Lung Cancer Treatment: Radiologist’s Emerging Role Using Thermal Ablations for Both Cure and Palliation
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Radiologist’s Emerging Role Using Thermal Ablation for Cure and Palliation
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Disclosures
None related to topic of talk

Credits
Brown Tumor Ablation Service
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Amy Doorley, NP
Robin Holley

Objectives
- Discuss available thermal ablation techniques for treating tumors in the chest
- Discuss clinical indications for thermal ablation
- Describe ablation procedures, including examples of available technology using several case examples
- Discuss complications and novel treatment options

Lung Cancer Scope
- Yearly US estimated 223,000 newly diagnosed
- 157,000 deaths
- 85% of pts who acquire lung cancer will die from it
- >94 million current and former smokers in the U.S. at high risk for lung cancer

Lung Cancer Facts
Indications for Thermal Ablation

- Early Stage NSCLC/Met Relapse in XRT Field
- Chest Wall Invasion
- Painless Bone Met
- Painful Bone Met

Thermal Ablative Technologies USA Market

- Microwave ablation (MWA)
- Radiofrequency ablation (RFA)
- Cryoablation

Microwave Ablation

- High Frequency electromagnetic wave
- Microwave antenna ~1GHz up to 2.45GHz
- Oscillation of polar molecules produces frictional heating
- No electrical current - no grounding pads needed
- Multiple applicators

Microwave Ablation

- Water molecule
- Oscillation of polar molecules produces frictional heating

Treatment

- Surgery for stage 1 → 70% 5 yr survival
  - Only 1/3 surgical candidates
- External beam
  - 21% 5 yr survival stage 1
- RFA
  - 27% 5 year survival stage 1
- Emerging treatments
  - MWA & Stereotactic Body RT

MWA Systems Available

- Acculis
- BSD Medical
- Covidien
- Forea
- Medwaves
- Neuwave
- HS
- Others?

Acculis 16 G 2450 MHz 120 watts single applicator

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**MONDAY**

**BSD 14 G 915 MHz**
60 watts up to 3 applicators

**Covidien 13 G 915 MHz**
45 watts up to 3 applicators

**Medwaves 16G 902-928 MHz**
10-32 watts up to 3 applicators

**Economics?**
- Generator ~35-50 K
- Applicators ~1K
- Medicare global ~$2500

**Procedure**
- Assemble team
  - Secretary, NP x 2, RN, CT x 2, +/-resident
- Tumor ablation service consult
  - Review PMHx, labs, meds, imaging, path
- Plan
  - Anesthesia, positioning, applicator, discharge
- The rest is easy
  - Image, local anesthesia, sedation, place antenae
  - with CT-fluoro
  - Cook tumor
- Observation 3 hrs

**MWA : Single Applicator**
- Smaller solitary tumors under 2cm in size if plan on single treatment
- Reposition necessary for tumors larger than 2cm
- Simultaneous placement and treatment for multiple lesions
**MWA: Multiple Applicators**

- Tumors over 3cm in size
- Close to vessels (heat sink)
- Reduced procedure time

**MWA Complications**

- Pneumothorax (26/66) 39%
- Chest Tube 12%
- Skin Burn 3%
- Post ablation syndrome 2%
- Pain 2%
- ARDS 2%

**Management of Air Leaks Post ablation**

- Tincture of time-up to 30 days
- Blood patch may work for initial puncture
- Bronchoscopic fibrin glue
- Bronchial valves*


**BPF 60 M 7mm NSCLC**

**Follow-up**

- 1 month baseline CT w & wo
- 3 month CT
- 6 month PET-CT
- Alternating CT & PET-CT @ 9 & 12 mos
MWA Induced Tumor Cavitation

Cavitation of mass correlated with survival

Wolf et al Radiology, 2008

Local tumor progression

- Focal enhancement (>15HU)
- Rim common up to 6 mos
- FDG activity 6 mos post MWA
- Increasing size after 3 months

MWA Advantages

- Large volumes in shorter time periods
- Heat sink effect not as apparent as RFA
- Improved penetration in lung tissue
- Much less painful than RFA

Radiofrequency Ablation

- insulated electrode shaft with uninsulated tip placed in tissue
- electrical generator connected to electrode
- reference electrode (grounding pads) placed on patient’s skin
- alternating high frequency current (460-480kHz) applied
Radiofrequency Ablation
- electrical impedance of tissue allows current to flow from generator into tissue
- RF currents create a conduit for frictional heating
- heat cytotoxic >50°C

RFA Tools of the Trade
- Generators
- Electrodes

RFA of NSCSC
- Treatment Halo

RFA Complications
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<th>Type</th>
<th>Frequency</th>
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<tr>
<td>Pneumothorax requiring chest tube or aspiration</td>
<td>0-54% (most &lt;20%)</td>
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<tr>
<td>Pneumonia</td>
<td>0-22%</td>
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<tr>
<td>COPD exacerbation</td>
<td>0-6%</td>
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<tr>
<td>ARDS</td>
<td>0-3%</td>
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<tr>
<td>Pulmonary disease</td>
<td>0-6%</td>
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<tr>
<td>Hemoptysis</td>
<td>0-12%</td>
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<tr>
<td>Hemorrhage</td>
<td>0-1%</td>
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<td>Pleural effusion requiring drainage</td>
<td>0-4%</td>
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<td>Pneumothoracic hemorrhage</td>
<td>0-1%</td>
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<td>Phrenic nerve injury</td>
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<tr>
<td>Death</td>
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Cryoablation
- Joule-Thompson Effect
  - 6000 psi argon gas expands from aperture inside cryoprobe

Cryoablation
- 1.5, 1.7 and 2.4mm percutaneous probes
- Argon based systems
- Ice ball visible with CT
- Relatively painless during treatment
- Multiple applicators
Comparison of survival after sublobar resections and ablative therapies for stage I NSCLC

- Primary end points overall survival, cancer-specific survival, and cancer-free survival
- 25 SLR
- 12 RFA
- 27 Cryo
- CECT, FDG PET/CT follow-up


Conclusion

- Ablation is a safe and effective tool to help treat patients with lung tumors
  - local control
  - symptom palliation
- NSCLC stage 1 survival similar with sublobar resection and ablation
- Combination Ablation and SBRT may be superior to one RX alone
- Randomized control trials are needed to identify exact clinical roles of each modality... MWA very promising