[MUSIC PLAYING]

SHYAM VARADARAJULU: Good evening. It's a pleasure being here today to talk about the endoscopic management of walled-off pancreatic necrosis, with a particular focus on endoscopic necrosectomy. So as you can see here on this cross-sectional imaging, walled-off pancreatic necrosis is a complex condition where the pancreas is extensively inflamed and you can have severe necrotic changes in the pancreatic parenchyma. And these liquification changes in the pancreatic parenchyma can be either pancreatic or can be extrapancreatic with a fluid collection cracking through the flanks and the [INAUDIBLE] pancreatic regions.

And you can see, as illustrated on these dark red arrows, there's a very slim residual pancreas and it is all completely surrounded by liquification necrosis. And management of walled-off pancreatic necrosis is quite challenging. As you can see here on endoscopic ultrasound, there's extensive degree of necrosis, and amount of debris can vary from case to case. In some patients you will have complete liquification and in others, as seen here on sonographic imaging, the percentage of necrosis can vary anywhere from 10% to 50%. It is very important to assess the amount of solid debris and manage the patient appropriately.

In this particular case, a patient underwent unsuccessful endoscopic drainage, leading to infection. And at surgery, this was what was left of the pancreas. So it's very important to have a strategic plan before managing these patients. And this is one of our earlier experiences in the management of walled-off necrosis in 76 patients. And as you can see here, that irrespective of the type of technique that is being adapted, whether it is a conventional drainage or multiple transluminal gateway technique, what we call MTGT, and whether the patient has a pancreatic stent or not, the treatment success rate was only 70%. In 30% of the patients, at least in the year 2013, we had a technical frequent failure that warranted a surgical intervention or adjuvant interventional radiologic treatment.

Also, as seen by this data, these patients have a prolonged hospital stay that can vary anywhere from two to sixteen days, and the number of interventions can be anywhere between one to four, depending on the quantity of necrosis within the collection. So the concept here is, better drainage is important for a successful outcome. Inadequate drainage leads to infection that, in turn, will require aggressive necrosectomy, and if that is a failure, leading to surgical interventions.

And in walled-off pancreatic necrosis, what we will be focusing today is: When is trans-mural drainage alone sufficient? What are the indications for necrosectomy? Is there a way that we can predict which patients will require necrosectomy or other adjuvant interventions? What are the techniques that are most suitable for drainage of fluid collections, particularly clearing the cavity of necrotic contents? What are the pitfalls that we need to be aware of? What is the role of lumen-apposing metal stents in treatment algorithm? And what are the new concepts we may have in the follow-up of these patients? I will try to address each of these questions in the following slides.

So the first important thing is to focus on the selection of technique, and this is done by risk-stratifying the patient. So when is drainage alone sufficient? In a significant proportion of patients we have seen, that just placing a transluminal stent or a nasocystic catheter alone will lead to successful treatment outcome. There is not much of data, except in one manuscript that has been published in the year 2014. This was a study from India where they clearly showed that if the percentage of necrosis is less than 10% within a cavity, you require only one session of drainage. If the percentage of necrotic contents is anywhere between 10% to 40%, patients will require more than two to three drainage sessions. And if you've got more than 40% necrotic contents, this patient will very likely require some sort of necrosectomy to be performed. And so, the extent of necrosis is predictive of the type of intervention that may be required.

The second study is a randomized trial that is well-known. This was a study that was conducted in the Netherlands, where 88 patients with walled-off necrosis were randomized either to surgery or the step-up approach, where patients initially underwent percutaneous drainage followed by laparoscopic depletment. And what you will find is that in 33% of patients, just percutaneous drainage alone resulted in a successful treatment outcome. So the bottom line is, if you have got a predominantly liquid component within the cavity or minimal solid debris, which can be less than 10% to 30%, then these patients can be managed with transluminal drainage. If you've got more than 30% necrosis, it is more than likely that we will require some sort of necrosectomy.

