SPEAKER: So we're going to talk about endoscopic ultrasounds. What is endoscopic ultrasound? Basically, you take a regular endoscope, you put a miniature ultrasound probe on its tip, and then you can use it at structures within the GI lumen. You can look at structures outside the GI lumen. And then you can direct needles and take samples and make holes and put stents in veins and all sorts of things.

So it's really exciting. But we're going to go over the indications today. We're going to go over the basics. You need to know when to consider endoscopic ultrasound and some of the contraindications as well.

So a couple of basic things. Frequency. So when people do transthoracic echos or do ultrasounds to look at fetuses, they're using a very low frequency. They're using a very low frequency because they need a lot of depth. They have to go through skin, potentially ribs. So when you have a very low frequency, your penetration is much higher but the detail is lost.

So that's why when somebody has a clot in the heart, transthoracic echo may not be good enough. You want to do a TEE. So then you're closer, you just have to go through the esophageal wall, and you can do a much higher frequency exam. So GI endoscopic ultrasound is basically 5 megahertz to 15 megahertz. When we're looking at the pancreas, 5 to 7 and 1/2 megahertz is great.

When you are looking at lymph nodes, the same. When you're looking at some structure within the GI tract, 7 and 1/2 to 10 megahertz is good but honestly now with our EUS scopes so good, there are a couple of presets, and we don't even need to switch frequencies anymore. Early on we used to be playing around and switching frequencies.

So we have the two basic workhorses for EUS. There's a radial scope and a linear scope. OK? So the radial scope, if you could imagine-- can I borrow your coffee cup please? If you can imagine this being the stomach or the rectum-- sorry if I put you off your coffee --but the radial scope goes down like this, and it gets the circumferential view of everything around there. So you can imagine if somebody has thickened wall on CT scan, you want to do a radial scope because you can look at the whole thing.

And then, as you push the scope all the way in and you're pulling it back, you're getting a circumferential view of the whole entire lumen. If you are staging esophageal cancer, rectal cancer, gastric cancer that's where radial EUS is of use. Now the problem with radial EUS is that it's first of all not designed for the pancreas, even though the initial studies at looking at criteria for chronic pancreatitis use radial EUS, you can't really do FNA. So we essentially don't use radial EUS for the pancreas at all anymore. It's basically for luminal stuff.

Now of course all the scopes have Doppler analysis. Now the linear-- that's the second and it's a busier scope than the radial just because we get so many PV indications. It's kind of designed like the duodenal scope if you have had rotations in ERCP. So it's kind of angled and the design of the probe is for the pancreas. Now you have to direct the scope left or right and you have to torque to direct it at the structure you're looking for.

So you're not going to get a circumferential view. So it's basically-- and this describes it really well. So this is ultrasound probe. This is the channel. This is the tip. It's like a bean coming out of a torch, but it's from the side, rather than the front.

The benefit of this is that through this working channel over here, you can put a needle out. And you can see that over here. And you can do aspirations, and biopsies, and then with a bigger therapeutic scopes, you can put stents and stuff as well.

Basically, this is an old scope that we don't even have anymore, but I kind of found it funny, because it's got this black out over here. But you can imagine seeing these structures over here. And this is an example of Doppler. You want to see if they are varices, and, of course, they are. So that's an example of that.

Now, many probes are small EUS scopes that you can put through the working channel of an ERPC scope, or a gastroscope. We don't really use them anymore. It's extremely unlikely. The last time I used a mini probe to put it up the bile duct thinking that somebody had glandular carcinoma. It was more than 10 years ago.

Now, this is important. And why is this important? This is important, because, first of all, this will make you understand everything about EUS. But even if you don't do EUS, there's going to be a bunch of questions on the boards about EUS, OK?

And they're going to use these descriptive terms. So if you don't know what hyperechoic is, what hyperechoic is. What an EUS looks dark, but then CT scan looks bright, and vice versa, you're not going to be able to answer the questions. So even if you're never going to do EUS, and on GI consoles, you just say call Kevin, or Ken, or whatever, for the purpose of the exams. And to score well on that, you need to know this, OK?

So hyperechoic, that basically means that when the ultrasound waves strike a structure they are all reflected back and recorded. OK, so the ultrasonic waves are not penetrating through that structure. And thus, that structure is going to look bright, OK?

So now when most of the ultrasound waves strike a structure and return, do not penetrate. And the structure looks bright, everything behind that structure is going to look dark, OK? And that is known as posterior shadowing. So the more hyperechoic some structure is, the more shadowing it is going to have, OK?

