Functional Medicine University’s
Functional Diagnostic Medicine Training Program

Module 2

Disorders of the Gastrointestinal System

By Wayne L. Sodano, D.C., D.A.B.C.I., & Ron Grisanti, D.C., D.A.B.C.O., M.S.
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Intestinal epithelial cell turnover rate is among the highest in the body due to the fact that the gastrointestinal tract must endure significant physical, chemical, and biological challenges. The new formed cells must establish ‘tight junctions’ between them, which prevent the passage of molecules and ions through the spaces between the epithelial cells. The molecules and ions must enter the cells by diffusion or active transport. This mechanism allows for control over what substances enter the body.

Damage to the epithelial lining and, thereby, the tight junctions, can be the root cause of a myriad of gastrointestinal dysfunctions and, in particular, immunologic disorders (autoimmune disease). With this in mind, effective therapy for most gastrointestinal disorders requires knowledge of gastrointestinal physiology in order to restore the dysfunctions and not mask symptoms.

**Diseases of the Esophagus**

**Achalasia**

Achalasia is a motility disorder characterized by a loss of peristalsis in the distal two-thirds of the esophagus and impaired relaxation of the lower esophageal sphincter. The cause of achalasia is unknown, however, neurological degeneration of the myenteric plexus has been postulated.

Oropharyngeal Dysphagia (difficulty swallowing) has a number of etiologies such as:

- **Neurologic disorders**
  - Multiple sclerosis
  - Guillain-Barre syndrome
  - Parkinson disease

- **Muscular and rheumatologic disorders**
  - Polymyositis
  - Sjogren syndrome

- **Metabolic disorders**
  - Thyrotoxicosis
  - Cushing disease
  - Wilson disease
  - Medication side effects
  - Anticholinergics
  - Phenothiazines

- **Infectious disease**
  - Lyme disease
  - Candida, herpes

- **Structural disorders**
  - Cervical osteophytes
  - Oropharyngeal tumors
Esophageal Dysphagia

Esophageal Dysphagia can be caused by mechanical lesions or motility disorders.

**Mechanical Obstruction**
- Shatzki Ring
- Peptic strictures
- Esophageal Cancer

**Solid Foods Worse Than Liquids**
- Intermittent Dysphagia; not progressive
- Chronic heartburn; progressive Dysphagia
- Progressive Dysphagia; age over 50 years

**Motility Disorders**
- Achalasia
- Diffuse esophageal spasm
- Scleroderma

**Solid and Liquid Foods**
- Progressive Dysphagia
- Intermittent; not progressive; may have chest pain
- Chronic heartburn; Raynaud phenomenon

*Note:* Schatzki Ring has been described as a smooth, benign, circumferential narrow ring of tissue located at the junction of the esophagus and stomach. The etiology of the rings is not clearly understood, however, many authorities attribute them to acid reflux disease. Treatment consists of stretching/fracturing the ring to allow food to pass.

**Gastroesophageal Reflux Disease (GERD)**

The usual symptom in GERD is heartburn that occurs 30 to 60 minutes after meals reclining after meals also can produce symptoms. GERD is usually caused by:

1. hypotensive lower esophageal sphincter
2. certain foods (coffee alcohol)
3. medications (calcium channel blockers, beta-blockers, nitrates)
4. obesity – increased intra abdominal pressure

One complication of GERD is called Barrett Esophagus. In this condition the normal squamous epithelium of the esophagus is replaced by metaplastic columnar cells. Barrett Esophagus is present in 8-15% of patients with GERD.
Diseases of the Stomach

**Gastritis** refers to an inflammation of the gastric mucosa. The inflammation can be superficial or it can penetrate deep into the mucosa. Gastritis is commonly divided into two categories:

- *Erosive and hemorrhagic*
  - Alcoholics
  - critically ill
  - drugs (NSAIDS, aspirin)

- *Non-erosive*
  - H.pylori

Gastritis makes the mucosa susceptible to digestive enzyme activity and can result in a gastric ulcer. Chronic gastritis can cause gastric atrophy, reducing or eliminating gastric secretions leading to achlorhydria and pernicious anemia. Remember the parietal cells secrete a glycoprotein called intrinsic factor which must be present for absorption of B12 from the ilium.

