

# **Gastroparesis Update Highlights from the NIH Gastroparesis Consortium and Dr. McCallums Clinical Research and Experience**

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# Introduction to the NIH Gastroparesis Clinical Research Consortium

Henry P. Parkman, Katherine P. Yates, Richard W. McCallum, Irene Sarosiek, Alan Maurer, Ron Schey, William L. Hasler, Gianrico Farrugia, Madhusudan Grover, Kenneth L. Koch; Linda Nguyen, Braden Kuo, William J. Snape, Thomas L. Abell, James Tonascia, Frank Hamilton, Pankaj J. Pasricha.



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National Institute of Diabetes and Digestive and Kidney Diseases

# CLINICAL BURDEN OF GASTROPARESIS FOR PATIENTS IS HIGH

## *Early Satiety and Postprandial Fullness*

Parkman et al. NGM 2017

- Severity is associated with body weight, quality of life, gastric emptying.

## *Nausea and Vomiting*

- Nausea is present in nearly all patients (95%)
- Nausea and vomiting decrease quality of life.
- Vomiting is more prevalent and severe in DG than IG.

Parkman et al. NGM 2016

## *Abdominal pain*

- Pain is the predominant symptom in one fifth of gastroparetics.
- Moderate-severe abdominal pain is prevalent in gastroparesis (66%), impairs quality of life, and is associated with idiopathic etiology, but not gastric emptying.
- Pain has largely been ignored in gastroparesis; its cause is unknown.

Hasler et al. *AJG* 2011;106:1492-502

# CLINICAL FEATURES OF IDIOPATHIC GASTROPARESIS

243 patients with IG studied in the NIH GpC

Mean age 41 years; 88% female, 46% overweight, 50% acute onset of symptoms, and 19% reported an initial infectious prodrome.

Severe delay in gastric emptying (>35% retention 4 hours) present in 28% of patients.

Predominant presenting Sx: nausea (34%), vomiting (19%), abdominal pain (23%).

Severely delayed gastric emptying: worse vomiting, loss of appetite, overall Gp sx.

86% met criteria for functional dyspepsia, primarily postprandial distress syndrome.

IG is a disorder that primarily affects young women, beginning acutely in 50% of cases; unexpectedly, many patients are overweight. Severe delay in gastric emptying was associated with more severe symptoms of vomiting and loss of appetite.

IG - a diverse syndrome, varies by sex, body mass, symptom onset, delay in gastric emptying.

Parkman, Yates, Hasler, et al.  
Gastroenterology 2011;140:101.

# COMPARING DIABETIC AND IDIOPATHIC GASTROPARESIS

416 patients with gastroparesis in NIH GpCR;  
254 had IG and 137 had DG (78 had type 1 and 59 had type 2).

Symptoms prompting evaluation more often included vomiting for DG and abdominal pain for IG.  
DG had more severe retching and vomiting than those with IG,  
IG had more severe early satiety and postprandial fullness subscores.

Gastric retention was greater in patients with type 1 DM.

More than 50% of patients with type 1 DM had severe retention (>35% at 4 hrs); they took prokinetic agents more frequently, had more hospitalizations, and were more likely to receive gastric electric stimulation.

There are similarities and differences in clinical characteristics of DG and IG. Gastroparesis is a heterogeneous disorder; its etiology affects symptoms and severity.

Parkman, Yates, Hasler, et al  
CGH 2011;9:1056.

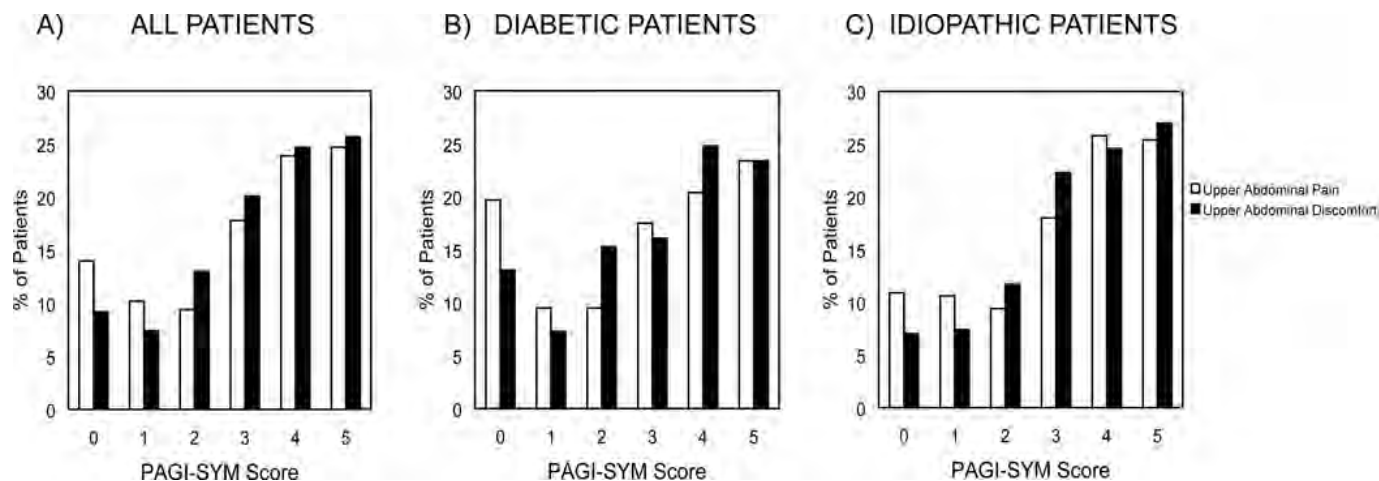
# FACTORS RELATED TO ABDOMINAL PAIN IN GASTROPARESIS

This study related pain to clinical factors in gastroparesis and contrasted pain/discomfort- with nausea/vomiting- predominant disease.

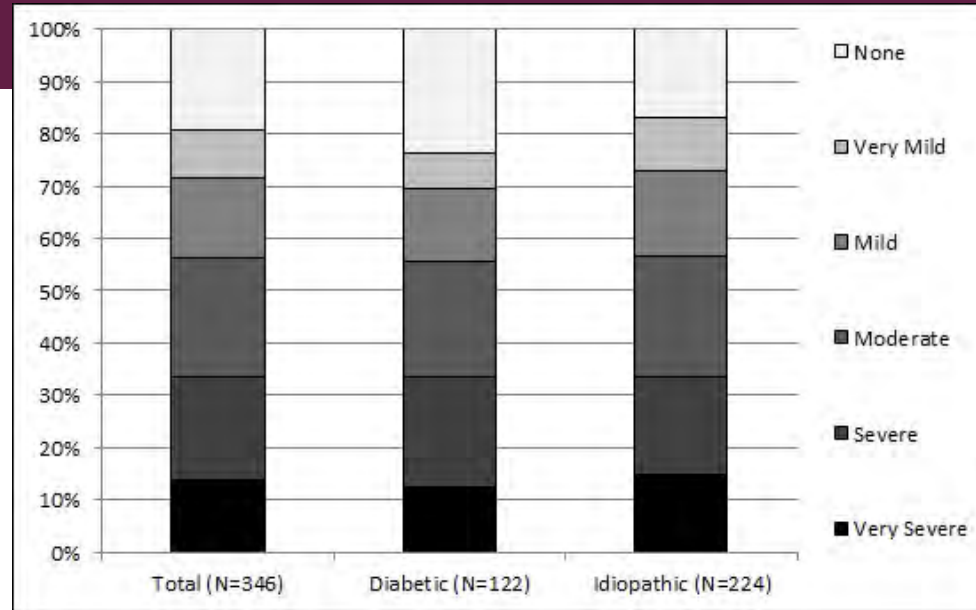
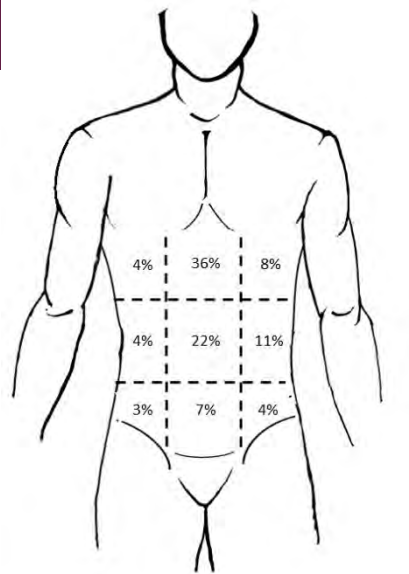
Clinical and scintigraphy data were compared in 393 patients .

Upper abdominal pain was moderate-severe in 261 (66%).

Moderate-severe abdominal pain is prevalent in gastroparesis, impairs quality of life, and is associated with idiopathic etiology, lack of infectious prodrome, and opiate use. Pain is predominant in one fifth of gastroparetics. Predominant pain has at least as great an impact on disease severity and quality of life as predominant nausea/vomiting.



# ABDOMINAL PAIN IN PATIENTS WITH GASTROPARESIS



Increased upper abdominal pain severity was associated with increased severity of the nine GCSI symptoms, depression, anxiety, somatization, use of opiate medications, decreased SF-36 physical component and PAGO-QOL, but not related to severity of delayed gastric emptying or water load ingestion.

Abdominal pain is common in patients with Gp, both IG and DG. Severe/very severe upper abdominal pain occurred in 34% of Gp patients and associated with other Gp symptoms, somatization, and opiate medication use.

Parkman et al  
DDW Abstract 2018

# OPIOID USE IN PATIENTS WITH GASTROPARESIS

Many patients with gastroparesis are prescribed opioids for pain control.

We characterized associations of use of potent vs weaker opioids and presentations of diabetic and idiopathic gastroparesis.

41% of 583 gastroparesis patients in GpCRC Registry were taking opioids;

Abdominal pain was the reason for prescription for 61% of patients taking opioids.

Mean scores for gastroparesis, nausea/vomiting, bloating/distention, abdominal pain, and constipation scores were higher in opioid users ( $P \leq .05$ ).

Opioid use was associated with greater levels of gastric retention, worse quality of life, increased hospitalization, and increased use of antiemetic and pain modulator medications, compared with nonusers ( $P \leq 0.03$ ).

Opioid use is prevalent among patients with diabetic or idiopathic gastroparesis, and is associated with worse symptoms, delays in gastric emptying, and lower quality of life, as well as greater use of resources.

## PSYCHOLOGICAL DYSFUNCTION IS ASSOCIATED WITH SYMPTOM SEVERITY IN PATIENTS WITH GASTROPARESIS

Gastroparesis patients may have associated psychological distress.

Beck Depression Inventory (BDI) and State-Trait Anxiety Inventory (STAI) scores for state (Y1) and trait (Y2) anxiety were obtained from 299 Gp patients.

BDI, Y1, and Y2 scores were greater with increasing degrees of investigator-rated gastroparesis severity. BDI, Y1, Y2 scores were higher for GCSI  $>3.1$  vs.  $\leq 3.1$ .

Antiemetic and prokinetic use and  $\geq 6$  hospitalizations/year were more common with BDI  $\geq 20$  vs.  $<20$ . Anxiolytic use was more common with Y1  $\geq 46$ ; antidepressant use and  $\geq 6$  hospitalizations/year were more common with Y2  $\geq 44$ .