So when is necrosectomy indicated? Some physicians would perform an endoscopic necrosectomy at the very index procedure, and others would wait. After transluminal drainage, where the patient does not respond well to treatment, they will proceed with a necrosectomy. In clinical experience, if you have got symptoms that is manifested by sepsis, a sudden inflammatory response syndrome, or an organ failure, or failure to thrive, then these patients may undergo necrosectomy at the index session. Or if you have got more than 30% necrotic degree, or if you place a stent and there is inadequate drainage, then the endoscopist will proceed to perform a necrosectomy at the very first treatment session.

Others may wait. Following transluminal drainage, if the patient has persistence of symptoms, persistence of walled-off necrotic cavity with necrotic debris within them after the index drainage, then on the second session, these patients will undergo endoscopic necrosectomy.

And when do you re-intervene? Being able to intervene, but after you perform a necrosectomy, when do you go back and perform repeat interventions? This is usually done when there is a non-resolution of organ failure, or sepsis, or SIRS within two to three days of intervention. And, on cross-sectional imaging, if the walled-off necrotic cavity size has not decreased by more than 25%, then these patients will require a second intervention, and so forth.

And when you stop intervention? Because it's very important to know when to stop treating a patient. Usually if you have got resolution of organ failure, or sepsis or SIRS, and if there is more than 75% of decrease in the walled-off necrosis size via cross-sectional imaging, and if the patient has got no symptoms, then you stop the treatment.

And is there a way that we can risk-stratify patients even at the index procedure and say who will require more aggressive drainage? And in whom we can anticipate necrosectomy is important. It is clearly shown that patients who have got disconnected pancreatic duct syndrome, where a part of the pancreatic duct has liquefied, and the tail does not communicate with the head region, these patients are very likely to have a more aggressive hospital course. And here are two classic imaging. On the left side you'll find [INAUDIBLE] where you find the tail opacifying, and you see a little bit of head of the pancreas. And you don't see anything in between. And this corresponds to the [INAUDIBLE] on the right side where you do not have any opacification of the tail. And this is called disconnected pancreatic duct syndrome.

In a recent study that involved close to 331 patients, we stratified patients into two groups: those with a disconnected duct and those without a disconnected duct. And what you will see is that approximately 30% of patients with a disconnected pancreatic duct syndrome will require more than one re-intervention. Also, patients with a disconnected pancreatic duct syndrome may require a surgical intervention in about 10% to 15% of the time, compared to patients who do not have a disconnected pancreatic duct syndrome and may have a better clinical outcome.

And who are these patients with a disconnected pancreatic duct? These are patients who generally have walled-off necrosis, in whom the size of the pancreatic fluid collection is more than 100 millimeters, or 10 centimeters. And these patients are also likely to have multiple pancreatic fluid collections within the pancreatic parenchyma. And these are the patients who will require more aggressive interventions.

And it is very important to know if you can identify a disconnected duct during the index procedure. If we are able to identify this successfully, then it is very likely that these patients can be managed offhand in a very successful fashion. And we can spare the patient more CT imaging later on to assess treatment response. So this is an imaging of a 61-year-old male patient who presented with walled-off necrosis. And what we are trying to do in this video is to correlate EUS findings of disconnected pancreatic duct syndrome and correlate that with CT scan or other cross-sectional imaging.

Here, we are identifying the pancreas from the [INAUDIBLE] region. And we are doing what we call a slow pull-through maneuver. And as you pull through you see a normal pancreatic parenchyma. And we are just continuing to withdraw the echoendoscope and you can still see normal pancreas. And that is the portal vein. And you find normal pancreas and soon you'll find walled-off pancreatic necrosis. And you'll see a large amount of solid debris within the fluid collection. And here again, you find a normal head, a huge walled-off pancreatic necrosis in the body region of the pancreas. Having identified it on EUS, we withdraw echoendoscope. And what you are finding here is the spleen, and superior to the spleen you find a rim of normal pancreas over the superior wall of the left kidney. And this corresponds to the big region of the pancreas, which is viable on cross-sectional imaging. And so this is what we call a disconnected pancreatic duct syndrome.

And after we know disconnected pancreatic duct syndrome, then we can choose the type of intervention that can be performed, or the type of stent that can be placed in these patients. Of late, there's a lot of awareness about lumen-apposing metal stents, also called [INAUDIBLE] metal stents. And this was one of the early studies from Japan that revealed that if a patient is initially treated with a lumen-apposing metal stent, then the procedural duration is significantly shorter by at least 15 months, and subsequent re-interventions where you may have to perform a endoscopic necrosectomy and so forth, is also significantly shorter in patients undergoing lumen-apposing metal stents.

