and the ITM is the iatrogenic side of bariatric surgery and its potential occurrence must be considered before surgery and all intra-operative measures to prevent it must be used but, above all, patients should be fully advised on this potential adverse effect of surgery and its treatment options going from PPIs to parachute conversion to RYGP.

Compliance with Ethical Standards This article does not contain any studies with human participants or animals performed by any of the authors.

Conflict of Interest The authors declare that they have no conflict of interest.

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