Robotic Sublobar Resection for the Surgical Management of Isolated Pulmonary Nodules

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Robotic Sublobar Resection for the Surgical Management of Isolated Pulmonary Nodules

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Disclosures

- None
Lung Cancer – 2015 United States Estimates

- **221,200 cases (115,610 Male and 105,590 Female)**
- More deaths than next four most common cancers combined
  - **158,040 deaths total**
  - **86,380 Male**
  - **71,660 Female**
- **13% of all cancer diagnoses**
- From 2007 to 2011 lung cancer incidence rates decreased by 3.0% per year in men and 2.2% in women
- **Overall Survival Rates**
  - One year: 44%
  - Five Year: 17%
- Early stage Lung cancer (Stage I and II):
  - Percentage of total diagnoses: 14%
  - Percentage of five-year survival: 54%

**Source:** Cancer Facts & Figures 2015
The surgical management of benign and malignant lung lesions is an evolving field.

Techniques for anatomic pulmonary resection:

- Rib-Sparing Thoracotomy (Current standard of care)
- Video-Assisted Thoracoscopic Surgery
- Robotic-Assisted Lung Resection
Video Assisted Thoracoscopic Surgery (VATS) paralleled laparoscopy offering a minimally invasive alternative to thoracotomy.

- **Similar mortality rates and long term survival rates with:**
  - Less morbidity
  - Less postoperative pain
  - Faster return to work compared to thoracotomy

- **Limitations of VATS**
  - Lack of depth perception
  - Rigid instruments
  - High learning curve
Background

- Robotic surgery may offer a minimally invasive technique that is safe, efficacious and easier to learn than VATS
  - Less post-operative pain
  - Shorter hospital length of stay
  - Better early post-operative quality of life scores
- This study assesses the efficacy and perioperative outcomes of robotic-assisted pulmonary sublobar resection.
Methods

- Retrospective chart review at LVHN from October 2011 to June 2014
- All anatomic lung resections evaluated
  - Excluded
    - Open or VATS cases
    - Lobectomies, sleeve lobectomies, pneumonectomies, wedge resections
- 626 lung resections performed
  - 186 robotic pulmonary resections performed
  - 36 robotic segmentectomies
- Perioperative outcomes evaluated:
  - Length of stay
  - Operating room time
  - Estimated blood loss
  - Number of lymph nodes
  - Surgical margins
  - 30-Day Mortality
  - Conversion rate
  - Hospital based complications
  - Tumor size
  - Recurrence
- Robotic segmentectomies that required conversions were excluded from further analysis.
Methods

- All cases were performed by a single surgeon using the Da Vinci Robotic Surgical platform
# Results

<table>
<thead>
<tr>
<th></th>
<th>Mean</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>65.4</td>
<td>41 – 83</td>
</tr>
<tr>
<td>BMI</td>
<td>27.9</td>
<td>17.9 – 42.3</td>
</tr>
<tr>
<td>Operative time</td>
<td>121 min</td>
<td>49 – 315 min</td>
</tr>
<tr>
<td>Estimated blood loss</td>
<td>51.9 mL</td>
<td>20 – 150 mL</td>
</tr>
<tr>
<td>Tumor size</td>
<td>1.57 cm</td>
<td>0.7 – 3 cm</td>
</tr>
<tr>
<td>Lymph Node Stations</td>
<td>3.32</td>
<td>0 – 7</td>
</tr>
<tr>
<td>Lymph Nodes</td>
<td>4.85</td>
<td>0 – 10</td>
</tr>
</tbody>
</table>
## Results

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Number</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Positive margins</td>
<td>0</td>
<td>0%</td>
</tr>
<tr>
<td>Recurrence</td>
<td>1</td>
<td>2.94%</td>
</tr>
<tr>
<td>Readmission rate</td>
<td>4</td>
<td>11.76%</td>
</tr>
<tr>
<td>30-day mortality</td>
<td>0</td>
<td>0%</td>
</tr>
<tr>
<td>Conversion Rate*</td>
<td>2</td>
<td>5.56%</td>
</tr>
<tr>
<td>Median length of stay</td>
<td>2 days</td>
<td>Range 1-17</td>
</tr>
</tbody>
</table>

*Excluded from overall complication rates*
## Results

<table>
<thead>
<tr>
<th>Hospital-based Complication</th>
<th>Number</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Air leak (&gt;5 days)</td>
<td>4</td>
<td>11.76%</td>
</tr>
<tr>
<td>Pleural effusion</td>
<td>2</td>
<td>5.88%</td>
</tr>
<tr>
<td>Recurrent pneumothorax</td>
<td>1</td>
<td>2.94%</td>
</tr>
<tr>
<td>Atrial fibrillation</td>
<td>1</td>
<td>2.94%</td>
</tr>
<tr>
<td>Acute kidney injury</td>
<td>1</td>
<td>2.94%</td>
</tr>
<tr>
<td>Acute blood loss anemia</td>
<td>1</td>
<td>2.94%</td>
</tr>
<tr>
<td>Discharged with chest tube</td>
<td>7</td>
<td>20.59%</td>
</tr>
</tbody>
</table>
Discussion

- Approximately 20-30% of anatomic lung resections are performed using VATS
  - Technical difficulty of VATS may be barrier to minimally invasive chest surgery
Discussion

- Increased identification of solitary pulmonary nodules
- Controversy regarding sublobar resection of early stage NSCLC
  - Adequate lymph node sampling
  - Preserves lung volume and function
  - Controversy: equivalent oncologic outcomes as a traditional lobectomy
Discussion

Potential Benefits of Robotic Surgery

- High definition 3-D camera
- Wristed instruments with 7 degrees of freedom
- Dampening of tremor
- Ability to control camera and up to 3 instruments simultaneously
- Shorter learning curve compared to VATS
Conclusions

▪ This study demonstrates the feasibility, safety, and efficacy of robotic-assisted pulmonary sublobar resection for the treatment of isolated lung tumors.

▪ Further areas of research should focus on comparisons to VATS procedures, cost-benefit analysis and oncologic efficacy.
  • Longer follow-up period is needed to assess long term oncologic efficacy
  • Cost analysis should be performed to evaluate if the higher price of the robotic systems outweigh the possibly decreased OR time and hospital stay.
References

Questions?