BDI, Y1, and Y2 scores were not different in diabetic and idiopathic gastroparesis and did not relate to degree of gastric retention.

Higher depression and anxiety scores are associated with gastroparesis severity on investigator- and patient-reported assessments. Psychological dysfunction does not vary by etiology or degree of gastric retention. Psychological features should be considered in managing gastroparesis.

## ETHNIC, RACIAL, AND SEX DIFFERENCES IN ETIOLOGIES, SYMPTOM SEVERITY, AND TREATMENTS IN PATIENTS WITH GASTROPARESIS

Gastroparesis is a chronic disorder of the stomach characterized by nausea, vomiting, early satiety, postprandial fullness, and abdominal pain. There is limited information on gastroparesis in minority populations.

718 adult patients with gastroparesis from NIH Gastroparesis Consortium:

552 non-Hispanic whites (77%), 83 persons of Hispanic ethnicity (12%), 62 non-Hispanic blacks (9%), 603 women (84%), and 115 men (16%).

Higher proportion of non-Hispanic blacks (60%) had gastroparesis of diabetic etiology than of non-Hispanic whites (28%); non-Hispanic blacks also had more severe retching and vomiting and a higher percentage were hospitalized in the past year (66% vs 38%).

Higher proportion of Hispanics had gastroparesis of diabetic etiology (59%) than non-Hispanic whites (28%), but Hispanics had less-severe nausea (, less early satiety (, and a lower proportion used domperidone (8% vs 21%) or had a peripherally inserted central catheter (1% vs 7%).

Women had higher proportion with gastroparesis of idiopathic etiology (69%) than men (46%); women had more severe symptoms of stomach fullness, early satiety , postprandial fullness, bloating, stomach visibly larger , and upper abdominal pain.

## CHRONIC UNEXPLAINED NAUSEA/VOMITING BUT NORMAL GASTRIC EMPTYING

425 pts chronic nausea & vomiting; 319 (75%) delayed, 106 normal GES.

Similar symptom severity for nausea, retching, vomiting, stomach fullness, early satiety, postprandial fullness, loss of appetite, bloating.

Total GCSI not correlated with gastric retention.

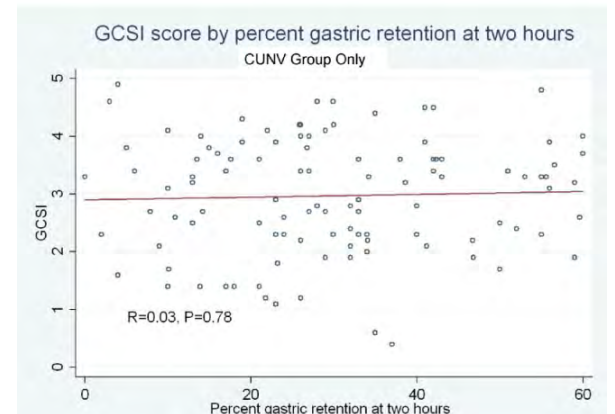
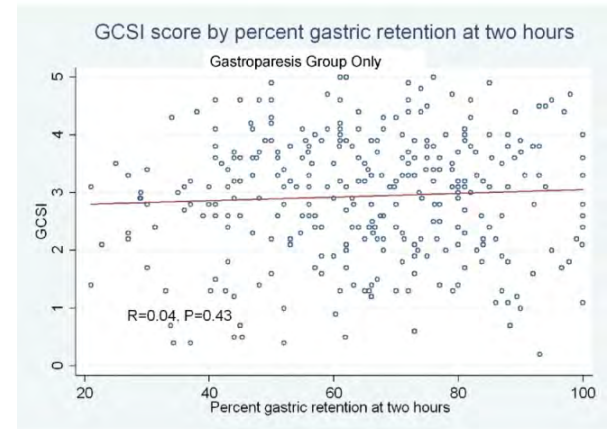
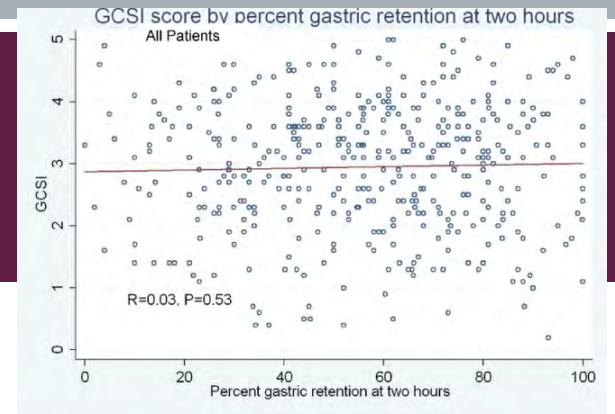
Those with delayed gastric emptying were more likely to be diabetic.

State anxiety scores were slightly higher among patients with delayed GE.

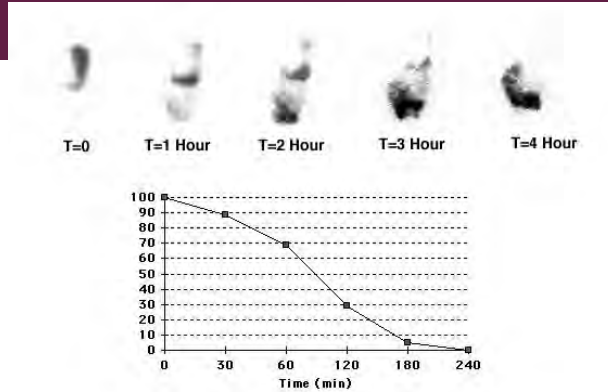
### Conclusions:

Patients with nausea and vomiting with normal gastric emptying are, for the most part, indistinguishable from those with gastroparesis.

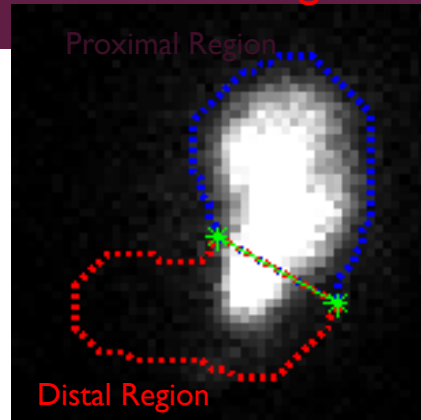
Pasricha et al.  
CGH 2011;9:567-76.



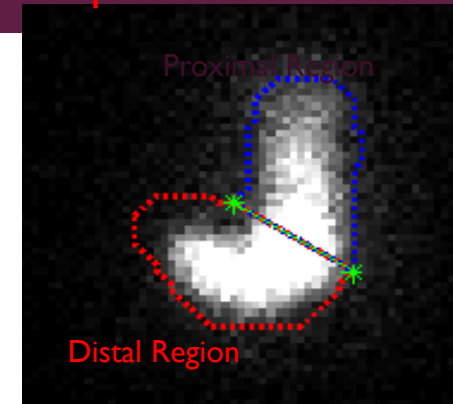
# RELATIONSHIP OF SYMPTOMS OF GASTROPARESIS TO GASTRIC PATHOPHYSIOLOGY



Normal FA: High IMD



Impaired FA: Low IMD



## *Gastric emptying of solids and liquids using technitium-99m radiolabeled meal*

Different measures of gastric function may suggest a different pathophysiological basis

for different symptoms in gastroparesis:

- increased gastric retention for vomiting;
- impaired intragastric meal distribution for early satiety;
- abnormal water load test for nausea.

Treatment approaches targeting distinct physiologic defects may be indicated for different symptoms of gastroparesis.

# OUTCOMES IN GASTROPARESIS USING NIH GPR I

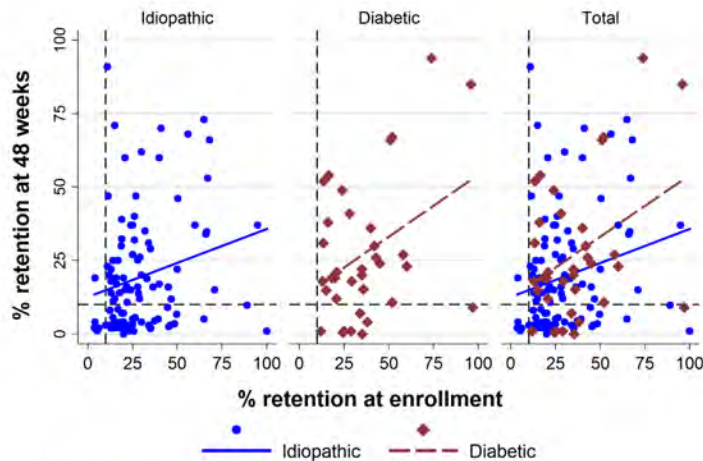
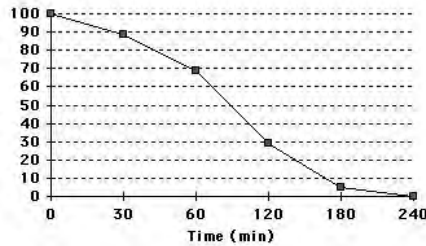
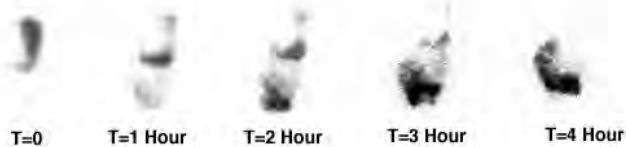
Patients with gastroparesis (diabetic or idiopathic) in GpRI.

Only 28% of 262 patients symptomatically improved at 48 weeks with decrease GCSI  $\geq 1$ .

Chronic nature of gastroparesis. The disease burden remains high.

<b>Positive predictors for improvement</b>	<b>OR</b>	<b>p</b>
age $\geq$ 50 years	3.35	0.001
<b>GCSI score</b>	<b>2.87</b>	<b>0.001</b>
antidepressant use	2.27	0.02
<b>gastric retention &gt; 20% at 4 hours</b>	<b>2.22</b>	<b>0.02</b>
<b>initial infectious prodrome</b>	<b>2.22</b>	<b>0.05</b>
<b>Negative predictors for improvement</b>		
anxiolytics	0.28	0.02
pain modulator use	0.34	0.01
<b>abdominal pain (moderate/severe)</b>	<b>0.40</b>	<b>0.04</b>
<b>overweight/obese</b>	<b>0.43</b>	<b>0.01</b>
depression	0.45	0.03
smoking history	0.46	0.04
gastroesophageal reflex severity	0.66	0.01

# GASTRIC EMPTYING CHANGES OVER TIME IN GASTROPARESIS: COMPARISON OF INITIAL AND 48 WEEK FOLLOW UP TESTS.



Graphs by Etiology: 0=Idiopathic,1=Diabetic

Parkman et al  
DDW 2018 abstract

GE can change over time in gastroparesis patients.

Patients can improve (43%)

Normalization GE occurred (36%); more so IG

Patients can worsen (15%); more so DG.