The second term that you need to know is hypoechoic. Now, hypoechoic on ultrasound means grayish, OK? Not black, it's grayish. Now, that means that some of the ultrasound waves are penetrating through and some are being reflected back, and the structure appears gray. So the structures behind it will be visible to you.

And then depending on how hypoechoic it is going towards anechoic the more and more ultrasound waves are going to go through. And you will get to a point where they'll be enhancement of structures behind it. So if you-- and I'm going to tell you why this happens.

So if you can imagine that the ultrasound waves are going through the GI tract, and then there's a big cyst there. And then all of a sudden, those waves are going to go right through. And everything behind the system's going to look brighter. So that is known as posterior acoustic enhancement, OK?

When the ultrasound waves are are not going through a very bright structure, there's shadowing. So what is it that decides that ultrasound waves are going to go through, and what is it that is going to decide that they're not going to go through? And it's basically water content. So if you have a vessel or a cyst, it's going to appear black, and it is going to be posterior acoustic enhancement.

If you have a structure that has absolutely no water in it, like a stone, a gallbladder stone, you will see a bright, very bright structure, and then there'll be complete blackness behind it. OK. it's just like if Adam were to stand in front of the sun, there'll be a shadow behind him. OK, I'm not saying he's low on water or anything, but that's an example I wante to give. And so anechoic would be if it's complete water content, vessels, and cysts, and things like that.

So what are normal wall layers? So a couple of things you need to remember, most GI tract wall layer thickness is two to four millimeters. It's not very thick. And the thicker ones are really the stomach and the rectum, partly because the muscle layer is thicker. And then in the stomach, there's a lot of redundant folds, this big folds it make that look thicker.

So this is the ultrasound. This is an example of a radial EUS exam, OK? And you can see there is fluid in this lumen.

This is the first layer, OK? And this first layer is the interface mucosa. OK, this is what you see. If you're in the esophagus, that silvery lining you see is this, OK?

Now, this second layer here, which is dark, is muscle. Now, this is bright, because there is no fluid in it. This is dark, because there is relative fluid in it. And this is the muscularis mucosa, OK? So all GI tract has two muscle layers. There's a muscularis mucosa, which is a very, very thin muscle there in the mucosa.

The third structure, the third layer, is bright, and that's the submucosa. And it's bright, because it's more fat and less fluid. And then the outermost layer of the GI lumen is a dark layer again. And that's the muscularis propria.

So when you're doing an EMR, or polypectory, it's OK to go to the submucosa. But if you start going deeper into here, that's when you're going to need a surgical consult. And this outermost layer basically is adventitia. It's the fat outside and then other structures that are pressing on the GI tract.

So what are the indications? So there are so many indications. Now, when I initially started giving this talk, I would try to fit it all in one page. And now I've had to break it down into multiple pages.

So initially when EUS was designed back in the 80s, and in Europe they were using it a lot, it was to look at submucosa lesions, believe it or not. It wasn't for staging of cancer, it wasn't for the pancreas, it was to actually look inside the wall layers, OK? But the number one indication is cancer basically. And the cancers for which we will be consulted for staging geoluminal cancers are esophageal, gastric, rectal, and ampullary.

Now esophageal and rectal are the dominant ones, because there is data that if you can stage it T2 versus T3 and one versus N2, there are implications as far as new adjuvant therapy goes, OK? In gastric cancer, you know, sometimes they want to know how many lymph nodes, because it's slightly different staging. The number of lymph nodes are very important. And then, of course, if you have an ampilary mask to see if it's just an adenoma, if it's creeping up the bile duct, even if it's not cancer, and then if it's invasive or not.

So suspected luminal cancer, so I got a lot of consults for Barrett's esophagus in which there is a nodule. And the question is, is it OK to do an EMR. The biopsy shows hybrid displays your intramucosal cancer. And the referring would be concerned. If I removed this, if it's going deep, will it lead to perforation number one? And number two, if it is cancer, and if it's truly T1, then I could be doing a curative thing. But if it's going into submucosa, OK, so T1B and T1A is a big difference.

If it's going into the submucosa, even though it's T1, T1B, there's a very high risk of lymph node metastases, even if not at that time, later on. So that person is not appropriate to just do endoscopic therapy. So we'll get it for that. And then, of course, you know somebody has taken gastric folds, and they want to make sure it's not an infiltrating linitis kind of picture.

Some mucosal masses, extrinsic compression, a lot of times, especially higher up in the stomach in the fundus is difficult to tell if it's the spleen or the splentic artery pressing onto the stomach, or if it's truly a mucous solution like a jest. So we are asked to evaluate that. OK.

