A Surgeon’s Take on Gastroparesis

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Medical University of South Carolina
Charleston, South Carolina
Surgical Management of Gastroparesis
What are the choices?

1. Gastric electrical stimulation (GES) aka the Gastric Pacemaker
2. Open or laparoscopic pyloroplasty
3. Endoscopic pyloromyotomy
4. Pyloroplasty and GES
5. Lap Nissen and pyloroplasty
6. Gastric bypass
7. Subtotal gastrectomy
Gastric Pacemaker Lead Implantation With a Laparoscopic Approach

Rana Pullatt, MD

David B. Adams, MD

G.I. SURGERY
Pacemaker Placement

- Halfway between rib margin and umbilicus
- Above the belt line
- Short trunk = at the umbilicus
- Obese = above the lowest fat fold
- Open surgery = separate incision for generator
Pacemaker Placement

• Halfway between rib margin and umbilicus
• Above the belt line
• Short trunk = at the umbilicus
• Obese = above the lowest fat fold
• Open surgery = separate incision for generator
Regulatory Status of the Gastric Pacemaker The

- GES -Enterra™ made by Medtronic
- Approved by the FDA through a humanitarian device exception (HDE) in 1996.
- Requires institutional IRB approval.
Regulatory Status

• This HDE regulatory category applies to devices intended to benefit fewer than 4000 patients.

• The approval process is similar to that of a premarket approval application (PMA) but is exempt from the effectiveness requirements of a PMA.

• The application is not required to include results of scientifically valid clinical investigations but must contain sufficient information for the FDA to determine that the device does not pose unreasonable or significant risk of illness or injury.

*The market is not big enough for industry to fund an RCT.*
MUSC GES Experience
Do Patient Factors Influence Device Removal?

- 176 patients
- 2010-16
- 81% Women
- Age – 17-80 (mean 44 years)
- 72% Laparoscopic
- 48.3% Diabetic, 13.6% prior foregut surgery
- Mean follow-up 41 months
- Mean time to removal 16 months
MUSC GES Experience
Do Patient Factors Influence Device Removal?

• How long were unremoved pacers in?
  – 15 days to 11.7 years (mean = 9 years)

• How long before pacers were removed?
  – 15 days to 5.5 years (mean = 1.3 years)
MUSC GES Experience
2010-2016

• 32 (18.2% removed)
  • 15 – Didn’t help = 8.2%
  • Treatment Failure
    – (2 of these wanted MRI’s)
  • 11 - Pain
  • 3 – Infection
  • 3 – Got better, didn’t need it

• 9 of the pain patients had generator re-sited
When do surgeons become dogs chasing their own tail?
Migrating Pacemaker
MUSC GES Experience

• Treatment Failure Group – 15
• No difference in age, open vs laparoscopic, sex
• More likely not diabetic - 50% vs. 26% - p=.08
• More likely had prior foregut surgery – 20% vs. 13% - p=.45
• More likely idiopathic – 53% vs 36% - p=.20
Pre-op workup for GES

- EGD
- Gastric emptying study
- CT or barium UGI
Duodenal Web
Gastric duplication
Indications for Gastric Pacemaker

GES is indicated in gastroparesis intractable to medical management for patients who meet the following conditions:

1. Abnormal gastric emptying study.
2. Upper GI endoscopy without evidence of obstruction of the gastric outlet.
3. Barium UGI study or abdominal CT scan without evidence of foregut obstruction.
4. History of recurrent episodes of severe nausea and/or vomiting for more than 12 months and failure of medical treatment for a minimum of 6 months.
5. Initiation of dietary modifications under the supervision of a registered dietician.
Indications for Gastric Pacemaker

GES is indicated in gastroparesis intractable to medical management for patients who meet the following conditions:

6. Evaluation of insulin dependent diabetics by an endocrinologist.
7. Treatment of dehydration and electrolyte imbalances.
8. Refractoriness to pharmacological intervention with:
   Prokinetics: metoclopramide and erythromycin.
   Antiemetics: antihistamine receptors, 5-HT antagonists (ondansetron), or dronabinol (THC from cannabis).
9. Gastroenterologist evaluation and referral to gastroenterology units with expertise in gastrointestinal motility disorders.
10. The procedure should be done by surgeons working in specialty gastroenterological units with a multi-disciplinary team of surgeon, gastroenterologist, and registered dietician with institutional IRB approval and oversight.
Temporizing Treatment

- PICC line for home fluids (infection risk small if not used for TPN)
- Endoscopic GJ (PEG J)
  - Makes pacer harder to do but not too hard.
  - Intractable nausea and retching leads to frequent J tube return to the stomach.
  - The usual tube leakage and dog eating the homework problems.
- Direct endoscopic J-tube with button
- Laparoscopic Jejunostomy tube
- Jejunostomy problems
  - J tube = EC fistula
  - J tube occlusion – med and TEN precipitation
  - Need 12 Fr PVC or 14 Fr Silastic tube
  - Balloon fracture eventually
# Table 1. Current Approaches for the Treatment of Gastroparesis

<table>
<thead>
<tr>
<th>Therapy</th>
<th>Recommendation</th>
<th>Level of evidence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prokinetics to accelerate gastric emptying and reduce symptoms</td>
<td>Strong</td>
<td>Moderate</td>
</tr>
<tr>
<td>Metoclopramide</td>
<td>Moderate</td>
<td>Moderate</td>
</tr>
<tr>
<td>Domperidone</td>
<td>Moderate</td>
<td>Moderate</td>
</tr>
<tr>
<td>Erythromycin</td>
<td>Strong</td>
<td>Moderate</td>
</tr>
<tr>
<td>Antiemetics</td>
<td>Conditional</td>
<td>Moderate</td>
</tr>
<tr>
<td>Tricyclics</td>
<td>Conditional</td>
<td>Low</td>
</tr>
<tr>
<td>Botulinum toxin</td>
<td>Strong, not recommended</td>
<td>High</td>
</tr>
<tr>
<td>Gastric electrical stimulation</td>
<td>Conditional</td>
<td>Moderate</td>
</tr>
</tbody>
</table>

*From Camilleri et al.*
Health care is not a binary world in which interventions are either effective or ineffective, appropriate or inappropriate.

There are large gray zones in which an intervention is neither clearly effective nor clearly ineffective — zones where benefits are unknown or uncertain and value may depend on patients' preferences and available alternatives.

Much health care occurs in these gray zones.
Surgical management of gastroparesis is gray zone medicine
High-frequency gastric electrical stimulation for the treatment of gastroparesis: a meta-analysis

Gregory O’Grady, MBChB¹,², John U. Egwuji, MD¹,², Peng Du, BE², Leo K. Cheng, PhD², Andrew J. Pullan, PhD²,³,⁴, and John A. Windsor, MD, FRACS¹

Vomiting Severity Score

Mean Difference
IV, Random, 95% CI

Pre GES  Post GES
SF-36 Physical Composite Score (PCS)

Mean Difference
IV, Random, 95% CI

Favours Baseline  Favours GES
SF-36 Mental Composite Score (MCS)

Mean Difference
IV, Random, 95% CI

Favours Baseline
Favours GES
Requirement for Enteral or Parenteral Nutritional Support

Odds Ratio
M-H, Random, 95% CI

Favours Baseline Favours GES

0.01 0.1 1 10 100
The Problem with RCT’s

• May lack external validity.
• Lack sufficient study periods or population sizes to assess duration of treatment effect.
• High costs and time constraints of RCTs may lead to reliance on surrogate markers that do not correlate with the outcome of interest.
• RCTs often take years to plan, implement, and analyze, reduce the ability of RCTs to keep pace with clinical innovations.
• RCTs are limited in their ability to assess the individualized effect of treatment, in particular the relationship to so-called gray zone medical diseases.
• RCTs are generally impractical for rare diseases such as gastroparesis that are intractable to medical management.
• Surgical trials have additional challenges, with enrollment and completion due to blinding of patients and health-care providers, high dropout rates, variability in surgical techniques, and long-term follow-up.
## Controlled Trials Assessing Effectiveness of GES