Improved GE associated with

initial increased gastric retention, narcotic use, less depression, more severe GERD Sx, elevated CRP.

decreased nausea and upper abdominal discomfort and weight gain at follow up.

Worsened GE associated with

longer duration symptoms, lower SF-36 physical quality of life.

Alterations in GE over time should be considered in clinical care of patients with gastroparesis.

# DIETARY INTAKE AND NUTRITIONAL DEFICIENCIES IN PATIENTS WITH GASTROPARESIS

Patients with gastroparesis on oral intake (N = 305); Block Food Frequency Questionnaire.

Caloric intake:  $1168 \pm 801$  kcal/day;  $58\% \pm 39\%$  of daily total energy requirements (TER).

194 patients (64%) reported caloric-deficient diets, defined as  $<60\%$  of estimated TER.

Only 5 patients (2%) followed a diet suggested for patients with gastroparesis.

Deficiencies in several vitamins and minerals. Only a third taking multivitamin supplements.

More severe symptoms (bloating and constipation) were present in energy-deficient diet.

Overall, 32% of patients had nutritional consultation after the onset of gastroparesis.

Nutritional consultation increased chances daily TER were met (odds ratio, 1.51;  $P = 0.08$ ).

Many patients with gastroparesis have diets deficient in calories, vitamins, and minerals.

Nutritional consultation is obtained infrequently.

Nutritional consultation suggested for dietary therapy and to address nutritional deficiencies.

# CONTINUOUS GLUCOSE MONITORING (CGM) PLUS CONTINUOUS SUBCUTANEOUS INSULIN INFUSION (CSII) REDUCES HYPOGLYCEMIA IN DIABETES (DM) WITH GASTROPARESIS (GP): A MULTICENTER PILOT STUDY (GLUMIT)

GLUMIT tested safety and efficacy of CSII and CGM in 45 individuals with uncontrolled DM (A1c>8%) and GP (>10% 4 hr retention) (29% T1DM). CSII+CGM for 24-week study. Patients recommended to use dual wave boluses for meal boluses, adjust insulin dose based on sensor glucose trends and predictive alerts.

## Diabetic Outcomes:

Baseline A1c levels ( $9.4 \pm 1.4\%$ ) decreased by 1.1% at 24 weeks ( $P=0.0002$  vs. baseline).

	Hypoglycemia (<70 mg/dl)	Euglycemia (71-180 mg/dl)	Hyperglycemia (>180)
Baseline:	3.9%	44.0%	52.1%
Follow-up: 1.7% ( $P<0.0001$ )		51.8% ( $p=0.004$ )	46.5% ( $p=0.04$ )

9 severe hypoglycemic events (third party assistance) occurred (2 during 2-8 week screening phase and 7 during 24 week treatment phase); 6 related to mismatches of insulin boluses/meal ingestion, 2 to insulin over-dosing, 1 no explanation.

Patients who had episodes of severe hypoglycemia had more severe GP at baseline, with nausea/vomiting scores 63.0% greater ( $p=0.002$ ) and early satiety scores 18.2% greater ( $p=0.04$ ) vs. those who did not have these episodes.

**Summary:** in DM patients with GP the CSII + CGM protocol for 6 months improved glycemic control with less time in hypoglycemia, more time in euglycemia and with an acceptable safety profile.

Patients with more severe GP warrant more careful surveillance.

# CONTINUOUS GLUCOSE MONITORING (CGM) AND INSULIN PUMP THERAPY IN DIABETIC GASTROPARESIS (GLUMIT-DG)

Diabetic gastroparesis are advised to lower blood sugars to reduce symptoms; unproven.

45 diabetics gastroparesis, poorly controlled (A1c>8%) with gastroparesis (>10% 4 h retention); 29% type I, 21±11 yr diabetes duration.

Intensive insulin regimens: Insulin pumps with continuous glucose monitoring (CGM).

Baseline A1c levels (9.4±1.4 %) decreased by 1.1% at 24 weeks (P=0.0002).

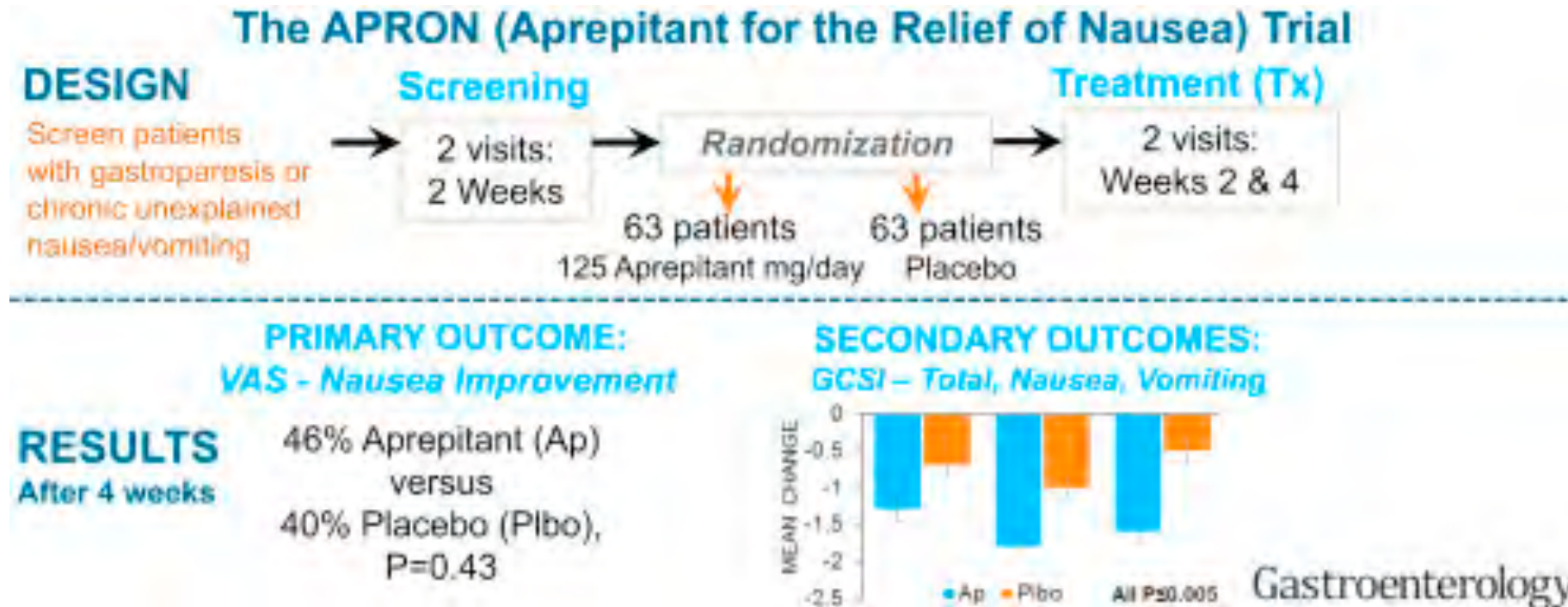
<b>Gastroparesis Outcomes:</b>	Baseline	Change at wk 12	Change at wk 24
Total GCSI score	29.3±7.1	-7.2±8.2 (p<0.001)	-6.6±8.8 (p<0.001)
Nausea/Vomiting subscore	8.1±4.2	-2.9±4.0 (p<0.001)	-2.8±4.1 (p<0.001)
Fullness/Early satiety	14.1±3.6	-3.1±4.5 (p<0.001)	-2.4±4.5 (p=0.002)
Bloating/Distention	7.1±2.3	-1.3±2.9 (p=0.001)	-1.5±2.5 (p=0.001)
Liquid nutrient tolerance	420±258	15±117 (p=0.47)	59±176 (p=0.05)

Symptom and nutrient tolerance benefits maintained for 24 weeks of therapy.

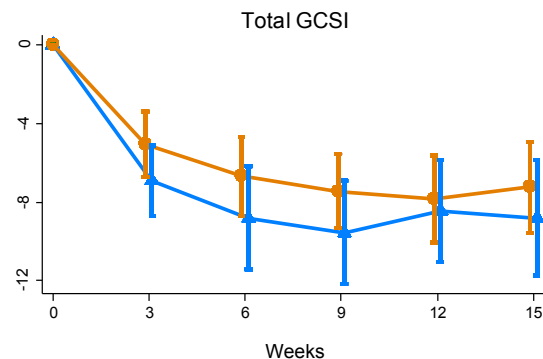
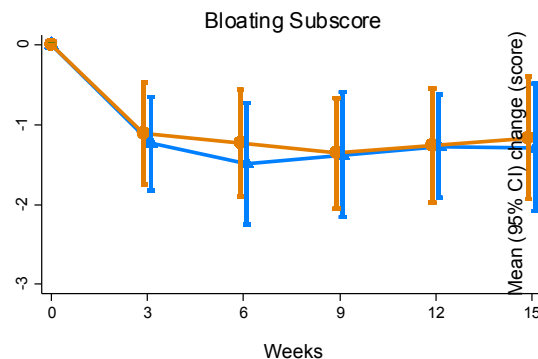
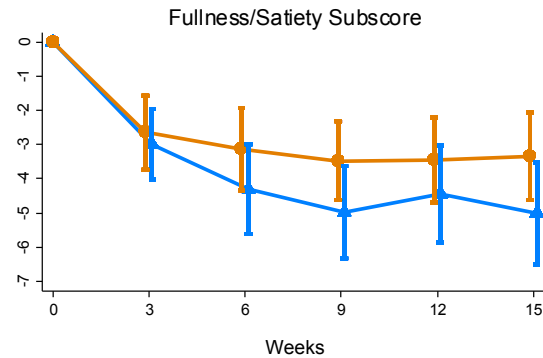
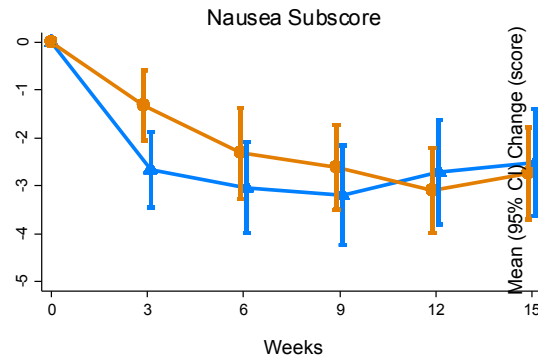
Feasibility for improving both diabetes control and lowering gastroparesis symptoms.

# APREPITANT EFFECTS ON NAUSEA AND OTHER SYMPTOMS IN PATIENTS WITH GASTROPARESIS AND RELATED DISORDERS

Randomized multicenter, double-masked 4-week trial of the neurokinin-1 receptor antagonist aprepitant (Emend) to reduce symptoms in patients with chronic nausea and vomiting caused by gastroparesis or gastroparesis-like syndrome.



# NORIG TRIAL: MAIN OUTCOMES



At 3 weeks:  
Improvement in nausea and abdominal pain at nortriptyline (10 mg), but not sustained over time as dosing was increased.

At 15 weeks:  
Higher doses of nortriptyline were associated with improvements in appetite, satiety, and body weight.