Pancreaticobiliary, this is the bulk of our work staging an FNA and needle biopsy as well. Needle biopsy basically means that instead of having a bored out needle all the way, the biopsy may have like a little cleft in it, or like a little ledge in it. And it collects cells as you're moving back and forth, whereas aspiration you're just sucking cells into the needle.

Pancreatic cyst, other pancreatic abnormalities, somebody has had pancreatitis and there's some strange lesion, they're not sure what it is. Ampullary neoplasm, we already talked about. An extrahepatic cholangiocarcinoma, we can also evaluate that FNA that. If somebody has cholangiocarcinoma, they may be candidates for transplant, but you can change that candidacy if you stick a needle in the liver. So if you have an intrahepatic cholangiocarcinoma that you're doing in the EUS for, it's only to look for lymph nodes and FNA those lymph nodes. If you see something in the liver, don't touch it, because you may take away a treatment option.

And, of course, if somebody's LFDs are off, they came in the hospital, you think cholangitis, no, that if these are coming down, [INAUDIBLE] in the brain, can't get an MRCP, or some other problem, you do a quick EUS and see if there are stones in the bile dict. So that's one of the common indications as well if you're on inpatient PB service.

So non-GI, staging of lung cancer, initially it was primarily looking for lymph nodes. But since then, I've been doing quite a few primary lung mass FNA. Now, you can only do a lung mass FNA or fine nodule biopsy if it's actually on the [INAUDIBLE] side very close to the esophagus with no intervening lung. If there's intervening lung, that means there's air. You're not going to see it.

So initially, I was really worried about causing an hemothorax. Now, if you're in radiology, and you do it, and there's a hemothorax, you just put a pig tail in. That's a little tricky if you're in the GI lab. But thankfully so far, I think I've probably done somewhere between five and 10, and they've been fine.

And then, a lot of other FNAs, lymph nodes, I've been asked to FNA a clot in the portal vein thinking that it could be a malignant clot, patient has HCC, did well, strange lesions wrapped around the aorta, of the IBC done, so all sorts of strange indications. So your first knee reflex when you-- I'm so sorry-- would be that this is crazy, I'm not going to do any EUS on this.

But talk to your EUS attending. He will go with the scan with you, and you may be able to get a diagnosis, which by IR would be close to impossible. Because for very small lesions and tricky areas, EUS is wonderful. And we'll go over some examples as well.

So therapeutic indications, so the most common ones I think are celiac plexus neurolysis, OK? So we use to do celiac plexus blocks for chronic pancreatitis. Now in chronic pancreatitis, the pain can be so multi-factorial, and we don't really know where the pain is coming from. And the data shows that even if they get temporary relief, the pain does come back. And how many times are you going to do a celiac block on someone with chronic pancreatitis?

So this has kind of gone. Celiac plexus neurolysis is very effective in the early-- after the diagnosis. But the effectiveness of this is kind of lost if the patient has chemotherapy, but the chemotherapy also decreases pain from pancreatic cancer. So somebody's going to have new regimen therapy and is not having a lot of pain, you can wait until they get their chemo, OK?

Ablation is still kind of in the research realm. The problem with this is that when you do alcohol ablation, even if the cyst size has decreased, or even if the cyst has completely disappeared, you don't know for sure that that mucinous epithelium is completely gone. And the surgical specimens from these-- and studies show that it's rare that it's completely gone. There are areas that are still left, OK?

This is still in the research realm as well. So in addition to giving people chemotherapy, injecting a chemotherapeutic agent right into the tumor. Pancreatic cancer is kind of a systemic disease, so the benefit is going to be not great.

This is another established one, especially in some centers like ours, where they do a lot of CyberKnife. So we put these gold fiduicials into the pancreas, into the tumor, and next. And it's basically from guidance, OK? So CyberKnife is a very, very intense dose of radiation, so you really need it focused on the disease, not like, you know, a wide area with the tumor in the middle of it.

So we put these little gold fiducials loaded on the 19 gauge needle, and they act as homing devices for these. So when the patient is breathing, and the pancreas and the tumor is thus moving, the machine that is giving the intense dose can move with it and keep its focus on the tumor. So access after failure, CP is established, cystenterostomies is established, treating abscesses, is when you have an abscess that cannot be drained by IR, you can do it EUS guided.