[A intrinsic factor protects B12 from begin digested and destroyed. Intrinsic factor also binds with receptors on the epithelial surface of the ilium to allow for absorption of B12]

Adequate stomach acid secretion is also a primary defense mechanism against infections of the GI tract. The proper amount of HCl and enzymes kill most bacteria and parasites that contaminate food. Unfortunately, standard treatments for stomach complaints focus on the use of proton pump inhibitors, histamine-2 receptor antagonists, and antacids; all of which increase the risk of infection and bacterial overgrowth. Tract mineral deficiencies are also commonly seen in low stomach acid and/or medications that block acid production.

**Peptic Ulcers**

Peptic Ulcer occurs when there is a break in the gastric or duodenal mucosa. The major causes:

- Infection (H.pylori)
- Aspirin and/or NSAIDs
- Alcohol
- Smoking (causes increased nervous stimulation of the stomach secretions)

Epigastric pain is present in 80-90% of patients and is considered a hallmark symptom. Complication of peptic ulcer disease includes gastrointestinal bleeding and ulcer perforation.
Diseases of the Small Intestine

Malabsorption

Malabsorption refers to a disruption of digestion and nutrient absorption. There are three phases of normal digestion and absorption:

1. Intraluminal
   - Pancreatic and biliary secretions

2. Mucosal
   - Sufficient surface contract
   - Brush border enzymes

3. Absorptive

Several diseases can cause malabsorption. The general term for malabsorption is ‘sprue’. Non tropical sprue is categorized as idiopathic sprue, celiac disease or gluten enteropathy. In celiac disease, gluten causes an immunological response which damages the small intestine mucosa. The classic symptoms of celiac disease include diarrhea, steatorrhea, weight loss, abdominal distension, weakness and muscle wasting. Skin rash may also be present and is referred to as dermatitis herpetiformis.

Celiac disease has also been associated with other autoimmune diseases such as Graves, Type I Diabetes, Addison’s Disease, Scleroderma, atrophic gastritis, and pancreatic insufficiency.

Tropical sprue refers to Malabsorption due to unidentified infectious agents. It usually occurs in the tropics and is treated with antibacterial agents.

Both pancreatic and biliary insufficiency can be evaluated by stool analysis. Fecal chymotrypsin, Elastase, fat, steroids, and fibers can provide insight into biliary and pancreatic enzyme function. These will be discussed in detail in future lessons.

The following page illustrates the clinical manifestations and laboratory findings in Malabsorption of various nutrients.
### Malabsorption

<table>
<thead>
<tr>
<th>Manifestations</th>
<th>Laboratory Findings</th>
<th>Malabsorbed Nutrients</th>
</tr>
</thead>
<tbody>
<tr>
<td>Steatorrhea (bulky, light-colored stools)</td>
<td>Increased fecal fat; decreased serum cholesterol; decreased serum carotene, vitamin A, vitamin D</td>
<td>Triglycerides, fatty acids, phospholipids, cholesterol. Fat soluble vitamins: A, D, E, K</td>
</tr>
<tr>
<td>Diarrhea (increased fecal water)</td>
<td>Increased stool volume &amp; weight; increased fecal fat; increased stool osmolality gap</td>
<td>Fats; carbohydrates</td>
</tr>
<tr>
<td>Weight loss; muscle wasting</td>
<td>Increased fecal fat; decreased carbohydrate (D-xylose) absorption</td>
<td>Fat, protein, carbohydrates</td>
</tr>
<tr>
<td>Microcytic anemia</td>
<td>Low serum iron</td>
<td>Iron</td>
</tr>
<tr>
<td>Macrocytic anemia</td>
<td>Decreased serum vitamin B12 or red blood cell folate</td>
<td>Vitamin B12 or folic acid</td>
</tr>
<tr>
<td>Paresthesia; tetany; positive Trousseau and Chyostek signs</td>
<td>Decreased serum calcium or magnesium</td>
<td>Calcium, vitamin D, magnesium</td>
</tr>
<tr>
<td>Bone pain; pathologic fractures; skeletal deformities</td>
<td>Osteopenia on radiograph; osteoporosis (adults); osteomalacia (children)</td>
<td>Calcium, vitamin D</td>
</tr>
<tr>
<td>Bleeding tendency (ecchymoses, epistaxis)</td>
<td>Prolonged prothrombin time or INR</td>
<td>Vitamin K</td>
</tr>
<tr>
<td>Milk intolerance (cramps, bloating, diarrhea)</td>
<td>Abnormal lactose tolerance test</td>
<td>Lactose</td>
</tr>
</tbody>
</table>

