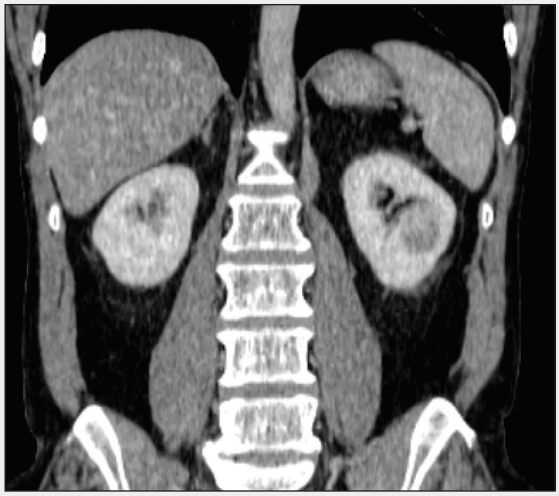
Renal and Adrenal

MODERATORS: DAVID M. LIU, MD, FRCPC, FSIR, AND RIPAL GANDHI, MD, FSVM
PANELISTS: RAUL UPPOT, MD; STEPHEN HO, MD, FRCPC; AND NADINE ABI-JAOUDEH, MD

CENTRAL RENAL CELL CARCINOMA



A coronal portal venous phase CT scan showing a 3.2-cm central renal cell mass, with displacement of calyceal fat, adjacent to the collecting system.

In a patient who is not a surgical candidate, how would you treat this lesion?

Dr. Ho: Given that the patient is a not a surgical candidate, percutaneous treatment seems to be the only option. However, using the RENAL scoring system, the lesion is highly complex due to its endophytic location, nearness to the collecting system, and its central location. I would estimate the RENAL score to be 10.[1] Although treatment by ablation would be difficult and potentially complicated, it would seem that the patient has little to no options, and therefore, I would likely still treat this with radiofrequency ablation (RFA) with pyeloperfusion.

Dr. Uppot: My approach to this case would be to first obtain proof that this is a malignant tumor. Per a published article by Tuncali et al, approximately 37% of solid masses are benign tumors.[2] Therefore, it is important to prove malignancy prior to treating this challenging central tumor. If the lesion is a biopsy-proven renal cell carcinoma, I would proceed with CT-guided cryoablation. If axial and sagittal images show the tumor to be in proximity to the renal pelvis and ureter, I would proceed with pyeloperfusion.

Dr. Abi-Jaoudeh: I would normally examine all available imaging and histology, in addition to the clinical history. Treatment via ablation would be a consideration.

What are the unique risks associated with treating this lesion, and what modality would you use for treatment?

Dr. Abi-Jaoudeh: I usually use cryoablation for treating kidney lesions. However, the risks include damage to the collecting system and bleeding. The recurrence rates are higher for central tumors, and this one is on the larger side, which increases this risk. In fact, central renal tumors > 3.7 cm have an extremely high recurrence rate.

Dr. Uppot: Major risks are injury to the ureter, collecting system, and central renal vessels. To address potential renal collecting system injury, I would place a ureteral stent for pyeloperfusion and choose cryoablation as my ablation tool. Pyeloperfusion will protect the ureter via heat sink, and cryoablation allows for visualization of the ice ball and its proximity to the ureter. Injury to central renal vessels is avoided by carefully planning the trajectory of the ablation probe to the tumor and ensuring it avoids the central renal vessels. However, puncture of smaller, nonvisible renal segmental vessels remains a risk factor for bleeding.

Dr. Ho: The unique risks associated with this lesion are due to its location (ie, urine leak/urinoma, higher risk for bleeding, and potential injury and subsequent stricture of the collecting system). I would use RFA, as collectively, our institution has less experience with

microwave ablation (MWA). In my opinion, cryoablation would not be suitable given the lesion's location and size.

How do you perform pyeloperfusion? Which types of lesions would specifically benefit from this technique?

Dr. Abi-Jaoudeh: Usually, I do not perform pyeloperfusion. We ask urology to place a ureteral stent preprocedurally, and we have found that this works well in preventing and managing complications. However, the few times I have done pyeloperfusion, we used the techniques described by Wah et al.[3] Specifically, a 5-F FlexiTip ureteral catheter (Cook Medical) is inserted into the bladder through a rigid cystoscope and then secured to a 14-F Foley catheter. Previously cooled dextrose 5% is hung 110 cm above the patient for retrograde gravity infusion. The quantity of fluid depends on the duration of the procedure. The ureteral catheter is removed at the end of the procedure.