The cases that are reported, the case series, are mostly for both diverticulitis abscesses. And they are essentially doing the same thing that radiology is doing is, where they put stents in and put drains in, and things. And if we have time at the end, I'll show you something that we have come up, or rather I have come up with that may be helpful as well.

So this is basically going to go over TNM staging. So if the tumor is limited to the mucosa, it's T1. If it's going into the submucosa, it's still T1, but it's T1B. Submucosa is T1A. Submusoca's T1B.

If it's into the muscalaris propria, which is the outer muscle band that we just saw, it's T2. If it's going through the muscle and outside, and we'll look at the EUS images for this as well, it's T3. And then, if the tumor invades adjacent structures, like the lung, or the pleura, or the aorta, then it's T4.

So this is an example of a T1. So this is the lumen. This is the ultrasound. You can see a little balloon around there. And you can see the tumor.

And so the muscalaris propria also has longitudinal and circular layers that you can sometimes see. So this is a good example where you can see both layers of the muscalris propria. But you can see that the tumor is limited to the submucosa's not going deeper than that.

Over here is an example where the muscle layer is full of tumor, but the border is really nice and smooth. So this is T2. And then over here, this is an example of T3. You see over here, it's contained within the muscle, then it's irregular here. Then it's penetrating through over here, and then there's a big, what we call, pseudopodia, little feet, or false feet, you can see this going on.

And this is another example of T3. This is an example of T4. So it's a big tumor. It's abutting the aorta.

Now, it's very difficult to tell. If you're put to [INAUDIBLE] scope down and pump air in, this may completely move away. So abutment doesn't necessarily mean invasion. But this is pretty sure where you can see the tumor breaking through the pleura over here.

So this is an example of T4 cancer. And then, of course, whenever we are looking at esophagus cancer, we're also looking at lymph nodes, so there are sort of criteria for calling a malignant node. But in the end, citology is the gold standard. So just because somebody has a big lymph node doesn't mean necessarily it's malignant.

So in general, if somebody has T3 disease and has big lymph nodes, we don't have any of them, we assume they're positive. If somebody is T1 and has a lymph node, well, that's an issue now. Is it truly a positive lymph node or not, because that has treatment implications. So you need to do fine needle aspiration on that.

So in general, big nodes round, dark, as in very hypoechoic, other criteria. If they are heterogeneous looking, they have hyperechoic [INAUDIBLE] foci, they're not round, but they're more elongated. Those are more likely to be benign nodes.

So rectal cancer is similar, as far as T1, T2, T3 goes. So this looks like a T1. Kind of getting close to the muscle over here, but still seems limited. But now this is obviously T3, where it's penetrating through.

So of course, it's not 100% accurate. And the most difficulty I have. Somebody has T3 disease, it's very easy, because you see the outer [INAUDIBLE] has T3.

But the T1, T2 is a big problem, because you don't know. It's in the submucosa. And now the tumor is dark and the muscle layer is dark. And is it just touching, it is penetrating it? So I think the EUS accuracy for T1 versus T2 is not as good.

And, of course, if there is inflammation, like somebody has pancreatitis, and then has a tumor there, and everything looks dark, and you're seeing a five centimeter abnormality, the tumor may just be two centimeters. Or vice versa, a lot of times, we FNA a tumor that we think is limited to the pancreas, but it's actually going into the retroperitoneal fat, and it's not as obvious. So inflammation makes a big difference.

So this seems to be a big favorite on the GI boards, submucosa lesons. So you guys really need to focus on this. So here you see a submucosa lesion. This is the interface mucosa. This is the muscularis mucosa. Then there is this bump over here and it's bright.

So this is an example of posterior acoustic shadowing. So it's bright, so water content is less, and there's a bit of a shadow behind it. So the only thing that is bright, just remember this and you'll get a bunch of questions right, the only struct-- only lesion that is bright in the GI wall on the EUS is the lipoma.

OK, now there can be a bunch of dark things in the GI tract. And then you really need to know which layer it's coming off of, OK? So over here, you're seeing the interface mucosa. You see the muscularis mucosa. You're seeing the muscular-- the submucosa, and the submucosa's pushed up.

But over here, you're seeing a communication. Can everyone see that? OK. So there is a hypoechoic-- I know it looks black, but trust me, it's not. It's hypoechoic, not anechoic. And it's arising from the muscle.

So now lesions in the GI tract that arise from the muscle are leiomyomas and GIST, OK? Now, can you differentiate between them by EUS? No, but you can play the odds.

So if it's in the esophagus, is more likely to be a leiomyoma. If it's in the stomach or in the rectum, it's more likely to be a GIST. Why is that important? GIST can turn bad. Leiomyoma's do not.

