Digestion: Upper GI
Anatomy and Physiology
Transcript

Hello, and welcome to the Institute of Nutritional Endocrinology's presentation on the Upper GI, Introduction in Anatomy and Physiology. I'm Dr. Ritamarie Loscalzo, and I'm very excited to share with you information about how the upper part of the gastrointestinal tract works so that you can help clients who are suffering from symptoms that indicate that there's an imbalance there.

Before we begin, let's just make sure that you're aware that any of the information I'm presenting here is not intended to replace a one-on-one relationship with a qualified healthcare professional, and it's also not medical advice. When you're presenting to your clients, you need to be really careful and make sure that they are aware that what you're presenting and what I'm presenting here today is intended as a sharing of my knowledge, information, clinical research, and clinical experience over many years.

I encourage you and you should encourage your clients to make their own healthcare decisions based upon your research and in partnership with a qualified healthcare professional. This is especially true for folks who are on any medications. I just want to make sure that the things that we talk about in terms of nutrition are not going to interfere with the protocol.

What I'm considering the upper is the esophagus. It's a no-brainer except when we talk about reflux. We don't have to do anything with it. I'll show you some pictures of it, but just understand that it's a tube, and it's going to contract the food down to the stomach.

We've got the stomach, we've got the pancreas, and we've got the top part of the intestine, this little loop here, which is called the duodenum. That's the only place where we digest. The rest of the small intestine is all about absorption. The liver and gallbladder we'll talk about separately except we'll mention the gallbladder as it's related to squirting bile at the earlier phases.

Your mouth is the gateway. Right? We talked about that before. It's, like, "Wow! Your mouth is the gateway right into your bloodstream." It moistens your food with saliva, and then your teeth mechanically break it down. You'll see you have a hard palate in the front. You've got a soft palate. The hard palate in the front is bone. The soft palate is cartilage.

Then you've got these salivary glands. They're a pretty good size, you see. We have three salivary glands. One's under your tongue, and that's the sublingual. One is under your mandible, which is your jawbone, and that's submandibular. Then the other is the parotid. Okay?

You've got your teeth. You've got incisors. You've got molars. The teeth need to be intact. We don't need to study the teeth right now. We just wanna use them. Teeth mechanically break down your food, and it takes stress off the rest of your system.

Chewing, only your mouth has teeth, so if you don't chew the food, you're going to see pieces coming down at the other end unless you have super, super, super strong HCl, hydrochloric acid, to break it down in the stomach. If it's not in the stomach long enough to break down those pieces, you're going to see them come out the other end.

You don't get all the nutrients out of the food when they're not chewed. If you see little bits of kale coming out in your poop, you didn't get the nutrients that were in there. You wasted your money. It just became expensive fiber.

The digestive process starts in your mouth when you properly chew. If you don't, if you just stick the food in, chew a couple of times, and swallow, your salivary amylase isn't going to have much of a chance to work on it. When you don't chew very well, you eat more quickly, you don't get the signal that you're full, you eat too much, and then you regret it.

Not chewing properly can lead to reflux because those particles coming down the esophagus can actually irritate it, can irritate the lower esophageal sphincter, which we'll look at in a minute, and cause it not to stay closed and allow the stomach contents to regurgitate up and cause reflux.

Then poorly chewed food can lead you to have gas, indigestion, heartburn, and irritable bowel, so it's really important to chew. That's why when we do cleanses, we do smoothies. That's why I recommend that you have at least one meal a day that's blended food so that you give your chewing a rest. I know you're in a hurry sometimes and don't have as much time as you'd like, so blending the food helps make up for the chewing.

I'm showing you this one just because I want you to see what happens when you swallow. You've got the food in your mouth here, and it's going through the mouth cavity. Down in the back is the epiglottis, but the epiglottis actually . . . see how we have two tubes here? We have the windpipe in front, and we have the esophagus behind it.

We don't want our food to go down the wrong pipe, as they say. I'm sure you've had that happen, where you start choking because suddenly there's a big bolus of food going down into your lungs. Your body's not going to let that happen, and you're just going to choke it up.

There's a little flap here. It's called the epiglottis. The epiglottis prevents food from going down the wrong tract. Right here it closes. That's where the epiglottis is. It's a flap. It flops down, and it covers it up. There's the epiglottis. See? It closes off.

