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Thoracoscopic truncal vagotomy versus surgical revision of the gastrojejunal anastomosis for recalcitrant marginal ulcers

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Abstract

Introduction Marginal ulcer is a common complication following Roux-en-Y gastric bypass with incidence rates between 1 and 16%. Most marginal ulcers resolve with medical management and lifestyle changes, but in the rare case of a non-healing marginal ulcer there are few treatment options. Revision of the gastrojejunal (GJ) anastomosis carries significant morbidity with complication rates ranging from 10 to 50%. Thoracoscopic truncal vagotomy (TTV) may be a safer alternative with decreased operative times. The purpose of this study is to evaluate the safety and effectiveness of TTV in comparison to GJ revision for treatment of recalcitrant marginal ulcers.

Methods A retrospective chart review of patients who required surgical intervention for non-healing marginal ulcers was performed from 1 September 2012 to 1 September 2017. All underwent medical therapy along with lifestyle changes prior to intervention and had preoperative EGD that demonstrated a recalcitrant marginal ulcer. Revision of the GJ anastomosis or TTV was performed. Data collected included operative time, ulcer recurrence, morbidity rate, and mortality rate.

Results Twenty patients were identified who underwent either GJ revision ($n=13$) or TTV ($n=7$). There were no 30-day mortalities in either group. Mean operative time was significantly lower in the TTV group in comparison to GJ revision (95.7 ± 16 vs. 227.5 ± 89 min, respectively, $p=0.0022$). Recurrence of ulcer was not significant between groups and occurred following two GJ revisions (15%) and one TTV (14%). Complication rates were not significantly different with 62% in the GJ revision group and 57% in the TTV group. Approximately 38% (5/13) of GJ revisions and 28% (2/7) of TTV patients experienced complications with Clavien–Dindo scores > 3. There was no difference in postoperative symptoms between both groups.

Conclusions Our results demonstrate that thoracoscopic vagotomy may be a better alternative with decreased operative times and similar effectiveness. However, further prospective observational studies with a larger patient population would be beneficial to evaluate complication rates and ulcer recurrence rates between groups.

Keywords Thoracoscopic truncal vagotomy · Gastrojejunal anastomosis revision · Recalcitrant marginal ulcer · Roux-en-Y gastric bypass · Bariatric surgery

Bariatric surgery, including Roux-en-Y gastric bypass (RYGB) and sleeve gastrectomy, is the most effective treatment for morbid obesity demonstrating sustained weight loss, improvement of diabetes, and reduction of cardiovascular disease [1]. However, marginal ulcers remain a risk of RYGB with a 1–16% incidence and of these patients, 9–33% continue to have manifestations and further complications that are refractory to medical management ultimately requiring revision [2–5].

There are few surgical options for patients with non-healing marginal ulcers. Many go on to have revisions of the gastrojejunal (GJ) anastomosis which may entail longer operative times and morbidity rates ranging from 10 to 50% [6]. Additionally, these patients have a 7–10% risk of recurrence following revision [7–9]. There is a small number of patients, however, considered for thoracoscopic truncal

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vagotomy (TTV). It has been used mainly in patients with high risk abdominal reoperations or in those patients with very small gastric pouches. Consequently, this treatment has not been widely adopted yet and there are minimal reports of its use and efficacy for recalcitrant marginal ulcers.

To date, there have been no comparison studies between revisions of the GJ anastomosis and thoracoscopic truncal vagotomy in the treatment of recalcitrant marginal ulcers. The purpose of this study was to examine the safety and efficacy of TTV in comparison to revision of the GJ anastomosis. We also determined changes in diet and symptoms for both groups to attempt to evaluate the benefit of TTV in comparison to GJ revision.