<table>
<thead>
<tr>
<th>Author, Year</th>
<th>General Conclusion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abell, 2003</td>
<td>GES set to high-frequency/low-energy decreased vomiting frequency and gastrointestinal symptoms significantly.</td>
</tr>
<tr>
<td>McCallum, 2010</td>
<td>GES for 6 weeks significantly reduced vomiting and gastroparetic symptoms for patients with intractable diabetic gastroparesis although tis had similar design issues with the cross over area.</td>
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<td>Abell, 2011</td>
<td>GES for 6 weeks significantly reduced vomiting and gastroparetic symptoms for patients with intractable diabetic gastroparesis although tis had similar design issues with the cross over area.</td>
</tr>
<tr>
<td>McCallum, 2013</td>
<td>Although the cross over section had design issues, at 12 months, GES implanted with ON stimulation was shown to decrease vomiting symptoms and days of hospitalizations compared to GES that was in OFF mode.</td>
</tr>
<tr>
<td>Abell, 2015</td>
<td>Patients treated with GES had clinically significant improvement in gastroparesis symptoms at 48 weeks compared to patients not treated with GES.</td>
</tr>
<tr>
<td>Ducrotte, 2017</td>
<td>GES was associated with significant reduction of symptoms in both diabetic and non diabetic gastroparesis patients.</td>
</tr>
<tr>
<td>Klinge, 2017</td>
<td>GES is cost effective and reduces symptoms and improves QOL in diabetes patients with recurrent nausea and/or vomiting.</td>
</tr>
</tbody>
</table>
Pyloroplasty

Gastroparesis Surgical Management
A pyloroplasty includes a full Kocherization to the duodenum

Hey doc, this was supposed to be a three hour cruise!
Efficacy of Laparoscopic Pyloroplasty for the Treatment of Gastroparesis
Efficacy of Laparoscopic Pyloroplasty for the Treatment of Gastroparesis

Efficacy of Laparoscopic Pyloroplasty for the Treatment of Gastroparesis

![Bar chart showing comparison between pre-operative (Pre-op) and post-operative (Post-op) symptoms of heartburn, nausea/vomiting, epigastric pain, bloating, and dysphagia. The chart indicates a significant improvement in symptoms post-operatively, with a p-value of less than 0.001.]
Efficacy of Laparoscopic Pyloroplasty for the Treatment of Gastroparesis

- Previous procedures - 68%
- Combined procedures along with pyloroplasty - 64%
  - PHE repair 26
  - Cholecystectomy 26
  - Gastrostomy takedown 24
  - Fundoplication 14
  - Extensive lysis of adhesion 4
  - Others <2
Depleted interstitial cells of Cajal and fibrosis in the pylorus: Novel features of gastroparesis.

• In gastroparetic patients, Cajal cell loss in the pylorus is twice as common as in the antrum and fibrosis in the pyloric smooth muscle is nearly three times more common than the antrum.

• These findings can provide one explanation for pyloric dysfunction which is a contributing factor to the pathophysiology of gastroparesis.

Neurogastroenterol Motil. 2016 Jul;28(7):1048-54
Endoscopic Pyloromyotomy

Gastroparesis Surgical Management
Gastric per-oral endoscopic myotomy for refractory gastroparesis: results from the first multicenter study on endoscopic pyloromyotomy (with video)

Mouen A. Khashab, MD, 1 Saowanee Ngamruengphong, MD, 1 David Carr-Locke, MD, 2 Amol Bapaye, MD, 4 Petros C. Benias, MD, 2 Sam Serouya, MD, 2 Shivangi Dorwat, MD, 4 Dalton M. Chaves, MD, 3 Everson Artifon, MD, 3 Eduardo G. de Moura, MD, 5 Vivek Kumbhari, MD, 1 Yamile Haito Chavez, MD, 1 Majidah Bukhari, MD, 1 Gulara Hajiyeva, MD, 1 Amr Ismail, MD, 1 Yen-I. Chen, MD, 1 Hyunsoo Chung, MD 6