Dr. Uppot: For pyeloperfusion, we work closely with our urologists. On the day of the ablation procedure, a urologist comes to our CT suite and places a 5-F stent with cystoscopic guidance under conscious sedation. We confirm that the proximal tip is in the renal calyces on scout CT. We connect the distal portion to a 1-L saline bag (warm normal saline bag for cryoablation and a cold 5% dextrose bag for RFA or MWA).

We place stents for all central renal tumors abutting the renal pelvis and ureter. We also place stents for lower pole medial tumors. For these types of tumors, we always review the coronal CT to identify the relationship of the tumor to the descending ureter. If the tumor is within proximity to the ureter, we place a stent. Proximity to the ureter can vary based on the size of the tumor that needs to be treated. We do not worry about tumors adjacent to peripheral upper pole calyces.

Dr. Ho: At our institution, the urology department performs pyeloperfusion, in which a ureteral stent is placed with continuous irrigation by cold water. Saline would not be used with RFA. Central lesions or lower pole medial lesions would benefit from pyeloperfusion.

How do you manage a collecting system or ureteral stricture that develops secondary to ablation?

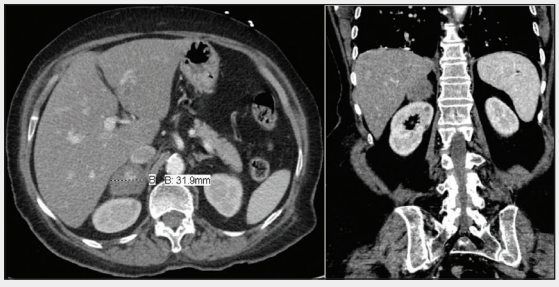
Dr. Uppot: When the injury is suspected during or at the end of the ablation procedure, and we have a pyeloperfusion stent in place, we either leave the stent in or exchange it for a larger-caliber double-J ureteral stent over a wire under fluoroscopic guidance. If the injury to the ureter is identified a few weeks or months after ablation, then we consult with the urologist to attempt to place a stent from below. In some cases, they are unable to cross the ureteral stricture, so we perform an antegrade stick under ultrasound and fluoroscopic guidance and place a nephrostomy tube.

After decompressing the collecting system over several days, we then attempt to place a nephroureteral tube using a hydrophilic guidewire via nephrostomy tube access. If successful, we leave a permanent double-J stent in place, which is exchanged every 3 months. When crossing the stricture is not successful, we place a permanent nephrostomy tube, which is exchanged every 8 weeks.

Dr. Ho: A ureteral stricture would be treated by either an internal-external stent or a double-J internal-only stent, depending on ease of access and ability to cross the stricture. Treatment of an isolated injury of the collecting system would depend on the amount of kidney affected, but we do not usually treat this and allow that portion of the affected kidney to atrophy.

Dr. Abi-Jaoudeh: The advantage of having a ureteral stent placed before the procedure is that you can avoid these complications.

ADRENAL METASTATIC LESION



Axial and coronal portal venous phase CT scans demonstrating a solitary, 3.2-cm, right-sided adrenal colorectal metastatic lesion, with displacement of the liver capsule, adjacent to the inferior vena cava (IVC) with mass effect.

What are the unique risks associated with ablation of adrenal lesions?

Dr. Abi-Jaoudeh: Hypertensive crisis is a serious concern with functioning and nonfunctioning

tumors/adenomas.[4] Other concerns include potential damage to the liver and IVC. Hydrodissection might be required in this case; however, it will be tricky because you must avoid the kidney, liver, and lung.

Dr. Ho: A catecholamine surge/response during ablation is the most challenging risk. Therefore, the patient requires a full workup in order to assess the potential for this risk and whether preprocedural blockade is required. In all cases of adrenal ablation, we involve anesthesiologists and place radial intra-arterial monitoring for beat-to-beat pressure monitoring to recognize and avoid a hypertensive crisis. The etiology of the adrenal tumor is also key to determine the risk, although hypertensive crises have also been reported with the ablation of metastases as well. With adrenal tissue ablation, there is also the consideration for adrenal insufficiency postprocedure.

Dr. Uppot: Unlike liver or kidney ablations, ablating the adrenal gland carries the risk of cathecholamine release and a hypertensive crisis. In a retrospective analysis of 64 adrenal ablations performed at our institution,[5] the incidence of a hypertensive crisis was 43%. Statistical analysis to evaluate factors predicting hypertensive crisis showed an increased risk if normal adrenal tissue was visible on preprocedural imaging and in cases when the tumor diameter was ≤ 4.5 cm. Tumors > 4.5 cm have likely completely replaced the normal adrenal gland and thereby limit the amount of normal adrenal tissue at risk for catecholamine release.

