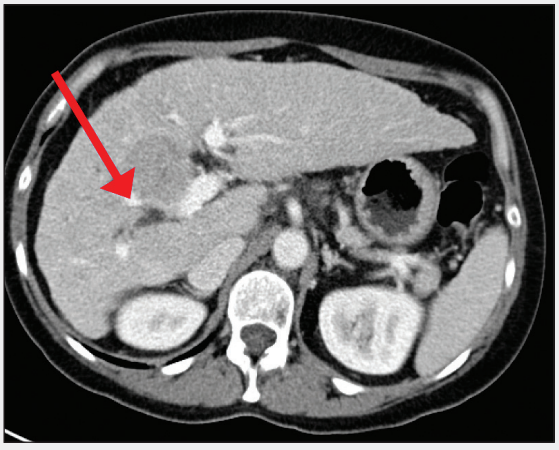
Liver Mass

MODERATORS: DAVID M. LIU, MD, FRCPC, FSIR, AND RIPAL GANDHI, MD, FSVM
PANELISTS: RAJ NARAYANAN, MD; DAVID LU, MD; AND FRED T. LEE JR, MD

PERIPORTAL HEPATIC MASS



A portal venous phase CT scan demonstrating a 3-cm lesion (arrow) arising from segment 4A/B of the liver, with direct contact to the right main portal vein (PV) and inferior branch of the right PV.

How would you treat this lesion?

Dr. Lee: Periportal masses represent a particular challenge in that you have to overcome both the heat sink effect from portal venous blood, as well as avoid significant biliary injuries, particularly in cirrhotic patients. This lesion, presumably a hepatocellular carcinoma (HCC), is fairly large by ablation standards, and you need to be able to create at least a 4-cm ablation zone to get a concentric 5-mm ablative margin around the mass. For metastases (particularly colon cancer), we aim for larger ablation zones, with the goal of a 1-cm ablative margin. Thus, this particular tumor (if a colorectal metastatic lesion) would require a 5-cm ablation zone for adequate coverage.

For patients with HCC and cirrhosis, the portal blood flow is often quite slow due to portal hypertension.[1] When using thermal ablative modalities, we are less worried about the tumor-protective heat sink effect in the periportal region—due to the slow blood flow—compared to the hepatic veins and large hepatic artery branches. However, we do worry about (rarely) causing portal venous thrombosis (PVT) in cirrhotic patients. We recently published results on this topic, where we noted that it is possible to cause PVT with microwave ablation (MWA) in those with cirrhosis and much less so in hepatic veins and arteries.[2] Interestingly, MWA-induced PVT responded well to anticoagulation.

Dr. Narayanan: If this is HCC, I would choose transarterial chemoembolization (TACE). Given the size and the proximity to the PV, the ablation modality of choice would be irreversible electroporation (IRE).

Dr. Lu: One must first confirm tumor type. Although the liver appears to be cirrhotic, without a triple-phase scan or biopsy, one cannot be certain that this is HCC versus cholangiocarcinoma. Assuming this is HCC, then TACE would be a reasonable first option, given the challenging location and risk to major bile ducts (there already appears to be bile duct obstruction). If TACE is not effective, ablative therapy may then be considered.

For thermal-based ablation modalities, would you use any adjunctive measures to decrease heat/cold sink from the adjacent PV?

Dr. Lee: We don't use any adjunctive measures to overcome blood flow in the liver, as modern ablation devices are generally powerful enough to overcome the heat sink effect posed by hepatic vessels. It is important to keep in mind that you need to ablate longer and harder (more probes, closer spacing, closer placement to vessels) for a tumor in this location than for a tumor in the periphery of the liver. In general, we aim for tumors adjacent to hepatic veins with impunity—they are very difficult to thrombose, and closing down a single hepatic vein is not usually clinically important as long as at least one other hepatic vein is open. We often ablate next to the inferior vena cava (IVC), and in those cases, you need to place the probes very close to the vessel and use more probes and power than for a peripheral lesion. For

the PV, the major issue is not so much the heat sink, but rather damage to adjacent bile ducts.