Baltimore, Maryland; New York, New York, USA; São Paulo, Brazil; Pune, India; Seoul, Korea

Figure 3. Results of clinical response (symptoms) after gastric per-oral endoscopic myotomy.
Endoscopic Pyloromyotomy

**TABLE 1. Demographic and clinical features (n = 30)**

<table>
<thead>
<tr>
<th>Demographics</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (y), mean ± SD</td>
<td>47.27 ± 13</td>
</tr>
<tr>
<td>Sex (female)</td>
<td>17 (57)</td>
</tr>
<tr>
<td>Cause of gastroparesis</td>
<td></td>
</tr>
<tr>
<td>Postsurgical</td>
<td>12 (40)</td>
</tr>
<tr>
<td>Diabetic</td>
<td>11 (37)</td>
</tr>
<tr>
<td>Idiopathic</td>
<td>7 (23)</td>
</tr>
<tr>
<td>Duration of disease before G-POEM (months),</td>
<td>21 (12–24)</td>
</tr>
<tr>
<td>median (IQR)</td>
<td></td>
</tr>
<tr>
<td>Gastric retention at 4 h (%)</td>
<td>37 ± 23</td>
</tr>
<tr>
<td>Previous therapy</td>
<td></td>
</tr>
<tr>
<td>Erythromycin</td>
<td>7 (23)</td>
</tr>
<tr>
<td>Metoclopramide</td>
<td>29 (97)</td>
</tr>
<tr>
<td>Domperidone</td>
<td>20 (67)</td>
</tr>
<tr>
<td>PEG-J</td>
<td>1 (3)</td>
</tr>
<tr>
<td>Endoscopic intrapyloric injection of botulinum toxin A</td>
<td>12 (40)</td>
</tr>
<tr>
<td>Transpyloric stenting</td>
<td>4 (13)</td>
</tr>
<tr>
<td>Predominant symptoms</td>
<td></td>
</tr>
<tr>
<td>Nausea/vomiting</td>
<td>26 (87)</td>
</tr>
<tr>
<td>Abdominal pain</td>
<td>4 (13)</td>
</tr>
<tr>
<td>Symptoms</td>
<td></td>
</tr>
<tr>
<td>Nausea</td>
<td>26 (87)</td>
</tr>
<tr>
<td>Vomiting</td>
<td>22 (73)</td>
</tr>
<tr>
<td>Abdominal pain</td>
<td>17 (57)</td>
</tr>
<tr>
<td>Weight loss</td>
<td>27 (90)</td>
</tr>
<tr>
<td>Required hospitalization for gastroparesis symptoms</td>
<td>18 (60)</td>
</tr>
</tbody>
</table>
Endoscopic Pyloromyotomy

**Figure 1.** Completed submucosal tunneling in the gastric antrum.

**Figure 2.** Pyloric ring visualized after completion of tunneling. The duodenal mucosa is well visualized beyond the ring. Caution has to be taken during pyloromyotomy to avoid inadvertent duodenal mucosotomy.
• 95 subjects
• Idiopathic (54.7%), diabetes (22.1%), post-surgical (18.9%) and other in 4.2%.
• 68.2% of the patients who had previous endoscopic or surgical interventions for gastroparesis.
• Average time = 34 minutes
• Ten patients had complications (10.5%),
  – 1 diagnostic laparoscopy, and 4 repeat endoscopy procedures.
• Overall Gastroparesis Cardinal Symptom Index improved from a preoperative mean of 3.82±0.86 to 2.54±1.27; p < 0.0001).
• Among the patients with postoperative GES available, 79.4% had objectively better 4-hour emptying with a mean improvement of 17.6% (p = 0.0015), and which included 68.6% with normal emptying
In re-do foregut surgery...
Anatomy is Queen but physiology is King
Nausea and Vomiting in Gastroparesis: Similarities and Differences in Idiopathic and Diabetic Gastroparesis