So one argument will be, maybe if a patient has got disconnected pancreatic duct syndrome and a walled-off necrosis, maybe we should treat them with a lumen-apposing metal stent to start with. Because they will have a very complicated hospital course, and maybe very likely a lumen-apposing metal stent, by causing better drainage will make the patient feel better. And secondly, these are sick patients. You want to have an expedited procedure in these patients because very often it is done under general anesthesia. And because of the fast procedural duration with lumen-apposing metal stents, this might be the way to go in very sick patients. Lumen-apposing metal stent placement is a one-step technique. Again, it's a short procedural duration and it enables us to perform interventions via the stent, such as an endoscopic necrosectomy.

And the second important thing when we treat patients is to perform irrigation, because in walled-off pancreatic necrosis you've got a large amount of necrotic debris. And here in this particular case, you will find that once we access the fluid collection, we hook a water pump to the channeller that is being attached. And we just irrigate this very aggressively with either normal saline or an antibiotic-infused medium so that the solution can undergo extensive lavage. And this is very important. As you can see here, this person has a lot of debris. And as illustrated here by the large amount of fluid that is being irrigated, the aim will be to completely clear out the cavity, and as you clear out the cavity you suck aggressively using your echoendoscope. And you can see that the entire cavity is now being very, very well irrigated with an antibiotic mixed saline. And this is what you want to achieve with irrigation. You want to clean out the cavity of much necrosis as possible, even during the index presentation.

On the other hand, if you have got a large amount of solid debris on CT scan, and there's very minimal, there's no liquid to drain. In these patients, you want to perform a necrosectomy. And what type of a necrosectomy will be performed? If the fluid collection is very close to the stomach, you just perform a trans-gastric necrosectomy. On the other hand, if the necrotic cavity is located very close to the anterior abdominal wall, then you want to do a percutaneous sinus-tract necrosectomy, which involves removal of the percutaneous catheter, dilating the tract using Savary dilators, driving your endoscope through the anterior abdominal wall, and doing a necrosectomy like you will do with a trans-gastric approach. So it really depends on how comfortable and how convenient you are. And more importantly, how proximate the walled-off necrosis is to your point of access, which is the stomach, or from the anterior abdominal wall.

And there are multiple ways you can perform a necrosectomy. Here, I'll play multiple videos to show you the different techniques that can be adapted. In this first video, what we are going to be using is an alligator forceps. It is just a large diameter forceps. And what you do is, you open up the forceps within the necrotic cavity and you just grab the solid material, and you keep pulling it out. In the second video, we are going to show you a more popular technique which is snares. A lot of people prefer to use a snare to fragment the necrosis. So you pass a snare, usually a 15 millimeter snare is what we prefer. You just go in, and you start fragmenting it. And then you grab the necrotic material, and you just get retract it back into the stomach and you drop it. Some would use an endoscope with a cap. So if you've got a cap, the advantage is you can use a snare to grab the necrotic material, draw it into a snare, and you go back and forth. But it is important that if you have got a lumen-apposing metal stent, you don't dislodge the stent when you move back and forth with a cap attached to the endoscope.

In this particular case, what you're seeing is a plastic stent and that is guiding the endoscope into the necrotic cavity. And once we go into the necrotic cavity, we just aspirate the antibiotic [INAUDIBLE] with saline. And once that is done, you can see that this patient has got a large amount of necrosis. And every end-point here when you perform necrosectomy, is to clear as much of that necrotic debris and what you want, eventually, is just red granulation tissue. The presence of red granulation tissue usually indicates the termination of treatment.

And finally, I'm going to use another video to just show you the importance of using different accessories that might be required. Once you fragment all this material, it should not be left within the necrotic cavity. It's very important that they are cleaned out, because it's after all infection. So you can use either a snare, or in this particular case, we are using what we call a net-- an endoscopic net-- that is now used to grab the infected material and drop it off into the stomach. And you can see it on the video on the left, your predominant amount of necrosis has been cleaned out, and the patient just has red granulation tissue. So there are multiple options of multiple techniques that can be used for performing endoscopic necrosectomy, we just have to choose one that works well for you. But usually the snare technique is the one that is being adapted at most centers.

