AMIT SINGH JOHAL: I always like to start the discussion just with a couple of cases so you can kind of get a sense of who we do this procedure on on a daily basis. So here's a 68-year-old male, history of cholecystectomy in the past. He's in the hospital with jaundice, right upper quadrant abdominal pain for a couple of weeks.

The ultrasound shows an 8 millimeter CBD, very poor visualization of the distal duct, which we see commonly. So they can't rule out a distal obstruction. He has a history of a sinus infection, also, in the recent past and did complete a course in antibiotics. His liver function tests are elevated and his bilirubin is 8.

So our plan for him is an EGD to evaluate the abdominal pain and also an endoscopic ultrasound to rule out a distal CBD obstruction. So the outcome-- he had his upper endoscopy. He was found to have moderate esophagitis and a large hiatal hernia.

The EUS showed kind of a post-cholecystectomy common bile duct with no filling defects. Pancreas was normal, and an EUS-guided liver biopsy was then decided to be performed to evaluate the cause of his elevated liver function test. So the liver biopsy did show acute hepatocellular injury consistent with DILI.

The second case is a 55-year-old man. He has a history of Barrett's esophagus, morbid obesity, diabetes, and hypertension. He was seen in the GI clinic for elevated LFTs. His recent lab work shows some mild transaminitis, and his ultrasound basically shows just some fatty changes.

So this is a very common scenario in our clinic. So we basically did an upper endoscopy for his Barrett's surveillance, and we decided to do an endoscopic ultrasound guided liver biopsy to stage his NASH. And he had nondysplastic Barrett's, and his EUS-LB did show NASH with moderate fibrosis. And he was subsequently referred to a weight loss management clinic.

So when we talk about patients who come in with elevated LFTs, I think it's important to decide and determine where EUS-guided liver biopsy fits in this algorithm. So as you can see, the patient comes into our clinic. The first thing we typically do is get some liver chemistries.

So we look for serologies for intrinsic liver disease. If they come back negative, the options are some form of imaging. If we see dilated ducts on an EUS, for example, or MRCP, we proceed to an ERCP. If the imaging is negative, that's when we consider an EUS-guided liver biopsy for diagnosis.

On the other hand, if our liver chemistry is due point to some form of intrinsic liver disease like hepatitis C, hemochromatosis, we do also consider a liver biopsy for staging of that disease. And the important issue now is which biopsy method do we choose? And so this is, obviously, determined by patient selection, if they're cirrhotic or not cirrhotic. But also, institutional habits is something that also plays a part here.

So we're saying that there is a pretty large proportion of patients who an EUS-guided liver biopsy would be a very legitimate option. So do you need to do an EGD if the patient has abdominal pain? Are you ruling out varices? Is there Barrett's esophagus? Do you need an endoscopic ultrasound? If there's somebody with hepatitis C and a lymph node that needs to be FNAed, that's another great case.

And there's a large proportion of people that just can't get a percutaneous liver biopsy because of anxiety. Transjugular, obviously, if your portal pressures are required, and percutaneous, they usually do image-guided.

The conventional liver biopsy methods obviously are percutaneous and transjugular. Issues with this sampling error becomes a big issue because they're only targeting one aspect, one portion of the liver, not the entire gland. And usually 18 or 20 gauge needles are what's used.

So why do we do EUS-guided liver biopsy? We think it's safe. We can use colored Doppler to avoid small vessels. Our complication rates are comparable to percutaneous and transjugular. We think it's very clinically effective. We get a concurrent EGD in EUS. Our specimens-- and we'll show you the data-- are equal or superior to percutaneous and transjugular. And we're able to reduce sampling error by sampling both lobes.

We think the patient experience is better. It's convenient and cost-effective. We get one procedure versus going to radiology and endoscopy. And a big part of our growth is the communications. Hepatology is obviously in the GI world. So we're able to schedule very simply, and we talked about the sedation.

HARSHI S. KHARA: The patient selection as well as the technique of how we do this successfully and what are the little nuances for this-- so the patient selection, just to continue from Dr. Johal, is crucial and very easy in a way.