When you're breathing, the epiglottis has to open, when you're chewing your food. That's why when you chew your food while you're talking or getting excited, you can run the risk of choking because you're talking, and your windpipe is open. You're breathing, and then you're trying to swallow at the same time, and the epiglottis can't close in time.

Your esophagus here is that long tube. Here's your long tube of your esophagus. You could see the trachea is in front of it, and it goes down to the lungs. The esophagus goes down. It's muscular. It's got muscular walls that contract and push the food down.

You could even swallow while you're standing on your head. Once you get it out of your mouth, it'll still make it down. It's hard to get it out of your mouth if you're upside down because it falls out, but once it's past the epiglottis, once it's down to the esophagus, you could be upside down, and it'd still get down to your stomach because . . . sh-sh . . . contract.

What's your stomach's job description? It's to mix and to churn your food into chyme. Chyme is the bolus of food. When you chew it, chew it, chew it, it goes down. It's called chyme. It's mixed with the digestive juices.

Your stomach is supposed to make stomach acid. There's different kinds of cells in here that will secrete acid into the lumen. The purpose of the acid, one of the purposes of the acid is to begin the protein digestion. Here's how that happens: you also secrete an inactive form of a protein-digesting enzyme called pepsinogen that begins the breakdown of protein, but pepsinogen can't be activated unless there's acid there.

If you have low stomach acid, and we'll talk about that, how to diagnose that, how to help your people with that, if the person has low stomach acid, they're not going to be able to digest their protein so efficiently because the pepsinogen doesn't get activated into pepsin.

The other thing that your stomach does is it makes intrinsic factor. The purpose of intrinsic factor is to escort B12 down to the distal ileum, where it gets absorbed. The B12 can't get absorbed unless you make intrinsic factor.

If you've got damage to your gut or if you've got a person who's had bariatric surgery, for example, and part of their stomach is removed, they're not going to have as efficient digestion as all this. They think they're just going to have a smaller belly so that they can't eat as much, but they're also missing function. They're missing function.

The other thing that the stomach does, and it's related to the acid as well as some other chemicals it secretes, is it kills the pathogens, and then it nudges the other organs. It signals the other organs to get ready.

Let's just take a quick look at the anatomy of the stomach. You could see where the esophagus is coming down. Okay? Here's your esophagus, and right here, right where I put my arrowhead, that's what's called the lower esophageal sphincter, LES. That's the LES, the lower esophageal sphincter. The purpose of the lower esophageal sphincter is that it keeps closed once this food has entered the stomach so that the contents of the stomach can't come back up.

We know and I'm sure you'll be seeing people who have reflux, GERD, heartburn, all names for the same thing where their acidic contents of their stomach has gone back up into the esophagus. While the esophagus has a mucous membrane, the whole digestive tract has a mucous membrane, it doesn't have the same level of mucous membrane as the stomach does, that really thick, rich bed of mucus, because it's not supposed to have acid in it. It's just supposed to have some light acids from your food that you eat, but lemon juice acid is nothing compared to hydrochloric acid, nothing. Okay?

Within here, you've got these folds. The folds have little mucus-secreting glands, and they also have places where the parietal cells are in there, which secrete your intrinsic factor. Then you've got these layers of muscle. The purpose of all these layers of muscle, the circular muscle, the longitudinal, the oblique, is for it to churn.

Since a picture is worth a thousand words and a video is worth probably a million, let's watch a little video that shows us what happens as the food goes from your mouth down into your stomach.

Video: *After you've chewed it, you push food to the back of your mouth with your tongue. That's a conscious act using voluntary muscles. The rest of the process is automatic. The epiglottis closes off your trachea, the tube to your lungs. This stops food from going down the trachea. Instead, it moves down the esophagus towards your stomach.*

Two layers of muscles surround the esophagus. When you swallow, they squeeze food downward towards your stomach. This steady contraction and relaxation is called peristalsis. It occurs throughout your digestive system.

Soon the food reaches your stomach. So far, very little of the digestive process has taken place, but now much more begins to happen. Like the esophagus, your stomach is wrapped in layers of muscles, but there are three layers of muscle instead of two. They also contract in a peristaltic rhythm.

The three layers contract in waves. This mixes the food with liquids that your stomach produces. These are gastric juices secreted by microscopic glands that line the inner wall of your stomach.