Now, you can take samples and you can stain for [INAUDIBLE], and TD34, and try and differentiate between them. But if it's really small, like this one, even if it's a GIST, you're not going to do surgery. So you can survey it.

So for those of you who were in grand rounds yesterday, here is a small recto carcinoid we do in the EUS. We see that it's not in the muscle. Seems to be contained within the submucosa. We put a band on it, we do an EMR. Rocky says don't do it.

[LAUGHS]

So now taking gastric folds, we get a lot of this. Rarely is it truly something sinister. So Menetrier's, just in large folds, linitis plastica. The thing about linitis plastica is that when you see it, the whole wall is dark, because this tumor infiltrating all the wall layers.

Now, sometimes the mucosa looks normal on endoscopy, but it just seems like the stomach is not extensible, and it's hard, and it's like rigid. And you need to do tunnel biopsies and multiple biopsies with a jumbo forceps to make a diagnosis.

AUDIENCE: Can you make a diagnosis linitis without biopsy? Sometimes they bring them back, they keep like snaring [INAUDIBLE]?

SPEAKER: Yeah, yeah, yeah. So I've tried multiple things. Kevin is a believer that you need to take a jumbo forceps and do multiple biopsies. A couple of times, I've done a mucosectomy, where you just snare a fold off and then you get deeper. But, of course, the complication rate goes up a little bit.

So you can imagine that the EUS scope is going through here. This is the esophagus. And you can see paratracheal area. You know the trachea cartilage containing air? You're not going to be able to look in front, anterior to the trachea. So if somebody sends you a patient with a lymph node anterior to the trachea, you're not going to be able to see it or sample it.

Left and right, tracheal nodes, subcarinal. Now everyone in this room, and everyone in the world, has a subcarinal lymph node. And it's a benign lymph node, and it's usually big, and it has a hyperechoic center.

But if somebody has cancer, you need to-- if you are going to sample a node, preferentially go for a node that is not subcarinal. Or unless it looks really abnormal and big, then you can sample that, because they're just so common. And then, of course, a lower esophageal station A, L, and M lymph nodes, AP window lymph nodes, these are all lymph nodes that you can sample. And this is important kind of for lung cancer staging and for esophageal cancer.

This is their diaphragmatic crust coming down. You can see this really well on EUS. This is the aorta. Can see the celiac trunk.

You can see the splendid artery going off this way, the hepatic artery going this way. So why is this important? We'll go over that a little bit in a minute as well. So the aorta-- and this is a mass over here that you can biopsy very easily.

You see this thing that looks like a seagull with its head chopped off? So that's the left adrenal. We can see the right adrenal as well.

The adrenal becomes important again with lung cancer and esophageal cancer staging. And And if somebody has a mat, you can FNA that. This is the needle going into it with a linear scope.

Mediastinal masses, now if somebody has a cystic structure in the mediastinum, OK, it's most likely a duplication cyst, or broncogenic cyst, or a forgotten duplication cyst. Do not FNA it.

You introduce an infection. These are benign. If it's symptomatic, your FNA's not going to really change anything. They need surgery.

If it's asymptomatic, you're not going to do anything. You're leaving it there. So there's a very high risk of infection. Don't be doing that.

And this is an example of a mixed solid and cystic lesion in the mediastinum. This is the cystic part, anechoic, hypoechoic needle. So talking about perigastric anatomy, so you're looking at somebody just head on with your eye at the level of the epigastrium. You have picked the liver up, you picked the gallbladder. This is the stomach. You can see a bit of the pancreas behind it.

So as the EUS scope goes down, you can look at the liver, the gallbladder, the bile duct, the vascular structures coming off the aorta, the pancreas. You can see the kidney, the spleen, so on and so forth. And this is the stomach on as well. So you can examine the whole pancreas really well, sample any area.

This structure here, the [INAUDIBLE], it can be a little bit tricky, OK? So you may need to push the scope in different directions. And that's kind of beyond the scope of this talk.

Skip that. Old image, but kind of a nasty pancreatic cancer over here. This is the bile duct. The bile duct's dilated. This is the portal vein. You can see the tumor invading into the portal vein, with the clot extending up it.

So what is the accuracy of FNA? I think the accuracy of FNA is actually more than 80% now. But some structures like GIST, in the selling of chronic pancreatitis, or acute pancreatitis, because it's a pancreatic tumor, if there's a lot of inflammation going on, the cytologist-- I mean this is more of almost a more of a cytology issue than a GI issue.