Nortriptyline did not improve overall symptoms, as defined by the primary outcome measure, in idiopathic gastroparesis over a 15 week period

Parkman, et al. *JAMA* 2013

## EFFECTIVENESS OF GASTRIC ELECTRICAL STIMULATION IN GASTROPARESIS: RESULTS FROM THE PROSPECTIVELY COLLECTED DATABASE OF GPR

92 (14.5%) of patients had GES after GpR enrollment;

48-week data from these patients were compared to the remainder 542 (control group) who never had GES.

38% of patients with GES were diabetic and 54% idiopathic.

Patients with GES had more delayed gastric emptying at 4 hrs (30.9 vs 21.8) with worse GCSI scores (3.8 vs 3.0).

After 48 weeks, GCSI scores in patients with GES improved by average of 0.9 compared with 0.3 in controls ( $p < 0.001$ ) with 43.6% showing improvement of at least 1 point compared with 24.7% in controls ( $p = 0.004$ ).

**Conclusions:** In this observational study in multiple practice settings,

15% of gastroparesis required GES therapy and were more likely to show clinically meaningful improvement at 48 weeks than those without GES Rx.

# DOMPERIDONE FOR GASTROPARESIS SYMPTOMS

We present outcomes research analysis of domperidone (DOM) therapy used for patients in the multicenter NIDDK GpCRC Registry.

650 patients: 123 (19%) and 527 (81%) in DOM and control groups.

Compared to control group, the DOM group experienced moderate, but significantly better GP symptom improvement in 3 of the 4 outcome measures: GCSI total score (delta=-0.22, p=0.005); any improvement (OR=1.63, p=0.01), improvement  $\geq$  1-point (OR=1.47, p=0.10), and Nausea subscore (delta=-0.32, p=0.01).

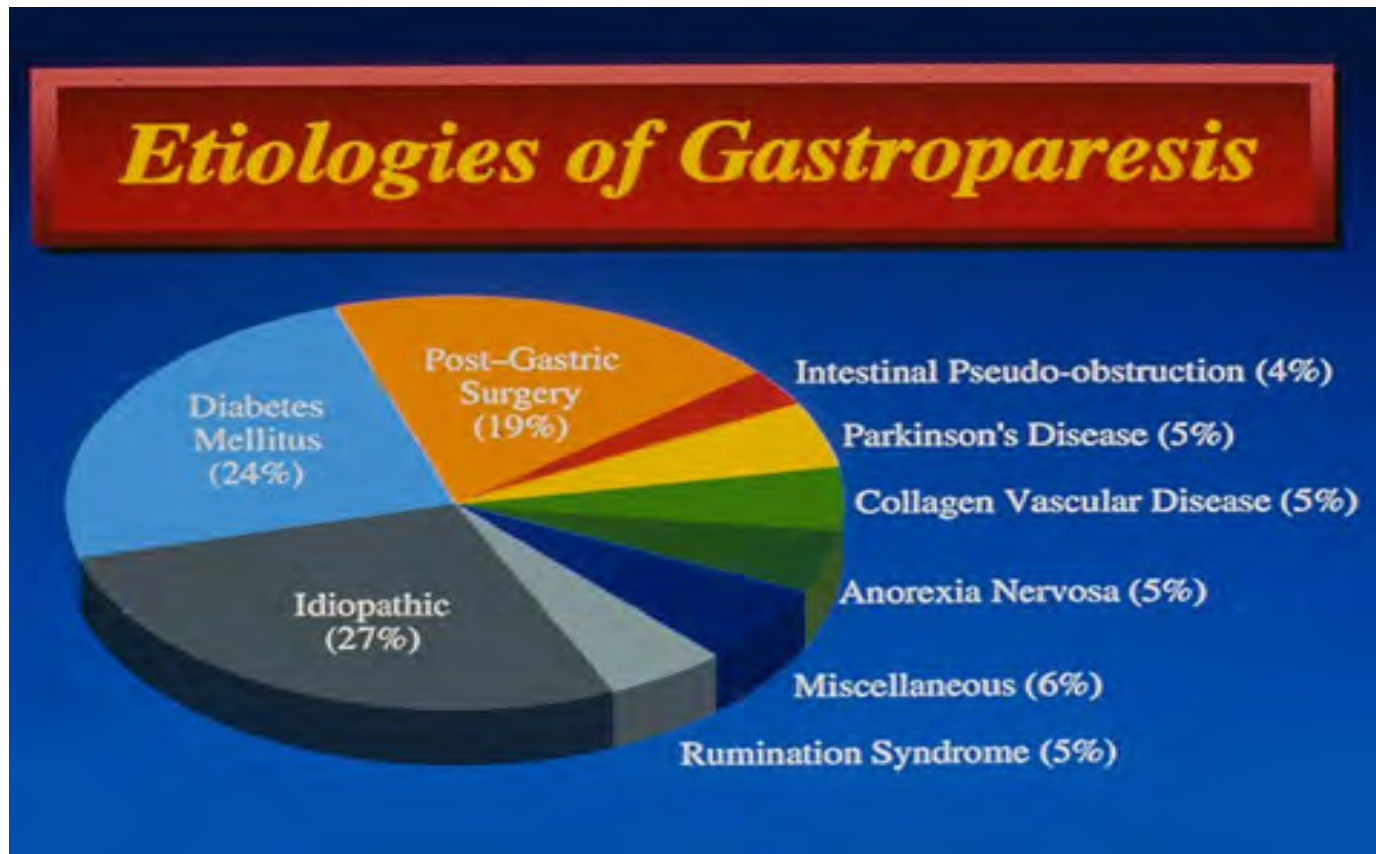
With multivariable patient-mix adjustment, the DOM vs. control differences was smaller: GCSI total score (delta=-0.12, p=0.15); any improvement in GCSI (OR=1.48, p=0.06), improvement in GCSI by  $\geq$  1-point (OR=1.25, p=0.40), and Nausea subscore (delta=-0.14, p=0.07).

In our GpCRC registry, we were able to use pragmatic modeling to evaluate domperidone for gastroparesis and showed treatment with DOM resulted in mild clinical improvement of GP symptoms.

# What is Gastroparesis?

- Gastroparesis, is defined as delayed gastric emptying with associated symptoms in the absence of any evidence of mechanical obstruction of the stomach or the upper GI tract.
- Gastroparesis is a functional gastrointestinal motility disorder meaning there is an abnormality in nerve, muscle and/or electrical activity in the stomach.
- The cardinal symptoms are early satiety, postprandial fullness , nausea, bloating, upper abdominal pain, GE Reflux ,and with more severe illness, vomiting- >1 hr. after meals- usually 2-6 hours
- In advanced cases there is weight loss, malnutrition, dehydration, electrolyte imbalance, hypo/hyper-glycemic fluctuations, bezoar formation and aspiration pneumonia.
- It affects up to 4% of the population in the United States, with 70% female; median age: 50 years.

## Etiologies of Idiopathic Gastroparesis (IG)



- Post Infectious

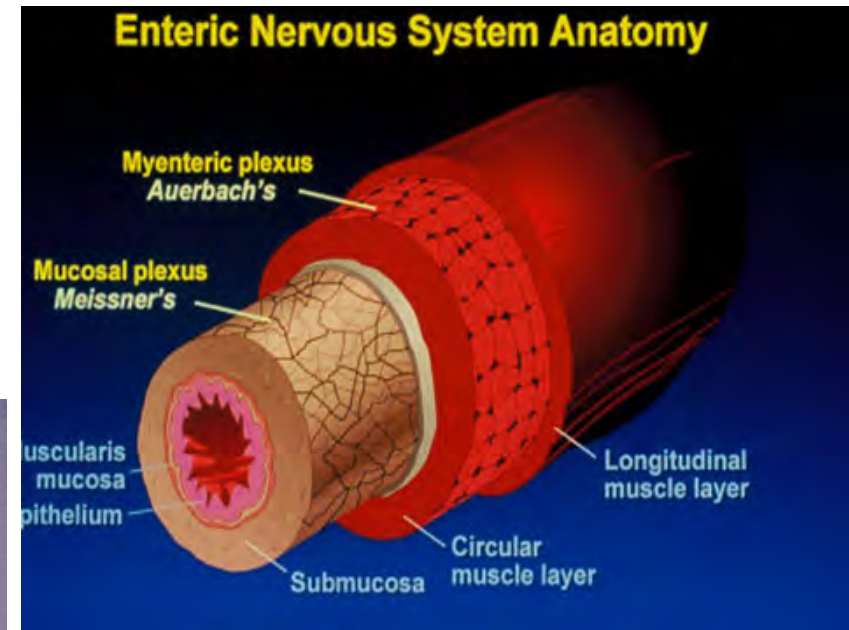
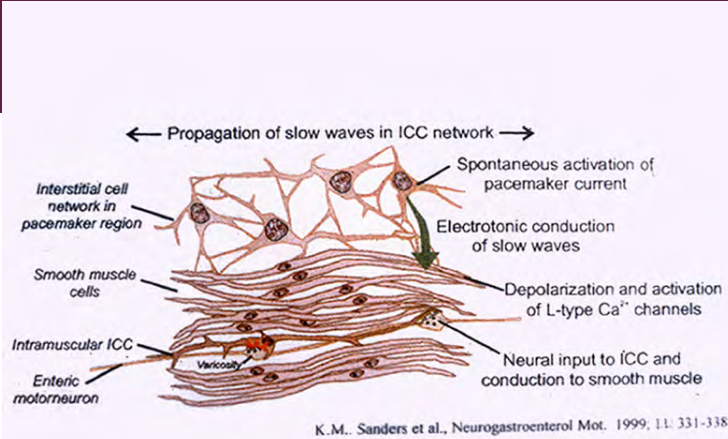
### **Entities Mimicking IG**

Connective Tissue Disorder  
Hypermobility Syndrome  
Ehlers-Danlos / POTS Syndrome  
Median Arcuate Ligament Syndrome  
CNS Degenerative Diseases  
Paraneoplastic Syndrome  
Functional (Non-ulcer) Dyspepsia  
Miscellaneous

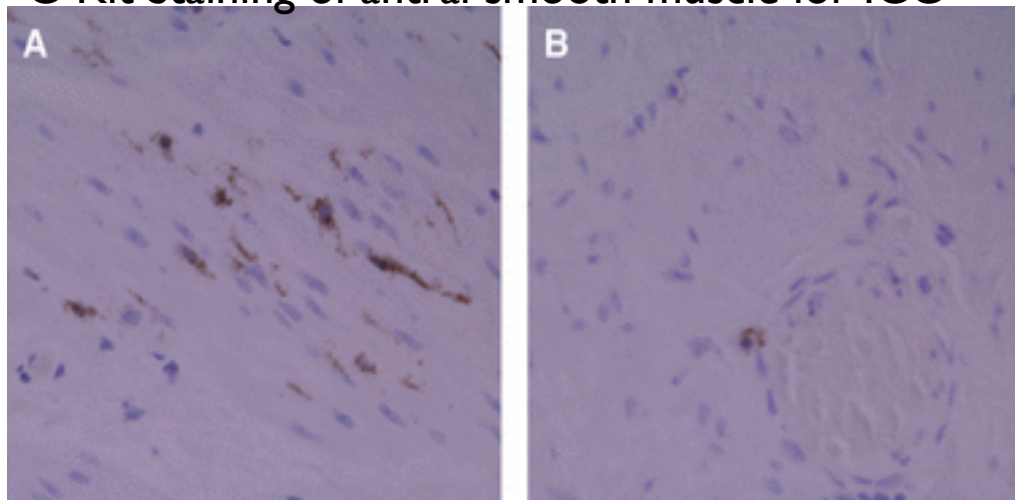
### **Medication Induced**

Opioids  
THC Derivatives  
Diabetic Medications

Approximately, 40% of patients refractory to medical therapy and requiring surgical intervention have depletion of ICC in the antrum or gastric body.