Materials and methods

A retrospective chart review of patients who required surgical intervention for recalcitrant marginal ulcers was performed from 1 September 2012 to 1 September 2017 at Oregon Health and Science University following Institutional Review Board approval. All underwent medical therapy along with lifestyle changes prior to intervention and had preoperative EGD that demonstrated a recalcitrant marginal ulcer. All were nicotine-free. All patients continued to have persistent symptoms despite optimal medical management.

Patients included underwent either TTV or revision of the GJ anastomosis following failed medical management. Preoperative workup consisted of EGD demonstrating non-healing ulcer following lifestyle changes and medical management. Manometry was not performed prior to surgery in both vagotomy and gastrojejunal revisions unless there was concern for dysphagia. Exclusion criteria included patients who underwent GJ revision or TTV over 5 years ago, if they underwent surgery for reasons other than an ulcer, or if their surgery was aborted.

All patients undergoing TTV were performed by the same attending surgeon. GJ revisions were performed by three separate attending surgeons at the same institution. Revisions were performed primarily laparoscopically (10/13) with one patient requiring conversion to laparotomy. Patients were all within the bariatric surgery program which involved routine follow-up. They underwent a postoperative 2-week follow-up visit with subsequent 3-month and 6-month follow-up.

Patients in the GJ revision group were sent home on a full liquid diet with plans to initiate a regular diet 4 weeks postoperatively with the nutritionist. They underwent more frequent follow-up if there were concerns for inability to tolerate a diet. Vagotomy patients had diets advanced as tolerated postoperatively. Data collected included operative time, ulcer recurrence, morbidity rate, and mortality rate. Outcome data included symptoms of dysphagia, diet changes, pain with oral intake, emesis, dumping syndrome, and further hospitalizations for dehydration. Statistical analysis was performed using *T* test and Fischer's Exact Test. Cost analysis was performed using a Wilcoxon rank-sum test.

Results

A total of 20 patients were included in the study. Thirteen patients underwent GJ revision and seven underwent TTV between 1 September 2012 and 1 September 2017. Baseline characteristics including age and sex were not significantly different between groups (Table 1). As demonstrated in Table 1, patients in the GJ revision group had greater previous NSAID use than TTV patients (39% and 14%, respectively). Prior smoking was similar between GJ revision and TTV groups (62% and 57%, respectively).

There were no 30-day mortalities in either group. Length of stay did not differ between groups as demonstrated in Table 1 ($p = 0.257$). Total hospital cost was higher in the GJ revision group ($94,011 ± 37,774) in comparison to the Vagotomy group ($86,918 ± 26,577); however, this was not statistically significant, $p = 0.97$. Approximately 62% (8/13) of GJ revisions and 57% (4/7) of TTV experienced a complication following surgery. Five patients (55%) who developed complications after GJ revision had Clavien–Dindo scores ≥ 3. Specific complications of the GJ revision group included postoperative bleed (1), anastomotic leak (2), anastomotic stricture and recurrence of ulcer requiring further procedures (2), dysphagia (1) and pneumonia (1). Two of the four patients in the TTV group who experienced complications had Clavien–Dindo scores greater than three. Complications included three patients with dysphagia (43%) and one patient with food impaction. One of these patients with dysphagia was eventually diagnosed with achalasia and underwent Heller myotomy. This patient did not have symptoms of dysphagia preoperatively nor did they undergo manometry prior to surgery.

Mean operative time was significantly lower in the TTV group in comparison to GJ revision (95.7 ± 16 vs. 227.5 ± 89 min, respectively, $p = 0.0022$). Recurrence of the ulcer was not significant between groups and occurred following two GJ revisions and one TTV. Following surgical treatment, approximately 62% of GJ revisions and 57% of TTV patients were able to tolerate a regular diet. Twenty-nine percent (2/7) of TTV patients had improvement of postoperative diets and only 8% (1/13) of GJ revisions had improvement in oral intake tolerance. The mean follow-up time varied significantly between patients as some were lost to follow up after surgery. The GJ revision group had a mean follow-up of 336 days and the vagotomy group had a mean follow-up of 141 days. Zero TTV patients had regression from their previous diet and