Stomach glands secrete two digestive substances. Cells called chief cells secrete an inactive enzyme, pepsinogen. Hydrochloric acid is secreted by parietal cells. The acid converts pepsinogen into pepsin, an active enzyme. Pepsin breaks down complex protein molecules into simpler chemical parts, but very little happens here to carbohydrates or fats. Their breakdown will take place farther down the line in your small intestine.

Then once the food is pushed, and it gets pushed, and it gets pushed down, and it gets down to the pyloric sphincter, then that's the connection to the duodenum. The pyloric sphincter is more of a true sphincter than the lower esophageal.

The lower esophageal is not actually a flap, but it's a muscular closing. It's a muscular contraction. It's right where the esophagus passes through the diaphragm. Sometimes you can get a problem with the diaphragm where your stomach starts to ride up above, and then the lower esophageal sphincter doesn't work at all. There are some adjustments and hands-on bodywork things that can be done if a person has that problem.

Let's talk about the stomach secretions. We already talked about the fact that there are mucous glands and mucous cells in there. They secrete mucus. How funny. Isn't that interesting? We also have acid that's being produced, and that's being produced by your parietal cells.

You also have the protein-digesting enzyme called pepsinogen. That gets produced by both the mucous cells and cells called the chief cells. Then there's an enzyme called gastrin, which is secreted just by the epithelial cells within the stomach.

Intrinsic factor, which is secreted by the parietal cells and intrinsic factor, remember, is the one that grabs onto B12. Think of it as a B12 escort, which is why a lot of people, even if they're taking B12, like in their animal products, if their stomach's messed up, they're not absorbing them. B12 deficiency is rampant even in people who eat a lot of meat and dairy products, which contain a lot of B12.

Then your stomach also produces ghrelin. Ghrelin is the signal that you're hungry. Ghrelin is the, "Hey, I haven't been fed in a while. I'm hungry," signal that gets produced. Ghrelin's interesting because ghrelin, once it starts to get out there, ghrelin actually stimulates growth hormone, which it says, "Well, okay, burn fat. Burn fat. There's no food coming in. I'm hungry." That's a good thing. Not that I want you to be starving all the time, but if you feel hunger, know that you're your ghrelin is stimulating your growth hormone and it's able to break down fat.

If you look at the stomach itself, there's the muscles again. The peristalsis is the name for the wave of muscular contraction. That's right here. It's the wave of muscular contraction that pushes the food along all aspects of the digestive tract. It's called peristalsis.

This other piece here is just an up-close-and-personal picture of the various kinds of cells in the stomach lining. You can see what can happen if there's an ulceration. I have a picture of it. You can see where these pieces would get broken down. That would be breaking down the stomach lining, which would be in the case of an ulcer.

Before we move on to those conditions and how to deal with them, let's look more at the anatomy. I want you to understand what happens with the pancreas. The pancreas is this little, long, finger-like projection. This is your pancreas. Right?

Your pancreas is a multipart gland. It's an exocrine gland, which means it secretes its secretions into a body part, not into the blood, and that's where it secretes the digestive enzymes into the common bile duct. It's also an endocrine gland. It produces insulin and glucagon that's not related to digestion directly and that gets secreted into your blood stream directly.

There's particular cells called the acinar cells that produce your enzymes that break down your starches, proteins, and fats and help all your fat-soluble vitamins like E, A, K, and D. These enzymes are classified into three groups: proteases, which digest protein; amylase, which digests starch; and lipase, which digests fat.

Another thing that the pancreas does is it secretes, mixed in with the juice that it secretes that has these enzymes in, it's got bicarbonate in it. Why is that? Your stomach functions at a pH of 2, 2, very, very low pH. If it's higher than that, you're not going to be very efficient. That's a very, very acidic environment.

Your small intestine, your duodenum, actually needs to be at a pH of 8 in order to effectively break down the food. Whoa! That's a huge difference, 2 to 8. How's it going to get there? You have this big, fat bolus of acidic food coming in from your stomach and dumping itself right here into your duodenum. Then what happens? It's all acidic.

If your pancreas doesn't secrete bicarbonate and if your gallbladder doesn't secrete bicarbonate to neutralize it, you can end up with burning. The burning is not in your stomach. It's in your duodenum. You can actually even get a duodenal ulcer if this goes on unattended for a while.

Pancreatic function is critical to the health of your digestive tract and to the health of the rest of you because it's important for you to get all those nutrients into your system.