### Intestinal Hyperpermeability (Leaky Gut Syndrome)

As discussed earlier, the epithelial cells of the intestinal tract normally form ‘tight junctions’. Damage to the intestinal mucosa integrity allows for passage of macro molecules to enter into circulation which can result in immunological disorders. Intestinal Hyperpermeability has been found in all chronic inflammatory bowel disease. Common causes of intestinal Hyperpermeability are:

- Viral
- Bacterial
- Yeast
- Yeast
- Parasites
- NSAIDs
- Alcohol
Intestinal Hyperpermeability (Leaky Gut Syndrome) con’t

Leaky gut can be assessed by using the Lactulose-Mannitol Intestinal Permeability Challenge Test. This test will be discussed in detail in future lessons.

Irritable Bowel Syndrome

IBS is a chronic functional disorder causing abdominal pain with alteration in bowel habits. The general consensus defines IBS as abdominal pain or discomfort that has two of the following features:

- Relieved with defecation
- Onset associated with change in frequency of stool
- Onset associated with a change in appearance of stool

The etiology of IBS has been attributed to small bowel bacterial overgrowth and/or dysbiosis. Significant improvement of symptoms of IBS has been attributed to treatment with Probiotics, especially Bifidobacterium infantis.

Dysbiosis

There are more than 400 microbial species in the healthy gastrointestinal tract. Overgrowth, (excessive colonization) of microbial species can change metabolic and/or immunologic status of the host. This change can lead to disease or dysfunction and is known as dysbiosis.

<table>
<thead>
<tr>
<th>Disease</th>
<th>Dysbiosis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Joint inflammation</td>
<td>Salmonella</td>
</tr>
<tr>
<td></td>
<td>Shigella</td>
</tr>
<tr>
<td></td>
<td>Yersinia</td>
</tr>
<tr>
<td>Rheumatoid arthritis</td>
<td>Klebsiella</td>
</tr>
<tr>
<td>Ankylosing spondylitis</td>
<td>Citrobacter</td>
</tr>
<tr>
<td>Thyroiditis (Graves’/Hashimoto’s)</td>
<td>Yersinia</td>
</tr>
<tr>
<td>SIDS</td>
<td>Sulfate-reducing bacteria</td>
</tr>
<tr>
<td>Colon Cancer</td>
<td>Phenolic compound</td>
</tr>
<tr>
<td></td>
<td>(bacterial putrefaction)</td>
</tr>
</tbody>
</table>

Hydrogen Breath Test (Methane)

This test is used to detect bacterial overgrowth. The patient drinks a challenge solution of lactulose or glucose. If bacterial exists in the small intestine, the patient will ferment the lactulose/glucose and release hydrogen or methane. Breath samples are taken every 15 minutes after ingestion of the challenge solution for up to 2 hours.

Bacterial overgrowth can also be assessed by testing the patient’s urine. The chemical by-products of microbial activity can enter the urine and be an indirect indicator of dysbiosis. Urinary organic acid will be discussed in a future lesson in this module.
Inflammatory Bowel Disease

Both ulcerative colitis and Crohn’s disease are included in IBD.

Ulcerative colitis: Chronic recurrent disease involving the colon, causing diffuse mucosal inflammation.

Crohn’s disease: Chronic recurrent disease involving any segment of the GI tract and is characterized by ‘patchy transmural inflammation’.

The cause of both diseases is still uncertain, however, an abnormal response of the mucosal immune system to luminal bacteria may be the trigger. (chronic bacterial infection)
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3. 2009 Current Medical Diagnosis & Treatment, 48th ed., Stephen J. McPhee and Maxine A Papadakis