TODD BARON: We're going to talk about options after stent placement for walled-off necrosis. And so the options after stent placement, it's important to realize that there are multiple options that are available with pros and cons of each approach, and we'll discuss the pros and cons. And it's also important to realize there are no standardized approaches. A lot of this is either tailored around the patient and/or their CT imaging and/or the center in which they're being treated, which have various methods of approaching these patients.

So here is a, sort of, an overview slide about the various options that are present. We'll start from the top to the bottom. So the first option is you place the stent, and you do nothing, which doesn't, obviously, mean doing completely nothing, but it means taking the patient off of proton pump inhibitors because we believe that acid secretion into the collection helps to actually debride some of the necrosis. And since most of these procedures are done through the stomach gastric wall, then acid works, presumably, in your favor. And then not performing necrosectomy unless symptoms do not resolve, or the patient clinically worsens.

So the things to watch out for in that approach are potential risk of infection and stent occlusion by debris. And there are no data supporting the impact right now of taking patients off of PPIs. There is potentially an increased risk of bleeding, although I think that risk is probably very small. There's also, of course, the risk, if the patient has poor gastric emptying, that they're going to have severe reflux symptoms that go untreated without PPI therapy.

Second option is to perform some sort of irrigation. And so the options are to actually just do irrigation of the index procedure meaning that you might drive into the cavity, lavage through the scope, because as you know, most endoscopes have a water jet irrigation system, and/or you obviously can flush placed diluted hydrogen peroxide, and/or some centers will do antibiotic installation in the cavity.

So the watch outs on this part of the equation would be not to dislodge a stent if you're entering the cavity at the index procedure. We'll talk a little bit about that. And that you need to ensure the patient will tolerate nasocystic catheter placement. If you notice, some patients have been intolerant in the past. For example, the nasogastric tubes or nasos of juvenile feeding tubes and have been known to pull out their tubes, then you may not want to proceed in that direction.

And then the third option is mechanical debridement. So this can either be done upfront and/or repeating as necessary based on the patient's clinical improvement. And the downsides and watch outs of this approach are the potential for bleeding and dislodging the stent or separating from the GI tract during this sort of process. The other that I didn't mention on this slide, is that it's also possible to cause a perforation of the opposite wall of the cavity when you're doing these debridements. And although that's a fairly uncommon circumstance, I have seen that of causing a perforation opposite to the stent by doing aggressive debridement.

So here are the options we mentioned, and a little bit starting on the left. So whether to dilate the stent immediately upon placement is also very individualized. So some people believe that you can accelerate the process, even if you're not going to drive into the cavity, by dilating the stent. I personally do not do a post-dilation at the index placement unless I know I'm going to drive into the cavity.

If I'm going to use the watch and wait approach, I will assume that that stent is going to expand to its full diameter probably relatively quickly, probably even within the first 24 hours, although, obviously, we don't know that for sure, but I'm pretty confident you'll get full expansion fairly quickly. But certainly if I'm going to do direct necrosectomy at the index procedure, I will dilate the stent. And I will dilate it with a CRE balloon using the 12, 13 and 1/2, 15 balloon up to the maximum diameter of 15, which is the diameter of the stent we're talking about.

And then finally, irrigation would be, again, to place a nasocystic tube. Now, my approach has evolved. And in general, this slide lays out my approach. So I usually, again, place the AXIOS. Always the 15 millimeter when we're talking about walled-off necrosis. And I usually do not perform balloon dilation at the index because I've gotten away from doing immediate entry and direct necrosectomy.

Obviously, if something happens in between, we usually re-image them, and then we'll do some sort of intervention. And I always have the patient on antibiotics. So some of these patients that have suspected or known infected necrosis will be on antibiotics prior to the procedure. You'll want to continue antibiotics in the post-intervention. But similarly, in patients with sterile necrosis, we know that we're infecting that and contaminating it with our procedure. So those patients, I give pre-procedural antibiotics, and I will also continue those until I at least get my first follow-up imaging study at a month.

OK. If the patient is having continued improvement. So I placed the stent. I haven't done anything else. I will re-image them again in four to eight weeks, and then depending on the CT MRI, I'll talk about when to do the stent removal. And I remove this, the AXIOS, when the collection is either completely resolved, or if it's very, very close to a complete resolution, and the patient is doing well. Because most patients can do well even with limited amounts of necrosis.

