Postgastrectomy Syndromes

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Grand Rounds

1/30/13
Objectives

- Understand the basics of gastric physiology
- Recognize and diagnose Postgastrectomy syndromes
- Understand the treatment options for Postgastrectomy syndromes
Historic Perspective

- Tremendous decrease in overall gastric resection in the past 35 years
- Cimetidine (Tagamet)- 1977
- PPI- 1980’s
- H pylori
Gastric Physiology

- Functions to prepare food for digestion and absorption
- Receptive relaxation of proximal stomach enables it to store solids while liquids may pass through
- Starts the process of digestion
Motility

- Pacemaker cells along greater curvature produce slow wave depolarizations at 3 cycles/min. Action potentials are produced by gastric smooth muscle cells to cause contractions.

- Cyclical pattern of slow waves and electrical spikes, the myoelectric migrating complex (MMC).

- Occurs during fasting, continues after vagotomy
Motility

- Receptive relaxation (proximal) and gastric accommodation (fundus) in response to a meal.
  - Mediated by Vagus, lead to early satiety and rapid emptying of liquids after vagotomy
- Mixing and grinding
- Emptying --> complex, neural and hormonal mediators, chemical and mechanical properties of the food
Regulation of Acid

- Sympathetic and Parasympathetic neural control
- Hormonal control
  - Gastrin, Somatostatin, Histamine, Bombesin, VIP, Ghrelin, etc
Acid Secretion

- Parietal cells in the body of stomach
  - Acetylcholine (Vagus)
  - Gastrin (G cells)
  - Histamine (ECL cells)
- Control both basal and stimulated acid secretion
Stimulated Acid Secretion

♦ Cephalic Phase
  ♦ Accounts for 20-30% of acid produced.
  ♦ Sight, smell, taste stimulate neural centers in cortex/hypothalamus --> Vagal stimulation --> Ach release --> increased acid secretion
Stimulated Acid Secretion

- **Gastric Phase**
  - Accounts for 60-70% of acid.
  - Begins when food enters gastric lumen. Products of digestion interact with microvilli on antral G cells --> Gastrin release.
  - Gastric distention activates stretch receptors --> vagovagal reflex arc --> Ach
  - Antral distention triggers G cells to increase Gastrin release (pyloro-oxyntic reflex)
Stimulated Acid Secretion

- Intestinal Phase
  - Accounts for about 10% of acid production
  - Initiated by the entry of chyme into the small intestine, lasts as long as partially digested food remains in the proximal bowel, poorly understood
Postgastrectomy Syndromes

- Result from the loss of reservoir function, denervation, disruption of the pyloric mechanism and the type of reconstruction.
- About 25% of all patients following gastric surgery
- Only 1-4% will develop severe, debilitating symptoms
Postgastrectomy Syndromes

- Metabolic/Nutritional alterations
- Dumping Syndrome
- Bile Reflux Gastritis
- Gastroparesis
- Afferent/Efferent Limb Syndromes
- The Roux Syndrome
- Postvagotomony Diarrhea
Metabolic/Nutritional Alterations

- **Anemia**
  - **Microcytic:** Iron absorbed in duodenum, bypassed in B II or R-Y. Also needs to be reduced by acidic environment to be absorbed. Common. Must r/o other causes.
  - **Macrocytic:** Intrinsic factor made by Parietal cells. Extent of gastric resection the key. Decreased parietal cell mass --> less intrinsic factor --> B12 deficiency. Acid facilitates bioavailability.
Metabolic/Nutritional Alterations

- **Bone Metabolism**
  - **Calcium**
    - Absorbed mostly in duodenum, requires acid for dissolution and ionization. Deficiency worse after B II or R-Y
  - **Vit D**
    - Fat malabsorption after gastric resection due to inefficient mixing of food, bile, pancreatic enzymes --> decreased absorption
**Metabolic/Nutritional Alterations**

- **Weight Loss**
  - Usually about 10% of pre-op weight. Usually stabilizes in 3-4 months. Loss almost entirely fat, with lean body mass unchanged.
  - Will correct after dietary modification
  - Need to determine if due to decreased intake or from malabsorption - can check stool for fecal fat.
Dumping Syndrome

- As many as 25% experience some symptoms.
- Usually resolves with time
- 1-2% will have debilitating symptoms, less than 1% will require surgical intervention
- Loss of pyloric regulation and receptive relaxation leads to rapid emptying of stomach contents into proximal bowel.
Early Dumping