Describe your premedication protocol, intraprocedural protocol, and postprocedural management algorithm to minimize the risk of an adrenal crisis.

Dr. Ho: Premedication depends on the patient's pretreatment blood pressure. All patients are seen by an anesthesiologist in the clinic prior to the procedure to determine premedication. Patients with hormonally active tumors, such as pheochromocytoma, are generally already on antihypertensive medications. During the procedure, the anesthesiologist directly monitors the patient, and generally, short-acting α-blockers are used in increasing doses. A critical component of the procedure is the communication between the interventional radiologist and anesthesiologist. There are cases in which we have temporarily stopped ablation to allow for direct vasodilators to take effect to prevent a hypertensive crisis. Patients are monitored in postanesthetic recovery for a minimum of 6 hours and are kept as inpatients at least overnight. Consideration of corticosteroid replacement is also important.

Dr. Abi-Jaoudeh: Consider having an endocrinology consultation before the procedure. If there is concern for a hypertensive crisis, they will prescribe α- and β-blockers and will give phenoxybenzamine and a β-blocker. α-Blockers alone may result in heart failure due to increased vascular resistance and decreased cardiac contractility. Therefore, it is important to give both medications in conjunction. Also, at the National Institutes of Health, where they have extensive experience with pheochromocytoma ablation, 250 mg of alpha-methyl-para-tyrosine two or three times per day is added to the regimen to inhibit catecholamine synthesis. The α- and β-blockers will be given 7 to 14 days before the procedure.

If there is any concern for hypertensive crisis, the procedure should be performed under general anesthesia, and a radial line should be placed to monitor blood pressure. It is important to inform the anesthesiologist of any concerns, so they can have a nitroglycerin drip ready. They should also let you know immediately if the blood pressure spikes. Postprocedure management is per usual, except that endocrinologist will see the patient at short intervals.

Dr. Uppot: Each institution has its own premedication protocol. In our practice at Massachusetts General Hospital, historically, we have not premedicated prior to an adrenal ablation. Instead, every adrenal ablation case is performed with the assistance of an anesthesiologist. Our anesthesiologists take precautions to address a potential hypertensive crisis by placing an arterial line to closely monitor blood pressure and pulse and having easy access to short-acting antihypertensive medications. Use of short-acting medications is critical, as once the stimulation from the adrenal ablation stops, the blood pressure can continue to drop.

Various premedication regimens exist. An example of one that can be prescribed on an outpatient basis is a combination of the selective reversible α-blocker once daily for 14 days and a long-acting selective β-blocker by mouth once daily for 4 days before the procedure.

What is your preferred ablation modality, and why?

Dr. Uppot: In the literature, RFA, MWA, and cryoablation have all been used to treat adrenal tumors. We have used all three. In my personal experience, the benefits of cryoablation are that you can visualize the ice

ball in relation to the adjacent bowel loops. However, the limitation of cryoablation is that it is difficult to immediately turn off the stimulation during an acute hypertensive crisis.

The advantage of MWA is that the small-caliber antenna easily fits into the small space of the adrenal gland and allows for a rapid ablation. However, MWA of the adrenal gland can result in a very rapid and dramatic hypertensive crisis and acute blood pressure drop once the stimulation is stopped by turning the microwave off. RFA offers the best compromise of pace of tissue destruction and ability to monitor and regulate a hypertensive crisis; however, the caliber of the probe tends to be larger than microwave probes. Ultimately, the best ablation modality is whichever the interventional radiologist is most comfortable with, as long as all precautionary steps to address a potential hypertensive crisis are taken.

Dr. Abi-Jaoudeh: For functioning adenomas or pheochromocytomas, I would choose RFA, because the current can be increased by small increments and blood pressure can be monitored.

Dr. Ho: My preferred modality of ablation is RFA. I have no experience with MWA, and I would have concerns about the rapidity of ablation. RFA is slower and, in my opinion, more controllable. ■

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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:

Raul Uppot, MD
Assistant Professor
Harvard Medical School
Division of Interventional Radiology
Massachusetts General Hospital
Boston, Massachusetts
Disclosures: None.

Stephen Ho, MD, FRCPC
Clinical Professor
University of British Columbia
Medical Head, Interventional Radiology
Vancouver, British Columbia, Canada
Disclosures: None.

Nadine Abi-Jaoudeh, MD
Associate Professor of Radiological Sciences
University of California, Irvine
Irvine, California
Disclosures: None.