Dr. Narayanan: With thermal ablation, there are measures that can be used to reduce the heat sink effect, such as inflating balloons temporarily during the ablation. MWA is a thermal option that we have used in lesions close to the PV or IVC. For lesions near the vasculature, we use IRE without adjunctive measures.

Dr. Lu: It is important to strive for a balance between overablation (to compensate for heat sink) versus underablation (primarily to decrease the risk of bile duct injury and, secondarily, to decrease risk of PVT). If the patient is a transplant candidate and on the waiting list, underablation to control tumor growth without aggressive curative intent would be preferable. One possibility to consider is IRE, which has no significant heat sink effect and, at the same time, has a lower risk for bile duct injury.

Is biliary injury a concern with thermal ablation? If so, how do you protect the bile ducts?

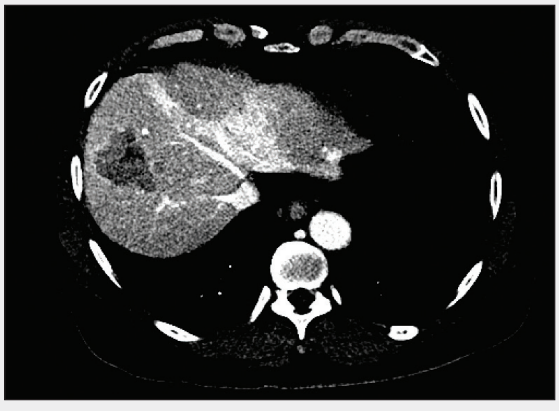
Dr. Lee: In this case, there are two significant issues that need to be balanced: (1) completely destroying the entire tumor, and (2) avoiding injury to the right hepatic duct. The patient looks to be cirrhotic, so an injury to the right hepatic duct could be catastrophic. There are many different ways to approach this case, none of which are great. One approach would be to use a nonthermal modality, such as ethanol injection or IRE. Ethanol monotherapy has the disadvantages of requiring multiple treatments for a tumor this size, and the local recurrence rates are high. IRE is a possibility in this situation, and there are anecdotal case reports of excellent results near bile ducts. However, it is important to keep in mind that there is a thermal component to IRE, depending on the pulse parameters, and there are also reports of bile duct injuries. In addition, the data regarding local tumor progression after IRE are not yet mature, and what data are available suggest that recurrence rates are higher than with thermal ablation methods. Finally, there are protective strategies, such as bile duct irrigation.

Understanding that there is no perfect way to treat this tumor, our approach would probably be a multimodality technique. We have had excellent results combining TACE with microwave in tumors up to 5 cm. However, we would have to modify our approach in this case to avoid heating tumor tissue adjacent to the bile duct. Thus, we would most likely perform TACE, followed 2 weeks later with ethanol ablation of the tumor adjacent to the bile duct and MWA of the remainder of the tumor. We have successfully used this strategy in several cases. After ablation, we would need to watch the tumor carefully and have a low threshold for retreatment (particularly of the perivascular tissue). Fortunately, ethanol injection can be performed under local anesthesia or moderate sedation for spot-treating recurrent tumor. When treating with ethanol under local anesthesia, it is important to avoid pulling the needle out immediately after injection, which can lead to ethanol spilling into the peritoneum (which can be quite painful).

Dr. Narayanan: Biliary injury is a concern. Protection will depend on the size and location of the lesion that is being treated and the size of the bile duct. Cooling the ducts during thermal ablation is an option. If the patient qualifies for IRE, we do not use protective measures for bile ducts.

Dr. Lu: Biliary injury is of the utmost concern, especially because there is already suggestion of bile duct stricture affecting central ducts, not just peripheral ducts. Ways to minimize bile duct injury would be ethanol ablation, ethanol ablation of perihilar tumor combined with thermal ablation of other portions of the tumor, addition of bile duct cooling during ablation via nasobiliary tube placement, or IRE (if the patient is a candidate).

HEPATOCELLULAR CARCINOMA WITH SATELLITE LESION



A 47-year-old patient with hepatitis B presented with a hypervascular lesion measuring 4.3 X 3.2 cm and an adjacent 1.1-cm satellite lesion.

