

E.8. Pathophysiology in the GI-system

Introduction

1. As usual, at the end of a chapter describing an organ system, I include a brief description of the major pathophysiological diseases in this system.	2. However, you should be aware that this does not include many types of diseases afflicting the GI such as infections, hereditary diseases or cancer. These are all beyond the scope of this website.
3. However, I do include on this page a relatively recent and very successful development; gastric bypass surgery .	4. This surgical technology is being increasingly used around the world to treat a very common disease; obesity! (<i>panel C</i>).

A. Esophagus: Achalasia and GERD

1. The most common diseases affecting the esophagus are related to the LES (= lower esophageal sphincter).	2. As you may remember, this sphincter should remain closed all the time (to avoid acid fluid flowing into the esophagus) and should only open when food passes from the esophagus into the stomach.
3. In esophageal achalasia , the LES does not open properly. In most cases, the cause of this is unknown.	4. But this failure to open leads to difficulties in swallowing, accumulation of food in the esophagus, regurgitation and sometimes chest pain. In severe cases, the patient may even lose weight.
5. The treatment is to either make a cut through the LES or to dilate it with a balloon attached to an endoscope.	6. The opposite of achalasia, when the LES does not close properly, is GERD (=Gastro-Esophageal Reflux Disease).
7. In this situation, because the LES does not close properly, acid fluid will flow into the esophagus, causing irritation and ulcers of the mucosa.	8. One solution is to lower the acid stomach fluid. This is done with so-called PPI (proton-pump inhibitor), which lowers the acidity (for example before a meal).
9. If the situation can not be solved with PPI's or with life style changes (diet etc.), then surgery is possible, by wrapping a part of the fundus around the distal esophagus (Nissen fundoplication).	

B. Stomach pathophysiology

1. The most common diseases in the stomach are: - Gastritis - Gastroparesis - Gastric ulcers	2. Gastritis occurs when the balance between acid production and the mucosal barrier is disturbed. There are many reasons for that (infections etc.).
3. As the acid 'bites' into the stomach wall, this will cause pain, nausea, vomiting, bleeding, and possibly even perforation (which is a medical emergency!).	4. Gastroparesis occurs when the movements of the stomach have decreased or have disappeared. As you can imagine, this is very bad for the digestion of the food.
5. Gastroparesis can be a complication of diabetes, or when the pylorus does not open properly. There could possibly be other reasons. We are only now starting to realize how often gastroparesis actually occurs in patients.	6. Gastric ulcers , also called, peptic ulcers, is when the mucosal layer protecting the wall of the stomach or the intestine is, for some reason, deficient or lacking. In this case, the acid 'bites' into the wall and produces an ulcer.
7. Gastric ulcers are most often caused by: a) infection with a bacteria (<i>Helicobacter pylori</i>) b) long term use of medicines such as aspirin, ibuprofen, etc.	8. In the case of an infection with <i>H. pylori</i> , antibiotics must be used. In addition, often PPI's (=proton pump inhibitor) are prescribed to reduce the acid fluid in the stomach. Stopping medicines and a good diet also helps!

C. Obesity Surgery

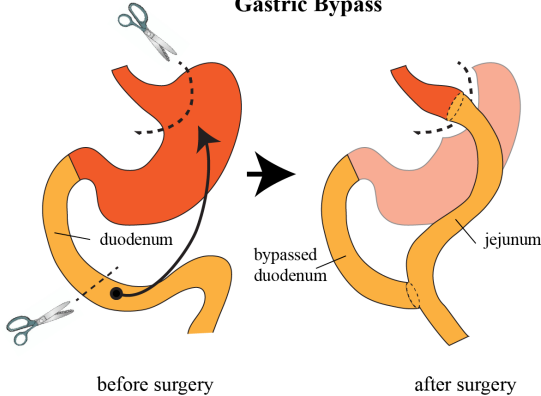
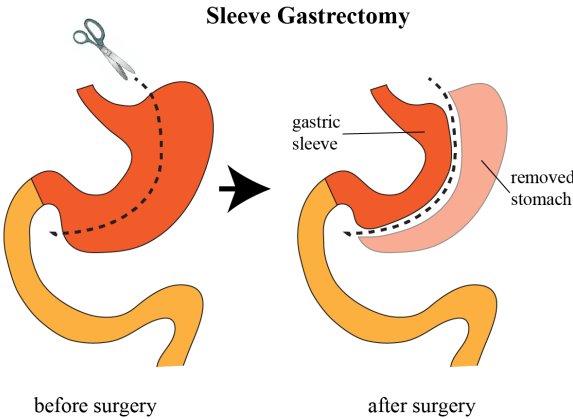
1. This is an interesting topic where physiology and pathophysiology come together!	2. In the past few years, several surgical approaches have been developed in order to treat a very common major (and western) disease; obesity !
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3.

The idea is to reduce the function of the stomach as the reservoir of our food. Apparently, in people who eat a lot, the food is stored in an ever-increasing stomach and therefore they become very fat!

4.

So, the idea is to reduce the function of the stomach. Several approaches have been developed of which I will discuss the two most successful ones: **gastric bypass** and **sleeve gastrectomy**.

