Small Bowel

Malabsorption

- Can occur at different phases
  - Luminal phase
    - Contact between ingested food and digestive enzymes
      - Example: pancreatic insufficiency
  - Mucosal phase
    - Substances are assimilated and absorbed in the required constituent form
      - Example: celiac disease, crohns
  - Delivery phase
    - Nutrients are taken up into the cytoplasm and transported to the lymphatic or portal venous system
      - Example: lymphoma

Diarrhea

- Mechanism:
  - Decreased absorption
    - A villous function
  - Increased secretion
    - A crypt function

Diarrhea: Categories

Inflammatory

-abdominal pain, fever, tenesmus

-stools mucoid, bloody, smaller volume

-blood and leukocytes microscopically

Noninflammatory

- Tend to produce watery diarrhea
- No fever or gross bleeding
- Stool appears normal on microscopy

Diarrhea: Categories

Secretory

- small and/or large-intestinal fluid and electrolyte secretion
- Stop with fasting:NO
- Stool osmotic gap: <50mOsm/kg

Osmotic

- Ingestion of poorly absorbed cations, anions, sugars, or sugar alcohols
- Stop with fasting: YES
- Stools osmotic gap: >100mOsm/kg

Carbohydrate Malabsorption

- Mechanisms
  - Reduced mucosal surface area
  - Reduced disaccharidases or transport proteins

- Most Common: lactose malabsorption
  - Congenital
  - Primary (delayed)
  - Late-onset acquired
    - Intestinal resections
    - Mucosal diseases
    - Post-infectious

Malabsorption

Carbohydrate clinical features:

- Increased gas, distention and possibly diarrhea
- Get extensive dietary hx to r/o dietary causes

- Tests:
  - A fecal pH less than 6 is evidence of carbohydrate malabsorption
  - Hydrogen breath test
    - Increase of 20parts/million→ colonic fermentation of the lactose by bacteria
    - False + can occur in bacterial overgrowth
    - False – recent antibiotic use
  - Avoidance trial

Fat Malabsorption

- Symptoms
  - Dairrhea, wt loss, AEDK deficiencies
- Tests
  - Qualitative fecal fat (sudan stain)
    - Low sensitivity/specificity
  - Quantitative fecal fat
    - Normal <7g/day; 48-72 hour
  - Etiology
    - Pancreatic, hepatic, mucosal, lymphatic

Protein-Losing Enteropathy

- 3 reason for GI protein loss
  - 1. Increased mucosal permeability
    - Menetriers, h.pylori, celiac, eosinophilic, vasculitis
  - 2. Mucosal erosions
    - IBD, C.Diff, ischemia, amyloid, GVHD
  - 3. Lymphatic obstruction
    - Cardiac, lymphangiectasia,lymphoma

Protein-Losing Enteropathy

- Clinical features
  - Edema, ascites, diarrhea, fat/carb loss

- Labs:
  - Low protein, albumin, gamma globulins
  - Lymphocytopenia

- Test
  - Alpha1-antitrypsin (AT) clearance test

Celiac Sprue

- Patients with celiac cannot tolerate a protein called gluten, which is found in wheat, rye, barley, and possibly oats.
- When patients eat gluten their immune system responds by damaging the small intestine.

Celiac disease “gluten enteropathy”

- genetically inherited associated with the HLA locus found on the short arm of **chromosome 6**. HLA-DQ2 is present in 95% of patients.
- pathology: flattening of the small bowel villi.

Classic disease

- 3 features
  - Villous atrophy
  - Symptoms of malabsorption
  - Resolution of mucosal lesions and symptoms upon withdrawal of gluten-containing foods.

Celiac– Clinical Features

- Vary tremendously from patient to patient.
- Symptoms are not specific for celiac.
- Some patients develop symptoms as children, others as adults.

Clinical Manifestations

- Classic
  - Diarrhea
    - Bulky, foul-smelling, floating stools due to steatorrhea and flatulence
  - Consequences of malabsorption
    - Weight loss
    - Severe anemia
    - Neurologic disorders due to Vit B Def
    - Osteopenia– def vit D and calcium

Clinical manifestations cont.

- Weight loss
  - ❑Some patients compensate by increasing dietary intake.
    - In debilitated patients, weight loss may be masked by fluid retention caused by hypoproteinemia.

Clinical manifestations cont.

- Weakness, lassitude, and fatigue
  - Not specific and are usually related to general poor health.

Atypical Celiac disease

- Minor GI complaints
- Anemia
- Dental enamel defects
- Osteoporosis
- Arthritis
- Increased transaminase (AST & ALT)
- Neurological symptoms
- infertility

Extra intestinal Symptoms

- Anemia
  - Impaired iron or folate absorption
  - In severe cases→ B12 def.
  - Impaired coagulability due to prothrombin deficiency from impaired Vit K absorption

Celiac diagnosis

- All diagnostic serologic testing should be done with pts on gluten containing diet.