Again, I tend to continue the p.o. antibiotics until the time of the stent removal. But there's not good evidence and data to support how long you would keep someone on antibiotics prior to a stent removal. And I'll replace the AXIOS stent with double pigtail stents if I think the patient has a duct disconnection. So patients with disconnected pancreatic ducts, either suspected or known based on imaging, meaning MRI or, for example, they had an ERCP, and they have a major ductal disruption, and I want to place a stent long term, when I remove the AXIOS, I'll place double pigtail stents.

Of course, I will re-image the patient with either, again, CT or MRI. And we can talk about that maybe on the question answer of which one to get. I usually will then do a direct endoscopic necrosectomy through the existing AXIOS with or without removal of the indwelling 10Fr stent, because I think there's slightly less risk of dislodging the stent as opposed to when you use a therapeutic forward viewing endoscope where you have less tolerance.

And, you know, we're going in at these odd angles, which may be also a reason that it gets dislodged is that you've got maybe a 12 or 13 millimeter endoscope going into the cavity. The other thing about re-imaging or CT, and I'll show a case that demonstrates exactly this point that I'm trying to make, is that if there's a collection that is in continuity and undrained, and now has new air in the collection. And, again, this might be, wordwise, difficult to understand.

But sometimes we think there's one collection, and it often is one collection. But sometimes it behaves as two separate collections because we're talking about something three dimensionally that's not perfectly round, that may be septated. They may be small connections between various points within the same collection, and you intervene on the major part of it, and yet there is a large segment of that that remains contaminated but undrained.

I don't know if I have a probably, well, pointer wouldn't help. But basically, if you're looking at the CT, there's the gastric air bubble is the really dark part in the middle of the slide toward the upper. That's the stomach. And then to the patient's left is a round collection. And then in the patient would have been posterior on the patient, is this area, another area of walled-off necrosis.

And it looks like there might be a tiny isthmus that connects the two. So we went in and did an endoscopic drainage. And my ultrasound, the one that was the easiest to get, was that lower one on this slide. And so this is a coronal CT of the same patient pre-procedurally. And so what you're seeing, again, is these two kind of separate collections that probably arose from the same process, or we know rose from the same process.

So on your left, is what turns out to be the collection that we drained initially through the stomach. On you're right, is this other collection that we thought, well, the two probably communicate, we'll drain one, we'll see how the patient does. So the patient was readmitted.

And you can see that on this slide, now the big, the really dark air is where the first collection where the AXIOS is sitting, and it's really very little left in that cavity. There's no obvious huge amount of solid debris. But that other part of the collection we talked about that we didn't drain now has air. So the reason that air got in there is the two communicate, but you're not effectively draining that one even though they do communicate.

And here's the follow up CT scan a month later with both AXIOS's in place. You can kind of see one better than other, but complete resolution. The patient was an outpatient. So we didn't do any direct necrosectomy, we just added a second stent in that patient.

Now, I'm going to introduce something called the endoscopic step-up approach. Now, you may or may not have heard of the step-up approach. This is a term that's used in a lot of medicine where you start at one level with your therapy, and this can be medical therapy, for example, IBD or anything, and then you ramp it up.

And this has actually been described with necrosis, but more in a percutaneous approach and not an endoscopic approach. So this was presented when we were at UEGW last week. I'm told that it was accepted for publication in *GI Endoscopy* by the group from Nagi Reddy based on data using the Nagi stent, which is also a bi-flanged stent that's 16 millimeters.

So they indexed procedure. They placed the stent. They did no additional therapy. They also did not routinely place anything through their stent. If the patient had no improvement or was worsening, they reassessed for a stent occlusion. And if they saw occlusion of debris inside the stent, all they would do is simply remove that debris from the stent. They didn't do any aggressive debridement, they just cleared the stent out.

If the patient had no improvement or worsened again, they placed a nasocystic tube with irrigation. And then if they didn't improve, they went to direct necrosectomy. And I don't have all the numbers from the presentation, but the majority of them improved at step one. And then a subset of those required two, and ultimately the third step in there.