- 10 to 30 minutes after ingestion
- GI symptoms of postprandial epigastric fullness, nausea, vomiting, crampy pain, belching, explosive diarrhea
- Accompanied or followed by cardiovascular symptoms of tachycardia, palpitations, diaphoresis, lightheadedness, flushing
Early Dumping

- Rapid entry of hyperosmolar chyme into the small bowel triggers rapid fluid shifts from the intravascular space to the gut lumen to establish isotonicity, leads to gut distention
- Fluid shifts can cause hypotension, triggering autonomic catecholamine surge
- Multiple gut hormones implicated, serotonin, VIP, CCK, neurotensin, peptide YY, enteroglucagon, etc.
Early Dumping

- Usually resolves with time
- Can be diagnosed with a provocative test using an oral challenge with 50 g glucose
- Tx: frequent small meals, separate solids/liquids, avoiding high-carb meals
Late Dumping

- Occurs 2 to 3 hours after meals
- Much less common than early dumping
- Rapid delivery of sugars into small bowel causes hyperglycemia and marked increase in insulin release, inducing a marked hypoglycemia
- Insulin shock causes catecholamine release with tachycardia, tachypnea, diaphoresis, palpitations and confusion
Late Dumping

- Medical Management
  - Dietary modification
  - Pectin -> binds carbs and delays absorption
  - Acarbose -> alpha-glucosidase inhibitor
  - Octreotide
- Surgical revision for refractory cases
Goal of revision

- Decrease the rapid gastric emptying and/or restore the gastric reservoir
- Jejunal interposition procedures
  - Isoperistaltic
  - Antiperistaltic
- Conversion to a Roux-en-Y
Isoperistaltic jejunal interposition

Fig. 2. Construction of an isoperistaltic jejunal loop interposition (Henley loop). A–C: The technique of conversion after Billroth I reconstruction. The 15-cm loop is harvested and interposed between the gastric remnant and duodenum. D–F: The technique of conversion after Billroth II reconstruction. The efferent limb anastomosis to the stomach is preserved, and a 15-cm length is rotated and anastomosed to the anterior duodenal wall at the site of the stump closure. The efferent limb is transected at the stomach and sutured to the distal end of the transected jejunum.
Antiperistaltic jejunal interposition

Converting to a Roux-en-Y
Fig. 3. Construction of a Roux-en-Y gastrojejunostomy. A–C: The technique of conversion after Billroth I reconstruction. The gastroduodenal anastomosis is disassembled and the duodenum is closed. The jejunum is transected; the distal end is sutured to the gastric remnant, while the proximal portion is sutured end-to-side 50 to 60 cm downstream. D–F: The technique of conversion after Billroth II reconstruction. The afferent limb is transected at the stomach and anastomosed end-to-side 50 to 60 cm downstream.
Bile Reflux Gastritis

- Commonly occurs after gastric reconstruction, is debilitating in 1-2%
- Occurs late, often more than 1 year post-op
- Constant burning epigastric pain, often radiating to the back, persistent nausea, bilious emesis (may contain undigested food) that occurs any time of the day or night
- Vomiting does NOT relieve pain
Bile Reflux Gastritis

- More common after B II, less with R-Y
- Diagnosis one of exclusion. Must have a careful and complete evaluation
- EGD may show beefy red gastric mucosa, and to r/o PUD or obstruction
- Gastric emptying study to r/o gastroparesis
- Quantify bile reflux, gastric analysis or scintigraphy, is essential. Bernstein Test
Bile Reflux Gastritis

- Medical management
- Rarely helpful
- PPI and H2 blockers, Sucralfate, Reglan, cholestyramine, ursodeoxycholic acid
Bile Reflux Gastritis

- Surgical goal is to separate the gastric mucosa from the offending biliary and pancreatic secretions
  - Isoperistaltic jejunal interposition (Henley loop)
  - Revision of a B II with a Braun enterenterostomy, addition of the "uncut" Roux-en-Y
  - Conversion to a Roux-en-Y - the procedure of choice, 80% relief
- MUST ensure that a complete vagotomy and antrectomy are done
B II revision

(From Madura JA: Postgastrectomy problems: Remedial operations and therapy. In)
Exclusion duodenojejunostomy, the "uncut Roux"