Celiac diagnosis

- Biopsies should be performed in all pts who are suspected of having celiac, regardless of serologic evidence
  - Small # of people have + serology but normal biopsies
  - Negative serology does not preclude presence of disease

Diagnosis– screening tests

- Antigliadin antibody (AGA)
  - ❑IgG good sensitivity (83-100%)
    - False + in cow milk protein intolerance and parasite infection.
  - ❑IgA good specificity (72-100%)
- Antiendomysial antibody (AEA or EMA)
  - ❑False – in IgA deficiency and kids <2 years.
  - ❑Sensitivity 97-100%; specificity 98-99%

Diagnosis- Screening Tests

- **Tissue transglutaminase Ab (IgA)**
  - Single preferred test (for over age 2)

    sensitivity 90-100%

    specificity 95-100%
- Antireticulin Ab

  Not very sensitive (not used)

**check IgA

(or include both IgA and IgG-based test)

Small Bowel Biopsies

- + serology
- High probability of celiac
  - Regardless of the serology
  - Biopsies from:
    - Duodenal bulb
    - 2nd and 3rd portion duodenum

Classic endoscopic appearance

- Scalloping
- Nodularity
- Absence of circular folds (small intestine plicae)

Complications

- Refractory sprue
  - Severe complications can develop
    - Ulcerative jejunitis, collagenous sprue, lymphoma
- T-cell lymphoma
  - High mortality rate

Celiac vs Non-celiac gluten sensitivity

- Symptoms or response to gluten free diet should not be used to diagnose Celiac disease.
- A diagnosis of non-celiac gluten sensitivity should be considered only after celiac has been excluded with appropriate testing.

- ACG clinical guidelines may 2013

Management of Celiac Dz

- GFD for life
  - (wheat, barley and rye)
- Oats appear safe, but should be introduced with caution
- Pts should be referred to a registered dietitian knowledgeable about celiac.

Small bowel question

- Pt with celiac has followed a gluten free diet for 6 months and was doing well but now diarrhea has returned. Review of her diet shows compliance. Endomysial antibody testing is now normal. What is the next step?
  a. Repeat small bowel biopsy
  b. SBFT
  c. CT scan of abdomen
  d. Colonoscopy with biopsies
  e. Bacterial aspirate if small bowel contents

Answer: d colonoscopy

- Pt had responded to gluten-free diet
- Common cause of recurrent diarrhea is **microscopic colitis**, detected with random biopsies in a normal appearing colon.
- About 15% of time the 2 diseases coexist.

Small bowel Question

- 52 yo recently traveled to Puerto Rico for 3 months. He developed fatigue, malaise and abdominal cramps 1 week after returning, followed by diarrhea and dyspepsia. Stools are “oatmeal-like”. Lab Hgb 11.3 with MCV 103. Stool studies neg. Enteroscopy is performed. Likely diagnosis?
  a. Celiac sprue
  b. Giardia
  c. Tropical sprue
  d. Lactase def.

Answer: c tropical sprue

- Can mimic celiac sprue.
- Etiology unknown although it is suspected to be infectious.
- Tx: tetracycline 250mg QID and folate 5mg daily for 6-12 months

KEY:

Diarrhea+ tropics+ macrocytic anemia = Tropical sprue

Types of Lactase deficiencies

- congenital form: Present at birth, very rare.
  - Autosomal recessive inheritance
- primary form: genetically determined and dependent on population(most common in Saharan and sub-Saharan Africa and East Asian and Pacific)
  - Onset is usually delayed
- secondary or acquired: occurs after intestinal injury.

Bacterial Overgrowth

- A direct consequence of the presence of increased amounts of colonic-type bacterial flora in the small intestine.
- Can result in fat, carbo, and protein malabsorption
- Macrocytic anemia→ cobalamin def.

Bacterial Overgrowth Etiology

- Small bowel diverticula
- Fistulas from crohn’s
- Bypass of intestine
  - Jejunoileal for obesity
- Functional stasis
  - Scleroderma
  - Diabetes

Bacterial Overgrowth diagnosis

- direct aspiration of aerobes and anaerobes from small bowel is the standard.
- Alternatives: carbon dioxide and hydrogen breath tests.

Therapy: If the cause is not correctable, can trial antibiotics.

largely empirical

Giardia

- Intestinal tract infection caused by protozoal parasite *Giardia lamblia.*
- Predominant age in US:
  - Preschool; especially daycare
  - Homosexual men
- Contaminates fresh water sources worldwide
    - (mountain streams)

Giardia cont.