And when you perform endoscopic necrosectomy, it's also important to be sure what we are treating because it can lead to potential complications. And in this particular case, what you are seeing are extensive vasculatures that are feeding into the cavity. And on current Doppler we just saw some vessels that was going into the cavity. It is very important that when you perform necrosectomy, you are very aware of these vessels, otherwise you will cause bleeding. And in the particular case, there's another video on the right side, and you think this is a huge anechoic collection. But what you're seeing is a splenic artery that is going right in the middle of that collection. So if you're going to use, for example, a zero 3/4 inch kite wire within the cavity, remember the wire has got a sharp tip and if you accidentally injure the vessel, you can have massive bleeding that is going to require emergency radiology-guided embolization to stop the bleeding.

So lumen-apposing metal stents are now a critical part of the treatment strategy for managing these patients. These stents are uniquely adapted for treating these patients because of the big flare diameter of the stents that is ten to fifteen millimeters. We hope that this will result in expedited drainage. But because of expedited drainage, we also need to be sure that we are treating patients in the correct fashion. Previously, we used to leave these stents for four weeks and six weeks, or seven weeks, and nothing would happen with plastic stents. But because lumen-apposing stents presented better drainage, the cavities have acquitted much faster. So within two to three weeks, you may have no fluid left behind and these stents need to be removed faster. You cannot wait for six or seven weeks because this will result in significant bleeding in these patients.

And here I'm going to play you a video of a patient who was lost to follow-up. It was seven weeks before he came to see us, and here you can see blood within the cavity. So this patient was seen after about seven to eight weeks, and when came with hematemesis, we found blood clots coming through the lumen-apposing metal stent. And then what we did was, we used current Doppler, and you can see here on endoscopic ultrasound there's several vasculature that is wrapping around the lumen-apposing metal stent. So this, again, illustrates to you that when the cavity is completely collapsed, the vasculature around the cavity will wrap on the vessel and cause delayed bleeding. So it's very important that we bring these patients earlier for treatment.

So in a recent randomized trial that is ongoing, we encountered several complications in patients in whom we had delayed follow-up. The predominant amount of complications was GI bleeding. In some patients, there was mucosal overgrowth and one patient had a stent in his biliary stricture. And what they found is that all these complications happened around the three or beyond the four week period. So in clinical practice what we recommend is that we will plan a CT scan at three to four weeks, and if the walled-off necrosis has resolved, the stents are removed. On the other hand, if the fluid collection is persistent, then we let the lumen-apposing stent stay in place and we perform a weekly CT scan. And once the fluid collection has resolved, the stent needs to come out, and it should not be left in place indefinitely because of these adverse events.

However, you have to remember that there are some caveats as well to follow imaging. Say, for example, CT scan is the most common modality that is being used to assess treatment response. But unfortunately, CT imaging will not just measure the liquid component, it measures the total size of the cavity. So if a predominant amount of fluid has been evacuated, and there's no solid debris left, and the cavity is filled with air, the CT scan will erroneously call it residual pancreatic fluid collection that measures more than ten centimeters. This does not mean that further interventions are required. So it's very important to tell the radiologist to quantify the amount of residual fluid or necrosis as one.

The second, in clinical practice what we do is, we perform an EUS to assess treatment response. We remove the stents and if the EUS reveals there's no residual fluid and there's no residual necrosis, it's another safety valve or another mechanism for us to confirm what we see on CT to assess treatment response in these patients. And most importantly, clinical evaluation is important. It is not sufficient to just look at a CT scan and look at size of the collection. If the patient has got resolved sepsis, SIRS, organ dysfunction, in conjunction with resolution of the fluid collection on follow-up imaging such as CT or EUS, that is when the stents need to come out. And recently there is a stent tracker app, this is being piloted by Boston Scientific in conjunction with Visible Health. And what they do is when you perform a procedure, you enter the details on a dedicated website about the details on the patient, the type of stent that has been placed, a weekly reminder is being sent to you on how many patients you have treated with these stents.