### C-Kit Staining of antral smooth muscle for ICC



Normal (>10 ICC/HPF)

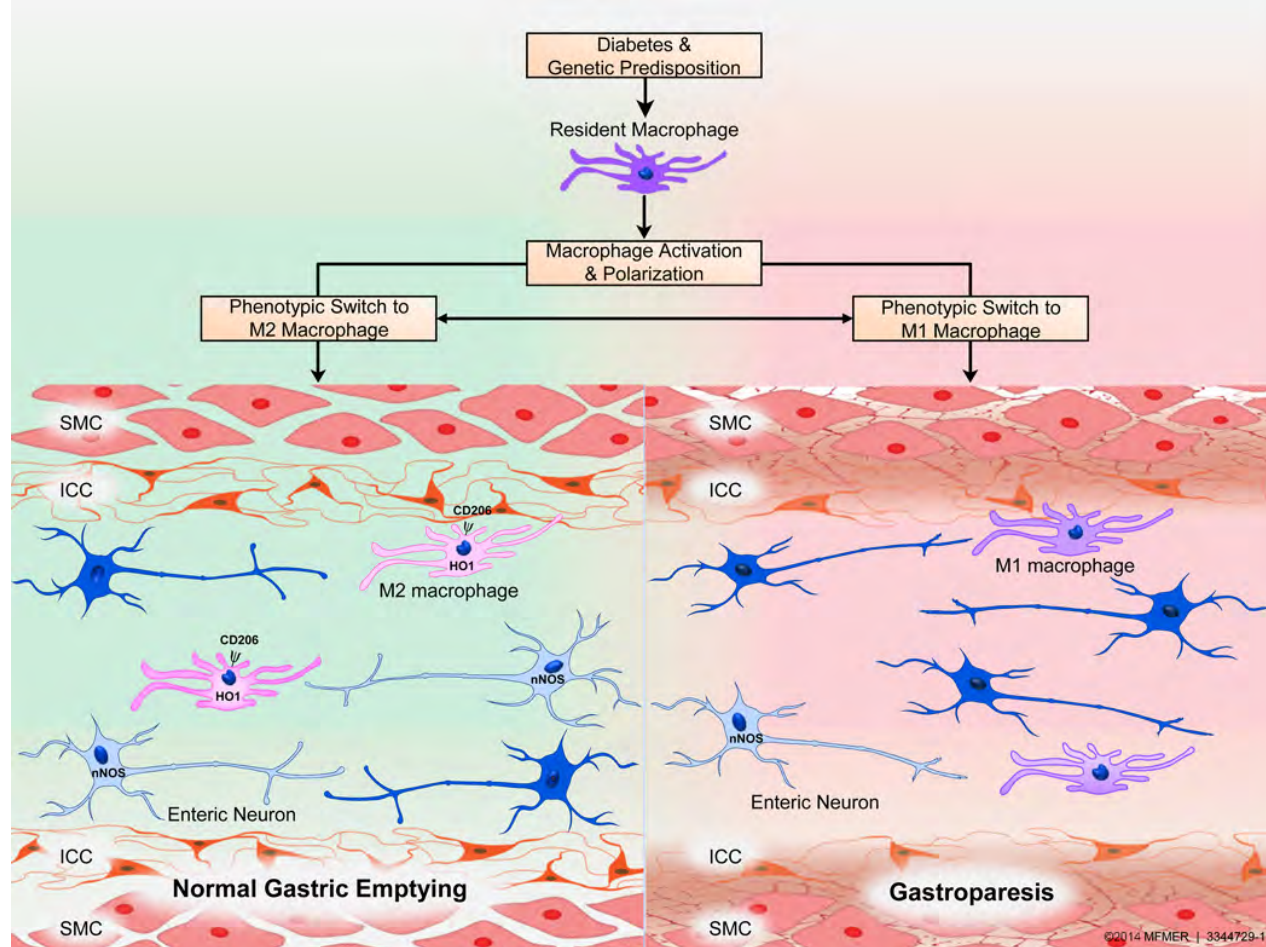
Gastroparesis

Bashashati M, McCallum RW. Is Interstitial Cells of Cajalopathy Present in Gastroparesis? J Neurogastroenterol Motil. 2015 Oct 1;21(4):486-93.



# MOLECULAR THEORY UNDERLYING GASTROPARESIS:

DIABETIC AND IDIOPATHIC GASTROPARESIS IS ASSOCIATED WITH LOSS OF CD206-POSITIVE MACROPHAGES IN THE GASTRIC ANTRUM

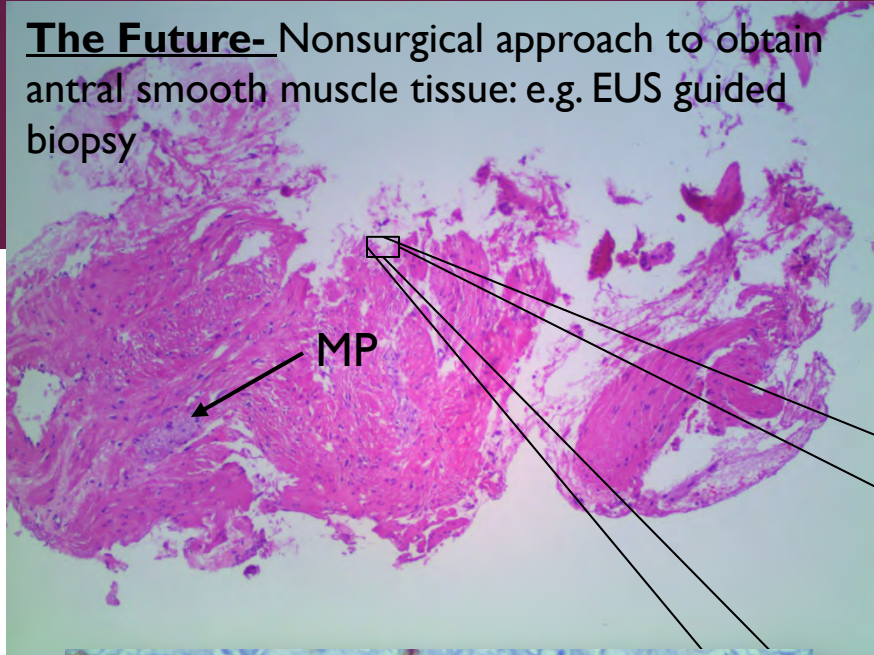


An M2 to M1 shift in gastroparesis is linked with the loss of ICC and nNOS neurons.

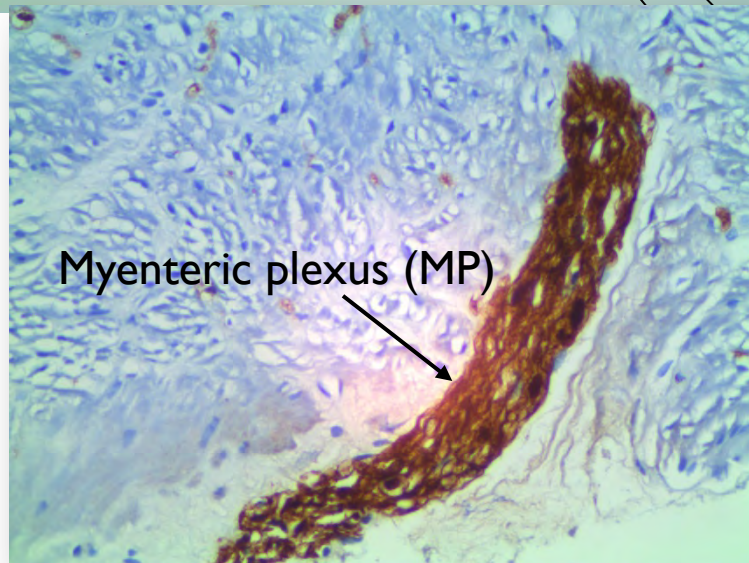
Neurogastroenterol Motil. 2015 Jan;27(1):7-18.

Neurogastroenterol Motil. 2017 Jan 9. doi: 10.1111/nmo.13018

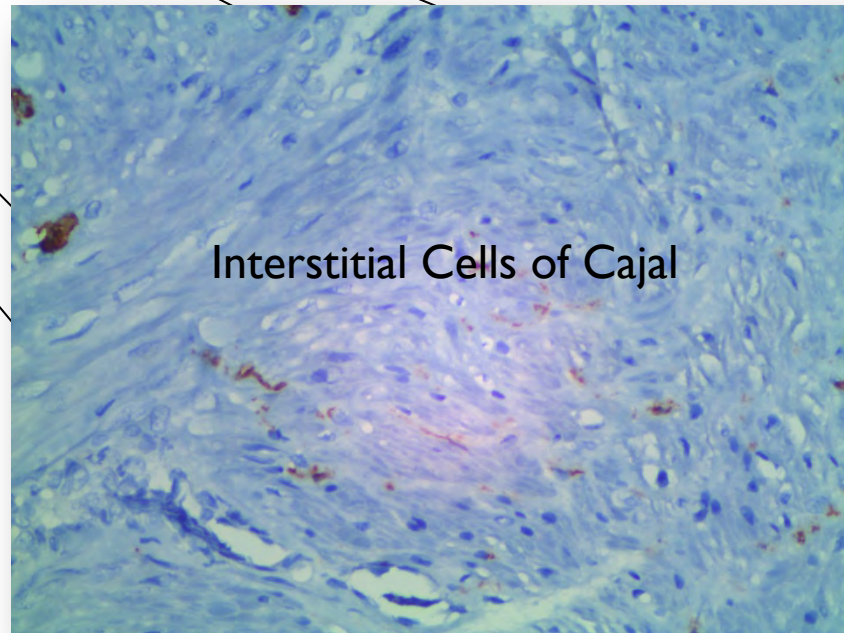
**The Future-** Nonsurgical approach to obtain antral smooth muscle tissue: e.g. EUS guided biopsy



EUS Guided Biopsy of Antral Smooth Muscle



Myenteric plexus (MP)



Interstitial Cells of Cajal

# TREATMENT OF GASTROPARESIS

- **Restoration of hydration, electrolytes and nutrition**
  - Liquid soft diet, low fat – low fiber
  - Caloric liquid supplements
- **Treat nausea – antiemetics**
- **Restore coordinated gastric and small bowel motility with prokinetic agents**
- **Glycemic control**
- **Pain control**
- **Psychological measures**
- **Botulinum toxin pyloric injections**
- **Feeding tubes – endoscopic or oral**
- **Surgery**
  - A) Jejunal feeding tube, full thickness gastric biopsy
  - B) Placement of gastric electrical stimulation (GES) system
  - C) Pyloroplasty
  - D) Gastric surgery- gastric bypass in obese diabetics ( BMI > 40) with gastroparesis

# Future gastroparesis pipeline:

A) Antiemetics: Tradipitant- VANDA (beyond Aprepitant; antagonist of human substance P/neurokinin 1 (NK1)- phase 3 trials in progress.

