Technical Tips for Percutaneous Ablation of Challenging Abdominal Tumors

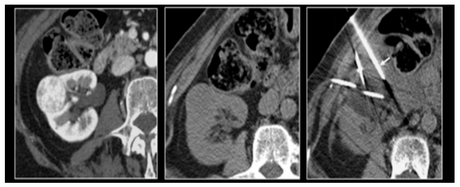
M.R. Moynagh, FFRRCSI; D. Hill, M.D.; A.N. Kurup, M.D.; J. Schmitz, M.D. ; P. Eiken, M.D.; G. Schmit, M.D.; T. Atwell, M.D.
Mayo Clinic, Rochester, MN, USA

Full eposter avaliable at EE-086

Background

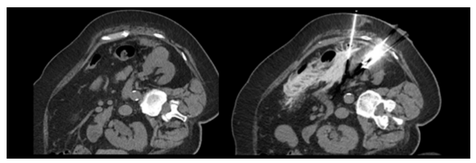
- Percutaneous tumor ablation gaining acceptance as a minimally invasive treatment for the management of liver, kidney, prostate and adrenal tumors.
- As the popularity of these procedures increases, so have the recognized challenges of treatment and complications.
- Over recent years, several techniques have been described to improve patient safety and outcomes.
- Tumor locations that were previously considered high-risk, in close proximity to vital structures, are now more accessible and amenable to ablation with satisfactory clinical outcomes.

Displacement - Fluid



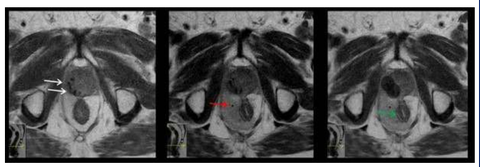
Key adjunctive technique in percutaneous ablation.

Infusion of sterile fluid (saline or D5W) via needle or catheter in order to displace adjacent critical structure and prevent ablation of non target structures. In the case shown, sterile saline has been instilled to displace colon away from target renal tumor allowing safe growth of ice ball during freeze cycles.



Contrast doped hydrodisplacement fluid:

Non-ionic or ionic contrast media can be added to the sterile infusion fluid prior to injection with suggested optimal ratio of 1:50 / 2 % . This can provided added visualization of adjacent bowel or solid organs.



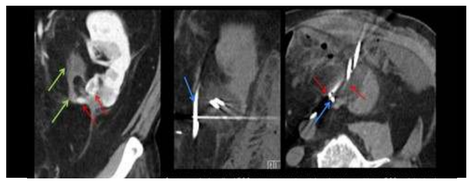
Hydrodisplacement fluid is also well visualized during MRI guided ablation procedures. In the case shown, after probe placement into right prostatic tumor (white arrows) , a catheter was placed in the right perirectal space (red arrow) and sterile saline instilled to displace rectum (green arrow) prior to commencing freeze cycles.

Pre ablation tumor embolization

Decrease post ablation bleeding

- Performance of prophylactic trans-arterial embolization prior to cryoablation of large renal cell carcinomas (>5cm) decreases bleeding complications without a discernible effect on renal function or recurrence rate.
- Balance with underlying renal function, coronary artery disease, need for anticoagulation cessation / bridging.
- Typically performed 24 hours prior to ablation

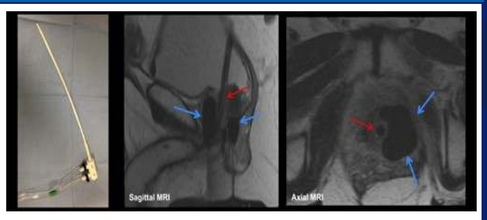
Retrograde pyeloperfusion



Ureteric / PUJ protection

- Ablation performed close to the ureter may result in ureteral injury and subsequent stricture formation
- Intraprocedural ureteric / PUJ protection - Infuse sterile fluid retrogradely via an externalized ureteral stent.
- Stent internalization for 6 weeks if ice ball encases the ureter.
- Now > 900 renal ablations with no ureteral strictures with this technique.

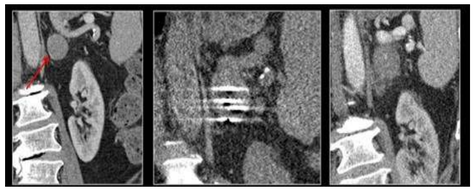
Urethral warming catheter



Urethral protection

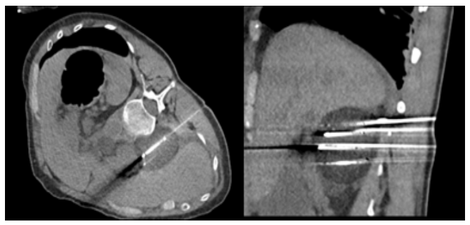
- During prostate cryoablation a protective warming catheter (red arrows) is placed via the urethra into the bladder prior to commencing freeze cycles.
- Continuous warmed fluid circulates via the closed-loop continuous- flow temperature-controlled urethral catheter during cryoablation to minimize injury of urethral tissue from adjacent ice ball (blue arrows)
- Significantly decreases risk of secondary urethral injury related to epithelial sloughing.