Liver mets, and lymph nodes, the yield is pretty good. The diagnostic accuracy is pretty high. Pancreatic cyst, just because they're mostly is cellular, cytology is extremely rare. That is going to help you unless there is a solid component. Complication rate in general, what we call patients is 1% for fine needed aspirational biopsy, and that in the pancreas is pancreatitis.

So looking at other structures, this is a dilated pancreatic duct. And this is the stone. So remember we talked about something that is really bright and there is a shadow behind it. You can't see anything over here, but now this is the pancreatic duct. And this is fluid filled.

So the structures behind this are really bright. This is another example. This is a cyst with a needle in it.

Now look at this, there's no cyst here. So this is normal echo. This is posterior acoustic enhancement.

This is another exam-- another example of the bile duct with small stones in it, with the radial scope, the portal veins over here on the side. Now, just very quickly about pancreatic cyst, so there are a bunch of different kind of pancreatic cysts. OK, there are many of them.

But for your purpose, you need to know, as far as pancreatic cystic neoplasm's go, three [INAUDIBLE]. If you want to know more about them, we, I think, [INAUDIBLE] wants me to give a talk next year about that and we'll go over them. So serious cystic tumors, OK, these are benign lesions, but they can grow. They happen in men and women, can be anywhere in the pancreas, and they can grow to a huge size without causing symptoms.

Now, some people say you should take them out before they become too big, because ultimately, in a young person, they will get to the point where they will cause some symptoms, including pancreatitis, because they're pressing on the pancreatic duct. So the symptoms are going to be because of space occupation. Some people say they're benign, you shouldn't do a major surgery for a benign lesion, OK?

Now if you want to diagnose these on CT Scan, it's usually a large lobular or small lobular lesion. But you can see like septations. And sometimes, there's a central scar or calcification as well. So this is actually a very diagnostic image for a serous cystic tumor.

On EUS, you see this structure. This is what a normal pancreas looks like. And then over here, you have some bigger cysts. And then over here, you've got tiny cysts. So it almost looks like a sponge here.

This is diagnostic of a serous cystadenoma. I will not sample this unless the surgeon who is sending the patient to me is going to say, well, that's your opinion. The radiologist says there is a neuroplasm, so maybe I should do surgery. So he wants more than just my opinion. Then, I need to do a fine needle aspiration.

Now, when we suck food out, it's almost always bloody, because you're breaking these little septations. But if you were able to just get fluid, the food's going to be really thin. Cytology rarely helps, but if it does, the glycogen rich cuboidal cells. And if you do mutational analysis, or NGS, on this, they'll be a mutation involving via gel on chromosome R3B.

Now MCN, to make the diagnosis of an MCN, you need ovarian stroma. And they only happen in women. We still get these, you know, surgical specimens for men, and it says [INAUDIBLE]. No, it's not, it's an IPMN. They just got it mixed up.

So these happen in women, typically in the body or tail. It may be unilocular, or it may have some septations. I like to show these images, because this is a cartoon.

And this is an upside image of almost this structure. Doesn't it look exactly like that, even with the separations? So random isn't it.

So with the serous cystic tumors, you can have the central calcification, or scar. These can have an actual calcification, or peripheral calcification. And there's some data that suggests that if you have that, the risk of malignancy is higher. Now, these should be resected if you diagnose them, since they typically are found in middle aged women. And there is a significant risk of cancer developing.

But a lot of times, these are very difficult to differentiate from branch duct IPMM So from a clinical and practical standpoint, we almost use the same criteria that we use for branch duct IPMM to folitor, to follow and monitor-- that's a new word, folitor, follow and monitor-- these lesions. Now, when you FNA these, now in serous cystic tumors, the CEA, which is a tumor marker, is usually very, very low. In these, the accuracy of CEA is approaching 80% if it's over 200.

Now, the range for every lab is different. So in our hospital, 70. In the CPC, [INAUDIBLE] years ago, it was 179. Some other labs may be different. So you can't go by the literature. You need to figure it out for your own lab.

So it's kind of tricky. If you do mutational analysis, a [INAUDIBLE] is also diagnostic, but it could also be diagnostic of an IPMN. But that does not necessarily mean that it's malignant, OK?

Now, IPMNs, this is an example of a main duct IPMN, of course, which is the high risk lesion. Now, this is a bad one, because it's longstanding. How do we know that? There's no parenchyma left. It's on a duct.

The duct's really dilated. And then if you look, there is cancer growing inside the duct over here. This is mucus and fluid, OK?

