Post surgical Gastroenterology problems

Dr Derek Luo
Gastroenterologist
Counties Manukau Health
Macmurray Centre
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Outline

1. Consequences of bowel resection
2. Post cholecystectomy Syndrome
3. Dumping Syndrome
1. Consequences of bowel resection
Intestinal sites of nutrient absorption

- **ESOPHAGUS**
- **LIVER**
- **PANCREAS**
- **STOMACH**
- **DUODENUM**
- **JEJUNUM**
- **ILEUM**
- **CECUM and COLON**

**GALL BLADDER**

**Bile**

**Pancreatic enzymes**

**Water and sodium**

- Amino acids, small peptides, monosaccharides, fatty acids, fat-soluble vitamins (A, D, E, K)
- Water-soluble vitamins, zinc
- Disaccharides
- Bile salts
- Vitamin B12
- Potassium, short-chain fatty acids, vitamin B12 (also synthesized here)

**Minerals (calcium, iron, others)**
Short Bowel Syndrome

- Malabsorption following massive small bowel resection
- Macronutrient and Micronutrients
- Most common cause of intestinal failure
- Usually in patients with Crohn’s disease, malignancy, radiation, vascular insufficiency
Risks of Short Bowel

- Normal small bowel length 480cm
  - <180cm risk of short bowel
  - <60cm but with a colon

- RF For SBS
  - Length of resection
  - Site
  - Presence or absence of ICV
Jejunal Resection: Consequences

- **Long vili – large absorptive surface**
- **High concentration of digestive enzymes**
- **Transport carrier proteins**
- **Digestive and absorptive site for most nutrients**
- **Resection results in temporary reduction in absorption**
Jejunal Resection: Consequences

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**Modest adaptive changes**
- Mainly functional (changes in transport and enzyme activity)
- Less structural (lengthening of vili to increase absorptive area)
- Main intervention of established benefit is oral feeding in humans (in rats growth hormone may be useful)
Ileal Resection: Consequences

- **Vitamin B12 deficiency**
  - **Disrupted if > 60cm ileum resected**

- **Bile salt deficiency and fat malabsorption**
  - **Disrupted if >100cm ileum resected**

- **Fluid absorption** – absorbs jejunal fluid – results in fluid and electrolyte losses

- **Compensatory increase by liver**
- **Fat malabsorption**
- **Fat soluble vitamin deficiency**
- **Excessive absorption of oxalate – kidney stones**
- **Loss of Ileal brake** – unabsorbed lipids reach the ileum delays gastric emptying (mediated by YY peptide)
Vitamin B12 Absorption
Bile Acid Absorption
Loss of Ileo-caecal valve

- Important barrier to reflux of faeces into small bowel
- Regulates passage of fluid and nutrients from ileum into the colon
- Requires longer parenteral nutrition – harder to wean

Effects
- Reduction in small bowel transit time – less absorption
- Small bowel bacterial overgrowth – B12/fat and bile salt mal-absorption.
Normal Colonic Function

- Absorption
  - Water absorption
  - Electrolytes
  - Short chain Fatty Acids
  - 15% energy requirements – fermented carbohydrates

- Slows transit – stimulates intestinal adaptation

- If have short bowel syndrome but intact colon – able to absorb 50% energy requirements in colon

- Retained colon – adaptation after small bowel resection
**Ileal Adapation**

- After resection, ileum able to adapt
- Short vili become longer
- Intestinal length can increase
- Diameter bigger
- Motor function
- Upregulation of brush border enzymes and transporters
Ileal Adaptation: Nutrient effects

- Enteral feeding: Best stimulant of intestinal adaptation presence of nutrients

- Mediated by growth factors and biliary and pancreatic secretions
  - Arginine – reduces intestinal permeability, enhances adaptation
  - Glutamine – reverses intestinal hypoplasia
  - Triglycerides – long chain better than medium chain promotes adaptation (but medium chain absorbed better)
  - Omega – 3 fatty acids – adaptation of small and large bowel
Ileal adaptation: Gut Hormones

- Glucagon-like peptide 2 (GLP-2) induces adaption after mid-small bowel resection
- Growth Hormones studies with Glutamine – results inconclusive
- Prostaglandins needed – NSAIDs inhibit adaptation
- Gut Hormones also affect
  - Motility
  - Loss of ileal brake
  - Hypergastrinaemia – loss of negative feedback – leading to PUD and Oesophagitis (exacerbated by delayed gastric emptying) – also inactivates pancreatic lipase – PPI useful for early phase
Bacterial Overgrowth