• Baseline symptoms were similar in T1DM and T2DM patients, even though T1DM patients had worse gastric emptying delays and higher HbA1c suggesting other factors mediate symptom severity.
• The poor relation of symptom severity to gastric emptying in T1DM versus T2DM patients is consistent with recent literature, and suggests other pathophysiologic abnormalities mediate GI symptom genesis.
• Factors such as poor fundic accommodation, heightened sensitivity to gastric distention, gastric dysrhythmias, and pyloric dysfunction warrant study as potential causes of GI symptoms associated with diabetic gastroparesis.

And the microbiome.....
Pyloroplasty & GES

Gastroparesis Surgical Management
Throw them everything but the kitchen sink school of surgery
27 patients from 2012 to 2015
Follow-up on 24 patients
Follow-up ranged from 3 to 38 months (mean: 17).
There was 71% improvement in total symptom score.
The long-term efficacy and safety of pyloroplasty combined with gastric electrical stimulation therapy in gastroparesis

Davis BR, Sarosiek I, Bashashati M, Alvarado B, McCallum RW
J Gastrointest Surg 2017;21:222–227

<table>
<thead>
<tr>
<th>Table 1</th>
<th>The severity of upper gastrointestinal symptoms in gastroparetic patients at baseline and after surgery (gastric electrical stimulator implantation plus pyloroplasty)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Nausea</td>
</tr>
<tr>
<td>Pre-op</td>
<td>3.6</td>
</tr>
<tr>
<td></td>
<td>(0.4)</td>
</tr>
<tr>
<td>Post-op</td>
<td>1.1*</td>
</tr>
<tr>
<td></td>
<td>(1.1)*</td>
</tr>
</tbody>
</table>

*p < 0.05

* Data represents mean (standard deviation)
Lap Nissen & Pyloroplasty

Gastroparesis Surgical Management
Lap Fundoplication Vagal Nerve Injury

- At risk patients
  - Paraesophageal (Type III & IV)
  - Re-do Lap Nissen
  - Heller esophagomyotomy
  - Scleroderma
She primarily complains regurgitation of solids and liquids. She can feel like she swallowed well, and then she starts coughing and solids and liquids can come back up. **She also feels like she is regurgitating "garbage". Food seems to get to her stomach then comes back up into her mouth.** She sometimes has dysphagia, has to chew her foods real well. She doesn't eat meat because it gets stuck in her chest. **She has heartburn and reflux all the time**, takes Nexium and Zantac which help somewhat. She had been on Omeprazole for years previously but Nexium seems to help her reflux symptoms better. She denies chronic cough or voice changes, no chronic bronchitis. **She has nausea, doesn't really vomit.** She has been diabetic x 35 years, on insulin pump, has been on insulin the whole time. She averages 40u daily on her insulin pump and uses a CGM. She is allergic to Reglan, Domperidone and EES did not help her symptoms. She complains of early satiety and bloating.
GERD & Gastroparesis

- GES - Delayed gastric emptying, 13.2% retention at 4 hours
- Mano -ineffective peristalsis with 50% ineffective contractions
- 24 hour pH –DeMeester score = 57.6
- EGD - Esophageal ulcer, Barrett's, erosive esophagitis
- Esophagram - Small Hiatal Hernia
GERD symptom predominant and gastroparesis

Loose 1 cm Lap Nissen and pyloroplasty
• 35 patients also had a pyloroplasty and Nissen.
• Twenty-eight (80%) of these patients reported significant symptomatic improvement.
• The median preoperative bloating score improved from 4 to 1 postoperatively (P < 0.05).
• The median gastric emptying scintigraphy T1/2 improved from 244 to 112 minute (P < 0.05).
Pyloroplasty with Fundoplication in the Treatment of Combined Gastroesophageal Reflux Disease and Bloating

Figure 4. Median preoperative and postoperative $T_{1/2}$ gastric emptying times; $P < 0.05$. 