Table 1 Demographic and clinical characteristics for patients who underwent GJ revision versus vagotomy

Variable	GJ revision $N=13$		Vagotomy $N=7$	
Demographics				
Average age in years (95% CI)	4	54.2 (46.1, 62.2)	2	54.9 (45, 64.7)
Female	9	69%	5	71%
Prior NSAID use	2	15%	0	0%
Prior smoking	1	8%	1	14%
Clinical characteristics				
Average operative time in minutes (95% CI)	13	227.5 (141, 313.9)	7	95.7 (80.5, 110.9)
Average length of stay in days (95% CI)	13	7.5 (0.8, 14.1)	7	4.1 (1.3, 7)
Total hospital cost	13	$94,011 ± 37,774	7	$86,918 ± 26,577
Morbidity rate	8	62%	4	57%
Recurrence of ulcer	2	15%	1	14%
Anastomotic leak	2	15%	0	0%
Anastomotic stricture	2	15%	0	0%
Dumping	1	8%	0	0%
Dysphagia	0	0%	3	43%
Pneumonia	1	8%	0	0%
Re-admission for dehydration	1	8%	0	0%
Clavien–Dindo				
1	1	8%	1	14%
2	2	15%	0	0%
3	3	23%	1	14%
4	2	15%	1	14%

$N=20$. Data reported as counts and percents unless specified

Kaplan–Meier log-rank p value for length of stay = 0.4907, for hospital cost $p=0.97$, for operative time = 0.0022*, and for time to recurrence = 0.2575

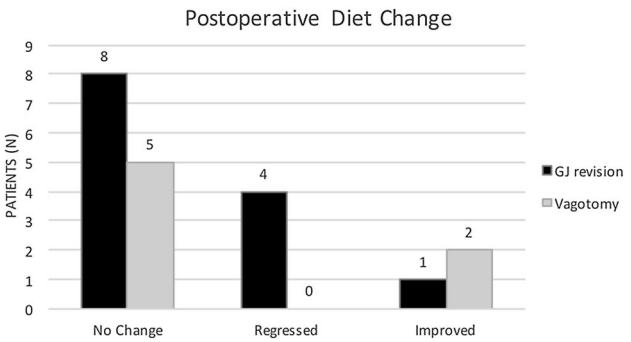

Fig. 1 Postoperative diet changes in gastrojejunal (GJ) revision versus thoracoscopic truncal vagotomy patients demonstrating no change, regression or improvement of oral intake tolerance

31% (4/13) of GJ patients had regression of oral intake tolerance (Fig. 1). There was no difference in postoperative symptoms including pain with eating, nausea and vomiting, dumping syndrome, and dysphagia between both groups.

Discussion

Non-healing marginal ulcers refractory to medical management and lifestyle changes are a rare problem with few surgical options and subsequent high complication rates following re-operation [3, 4, 10]. Our knowledge to date comparing the effectiveness of thoracoscopic vagotomy and GJ revisions is lacking and both procedures come with risk. However, as our study demonstrated, thoracoscopic vagotomy may be an alternative approach with equivalent results and decreased operative times. Although our population size is small, we can construe that thoracoscopic vagotomy may have promising results for not only the hostile abdomen, but as a first line treatment for recalcitrant marginal ulcers.

Thoracoscopic vagotomy is not a new approach, but its use is rare in many centers. Kux et al. first described the method of thoracoscopic vagotomy for duodenal ulcers in 1953 [11]. Since this time, its popularity grew in those patients with multiple previous operations and adhesions with promising results of ulcer regression. In 1978, Proot et al. demonstrated successful treatment and resolution of ulcers in 33 of 38 patients and other small series demonstrated comparable results to our study with minimal recurrence of ulcers [12].