- Bacteria growth determinants
  - gastric acid
  - pancreatic enzyme
  - enterocyte turnover
  - antegrade peristalsis
  - Ileocaecal valve

- Small bowel bacteria – usually only have one small aerobic population

- Large bowel – anaerobic

- Colonic bacteria can help in SBS by metabolising and recovering malabsorbed nutrients – ie improve absorption

- Small bowel overgrowth (inflammation) can lead to Malabsorption
  - Bacterial deconjugation of bile acids – monoglyceride and fatty acid malabsorption
  - Inflammation reduces absorbtive area – protein loss
Diet Composition and Diarrhoea

- Carbohydrates are the major cause of diarrhoea due to osmotic load after breakdown by pancreatic enzymes.

- In the colon, bacteria breakdown malabsorbed substances to cause further osmotic load.

- Retained colon able to absorb fluid, electrolytes, short chain fatty acids.

- Protein and Fat – less osmotic load.
Consequences of Short Bowel

- Likelihood of resuming an oral diet depends on
  - Length of remaining small bowel
    - Intact duodenal >200cm of jejunum and intact colon eventually able to eat
  - Remaining segments of bowel
    - Proximal small bowel resection – protein, CHO, Fat absorption - Ileum able to compensate
    - Distal (ileum) small bowel resection – B12/Fat/Bile salt malabsorption if <100cm resected – liver able to compensate. Loss of ileal break.
  - Presence of the colon and intact ICV
  - Intestinal adaption
Intestinal Rehabilitation

- Early Management
  - Parenteral Nutrition
  - Fluid and electrolyte balance
  - H2RA or PPI to prevent gastrin hypersecretion which inactivate pancreatic enzymes
  - Fish oil based IV lipid emulsion
  - Enteral feeding – complex enhances adaptation (rather than elemental). Continuous tube feeding helpful postoperatively
Limited ileal resection

- <100cm ileum resected able to eat solid food
- Cholestyramine for bile salt malabsorption
  - Questran Lite
  - Colestipol
- B12 injections IM monthly

What happens when bile is malabsorbed?

- Normal: 98% is reabsorbed
- Mild defect: biosynth. in liver makes up for deficiency
- Severe defect: large part of bile is lost, fat malabsorption

Note: at any time, most of the bile acid is circulating in the intestine and blood (bile in stools does not give clues to a severe deficiency!!)
Extensive Small Bowel Resection

- Transition from Parenteral to Enteral feeding
- Intestinal Adaptation not complete
- Calcium, Zinc, Fat soluble vitamins (ADEK) monitor 3 monthly
- Vitamin B12
- Fat malabsorption – increased oxalate absorption -> Calcium Oxalate stones
Extensive Small Bowel Resection

- **H2 Blockers/PPI and Octreotide** inhibit excess gastric or pancreatic secretion

- **Octreotide**
  - reduces fluid losses but also decreases splanchnic protein synthesis and may interfere with adaptation
  - increases Small bowel transit
  - increases risk of gallstones

- **Loperamide**

- **Thickening agents**
  - But have CHO – may stimulate SBBO

- **Growth Factors**
  - GLP-2 eg Teduglutide - modest effect for severe SBS and intestinal failure – reduces time requiring parenteral nutrition
  - Glutamine and Growth Hormone – conflicting results
2. Post-Cholecystectomy Syndrome
Presence of symptoms after cholecystectomy

Caused by alterations in bile flow due to loss of GB reservoir
- Continuous flow of bile into Duodenum – leading to Oesophagitis and Gastritis
- Diarrhoea and colicky pain
Post Cholecystectomy Syndrome

- First described in 1947 by Womack and Crider
  - Non GB pain that persists
  - Development of GB pain that is new

- Development of symptoms eg gastritis or diarrhoea post cholecystectomy

- Cholecystectomy was the treatment of choice since 1860 for biliary colic and cholecystitis

- 80-95% successful if stones present

- 40% failure rate if no stones present
Post-Cholecystectomy Syndrome

- 500,000 Cholecystectomies performed in USA per yr
- 10% develop PCS
- Diagnosis improving with improved imaging – eg functional disease of the biliary tract/SOD etc
PCS: Epidemiology

- Organic vs Functional
- 5-30%
- Ddx: Functional disorder, Peptic ulcer disease, wound pain, stones, subhepatic fluid collection, incisional hernia - ?bile reflux
- Urgent operations – higher risk of PCS
- Predictors? – studies inconsistent
- Age – 20-29y 43%; 30-39% 27%; 40-49y 21%; 50-59% 26%; 60-69y 31% - rare >70y
PCS: Aetiology