This is an example of a branch duct IPMN, where the main duct is really normal, and then you have got this cluster of small cysts over here. Now, these are the low risk lesions. This is the high risk lesion. If you have a reasonable surgical candidate, 10 millimeters, or solid component, or nodularity, or symptoms, these are all the risk factors for malignancy, and thus indications for resection.

These, again, are low risk, so size over three and a half centimeters, even though I'm following people with four centimeter cysts. If there is a solid component or if there are symptoms, those are some of the things that we worry about. Or if the main duct starts growing over here, then you start growing a mixed type IPMN. And then that is a risk factor as well for malignancy developing.

CEA in this is high. If you stick these or this, sometimes you'll get thick, viscous fluid, which is also pretty diagnostic. If you do next gen sequencing, GNS is extremely specific. [INAUDIBLE] is specific. Sensitivity is 50%. GNS sensitivity is 50-60% as well, OK? Now if you find other mutations like B53, and B16, and stuff like that, they may be the indicators of a higher grade displagia, or cancer going on, but that data has kind of limited. A lot of it is from our sector.

So we're going into-- in the indications now, we're going into celiac plexus neurolysis. So this is the probe. We're just into the stomach over here. Now, many, many years ago when we started doing EUS and fine needle aspirations, and so on. For Mike Leavey at Mayo Clinic were doing EUS mode of sedation. And he thought that people with cancer had lymph nodes in the celiac area, so he was FNAing them.

And the patient would tolerate the whole procedure perfectly, except when he would stick a needle in this lymph node, what he thought was a lymph node. And the patient would jump. They were not under propofol, so they would jump. And we need to give him more, and all this kind of stuff.

And then on the aspirate, he started seeing some nerve fibers in there. And that's when we realized that on EUS, we can see the celiac plexus. So now when we do neurolysis, if we see the celiac plexus around here, we will directly ablate that with a local anesthetic and alcohol.

So this is an example of the aorta with the celiac trunk coming off. And you can see the needle going over here. Now, the closer you get to the-- yeah, I know-- the closer you get to the celiac trunk, the higher your yield is, the more chances that you will ablate those nerve fibers that are just wrapped around it.

So you want to get really close, but what you can't have happening is the patient moving, and you're distracted, and dancing to music. Because if you do that-- so there have been severe complications, including infarction of the small bowel. Because if you inject alcohol into their SMA or the celiac, you can imagine what's going to happen. Now, the other thing you need to worry about is so some people to avoid this have said, OK, we're just going to inject on either side of the celiac trunk. We're not going to put the needle right here.

Now, if you're doing that, once you have the needle out, do not move this hand, because it's a sharp needle. And you're like, oh, so where's the celiac trunk? You do this, and the needle goes like this. And you're right on the trunk. You can transect it, so you don't want to do that.

So this is like one of our sexy things that is going on now. I've been getting a lot of consults to evaluate abscesses in people's pelvises, and then recently, one in the liver as well. And the question was could you treat this?

Now, what endostenographers around the country have been doing, and this is from the radiology literature, we would put a stent in and we will put a drain in. But since the radiologist can't do it from the outside, we've got to do it from the inside. So pigtails, so you've got a communication between the rectum, or the sigmoid, and an abscess.

Now, the abscess, of course, is dirty, but the aim is that the abscess cavity is going to be clean at some point. But now you have a track. So what they're also sometimes doing is putting in nasal cystic for liver, or for pelvic abscesses, a transanal drain, which is hanging out.

And then when you send the patient home, somebody coming and flushing it, and all that kind of stuff, which sounds crazy, but it's a translation of the radiology literature. That's how you treat it. So the first time I was asked to do this was a couple of years ago I said I'm not making a tract, and I'm not doing this crazy stuff. I will irrigate it.

So what I did is I irrigated it until it completely became clear. And my hypothesis is that why does it have to be weeks? Why can't we just do it in 20 minutes? If all the pus is out, all the pus it out. I mean, even with the drain, you're not going to be 100% sure that you've got everything.

And I injected antibiotics. I don't know if it's doing anything or not, but gentamicin you can get in really concentrated forms. it's 40 milligrams per ML. So if you have like a three centimeter abscess, you can put like 200 milligrams of gentamicin right into it.

So this is the patient who had appendiceal abscess. Now, don't think that I went all the way to the cecum for this. The sigmoid goes close to it, so I did it from the sigmoid. This is the abscess and this is the needle. And so you do an equal volume lavage.