Bloating statistically better in patients with bloating and abnormal gastric emptying

World J Surg. 2007;31:332-6
Gastric Bypass

Gastroparesis Surgical Management
Nausea and Vomiting in Gastroparesis: Similarities and Differences in Idiopathic and Diabetic Gastroparesis

- 7 centers of the NIDDK Gastroparesis Clinical Research Consortium Registry
- The clinical perception that patients with diabetes and gastroparesis are frequently underweight is not supported by our findings.
- Almost half of T1DM patients with gastroparesis were overweight or obese and only 3% were underweight.
- T2DM patients with gastroparesis were even heavier.

Neurogastroenterol Motil. 2016 July ; 28(7): 1001–1015
The Total Symptom Score (TSS) for gastroparetic patients was collected for 5 of the 7 patients (mean f/u 315 days).

The TSS for severity and frequency significantly improved from:

- Pre-op Mean severity = 13.8
- Post-op Mean severity = 7.6
- P = .04.
Open Subtotal Gastrectomy

Gastroparesis Surgical Management
Near-total completion gastrectomy for severe postvagotomy gastric stasis: analysis of early and long-term results in 62 patients

- Mayo Clinic from 1985-96
- Follow-up was complete in 98% at 5.4 years.
- All had undergone prior vagotomy and had a median of four previous gastric operations.
- Hospital mortality was zero.
- Complications occurred in 25 patients (40%)
Near-total completion gastrectomy for severe postvagotomy gastric stasis: analysis of early and long-term results in 62 patients

J Gastrointest Surg. 1999 Jan-Feb;3(1):15-21, discussion 21-3

Outcome Measures

Table 1. Modified Visick Grading System

<table>
<thead>
<tr>
<th>Grade</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>No symptoms</td>
</tr>
<tr>
<td>2</td>
<td>Mild symptoms easily controlled by simple care such as avoiding certain foods or small meals, etc</td>
</tr>
<tr>
<td>3</td>
<td>Moderate symptoms not controlled by simple care but not interfering with social or economic life</td>
</tr>
<tr>
<td>4</td>
<td>Moderate symptoms interfering with social or economic life</td>
</tr>
<tr>
<td>5</td>
<td>Symptoms as bad or worse than preoperatively</td>
</tr>
</tbody>
</table>
Near-total completion gastrectomy for severe postvagotomy gastric stasis: analysis of early and long-term results in 62 patients

Forstner-Barthell AW, Murr MM, Nitecki S, Camilleri M, Prather CM, Kelly KA, Sarr MG.
J Gastrointest Surg. 1999;3:15-21

- Univariate analysis revealed no preoperative characteristic to be predictive of good outcome.
- Logistic regression analysis suggested that the combination of nausea, need for total parenteral nutrition, and retained food in the stomach predicted a poor outcome (P<0.05).
- Completion gastrectomy is successful in 43% of patients.
- The combination of nausea, need for total parenteral nutrition, and retained food at endoscopy are negative prognostic factors.
Near-total completion gastrectomy for severe postvagotomy gastric stasis: analysis of early and long-term results in 62 patients

Forstner-Barthell AW, Murr MM, Nitecki S, Camilleri M, Prather CM, Kelly KA, Sarr MG.
J Gastrointest Surg. 1999 Jan-Feb;3(1):15-21, discussion 21-3

• All or most symptoms were relieved in 43% (Visick grade I or II)
• 57% of the patients remained in Visick grade III or IV.
• Nausea reduced from 93% to 50%,
• Vomiting 79% to 30%
• Postprandial pain 58% to 30% (P<0.05),
• Chronic pain, diarrhea, and dumping syndrome were not significantly affected.
Thirty-five patients underwent laparoscopic total or near-total gastrectomies for postoperative (43%), diabetic (34%), or idiopathic (23%) gastroparesis. There were no mortalities. Six patients suffered a leak, all treated with surgical reintervention. Median follow-up of 6 months. Nausea improved or resolved in 69%. Chronic abdominal pain improved or resolved in 70%. Belching and bloating resolved for 79 and 89%, respectively (p<0.01).
Laparoscopic Gastrectomy

Gastroparesis Surgical Management
End of the Road for a Dysfunctional End Organ: Laparoscopic Gastrectomy for Refractory Gastroparesis

Fig. 1 Comparison of symptoms before surgery (dark bars) and after surgery (light bars).