- Bile is thought to be the cause
- Stomach or Duodenal irritation -> Diarrhoea
- Gastric bile acid increases
PCS: Ddx

- Gallbladder remnant and cystic ducts
  - Residual or reformed gallbladder
  - Stump cholelithiasis
  - Neuroma

- Liver
  - Fatty liver
  - Hepatitis
  - Hydrohepatosis
  - Cirrhosis
  - Chronic idiopathic jaundice
  - Gilbert
  - Dubin Johnson
  - Hepatolithiasis
  - PSC
  - Cysts
PCS: Ddx

- Bile Duct
  - Cholangitis
  - Adhesions
  - Strictures
  - Trauma
  - Cysts
  - CCA
  - Obstruction
  - CBD stone
  - Dilatation
  - Dyskinesia
  - Fistula

- Peri-ampullary
  - SOD
dyskinesia/spasm/hypertrophy
  - SOD stricture
  - Papilloma
  - Cancer
  - Pancreatitis
  - PD stone
  - Pancreatic Cancer
PCS: Ddx

- Oesophagus
  - Aerophagia
  - Diaphragmatic hernia
  - Hiatus Hernia
  - Achalasia

- Stomach
  - Bile gastritis
  - PUD
  - Gastric Cancer

- Duodenum
  - Adhesions
  - Diverticulosis
  - IBS
PCS: Ddx

- Small Bowel
  - Adhesion
  - Incisional Hernia
  - IBS

- Colon
  - Constipation
  - Diarrhoea
  - Incisional Hernia
  - IBS

- Vascular
  - Intestinal angina
  - Coronary angina

- Nerve
  - Neuroma
  - Intercostal Neuralgia
  - Spinal Nerve lesions
  - Sympathetic imbalance
  - Neurosis
  - Psychological
PCS: Ddx

- Other
  - Adrenal Cancer
  - Arthritis
  - Thyrotoxicosis
  - Foreign body – gallstone/surgical clip
Presentation

- Wide range of symptoms
- RUQ pain
- Jaundice
- Fever
- Diarrhoea
- Nausea
- Bloating
- Gas
Workup

- Tailor according to clinical suspicion
- Bloods - CBC, U&E, LFTs, Cardiac enzymes
- CXR
- ECG/ETT
- OGD
- USS? CT? MRCP? EUS Biliary scintiscan
- ERCP +/- sphincterotomy – biliary manometry?
- Morphine provokation, Secretin stimulation – check for PD dilatation, signs of chronic pancreatitis
Surgery

- Resection of Neuroma
- Transduodenal sphincteroplasty/septoplasty between PD and CBD
3. Dumping Syndrome
Stomach

- Stomach – capacity 1.5-2L
  - Cardia
  - Fundus
    - reservoir
  - Body
  - Pylorus
    - Churns and mixes

- Motility
  - Myogenic, circulating hormones, neural activity, sympathetic/Parasympathetic
Post-gastrectomy Syndromes

- Small Capacity
- Dumping Syndrome
- Bile gastritis
- Afferent Loop syndrome
  - kinking
- Efferent Loop syndrome
- Anaemia
- Metabolic bone disease
Gastrectomy

- Roux-en Y gastric bypass
- Bilroth I
- Bilroth II
Pathophysiology

Meal

- Rapid gastric emptying
  - Hyperosmolar jejunal chyme
    - Intraluminal fluid sequestration
      - Decreased blood volume
        - Hypotension
        - Tachycardia
      - Bloating
        - Abdominal pain
        - Diarrhea
  - Inappropriate gut hormone release
    - Vasomotor and GI symptoms
  - Rapid glucose absorption
    - Inappropriate insulin release
      - Late hypoglycemia
How common is it?