**Fig. 9.** The uncut Roux-en-Y gastrojejunostomy. Closure of the afferent limb with a double staple line forces the duodenal contents into the more distal jejunum through the jejunoojejunostomy. (Modified from Behrns KE, Sarr MG. Diagnosis and management of gastric emptying disorders. Adv Surg 1994; 27:233.)
Gastroparesis

- Delayed gastric emptying in the absence of mechanical obstruction
- Common after truncal vagotomy, arguably the most common of the postgastrectomy syndromes.
- Epigastric fullness, pain and rarely a functional gastric outlet obstruction.
Gastroparesis

- Generally inversely proportional to the extent of gastric resection
- Jung et al found that food retention at endoscopy was 21% at 2 years after overnight fast. Incidence B I > B II.
- Kubo et al found similar incidence, and B I > R-Y.
Gastroparesis

- Can occur early in as many as half of patients after gastric resection. Unable to tolerate diet 7 to 14 days after surgery.
- Vast majority improve with time.
- If persistent, must investigate. Occurs late in about 2%. Usually chronic gastroparesis manifests late after operation with early satiety, nausea, intermittent vomiting, pain, hiccups, belching, worsens throughout the day, gastric bezoars and emesis of food ingested days earlier.
Gastroparesis

- Other causes MUST be ruled out
- Metabolic --> electrolyte abnormalities (K+, Mg++, Ca++), endocrine (hypothyroid, hyperglycemia), medications (opiates, etc.)
- Functional --> pre-op GOO, truncal vagotomy
- Mechanical --> most common. Stomal edema, small leak, adhesions, kinking, hematoma, intussusception, stricture.
Gastroparesis

- Dx --> must include at least EGD and gastric emptying studies. +/- UGI.
- Tx --> smaller meals, Reglan (DA antagonist), Erythromycin (motilin agonist), Domperidone (Ach release), sometimes surgery is required
Gastroparesis

- Original operation dictates the corrective procedure.
- Mechanical causes all require surgery
- If V & P, partial gastrectomy and B II.
- If partial resection, will need further resection, near-total or even total gastrectomy. Most advocate R-Y and completion vagotomy.
- Echauser et al showed nearly 80% relief with near-total gastrectomy with R-Y.
Afferent Loop Syndrome

- Is a mechanical problem with partial obstruction of the afferent limb.
- Afferent limb almost always 30-40 cm or longer. Always with a B II.
- Treatment is always surgical.
Afferent Loop Syndrome

- **Acute**
  - Complete obstruction of afferent limb
  - Severe RUQ or epigastric pain, hyperamylasemia can confuse with pancreatitis.
  - Dx --> UGI and EGD
  - Prompt surgical intervention to correct underlying cause.
Afferent Loop Syndrome

- **Chronic**
  - From partial obstruction. Much more common.
  - Severe postprandial pain, bile and pancreatic secretions build in afferent limb until the intraluminal pressure overcomes the obstruction, resulting in projectile bilious vomiting that provides IMMEDIATE relief of pain.
Afferent Loop Syndrome

- Kinking and angulation
- Internal herniation behind efferent limb
- Stenosis of gastrojejunostomy
- Redundant twisted afferent limb (volvulus)
- Adhesions involving afferent limb

Afferent Loop Syndrome

- “Blind Loop Syndrome” --> bacterial overgrowth of the chronically obstructed limb, binds with B12 and deconjugates bile acids, leads to megaloblastic anemia and diarrhea
Afferent Loop Syndrome

- **Dx --> UGI will show dilated limb, EGD: afferent limb may not be seen, CT may be helpful**
Afferent Loop Syndrome

- Revision of a B II
- Conversion of B II to B I
- Conversion of a B II to R-Y with a long roux limb. Requires a complete vagotomy to prevent marginal ulcer.
- Create enteroenterostomy below the stoma if adhesions prohibitive.
Fig. 12. Conversion of a Billroth II to a Billroth I reconstruction. The gastrojejunostomy is disassembled, and jejunal continuity is reestablished. The end of the gastric remnant may be sutured to the side of the duodenum (below D).
Efferent Loop Obstruction

- Much less common
- Can be difficult to distinguish from afferent loop syndrome and bile reflux gastritis
- Crampy LUQ and epigastric pain, nausea, bilious vomiting.
- From adhesions or internal hernia of the limb behind the gastro-j anastomosis in a right-to-left direction.
- Dx with UGI. Tx always surgical.
The Roux Syndrome