It's for any patient who needs a liver biopsy who also needs an endoscopy for any other reason, if a patient has a Barrett's follow-up and needs evaluation for the liver enzymes, or if they have a varice rule out where there's a suspected cirrhosis and they need varices ruled out, but at the same time, they also need liver histology to confirm if they have early cirrhosis or not.

If they need a concurrent endoscopic ultrasound for evaluation of other organs, such as pancreas, gallbladder, bile duct, or other structures, to rule out any other biliary or pancreatic pathology, and if they rule that out, or if there's no other reason, then at the same session, instead of having that additional step of getting liver histology, we can do it in the same procedure.

The other benefit, as Dr. Johal mentioned earlier, is the ability to biopsy both lobes, both the left and the right lobes, for any kind of sampling variation. The important point is also who is not an appropriate candidate for EUS-LB. So our cut-off criteria is usually thrombocytopenia for platelets less than 50,000, patients who have coagulopathy, but are not greater than 1.5. And this is to reduce the risk of procedure-related bleeding.

Significant ascites-- now patients who have minimal ascites pocket and were able to get a safe window, we do perform liver biopsy. But if there's a lot of ascites in between the stomach and the liver, we do not go through the ascites pocket to access the liver.

In patients who have cirrhosis on imaging and also need portal pressures at the same time-- so at this time, they're not able to get portal pressure measurements. And these patients do go to into interventional radiology where they can have both of these done together.

So our protocol for the EUS liver biopsy is to use a 19 gauge Expect Slimline Flexible or the 19 gauge Acquire core needle. We go to the apex of the duodenal bulb. So the linear echoendoscope is advanced to the duodenal bulb and is part 180 degrees to look up towards the liver, as you can see in figure number two. The knob is turned back, which is towards you, to oppose the transducer up against the liver.

And at this time, we used Doppler to check for any intervening blood vessels and a safe puncture side. And then the liver is punctured with the 19 needle. We do 7 to 10 actuations are fanning, just like you would do for a core specimen, or one to two actuations with a long pass. So if we have a single long pass, then one to two actuations are enough.

For the left lobe, it is a similar technique where we identify the celiac artery right at the cardio, where we identify the celiac take-off of the aorta. And then we counterclockwise torque 90 degrees knob towards us to bring the left lobe off the liver and follow the same protocol.

This is a video clip about identifying the liver lobe and making sure that we are identifying the liver versus the spleen. They're both close to each other. Patients with splenomegaly disease [INAUDIBLE] are here. You can see the liver, and you can identify that with the presence of the hepatic ring. However, if you torque the other way, it's very easy to see the spleen and not to mistake one for the other.

As you can see this is the liver coming in view with the hepatic vasculature to make sure you're identifying the right organ prior to the puncture. And then talking the other way, this is the spleen, and the echogenicity of it is very similar. So it's important to make sure that, under endoscopic ultrasound, we identify one versus the other.

This is a technique video of the in-room video, and you can see my colleague Dr. Johal using the Acquire needle with the full suction set at 20. And 7 to 10 actuations are made under EUS guidance. This is done under direct visualization to rule out any intervening vessels. The suction is closed, and the needle is withdrawn from the liver.

This is the EUS view how we would find the left lobe access. We would Doppler to make sure there is no intervening blood vessels, and there is a long throw that we can pass the needle through. The needle is then advanced in a transgastric maneuver. The suction is turned on after the needle is introduced, and 7 to 10 actuations are made, looking in the syringe also for visible blood, at the same time, under EUS guidance. And suction is turned off, and the needle is removed.

This is the transduodenal bulb access for the right lobe of the liver. Doppler is turned on to rule out any intervening blood vessels. The needle is introduced. And in a similar fashion, suction is turned on. 7 to 10 actuations are made. Suction is then turned off, and the needle is withdrawn.

Once we take the needle out of the echoendoscope, the tissue is expressed through a sieve. So this is when-- our assistant is pushing the stylet through. And we filter this through a sieve to filter out the core tissue and separate it from blood. This makes the specimen that is handed to surgical pathology less bloody.