But using this approach, they had, I think, I want to say it was a 96% nonsurgical successful resolution. So that would be another approach managing these patients. And in a way, our practice is sort of like that in that if we don't get improvement, although we don't just debride the stent, then if we decide we're going to do an intervention, we go back and do direct necrosectomy.

I would say the other thing to think about is the approach to the extremely ill WON patient. Now, that patient I might be more aggressive on my therapy up front because by definition, that patient is extremely sick, septic, and you may say well, if we place a stent and we're not aggressive, and the patient doesn't do well, they may not survive, for example. So an extremely ill patient, I'm more likely to immediately do direct necrosectomy.

So this is what we mention upfront if you're going to do that. Place the stent, balloon dilate, direct necrosectomy with the goal to remove all the fluid. Because I think that while we get really tied up into getting out the solid debris which is clearly the end point. What makes some of these patients really, really sick is more infected fluid than solid, and fluid can be more easily evacuated.

So I try to get all the fluid component evacuated and then take some, depending on case volume, how the patient is doing, debride as much. But I'll probably do more of a limited necrosectomy using a braided snare. We're talking about a cold snare technique. And then, I only really only occasionally use now nasocystic placement in selected patients because it's poorly tolerated.

Now, the other thing to talk about is what's called paracolic extensions. So when we drain walled-off necrosis endoscopically, we're dealing with what's called the central part of the necrosis. That's what's really close to the duodenum and close to the stomach. But the pancreas lies in the retroperitoneum, and this area around both sides of the colon, the necrosis can spread in what's called the paracolic gutters. And so those areas are not, while again, might be and often are in direct continuity with the central component, when you drain the central component you may or may not be draining these long paracolic gutter extensions which go all the way down to the pelvis.

So in that case, if there's no improvement after the AXIOS, and the major component is either one or both, it can be on one side or both sides, then I will probably, after imaging, if I'm showing that I'm making progress on the central part, then I'll ask my interventional radiologist to place a percutaneous drain on one side or both sides, and generally then use that for irrigation. Because we know, again, that it will connect back up to the central part, so getting these drains in place gets the fluid out, and then you can irrigate back up, and it'll make its way through into the stomach.

Role of nutrition. Often we're asked when do we allow the patient to eat? I feel like if the patient is able to eat even the same day of the procedure. Let's say I do the procedure in the morning, and the main reason they're not eating is they have gastric outlet obstruction or major gastric compression.

If I feel like I got a very good decompression later that afternoon, evening, and the patient feels hungry, not vomiting, then I will actually introduce feeding. If the patient is hungry and not vomiting. If they're not able to eat. So they're not vomiting, but they just don't have the urge to eat, then I'll place a nasogastric tube or nasojejunal tube.

So really, I only add the tubing if they say, well, you know, I'm not vomiting, I probably could tolerate food, I just don't feel like eating, and you don't want to force the patient to eat. And then finally, I only use parenteral nutrition, or what's called TPN, total parenteral nutrition, if enteral nutrition fails, because we know that total parenteral nutrition or parenteral nutrition through an IV or a large-bore catheter is associated with more complications, infectious complications, and so therefore, I limit at that.

Our first question from the audience. Do you image these patients more conservatively than you did prior to LAMS?

Yes. So when I first started treating patients with necrosis, I was often imaging them. And I still see other physicians say, well, get CT in four or five days or a week. And I think a couple of things you got to keep in mind. Some of these patients are very young patients. And I've been to talks to even when radiologists talk. They are the most imaged patients.

From the onset of their pancreatitis, they get so often CTs that one of the concerns of over imaging not only is cost, but radiation exposure. And this doesn't just dissolve and miraculously go away. So you sort of have to trust your clinical judgment knowing that either when you're trying to get a CT or imaging set to reassure yourself, if the patient's doing better, you're probably not going do anything with that information.

So I think rather than over image, I would under image. And that's why you might want to select using MRI. Even though, for us, as gastrologists, MRIs, we don't interpret as easily as CTs because our eye is much more trained to CT. When I've talked to a radiologists, they feel like they get the same amount of information from an MRI as they can from a CT in these patients. And, again, the radiation exposure is not a concern. But back to your question, the answer is yes, I'm doing less, sort of, routine and frequent imaging than I did in the past.