Adrenal - Adrenergic blockade



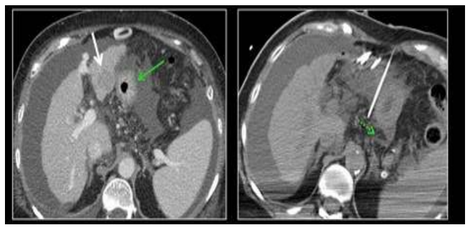
- Ablation of tumors involving the adrenal gland has been associated with profound blood pressure fluctuations including hypertensive crisis.
- Pre-ablation α-blockade can decrease the severity of the hypertensive episode, at the expense of higher need for vasopressors periprocedurally.
- Premedication with alpha-blockade should be considered in most patients.

Adrenal – Blood pressure



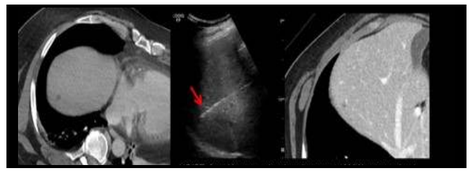
- Intra procedural hemodynamic changes can occur either from direct or indirect ablation of the adrenal gland, particularly during the thawing phase of any freeze cycle.
- Arterial lines are used to preemptively manage any severe hypertensive episode by aggressively monitoring the arterial blood pressure during ablation
- Close interaction with anesthesia colleagues during procedure is essential, as is rapid availability of relevant IV antihypertensive / pressor agents

Displacement – Lever Technique



- Stomach can be difficult to displace using standard fluid hydro displacement
- Ablation probe can be used as a lever to displace stomach from liver tumor using site of skin entry as a fulcrum. After gently torqueing the handle medially, the stomach moves laterally, increasing distance from the ablation zone.

Ultrasound (US) Fusion

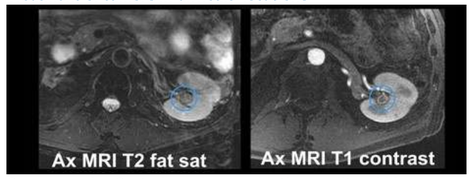


Advantages of US Fusion Imaging

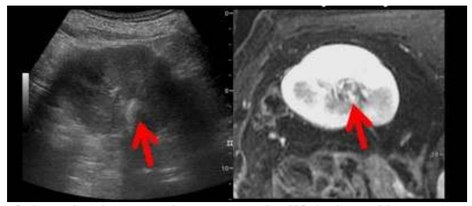
- Expansion of ablation cases
- Target tumors with poor US or CT visualization
- Real time imaging and probe placement
- Out of axial plane probe placement
- Treat tumors in difficult locations
- Improved operator confidence
- Improved accuracy of device placement

US Fusion Techniques

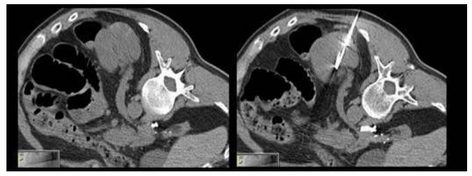
Treatment of tumors in difficult locations



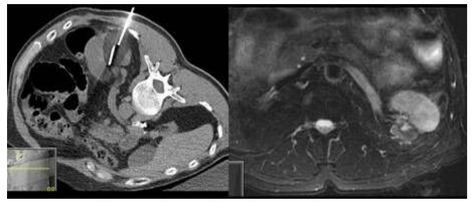
Case example : Central renal mass ablation—solitary kidney



•Safe probe placement into mass under US fusion guidance



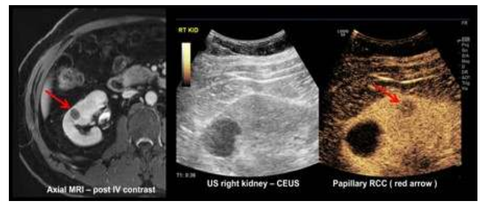
Pre ablation CT Post probe placement



Cryoablation T2 MRI : local tumor

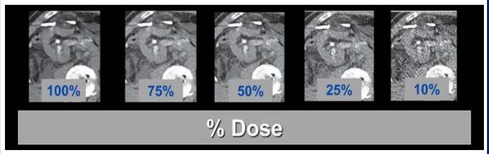
Creatinine = 2.9 pre ablation → 3.1 mg/dL post

Contrast-enhanced ultrasound



- Technique can be performed for lesions that are poorly visualized on conventional US in order to guide ablation probe placement.
- Contrast-enhanced ultrasound (CEUS) involves the administration of intravenous contrast agents containing microbubbles of perfluorocarbon or nitrogen gas. The bubbles affect ultrasound backscatter and increase vascular contrast.

CT – Tube current modulation



- Without compromising the clinical outcome, the smallest radiation dose should be used to guide and monitor ablation.
- It has been shown that reduction of mAs by 25-50% results in image quality sufficient to effectively monitor cryoablation.

Summary

After reviewing this exhibit, the participant should be able to appreciate important adjunctive techniques related to tumor ablation:

Procedural techniques:

- Hydro displacement and other mechanical displacement maneuvers
- ureteral stents to protect collecting system
- Urethral warming catheter to minimize urethral injury
- selective embolization to minimize bleeding
- alpha blockade for adrenal ablation

Imaging techniques:

- ultrasound-fusion imaging for lesion localization
- contrast-enhanced ultrasound to identify index lesion(s)
- manual dose reduction during CT monitoring