B) Prokinetic agents:

1) Ghrelin agonists: Relamorelin- Rhythm Pharma, phase 3

2) 5HT-4 agonists: Velusetrag- Theravance Pharma, phase 3

Prucalopride-Shire-now Takeda Pharma

3) Dopamine 2 and 3 antagonists:

a) intranasal metoclopramide- Evoke Pharma, phase 3

b) Domperidone-like agents with no cardiac toxicity: TAK-906(ATC-1906): in phase 2 trials

c) Neurogastrix- agent from Europe, to be studied in USA

# Gastric Neurostimulation (Enterra® Therapy) for the Treatment of Gastroparesis Refractory to Medical Management

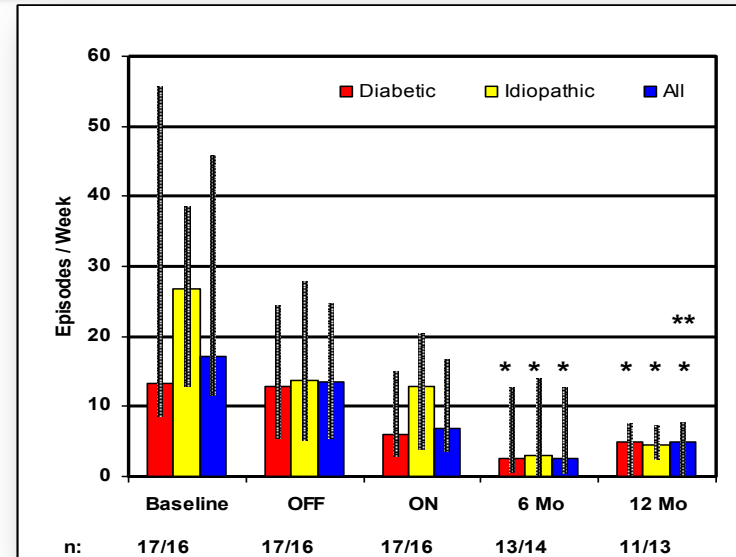
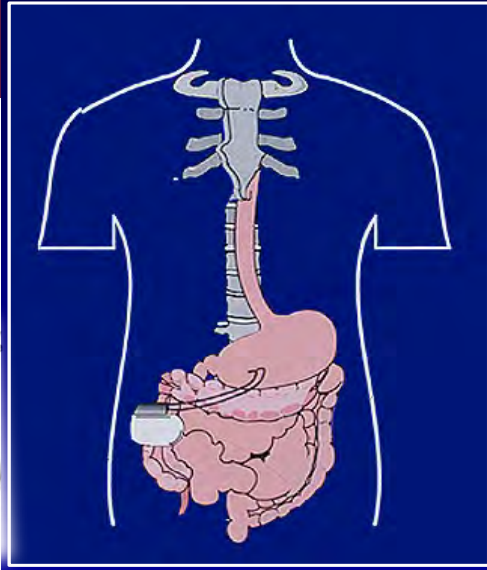
Indicated for the treatment of chronic, intractable nausea and vomiting secondary to diabetic or idiopathic gastroparesis under a Humanitarian Device Exemption (HDE).

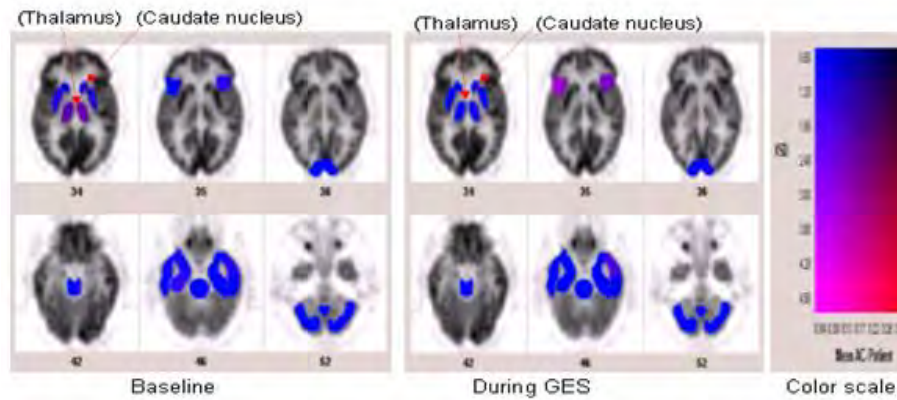
System includes:

- \*Implantable neurostimulator:  
Medtronic Model 7425G or 3116
- \*Neuromuscular leads (2):  
Medtronic Model 4351

Stimulation Parameters

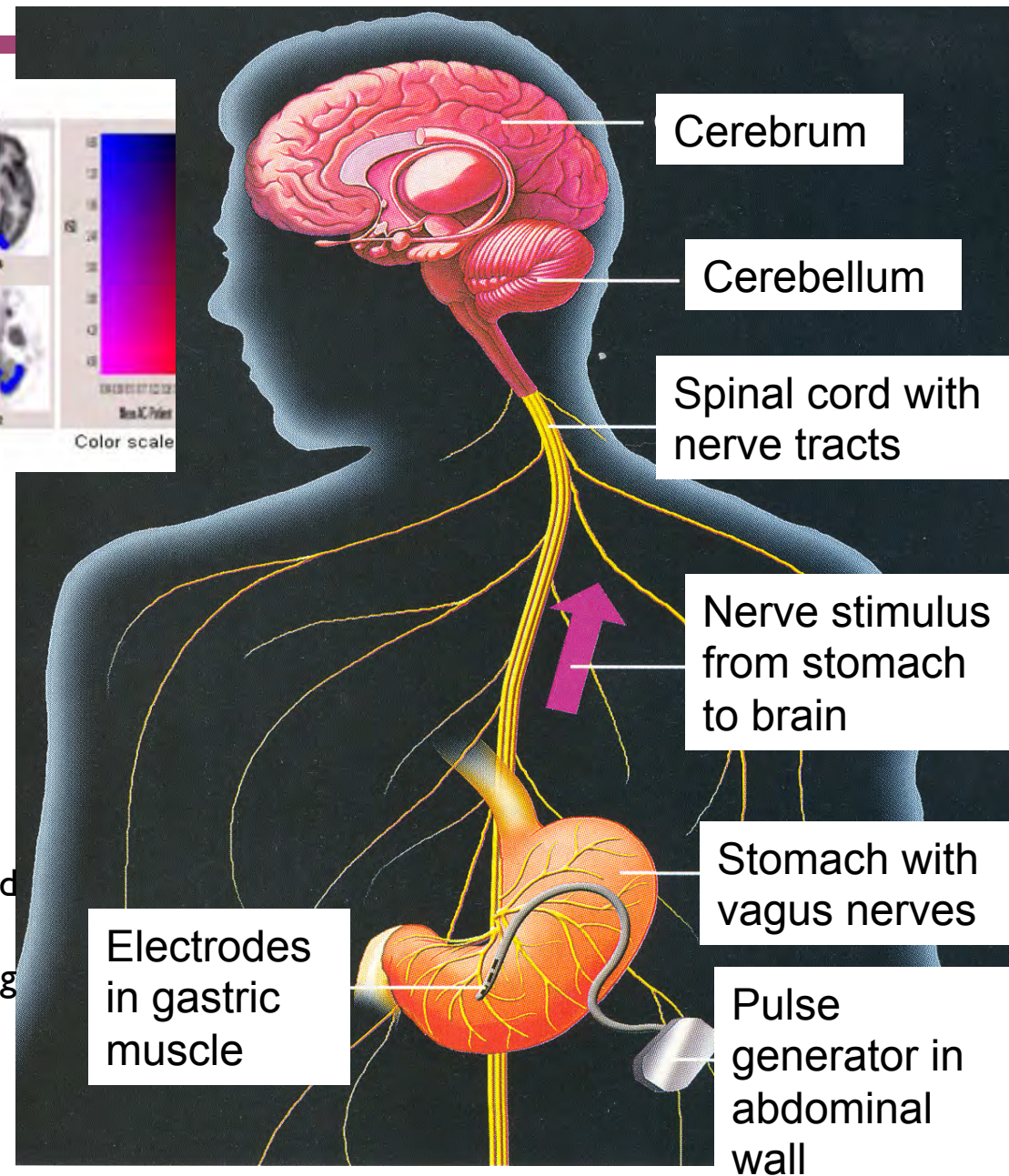
- Amplitude: 5 milliamps
- Pulse Width: 330  $\mu$ sec
- Cycle: 12 cpm
- (On Time: 0.1 sec-14 Hz;
- Off Time: 5.0 sec)



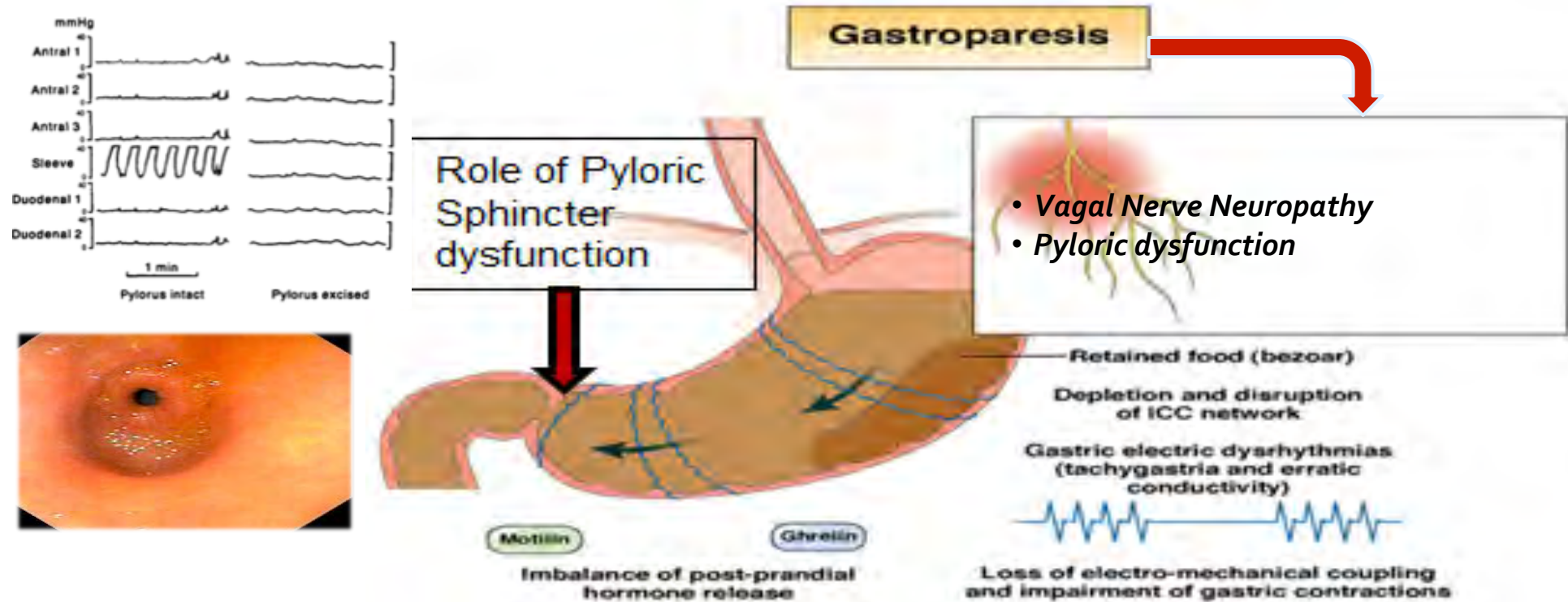


## Mechanisms of Action of Enterra System:

- 1) Centrally acting anti-emetic-  
Thalamic and caudate lobe areas identified by PET Scan.
- 2) Increased vagal activity- associated increased fundic relaxation and food intake.
- 3) It does not change gastric emptying or electrical dysrhythmias
- 4) Abdominal pain is not a target



