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CT Guided Cryoablation of Primary and Metastatic Lung Tumors: Low Recurrence and Complication Rates

Mark Krycia
Hussein D. Aoun

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CT Guided Cryoablation of Primary and Metastatic Lung Tumors: Low Recurrence and Complication Rates

Mark Krycia, MD
PGY1 Resident
Henry Ford Hospital

Hussein D. Aoun, MD
Assistant Professor of Radiology and Oncology
Karmanos Cancer Institute/ Wayne State University
Introduction

- Incidence of 1° lung cancer - 224,390+ in 2015
- Treatments –
  - Surgery - Gold standard (lobectomy vs sublobar resection)
  - XRT – SBRT
    - Recurrence rates:
      » ~12% @ 2yr  
      » up to 28% @ 3yr
      » ~24% @ 2yrs for central tumors

- Ablation
  - Thermal ablation matches sublobar resection outcomes in older patients with early NSCLC
    » Kwan et al JVIR 2014
  - Heat – based: RF, MW, laser
  - Cryo – similar performance for broader population?
Why Cryoablation?

- Excellent visualization: vasculature, nerves, esophagus etc.
- Virtually painless:
  - Truesdale CM, et al 2013, JVIR
- Does not discriminate:
- Potential Cryoimmune
  - Takahashi et al, 2016, Cancer Immunol
    » Increased cell destruction with cryo leads to more fav immune
  - Niu et al, 2013, WJ Gastro
    » Cryoimmune (29 mos) > cryo (17.5 mos) > untreated (3 mos)
Percutaneous Freeze Planning: Technique

Visible Margin

-140° Probe temp = ~12mm inside

-20° Lethal for kidney (vascular) = 3-5mm inside

-40° Lethal double freeze (fibrous) = 5-10mm inside

Probe 1-2 Rule:

1 cm - TUMOR margins
2cm – PROBE spacing

Littrup, et al. JVIR 2009
Methods and Materials:

385 masses, 287 procedures, 167 patients

• Primary: 124 masses, 93 procedures, 58 patients
• Metastasis: 261 masses, 194 procedures, 109 patients
• Mean F/U: 22.9 mos; 205 > 12 mos; 78 > 36 mo; long ~10.5 yrs
• Complications – CTCAE (minor=1-2, major 3-5)
• Recurrences
  – Central (Perivascular ≥ 3 mm vess.)
  – Peripheral – Non-vascular
### Methods and Materials: Size and Location

#### Primary

<table>
<thead>
<tr>
<th>Dia.</th>
<th>Central</th>
<th>Periph</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt;3cm</td>
<td>25</td>
<td>22</td>
</tr>
<tr>
<td>&lt;3cm</td>
<td>22</td>
<td>55</td>
</tr>
</tbody>
</table>

- 47 central, 77 peripheral
- 47 tumors > 3cm, 77 ≤3cm

#### Metastatic

<table>
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</tr>
<tr>
<td>≤3cm</td>
<td>78</td>
<td>139</td>
</tr>
</tbody>
</table>

- 100 central, 161 peripheral
- 44 tumors > 3cm, 217 ≤3cm
Local Recurrences: Total Lung Masses

- **Recurrence:**
  - (6.2%) 24/385 masses;
  - Progression – 1.8% (7/385), within cryozone
  - Recurrence – 4.4% (17/385), outside cryozone – “satellite”

- **Location:**
  - central 14/147 (9.5%) ; periph. 10/238 (4.2%) = p <0.05

- **Tumor Size:**
  - > 3cm (13.2%) 12/91; < 3cm 12/294 (4.1%) p<0.005
Overall Complications Total: CTCAE 3-5

- 4.9% (14/287) Total within one month
- 4.2% (12/287) procedure related
  - Central: 4.7%(6/129)
  - Peripheral: 3.8%(6/158)  N.S.

- Tumor Size: central and peripheral
  - >3cm: 11.1%(9/81)  <3cm: 1.5%(3/206)  p<0.001
46 y/o male with NSCLC

12 mos

36 mos

72 mos
Lung Cryotherapy Conclusions:

- Excellent CT Guidance and Visualization
- Technically feasible and effective treatment option for Primary Lung Tumors & Lung Metastasis
- Tighter probe spacing: Recur. rates <10%
  - Larger tumors >3cm and peri-vascular Tumors
- CX -> 3cm but not location – staged (COPD, etc!)
- Immunostimulation potential-future???