- Clinical findings:
  - 70% have intestinal symptoms
    - Diarrhea
    - Flatulence
    - Cramps
    - Bloating
    - Nausea
  - Chronic diarrhea, malabsorption, and weight loss
  - 20-25% of infected pts are asymptomatic

Workup

- Stool
  - Immunoassays for Giardia antigen routinely used in labs
- r/o malabsorption
  - B12
  - Albumin
  - Stool fat test
- Tx:
  - Metronidazole, Nitazoxanide, Paromomycin

Small Bowel

45 yo has had malabsorption for the last year with low volume diarrhea, polyarthritis and occasional visual hallucinations. PE is neg. CT shows generalized lymphadenopathy. EGD shows broad flattened villi in the duodenum. Bx show numerous PAS + macrophages in the submucosa. Which therapy may be useful for this pt?

a. Gluten free diet
b. Steroids
c. Antibiotics
d. antacids

Answer: c antibiotics

- Whipples disease
  - *Tropherma whippelii*
  - Rare infectious condition that prevents small bowel from absorbing nutrients
  - Can affect multiple organs
  - May get a description of “foamy macrophages”
- Most common sx: arthralgias, weight loss, recurrent abd pain, diarrhea. CNS manifestations also classic

In the interest of time the next few slides will not be covered in lecture

Water soluble vitamins

- B12
  - Cobalamin
    - Requires ingestion of animal products
    - Deficiencies:
      - Megaloblastic anemia and hyperhomocystinemia
        - Identical to folic acid def
      - Neuropsychiatric abnormalities
      - Posterior column of spinal cord degeneration
      - Loss of taste, anorexia, diarrhea
  - Serum methylmalonic acid levels
    - Normal in folate def
    - Increased in B12 def (or before)

B12 deficiency causes

- Achlorhydria in elderly
- Pernicious anemia
  - Lack of IF and acid
- ZE syndrome
- Bacterial overgrowth
- Gastric bypass

Other water-soluble vitamins

- Folic acid: Macrocytic anemia, glossitis, increased risk colon ca and CV disease
- Vit C: scurvy
- Thiamine (b1): beriberi with cardiac or neurologic disorders. May be exacerbated by glucose administration to thiamine-def patients
- Riboflavin (b2): angular stomatitis, cheilosis, dermatitis, visual impairment
- Niacin (b3): pellagra (diarrhea, dermatitis, dementia)
- Pyridoxine (b6): def cause of increased ratio of AST to ALT in alcoholic hepatitis

Fat-soluble vitamins

- A: night blindness
- D: nausea, vomiting, weakness
- E: neurologic symptoms, hemolysis
- K: excessive bruising and bleeding
- Absorption requires luminal bile salts and pancreatic esterases, assembly into chylomicrons and lymphatic transport
- Excess can cause toxicity

Minerals

- Iron
  - Microcytic hypochromic anemia
- Zinc
  - Required as a cofactor for many enzymes
  - Def impairs growth, development and reproductive and immune functions
- Copper
  - Microcytic hypochromic anemia, leukopenia, neutropenia, diarrhea and bony changes

Minerals

- Selenium
  - Cardiomyopathy
  - myositis
- Manganese
  - Night blindness, tachycardia, tachypnea, HA

- May develop deficiency in pts receiving long-term TPN or TF

Matching Vitamin/Mineral def with symptoms/signs

- Vitamin A
- Vitamin C
- Vitamin K
- Zinc
- Chromium
- Copper

- Glucose intolerance
- Night blindness
- Hypogonadism
- Impaired wound healing
- Menkes (kinky hair) syndrome
- Easy bruising

Answers

- Vitamin A: night blindness
- Vitamin C: impaired wound healing, bleeding gums, depression
- Vitamin K: easy bruising, bleeding
- Zinc: hypogonadism, growth arrest, poor wound healing
- Chromium: glucose intolerance
- Copper: Menkes syndrome, microcytic anemia

Nutrition-general information

- When is nutritional support beneficial?
  - In normal pt after 7-10days of no po intake
- Best indicator of malnutrition?
  - Unintentional weight loss during prior 3 months
    - Only criterion to offer predictive value
      - >20% baseline severe protein-calorie malnutrition
      - 10-20% moderate
      - <10% mild
- Enteral vs parenteral
  - “if the gut works use it”

Enteral nutrition

- Contraindications
  - No access
  - Bowel obstruction
  - Severe intestinal dysmotility
  - High-output fistula
  - Intractable severe vomiting or diarrhea
  - Bowel ischemia
  - Severe malabsorption
  - Pt refusal

Parenteral nutrition

- Complications
  - Catheter infections
  - Central venous thrombosis
  - Nutrient excess or deficiency
  - Metabolic bone disease
  - TPN-related hepatobiliary disease

Refeeding syndrome

- Can happen in severely malnourished pt who receives high-glucose, high-volume feedings abruptly
  - Severe electrolyte shifts
- Avoid refeeding syndrome by:
  - Thiamine for 3 days
  - Slow initiation of feeding with liberal amounts of electrolytes (K, Mg,Phos)
  - conservative use of dextrose
  - Sodium and volume adjustment as indicated by clinical exam