# The last 5 years- a new era in Gastroparesis - recognition of the role of the pylorus in pathophysiology - implications for diagnosis and therapy



# HISTOLOGICAL STUDIES OF THE PYLORUS IN GP VS. CONTROLS

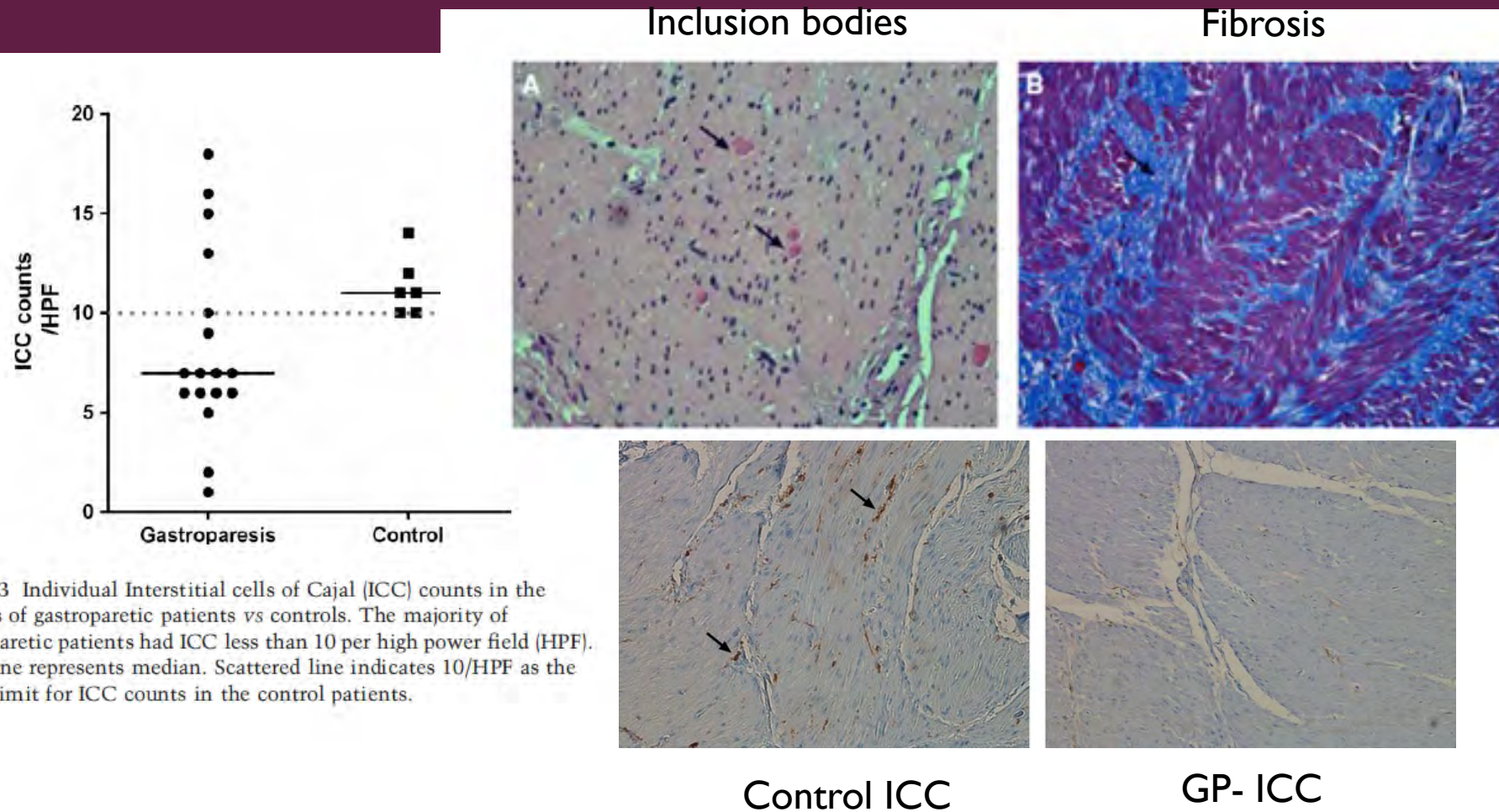
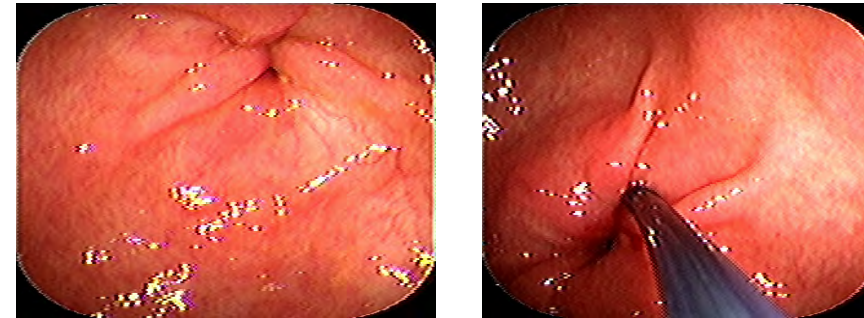


Figure 3 Individual Interstitial cells of Cajal (ICC) counts in the pylorus of gastroparetic patients vs controls. The majority of gastroparetic patients had ICC less than 10 per high power field (HPF). Solid line represents median. Scattered line indicates 10/HPF as the lower limit for ICC counts in the control patients.

# Evolving pyloric based therapies for GP



## Botox Injection into Pylorus for Gastroparesis



## -LAPAROSCOPIC PYLOROPLASTY WITHOUT GES IMPROVED SYMPTOMS OF GASTROPARESIS

## Heineke-Mikulicz Pyloroplasty

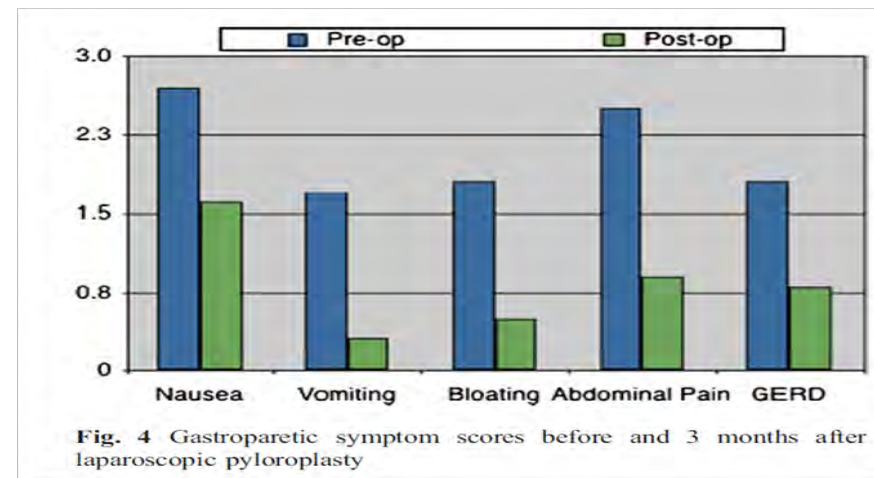
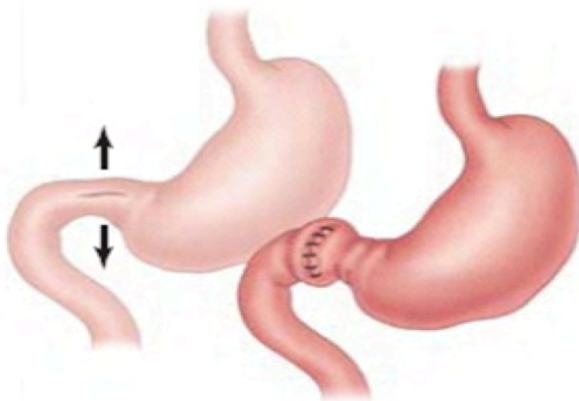


Fig. 4 Gastroparetic symptom scores before and 3 months after laparoscopic pyloroplasty

# THE LONG-TERM EFFICACY AND SAFETY OF PYLOROPLASTY COMBINED WITH GASTRIC ELECTRICAL STIMULATION THERAPY IN GASTROPARESIS

Dr. Brian Davis, Dr. Irene Sarosiek, Dr. Mohammad Bashashati Ben Alvarado, Dr. Richard W. McCallum

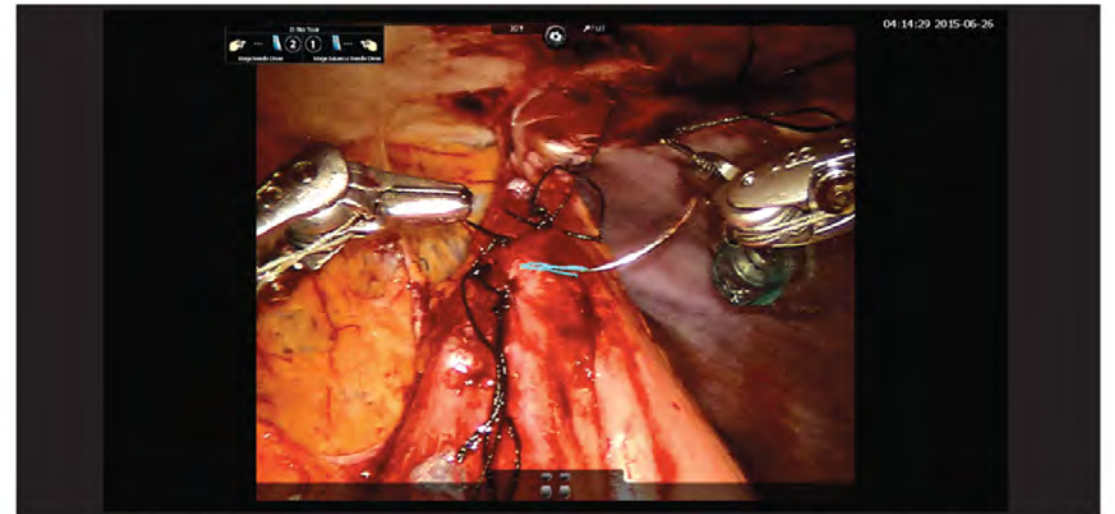


Total symptom scores assessing severity of nausea, early satiety, bloating, vomiting, post-prandial fullness and epigastric pain were obtained at baseline and at follow-up visits, ranging from 3- 48 months after the surgery