- Controversial if this is a real entity or a consequence of vagal denervation.
- Some report incidence as high as 30% after R-Y reconstruction while others have not found it to be clinically significant.
The Roux Syndrome

- Complex of symptoms including postprandial epigastric fullness, nausea, intermittent vomiting and often weight loss.
- Thought to be the result of an atonic roux limb that serves to impede gastric emptying.
The Roux Syndrome

- Some believe it is a result of the loss of the duodenal pacemaker.
- Pacesetter potentials are fastest in the duodenum, spread distally to the terminal ileum.
- Studies have demonstrated that when the jejunum is transected, the frequency of the pacesetter potentials is decreased and ectopic pacemakers appear, driving potentials retrograde toward the stomach.
The Roux Syndrome

- However, this dysmotility occurs in all patients. Why symptoms occur in some is unclear.
- Miedema et al found that although transit was universally slowed in the roux limb, there was no transit difference between asymptomatic and symptomatic patients.
- Also, it seems to be more common in patients with a large gastric remnant and after truncal vagotomy.
The Roux Syndrome

- Dx difficult. UGI can be interpreted as normal or complete GOO. However, EGD usually reveals a widely patent anastomosis. Gastric emptying studies usually show delay. “True” syndrome generally a late complication, usually in women.
- Tx --> trial of prokinetic agents
The Roux Syndrome

- **Surgical Tx**
- Mainstay of tx is aggressive gastric resection with R-Y reconstruction.
- Extent of gastric resection debated
- Others advocate gastric resection if gastric motility seems to be the problem and resection of the roux limb if it appears unusually dilated or flaccid, with R-Y, B II or the “uncut” roux as reconstruction. Too rare for meaningful data.
Postvagotomy Diarrhea

- Exact mechanism unclear, generally thought to be a result of vagotomy. Vast majority of these patients have also had some form of gastric resection.
- Diarrhea occurs in about 30% of patients after gastric surgery, in about 20% after truncal vagotomy, is clinically significant in less than 10% and is both refractory to medical tx and severe enough for surgical intervention in 1% or less.
Postvagotomony Diarrhea

- For the vast majority it is not severe and resolves after several months.
- Severe form may have 10 to 20 episodes per day, often explosive, often no temporal relationship with food, occurs at all times (during sleep), may have weight loss, malnutrition and weakness.
Postvagotomy Diarrhea

- Many proposed mechanisms
- Vagal denervation leading to intestinal dysmotility, rapid gastric emptying of liquids. Much less common after highly selective vagotomy.
- Hypoacidity, malabsorption of bile acids and bacterial overgrowth in the proximal bowel.
Postvagotomy Diarrhea

- Dx --> must exclude other causes --> undiagnosed IBD, sprue or lactase deficiency, infections (amebiasis, C. diff), caffeine, etc.
Postvagotomy Diarrhea

- Tx --> long trial of conservative therapy
- Dietary modifications --> fiber, decreasing carbohydrate intake, avoiding dairy, frequent small meals.
- Cholestyramine --> resin that binds and inactivates bile salts
- Oral Neomycin --> short course to treat or rule out bacterial overgrowth
- Anti-diarrheal agents --> Loperamide, diphenoxylate.
- Opiates not a long-term solution. Octreotide not effective.
Postvagotomy Diarrhea

- Surgery for refractory cases and severe symptoms
- Herrington and Sawyers --> Antiperistaltic jejunal interposition 75-100 cm from ligament of Treitz
  - The standard approach. Relief for majority.
- Other procedures
  - Cuscheiri --> reversed ileal onlay graft
  - Chrysopathis --> construction of a jejunal loop with circular peristalsis
  - Rygick and Poth --> modified antiperistaltic jejunal interposition that avoids twisting of the vascular pedicle
Summary

- Rarely encountered. Therefore, are more difficult to recognize and diagnose.
- Bile reflux gastritis and gastroparesis are the most common.
- Generally, fewer complications after R-Y and more seen after B II.
- Conversion to R-Y usually the best strategy, with some exceptions.
References

Ritchie WP. Alkaline Reflux Gastritis: Late Results on a Controlled Trial of Diagnosis and Treatment. Ann Surg 1986 May; 203 (5): 537-44.