What modality would you employ in this case?

Dr. Lee: The hypervascular lesion has several imaging signs of biologic aggressiveness, including size > 3 cm, irregular shape, lack of a definitive capsule, and satellitosis. In

general, we treat HCC > 3 cm with a dual therapy (ie, TACE followed by MWA). The case for dual therapy is even more pressing in a case like this, in which the chances of local tumor progression are high with any monotherapy.

Dr. Narayanan: The patient's entire clinical picture and imaging will have to be discussed in a multimodality tumor board. There are both transarterial and ablation options. We would use MWA and would plan to treat the main lesion and the satellite lesion. Transarterial therapies include TACE/beads/yttrium-90.

Dr. Lu: MWA, to get both. It is easier to treat larger lesions with MWA, which heats faster and can generate larger ablation zones in shorter time compared to radiofrequency ablation, especially with multiple applicators.

Does the presence of a satellite lesion affect your decision or considerations for management?

Dr. Lee: As previously noted, this case has several signs of aggressive biologic behavior, and we tend to treat these with dual therapy (TACE plus MWA,) as well as create a larger and hotter ablation zone that would encompass both the index tumor and satellite. This requires longer ablations and more probes. In this case, we would probably use three probes and ablate for at least 10 minutes. Fortunately, unlike the previous case, this tumor looks to be located more cephalad in the liver, presumably far away from the PV, which decreases the chance for significant hepatic duct injury.

Dr. Narayanan: No, it does not. We would plan to treat both lesions.

Dr. Lu: No, this could be regarded as a single larger lesion, and the procedure must ensure a complete ablation margin sufficient for both lesions.

What time interval would you use for follow-up in the setting of a satellite lesion? Is this different than for a solitary lesion?

Dr. Lee: We generally perform follow-up imaging 1 month after ablation and every 3 months thereafter for the first year. In this case, we would maintain the same imaging schedule but have a low threshold for reintervention, knowing that this tumor is likely to be aggressive.

Dr. Narayanan: The first follow-up would be at 4 weeks, and we'd use the same follow-up for both lesions, as they will be treated together. After the initial follow-up exam, we would see the patient again at 3, 6, and 12 months for imaging, lab work, and to check for appropriate markers.

Dr. Lu: My follow-up protocol would be the same: at 1 month, then 3, 6, 9, and 12 months the first year. ■

1. von Herbay A, Frieling T, Haussinger D. Color Doppler sonographic evaluation of spontaneous portosystemic shunts and inversion of portal venous flow in patients with cirrhosis. J Clin Ultrasound. 2000;28:332-339.
2. Chiang J, Cristescu M, Lee MH, et al. Effects of microwave ablation on arterial and venous vasculature after treatment of hepatocellular carcinoma [published online ahead of print June 3, 2016]. Radiology.

MODERATORS:

David M. Liu, MD, FRCPC, FSIR
Vancouver Imaging
Clinical Associate Professor
Faculty of Medicine
University of British Columbia
Vancouver, British Columbia, Canada
Disclosures: Consultant to Sirtex Medical and BTG.

Ripal Gandhi, MD, FSVM
Miami Cardiac and Vascular Institute
Associate Clinical Professor
FIU Herbert Wertheim College of Medicine
Miami, Florida
Disclosures: None.

PANELISTS:

Raj Narayanan, MD
Chairman
Department of Interventional Radiology
University of Miami
Miami, Florida
Disclosures: Consultant for BTG and AngioDynamics.

David Lu, MD
Professor of Radiology
David Geffen School of Medicine at UCLA
Los Angeles, California
Disclosures: Has received funding for consulting or research and education from Perseon, Neuwave, Covidien, Philips, Bayer.

Fred T. Lee Jr, MD
Professor of Radiology, Biomedical Engineering, and Urology
Robert A. Turrel Professor of Medical Imaging
Chief, Abdominal Intervention
University of Wisconsin School of Medicine
Madison, Wisconsin
Disclosures: Consultant to Ethicon, Inc.; consultant and stockholder and Board of Directors, Histosonics, Inc.