( Evidence for the Final Solution for Gastroparesis)

*In this prospective single-arm trial, 27 gastroparesis patients who underwent simultaneous gastric electrical stimulator implantation with Heineke-Mikulicz pyloroplasty were studied.*

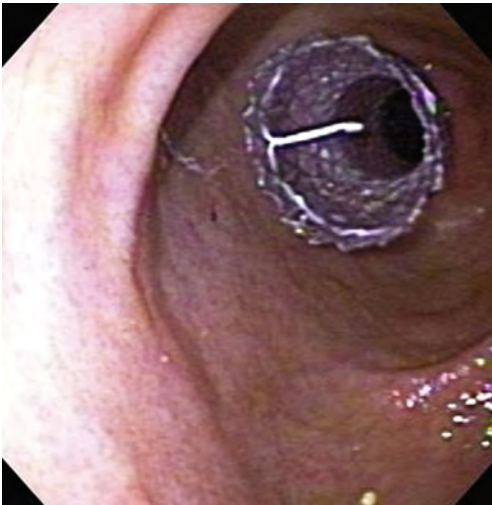
- *There was 75% improvement in total symptoms score.*
- *Gastric emptying was normalized in 70%.*
- *There were no post-surgical complications.*



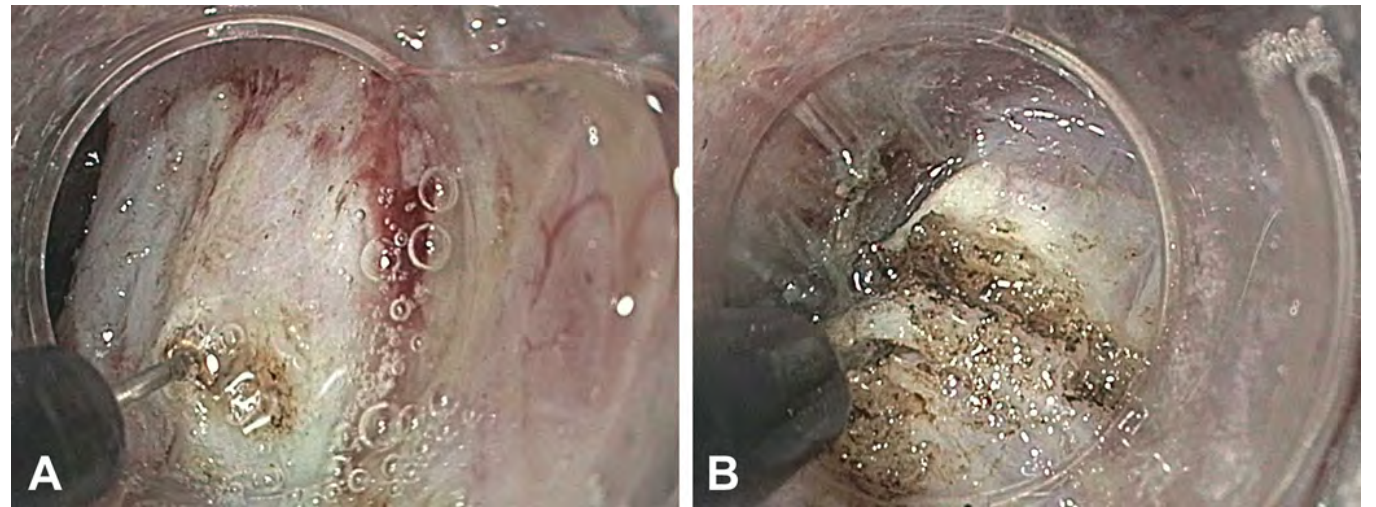
**Figure 1.** Robotic pyloroplasty closure is pictured demonstrating robotic wrist articulation to create a Lembert stitch layer with a telestration marking to show the path of the needle.

# THE BRAVE NEW WORLD FOR GASTROPARESIS- AN ENDOSCOPIC REVOLUTION

Pyloric stenting



Endoscopic pyloromyotomy



Khshab et al. Gastric peroral endoscopic myotomy for refractory gastroparesis: first human endoscopic pyloromyotomy. (GIE)

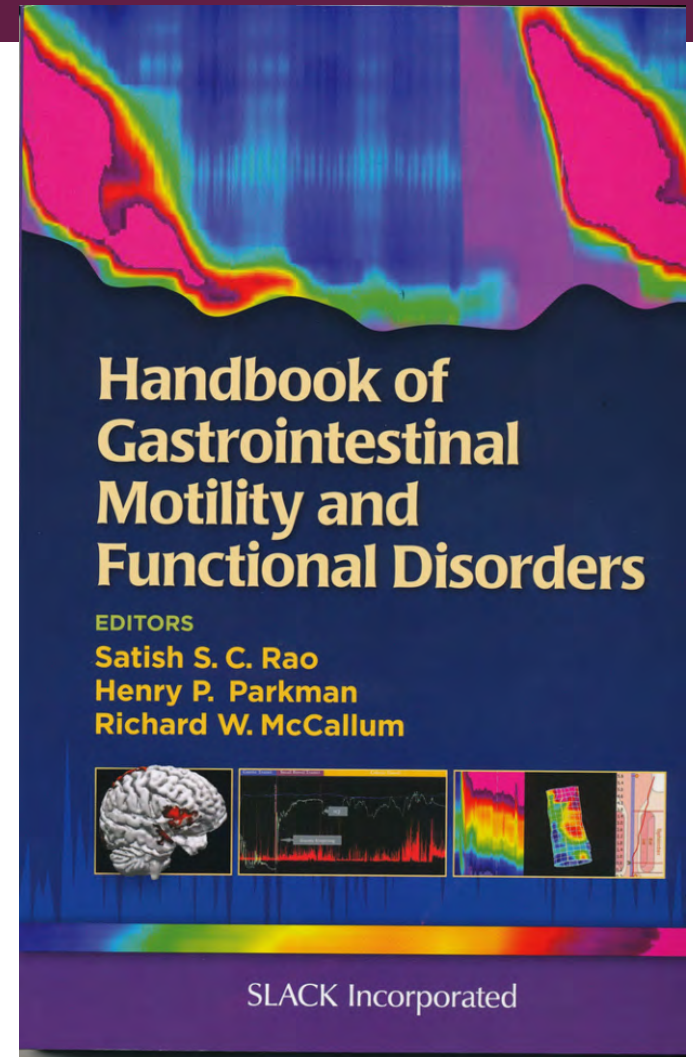
## Key Remaining Question: Is GES Needed or will Pyloroplasty Alone suffice?

On going double-blind randomized trial of GES + Pyloroplasty at Texas Tech University HSC El Paso.

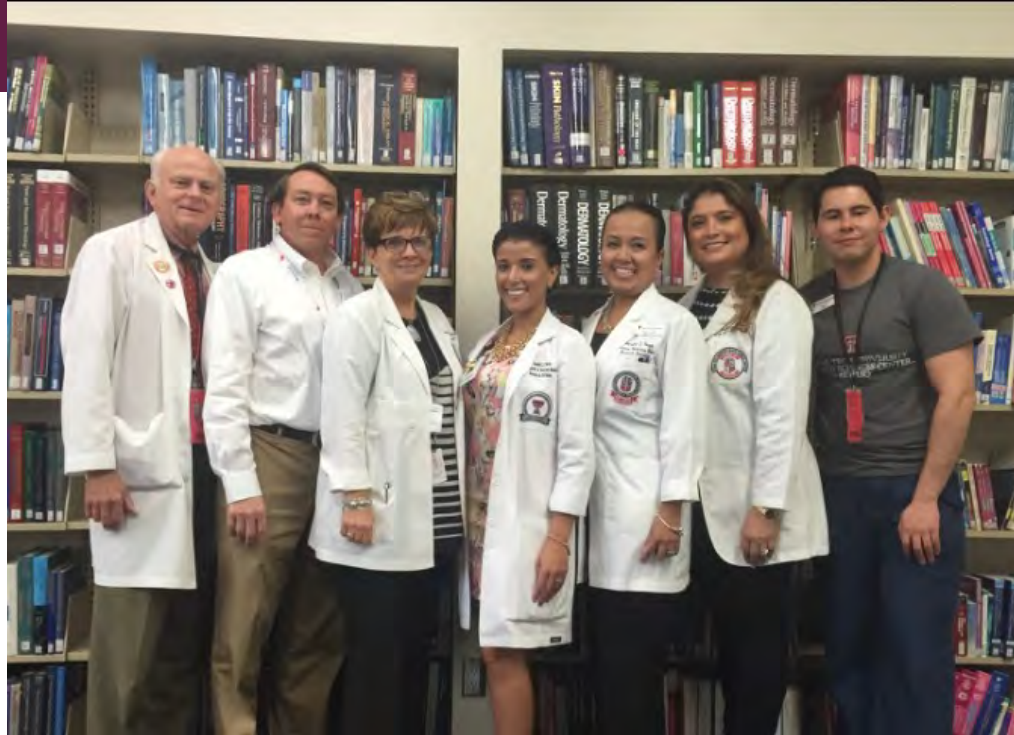
- The GES device is either “ON or “OFF” – symptoms and gastric emptying monitored for 3 months post-operatively
- Current status- 20 patients enrolled **STAY TUNED FOR RESULTS OF THIS PIVOTAL STUDY**

# MAJOR ADVANCES IN THE DIAGNOSIS AND MANAGEMENT OF GASTROPARESIS SINCE 2010

- 1) Gastric emptying methodology- “the gold standard” plus additional new technology
  - 2) Understanding electrophysiology, enteric neurons, and interstitial cells of cajal (ICC) in antral and pyloric smooth muscle will be routine with new non-surgical techniques to access this tissue.
  - 3) An ongoing focus is preventing GP by drilling down to the molecular level of the smooth muscle- specifically M1 and M2 macrophages- and inflammatory pathways - to preempt ICC depletion and damage to the enteric nervous system
  - 4) A revolution in recognizing the role of the pylorus has transformed our approach to diagnosis and therapy.
  - 5) Medical therapy with antiemetics and prokinetics should be actively initiated but when responses are sub optimal the current “final solution” for GP is Gastric Neurostimulation combined with a Pyloroplasty
- Stay tuned for nonsurgical- endoscopic solutions



# TEXAS TECH UNIVERSITY CENTER FOR NEUROGASTROENTEROLOGY AND GI MOTILITY



Special Thanks..To the NIH and their decision to fund seven centers of academic excellence over the past 12 years.This GP Consortium has made seminal contributions to advancing the field.With a 5 year renewal of funding we look forward to continuing our participation with the NIH Consortium.

- Curing GP is on the Horizon.