In 2009, there was a similar study describing 39 revisional operations for marginal ulcer and 7 patients undergoing truncal vagotomy [7]. This group, however, had abandoned the vagotomy due to the lack of evidence for its efficacy and difficulty with the procedure at that time. During this series, there was one perforation, one death and three recurrences following vagotomy [7]. We did not see any of these concerning aspects within our own results or other case series which may be explained by easier dissection of the vagus nerve within the chest and more experience with this particular procedure over the years.

More recently, Hunter et al. demonstrated an 82% improvement in symptoms in a series of 17 thoracoscopic vagotomy patients, which was not included in this particular series [10]. No patients in that study demonstrated evidence of persistent or recurrent marginal ulcers. Patients in this study seldom required a chest tube and were usually discharged on postoperative day 1, as well [10]. Although our TTV patients did not have a statistically significant decreased length of stay in comparison to the GJ revisions, this is likely due to our small sample size as the TTV group did have a shorter LOS by 3 days. Although, LOS was ultimately shorter with decreased mean hospital cost in the vagotomy group, there was no significant statistical difference, which may be attributed to small sample size. Reasoning for the longer LOS in the vagotomy group compared to prior studies may be attributed to pain control with chest tube placement, but we continue to refine our postoperative management with smaller blake drains and removal on postoperative day 1. Of note, there were no conversions to thoracotomy, while some GJ revisions did require a laparotomy.

Analogous to our own results, Hunter et al. demonstrated several patients with continued pain with eating, nausea, vomiting, and dysphagia [10]. However, when analyzing recurrent symptoms between groups, there was no trend towards significance in the number of symptoms. We did see a larger group of vagotomy patients (47%) with postoperative dysphagia in comparison to GJ revisions (0%); however, when looking at symptoms present at follow-up both groups had high rates of symptoms of dysphagia (46% for GJ revision and 71% for vagotomy patients). With this large amount of dysphagia postoperatively in both groups, there may be a more definitive reason to obtain manometry in all preoperative candidates for both revision and vagotomy. However, there was also an overall improvement in oral intake for both groups. Furthermore, despite continued symptoms in approximately 85% of all patients, there were only three total ulcer recurrences confirmed with EGD.

Despite thoracoscopic vagotomy, there was still one patient that had recurrence of ulceration ultimately requiring GJ revision. Given this finding, there may be cases in which it may be beneficial to perform vagotomy combined with gastrojejunal revisions, especially in cases of stricture. Currently, there are only a handful of case reports and one case series that have studied this procedure [13–15]. Chang et al. demonstrated promising results in this case series with average LOS of 4.2 ± 1.2 days and operative times of 80–300 min with fairly promising results and ulcer resolution [14].

Of the patients who experienced additional complications following surgical intervention, there were similar incidences of Clavien–Dindo scores > 3. None of the thoracoscopic vagotomy patients experienced a postoperative leak, which is attributed to minimal adhesions and an easier dissection in comparison to the GJ revisions. This also accounts for the markedly improved operative times for thoracoscopic vagotomy. The difference in complication severity and rates may become more evident and significant with a larger sample size in future prospective studies.

The main limitation of this study was the small population size and variable follow-up interval. While this is a rare procedure, further studies would benefit from a prospective trial or even a randomized control trial in patients with recalcitrant marginal ulcers. This study demonstrates that there may be no difference in outcomes, but decreased operative times overall. Although many patients had close follow-up after the procedure, some were not able to be contacted. Our hopes in the future would be to evaluate changes in quality of life following this procedure that includes improved pain scores, decreased use of opioids, and need for re-hospitalization or procedures in order to demonstrate a possible benefit with either thoracoscopic vagotomy or GJ revision.

In conclusion, our results demonstrate that thoracoscopic vagotomy may be a better alternative with decreased operative times and similar effectiveness due to avoidance of a previously entered operative site. However, further prospective observational studies and randomized control trials with a larger patient population would be beneficial to evaluate complication and ulcer recurrence rates between groups.

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Compliance with ethical standards

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