	Gastric Bypass  before surgery after surgery BasicPhysiology.com	
5. In the gastric bypass, the cardia, where the food comes in from the esophagus, is isolated from the stomach and attached to the jejunum.	6. In this way, the food drops immediately into the small intestine, thereby <i>bypassing</i> the stomach. This will quickly give a ‘full’ experience to the patient to stop eating.	
7. In order to keep the juices from the stomach, the pancreas and the liver available to digest the food, the duodenum is attached to the jejunum so that these can reach the food in the jejunum.	8. Later, surgeons developed an even more and simpler approach, which is becoming very popular nowadays and that, is the sleeve operation.	
	Sleeve Gastrectomy  before surgery after surgery BasicPhysiology.org	

9. In this operation, a large part of the stomach, along the major curvature, is simply cut away, leaving only a small ' <i>sleeve</i> ' between the esophagus and the duodenum. In a sense this is a more simple operation.	10. In both cases, the results are, for most patients, very good. They literally lose a lot of weight. Of course, they also must adhere to a strict diet or else, gradually, the stomach and the intestines will again adapt to too much food and the person will get fat again!
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D. Small Intestine pathophysiology

1. In the small intestine, several diseases can occur such as: - Celiac disease - Crohn's disease - Intestinal obstruction - Irritable bowel syndrome - Short bowel syndrome	2. Celiac disease occurs in people who are allergic to gluten (a protein found in wheat, bread, beer, etc.). When they eat gluten protein, their body will induce an immune response that destroys the villous layer lying on the mucosa. This will therefore severely impede the absorption of all kinds of nutrients.
3. Celiac disease is hereditary, meaning that it runs in families. The only treatment is to avoid eating gluten (i.e. gluten-free diet).	4. Crohn's disease is a chronic inflammatory disease that may affect any part in the intestine (from mouth to anus) but is most commonly found in the small intestine. It induces inflammation and possibly ulceration of the mucosal wall.
5. The cause of Crohn's disease is not known but the symptoms can be stomach cramps, diarrhea or constipation. Possible treatments are drugs, diets or sometimes even surgery (to remove the affected part of the intestine).	6. Intestinal obstruction is when something blocks the passage of fluids and digested food. This can be due to a local bleeding, cancer, twisting of the intestines (=volvulus), adhesions (due to inflammation), etc.
7. Intestinal obstruction is very dangerous, causing pain, malnutrition, nausea, abdominal swelling and must be treated urgently.	8. Irritable bowel syndrome (IBS) causes symptoms such as bloating, nausea, cramps, diarrhea, etc. We also don't know the mechanism, or even if there are multiple mechanisms of this disease.

9. IBS is often variable with some ‘good’ days followed by ‘bad’ days. This is sometimes triggered by diet, daily life etc. There is no cure and is often a lifelong problem. In some people medicines and/or diet is helpful in reducing the symptoms.	10. Short bowel syndrome. As you now know, the small intestine is very long (5-6 meters). But in some cases, the small intestine is too short. This can be due to the fact that you were born with a short intestine (very rare) or because a large part had to be removed (due to cancer or Crohn’s disease etc.).
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E. Large Intestine pathophysiology

1. These are the most common colonic diseases: - Congenital megacolon - Diverticula - Ulcerative colitis - Crohn’s disease - Polyps - Irritable Bowel Syndrome	2. Congenital megacolon (also called Hirschsprung disease) is caused by a lack of ganglion and nerve cells in a part of the colon. Therefore, peristalsis cannot occur in that region leading to a ‘functional’ obstruction (cramps, constipation etc.). When this occurs over a long time, a megacolon (a huge colon) may develop.
3. In most cases, surgical removal of the non-functional and distended colon is required to solve the problem.	4. Diverticula are small sacks that may occur in the walls of the colon, especially if there is frequent high pressure inside the colon.
5. These diverticula may grow larger and larger and appear through and outside the colonic wall inside the peritoneal cavity.	6. The two major problems with (large) diverticulitis are a) bleeding and b) inflammation (=diverticulitis).
7. Ulcerative colitis is a chronic disease whereby the mucosa is inflamed, most often in sigmoid and rectum.	8. Crohn’s disease can occur in the colon but not as common as in the small intestine (see panels C4 and C5).
9. Polyps: abnormal local growths on top of the mucosa which can develop into cancer. In some families, there can be hundreds of these (familial polyposis). Surgical removal is then necessary.	10. Irritable Bowel Syndrome; similar to what may occur in the small intestine (see panels C8, C9).

F. Anal Canal pathophysiology

1. Fissures (cracks) in the skin and/or the anal mucosa, caused by accident, exercise or (lack of) personal hygiene.	2. Hemorrhoids are large enlargements of the veins, either from the internal or the external hemorrhoidal veins. These can be uncomfortable, itching, painful or even bleed. Then surgical removal is necessary.
3. Fistula: an abnormal tubular connection between the anal canal or the rectum with the skin and the outside world. Fistulas are most often caused by an abscess in the anal mucosa which has not been treated.	4. As it grows and grows outside the anal canal, it finally pushes into the skin in the neighborhood of your anus and punches a hole; a fistula! Surgery is the only way to close it and solve the problem.