Journal of Gastrointestinal Surgery
March 2015, Volume 19, Issue 3, pp 411–417
Tailored approach to gastroparesis significantly improves symptoms

Lauren E. Arthur Lauren Slattery William Richardson

• 58 patients
  – 33 had gastric stimulator (GES)
  – 7 pyloroplasty (PP)
  – 16 with both gastric stimulator and pyloroplasty (GSP)
  – 2 sleeve gastrectomy.

• For the 16 patients in the GSP group, the second procedure was performed if there was inadequate improvement with the first procedure.
Tailored approach to gastroparesis significantly improves symptoms
Lauren E. Arthur Lauren Slattery William Richardson

• All procedures significantly improved symptoms.
• GES demonstrates more improvement than PP
• If PP or GES does not adequately improve symptoms GSP is appropriate.
• Gastrectomy was reserved as a last resort.
GES
Nausea vs. Improved Gastric Emptying
NM Gastric Emptying

The standardized meal includes: two egg whites, two slices of toast, two packages of strawberry jelly, and 4 ounces of water.

Anterior and posterior static images of the stomach and upper abdomen are obtained immediately and 1, 2, and 4 hours postprandial.
Nausea and vomiting in gastroparesis: similarities and differences in idiopathic and diabetic gastroparesis

Nausea is present in essentially all patients with gastroparesis irrespective of cause and associated with decreased quality of life. In contrast, vomiting was more prevalent, more severe, and occurred more often in diabetic than idiopathic gastroparesis.

Neurogastroenterol Motil. 2016 Dec;28(12):1902-1914
Evidence, Experience, Empathy, Intuition
Diabetic gastroparesis
GES
Middle-aged woman idiopathic gastroparesis
GES
GERD symptom predominant and gastroparesis –

Lap Nissen and pyloroplasty
Post Nissen onset of gastroparesis
Lap pyloroplasty
Post partial gastric resection and vagotony

Open gastrectomy with Braun gastrojejunostomy and jejunal anastomosis to tubular stomach
The uncut Roux reconstruction after gastrectomy
Morbid obesity and gastroparesis

Laparoscopic Roux-en-Y gastric bypass
Chronic pain and opioid dependence, gut hypersensitivity, colonic inertia

BEWARE! BEWARE!
Gastric electrical stimulation (GES) may be considered MEDICALLY NECESSARY for gastroparesis when all of the following are present:

1. The patient has a history of recurrent episodes of severe nausea/vomiting for more than 12 months and undergone comprehensive medical therapy for a minimum of six months
2. Upper endoscopy demonstrates no evidence of gastric outlet obstruction
3. Imaging, either barium upper GI or abdominal CT, demonstrates no evidence of foregut obstruction
4. There is abnormal gastric emptying confirmed by nuclear study
   a. One hour testing with > 50% retention of liquids, and/or
   b. Two hour testing with > 60% retention of solids, and/or
   c. Four hour testing with > 10% retention of solids.
5. The patient is refractory to maximum pharmacologic intervention including
   a. Prokinetics – metoclopramide and erythromycin
   b. Antiemetics – antihistamine receptors, 5-HT antagonists, or dronabinol
6. The patient has undertaken dietary modifications under the supervision of a registered dietician
7. The patient’s care is provided by a multi-disciplinary team including surgeon, gastroenterologist and registered dietician
8. The procedure is performed at a center with IRB approval and oversight
Selected References

Selected References