- Clinically significant in 10% after any type of gastric surgery
- Up to 50% of Laparoscopic roux-en Y gastric Bypass
- More common in types of surgery
  - Vagotony (for peptic ulcer disease)
  - Pyloroplasty
  - Gastrojejunostomy
  - Laparoscopic Nissen fundoplication
Less elective gastric surgery for PUD these days

Bariatric surgery

- Neurologic Immune Restoration Inflammatory Syndrome
- Octreotide helps
- Due to pancreatic islet hyperplasia which may require resection
Digestion

- Body of stomach – chemical digestion by acid and proteases
- Food transferred to Antrum – high amplitude contractions
- Food broken down in to 1-2mm
- Pass through pylorus – this stops larger particles going through

- Gastric emptying depends on
  - Fundic tone
  - Antropyloric mechanisms
  - Duodenal feedback
- All affected by surgery
Surgery

- **Gastric resection**
  - Reduces fundic reservoir
  - Less accommodation (stretching)

- **Vagotomy**
  - Increases gastric tone
  - Limiting accommodation

- **Pylorus removed/bypassed**
  - Increased gastric emptying

- **Bypass eg Gastrojejunostomy**
  - Duodenal feedback inhibition of gastric emptying lost

  *Accelerated gastric emptying is the hallmark of Dumping syndrome*

  - Gastric mucosal function altered – less secretion, enzymes, hormones affected
Early Dumping

- Early dumping and reflux gastritis
  - Less common with partial/segmental gastrectomy
  - More common with distal surgery

- Truncal vagotomy, patricle gastrectomy, roux-en Y gastrojejunostomy - 41% developed dumping within first 6 months

- Severe dumping is rare <5%

- Occurs in 45% of those malnourised and who have had complete or partial gastrectomy
Early Dumping

- Rapid emptying – Diarrhoea
- 30-60 min after a meal
- Hyper-osmolar contents into small bowel
- Fluid shifts – intravascular volume contraction – vasomotor symptoms -> tachycardia, light headedness
- Small bowel distension – bloating, cramping
- This simplistic hypothesis has been called into question
Early Dumping

- More likely due to interplay of gut hormones
  - Enteroglucagon
  - Peptide YY
  - VIP
  - GLP-1
  - GIP
  - Neurotensin

- Causes sympathetic overdrive

- Role of serotonin

- Ileal brake – mediated by the above
Late Dumping

- 1-3 hours after a meal
- Hyperinsulinaemic hypoglycemia
- CHO into proximal small bowel rapid absorption of glucose
- Insulin stays high – then get hypoglycemia – Incretin effect
- GIP, GLP-1 exaggerated response after gastrectomy
Late Dumping: Hypoglycemia

- OGTT – Hyperinsulinaemic Hypoglycemia
- Gastric scintigraphy – delayed then accelerated gastric emptying
Clinical Presentation

- Gastrointestinal
  - Early satiety
  - Crampy abdominal pain
  - Nausea
  - Vomiting
  - Explosive diarrhoea
  - Borborygmi
  - Hunger

- Vasomotor
  - Diaphoresis
  - Flushing
  - Dizziness/Faintness
  - Palpitations
  - Intense desire to lie down/Fatigue
  - Headaches
  - Syncope
  - Poor concentration
  - Decreased consciousness
Sigstad’s Diagnostic Symptoms

- Symptoms and points
  - Shock +5
  - Near syncope, impaired consciousness +4
  - Desire to lie or sit +4
  - Breathlessness +3
  - Weakness/exhaustion +3
  - Sleepiness, drowsy, apathy +3
  - Palpitation +3
  - Restlessness +2
**Medical Treatment**

- **Acarbose**
  - Alpha-glycoside hydrolase inhibitor – interferes with carbohydrate absorption
  - Increases post prandial glucagon-like peptide 1 levels -> decrease in insulin release
  - Causes diarrhoea – fermentation of unabsorbed carbohydrates and flatulence

- **Octreotide** 50mcg/ bd or tds 30min premeal – or LAR
  - Short term success.
  - Synthetic analogue of Somatostain
  - “Endocrine brake” – inhibits insulin and several gut derived hormones
  - Slows gastric transit time
  - LAR improved QoL but short acting better for late dumping symptoms
Surgery

- Prevention preferrable
- Proximal Vagotomy preferred over antrectomy and truncal vagotomy
- Pyorus preserving gastrectomy

Examples to fix the problem
- Bilroth II to Bilroth I
- Surgical narrowing of the gastrojejunal stoma
Diet

- Daily energy intake divided into 6 meals
- Fluid intake with meals is restricted (within 30 min)
- Avoid simple sugars
- Avoid milk products
- Protein and fat increased to balance drop in carbs
- Lying supine 30 min delays gastric emptying and increase venous return – less syncope
- Dietary fibre to treat hypoglycaemia – prolong bowel transit delayed glucose absorption
Summary

- Generally post operatively after resection most patients are well
- Small subset of severe disease
- Treatment depends on site and length of resection
- Adaptation can take time
Questions?

- derek.luo@middlemore.co.nz
- (021) 535882