This is not standard of care. This is just what we have been doing. So this is not going to be on the board. So you lavage it until it's clear, all the pus is gone, and a [INAUDIBLE] inject antibiotics. And this is, I mean, there's nothing here now. So this is something we're working on that I think is going to be good.

So we have a bunch of questions. Now, I want to make myself look good., so I'm going to make sure that you guys know the answers to this if there's going to be a post or quiz. So rather than me pick on people, we are going to do a yes/no. And then those of you who think yes, raise your hands, OK?

So a 66-year-old man with liver disease and had an EGD by Dr. Rabinowitz and found an enlarged fold in the gastric fundus, he says rule of varice, Appropriate for EUS? Everyone agrees, OK?

70-year-old female with a three centimeter submucosa lesion in the cecum seen on screening colonoscopy, but Dr. Franz says he wants an EUS. Yes/no? Why no?

AUDIENCE: Too far.

SPEAKER: Too far, very good. Can't do it. And besides, can you imagine? Cecum is huge.

Can you imagine the stool in the air and everything? I mean, how would you even do it? I've done a couple of times I've put the colonoscope down and put a mini probe. You can't see anything.

So a 55-year-old male with a three centimeter rectal cancer, and CT shows no mats, no lymph nodes, nothing. And the colorectal surgeon wants a rectal ultrasound, yes or no? Yes, so you either need to do an MR, or in EUS, to do T staging. And CT's not great for small lymph nodes.

44-year-old female with [INAUDIBLE] pain, fever, jaundice, gall bladder stones, and a 15 millimeter CBD on CT scan, but no stone in it. EUS?

AUDIENCE: [INAUDIBLE]

SPEAKER: Has coils in the brain.

AUDIENCE: Oh.

[INTERPOSING VOICES]

SPEAKER: Straight to ERCP, right? Very good. So a 78-year-old male with jaundice, weight loss, bile duct dilation, this, believe me, says normal CT.

AUDIENCE: Yes.

SPEAKER: Yes, most likely is going to have a small pancreatic cancer. That's not. So for tumors smaller than two centimeters, CT is not great. I can't tell you the number of times I've found liver mats CT negative. And that completely changes obviously everything for the patient.

AUDIENCE: The thing about the [INAUDIBLE] is that standard of care to do that now.

SPEAKER: So you can do either MR or RUS. And a lot of times, I've seen surgical preference deciding which way to go. Some surgeons ask for both. So this is the kind of stuff that's going to be on the boards, OK? So these are your options, lipoma, leiomyoma, linitis plastica, polyp, and carcinoid. And you are going to tell me which one goes on which line, OK?

66-year-old male with a eight millimeter hypoechoic lesion in the submucosal layer of the rectum. Carcinoid [INAUDIBLE]. OK.

Seventy-year-old female with diffused hypoechoic gastric body wall technique two centimeters, normal is four millimeters, can complete loss of [INAUDIBLE] architecture.

Very good. 36-year-old female with a 15 millimeter hypoechoic mass arising from the muscularis propria of the [INAUDIBLE]--

AUDIENCE: Leiomyoma.

SPEAKER: 51-year-old male with the two centimeter hyperechoic gastric anterior lesion arising from the submucosa. Hyperechoic.

AUDIENCE: [INAUDIBLE].

SPEAKER: Very good. 50-year-old male with a nine millimeter isoechoic lesion arising from the mucosa layer of the rectum. You guys are so good. Or maybe it's just a good talk I think. OK, so we need to know what these lesions are, OK? And you can pick from here.

66-year-old male with six small lesions spread throughout the pancreas, eight millimeters to 15 millimeters, and they're anechoic. Which one? Which IPMM?

AUDIENCE: Branched out.

SPEAKER: Branched up, very good. 70-year-old female with a three centimeter irregular hypoechoic lesion in the head of the pancreas. Hypoechoic irregular.

AUDIENCE: [INAUDIBLE].

SPEAKER: [INAUDIBLE]. So there's no question, right? Because here is this adenoma. It's not going to be anechoic. It's going to be multicystic. MNC is going to be anechoic. Branched out IPMM is what I mean, so it's hypoechoic. So it's tumor, or it could be autoimmune pancreatitis, or pancreatitis, but it's not going to be a cyst.

56-year-old female with a 35 millimeter thick walls septed and anechoic lesion in the tail of the pancreas?

AUDIENCE: [INAUDIBLE]

SPEAKER: MCN, yeah. So this is not up there. 51-year-old female with a 55 millimeter asymptomatic lobulated, multicystic, multiple timing. Very good. OK. So you guys can just read that.