And as you'll see in a minute, it looks like blood, but there is definitely core tissues in it. And this is important to identify for the visible tissue accuracy, which Dr. Diehl will go more in depth. And as you filter out the blood on the sieve, we flush it with saline on the top to wash these cores off. And you can see pieces, long pieces, of liver on the sieve.

The specimen is then poured into a formalin cup and sent to surgical pathology, not cytology. And these are core liver tissues. The rest-- the needle is again flushed out to rule out-- to get any residual tissue from the needle lumen onto the sieve. And this is then transferred over to a formalin cup.

DAVID DIEHL: Another thing we found is that if we remove the blood at this step, it makes it easier for the surgical tech up in the path lab. But if you don't use the sieve-- we worked out this method with our pathology team. So you put the needle contents right into formalin. When it gets to the lab, they pour it out onto a Petri dish. And they can actually see pieces of liver, and they're picking those out one by one. And then they wrap them up in lens paper.

Now, it's very important for this step to be done properly because if the surgical tech who receives this specimen doesn't do it well, then the pathologist is just going to get a jumble of tissue. And they're not going to be very pleased. Whereas, if they do it this way, the pathologist will see long cores, longer cores of tissue. And it's much easier for them to read those specimens.

And this is what it looks like when there's multiple long cores on one slide. And we're finding with the 19 gauges Expect needle, we're getting a good count of portal triads, well over the minimum recommended by the Liver Society, and very good specimen lengths.

Again, if you're going to start doing this-- if you haven't done this yet, you should talk to your pathologist. Tell them what you're going to do. Tell them that these are going to be small cores of tissue. And they'll know what to do with them.

They're very experienced handling small tissue, but they can't just handle it in any which way. It has to be in a particular way. And again, this method was figured out by our pathology team. They figured out, well, we're going to get these cores. We'll line them up.

We've done a number of studies on use of the 19 gauge needle. And our first experience, there's a multi-center experience, eight centers and there was 110 patients. And we were using either a regular 19 gauge Expect needle.

And then we sort of started transitioning to the Expect Flex needle, which is the Nitinol needle. And it was very high-- in this study was 98% of the specimen adequacy for pathologic diagnosis, median tissue length of 38 millimeters, and median CPT, or complete portal triad, count of 14.

Another point is the 19 gauge needle is certainly adequate for liver biopsy. But it's different than-- if you remember the old fashioned needles that we used to use, those large needles, the specimens are smaller, but certainly adequate. But again, the pathologist has to understand that they're going to see smaller cores.

If you look back at the literature with the different needles, different types of brands of 19 gauge needle, very good yields, 86% and up. Another thing that we were interested in looking at is if you compare the transjugular biopsy and percutaneous biopsy, are the specimens comparable?

And if you look at these graphs, the first chart is the portal triads, and the second is the total specimen length. And you can see that they're comparable or even better with the EUS-guided than the percutaneous or the transjugular. And the fact of the matter is, the radiologists, when they do percutaneous, they're not using a large needle. They're using a smaller needle. They're using an 18 or a 20 gauge needle for that.

If you biopsy both sides, you just get more tissue. And so the counts tend to be better. But if you do one lobe and you see good tissue, then you don't necessarily have to do both. We're in the process of doing a study looking at left versus right for NASH. And there is some difference in fibrosis distribution in left versus right. So there may be some scenarios where bilobar is preferred.

So just in conclusion, clearly the EUS-guided liver biopsy is becoming a more commonly used technique for liver biopsy. It definitely has a niche, which I think will be growing. There's still some patients we're going to send for transjugular. And there's some patients who may end up getting a percutaneous, but I think that the EUS-LB is established at this point.

And it certainly can be cost saving. If a patient needs an EGD or an EUS and a liver biopsy, which is actually a common occurrence, you can do both in one setting, which is a great advantage. And as was mentioned, we can biopsy widely disparate areas of the liver. And sometimes our transplant surgeons are interested in such a thing.

And it's very safe. I will say that we've had one instance of bleeding in a patient with coagulopathy. Currently, we wouldn't have done a liver biopsy. I've heard of splenic punctures, inadvertent splenic punctures. So that's the point that Dr. Khara was making. Just double check to make sure you're looking at the liver because in a fatty liver, the echotexture is very similar between spleen and left lobe of the liver.