Robotic Segmentectomy

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Robotic Segmentectomy

Disclosures

• Baxter: Consulting
• Medtronic: Consulting
TECHNIQUE DEVELOPMENT
Robotic Segmentectomy

Initial Experience

- Started concurrently with VATS lobectomy in July 2002 at MSKCC
- Intuitive dry lab and cadaver training
- Patients consented for robot, but not on protocol
- First successful case November 2002
Robotic Segmentectomy

Initial Technique

• 3D binocular visual system
• Wristed instrumentation
• Initial FDA-approved indication: cardiothoracic surgery
Robotic Segmentectomy

Initial Technique

- 3 incisions
- 4 cm non-rib spreading utility incision
- Individual dissection and ligation of hilar structures
- Isolated lung lesions
Robotic Segmentectomy

Docking

- Camera: 7/8th ICS anterior to PAL
- Arm 2: 8/9th ICS posterior to tip of scapula
- Arm 1: 4/5th ICS mid axillary line
- Assistant: works through anterior incision
Robotic Segmentectomy
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Robotic Segmentectomy

daiVinci® Si
Robotic Segmentectomy

Robotic Anatomic Segmentectomy of the Lung: Technical Aspects and Initial Results

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Background. Robotic lobectomy with radical lymph node dissection is a new frontier of minimally invasive thoracic surgery. Series of sublobar anatomic resection for primary initial lung cancers or for metastasis using video-assisted thoracic surgery have been reported but no cases have been so far reported using the robot-assisted approach. We present the technique and surgical outcome of our initial experience.

Methods. Clinical data of patients undergoing robotic lung anatomic segmentectomy were retrospectively reviewed. All cases were done using the DaVinci System. A 3- or 4-incision strategy with a 3-cm utility incision in the anterior fourth or fifth intercostal space was performed. Individual ligation and division of the hilar structures was performed using Hem-o-Lok (Teleflex Medical, Research Triangle Park, NC) or endoscopic staplers. The parenchyma was transected with endovascular staplers introduced by the bedside assistant mainly through the utility incision. Systematic mediastinal lymph node dissection or sampling was performed.

Results. From 2008 to 2010, 17 patients underwent a robot-assisted lung anatomic segmentectomy in two centers. There were 10 women and 7 men with a mean age of 68.2 years (range, 32 to 82). Mean duration of surgery was 189 minutes. There were no major intraoperative complications. Conversion to open procedure was never required. Postoperative morbidity rate was 17.6% with pneumonia in 1 case and prolonged air leaks in 2 patients. Median postoperative stay was 5 days (range, 2 to 14), and postoperative mortality was 0%. Final pathology was non-small cell lung cancer in 8 patient, typical carcinoids in 2, and lung metastases in 7.

Conclusions. Robotic anatomic lung segmentectomy is feasible and safe procedure. Robotic system, by improving ergonomic, surgeon view and precise movements, may make minimally invasive segmentectomy easier to adopt and perform.

Robotic Segmentectomy

Initial Experience

- Retrospective review of consecutive patients undergoing robotic anatomic segmentectomy at two institutions (MSKCC, European Oncology Institute Milan) from Jan 2008 – Dec 2010
- Analysis of indications, technique and perioperative results

### Robotic Segmentectomy

#### Demographics

Table 1. Patient and Tumor Characteristics

<table>
<thead>
<tr>
<th>Variable</th>
<th>Number</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age, years, mean (range)</td>
<td>68.2 (32–82)</td>
<td></td>
</tr>
<tr>
<td>Sex, male/female</td>
<td>7/10</td>
<td>41.2/58.8</td>
</tr>
<tr>
<td>Tumor size, cm, mean (range)</td>
<td>1.11 (0.6–2.8)</td>
<td></td>
</tr>
<tr>
<td>Type of segmentectomy</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Left LL superior segment</td>
<td>4</td>
<td>23.5</td>
</tr>
<tr>
<td>Right LL superior segment</td>
<td>3</td>
<td>17.6</td>
</tr>
<tr>
<td>Lingulectomy</td>
<td>3</td>
<td>17.6</td>
</tr>
<tr>
<td>Left UL trisegmentectomy, lingula sparing</td>
<td>2</td>
<td>11.9</td>
</tr>
<tr>
<td>Left LL basilar segment</td>
<td>4</td>
<td>23.5</td>
</tr>
<tr>
<td>Right UL anterior segment</td>
<td>1</td>
<td>5.9</td>
</tr>
<tr>
<td>Pulmonary lung cancer histology</td>
<td>10</td>
<td>58.8</td>
</tr>
<tr>
<td>Adenocarcinoma</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>Squamous cell carcinoma</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Bronchioloalveolar carcinoma</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Typical carcinoid</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Lung metastasis</td>
<td>7</td>
<td>41.2</td>
</tr>
</tbody>
</table>

LL = lower lobe; UL = upper lobe.
Robotic Segmentectomy

**Outcomes**

<table>
<thead>
<tr>
<th>Category</th>
<th>Result</th>
<th>Median (Range)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operative time (min)*</td>
<td>189</td>
<td>(138 - 240)</td>
</tr>
<tr>
<td>Chest tube (days)*</td>
<td>3</td>
<td>(1 - 13)</td>
</tr>
<tr>
<td>Length of stay (days)*</td>
<td>5</td>
<td>(2 – 14)</td>
</tr>
<tr>
<td>Complications</td>
<td></td>
<td></td>
</tr>
<tr>
<td>None</td>
<td>14</td>
<td>(82.4%)</td>
</tr>
<tr>
<td>Minor</td>
<td>3</td>
<td>(17.6%)</td>
</tr>
<tr>
<td>Major</td>
<td>0</td>
<td>(0%)</td>
</tr>
<tr>
<td>Perioperative mortality</td>
<td>0</td>
<td>(0%)</td>
</tr>
<tr>
<td>Conversions</td>
<td>0</td>
<td>(0%)</td>
</tr>
</tbody>
</table>

Robotic Segmentectomy
daVinci® Xi
Robotic Segmentectomy

**Xi System Advances**

- Rotating boom (270 degrees) allows side-docking in all cases
- Facilitated docking process
  - Laser guidance to camera port
  - Targeting feature
- Improved cannula mounting
- 8 mm camera may be placed in any arm
- Enhanced patient clearance features of the arms to eliminate external collisions
- Vascular stapler
Robotic Segmentectomy

Port Placement

- Spatula
- Camera
- Fenestrated bipolar/Stapler
- Tip up fenestrated grasper
Robotic Segmentectomy Dissection

- Fenestrated bipolar forceps and spatula with monopolar cautery
- Posterior arm with tip up fenestrated grasper for lung retraction
- 1st assistant provides suction through 5 mm posterior non robotic port
- No foreign bodies in the chest
- Endovascular stapler through posterior or utility incision
Robotic Segmentectomy
Case Presentation

- 77 y.o. woman biopsy proven 1.5 cm adenocarcinoma lingula
- PET/CT: SUV 5.5 with no other disease
- S/p AVR/MVR with PPM
- PFTs: FEV1 124%; DLCO 76%
Robotic Segmentectomy
Robotic Segmentectomy

- Final pathology: 1.5 cm acinar predominant (70%) adenocarcinoma; tumor 1.4 cm away from closest staple line; node negative
Robotic Anterior Basilar Segmentectomy

- 67 y.o. man with metastatic colon cancer
- FEV1: 69%; DLCO: 74%
Robotic Anterior Basilar Segmentectomy

- Initial right VATS wedge resection
- Patient discharged in one day
- Proceeded with left side within 2 weeks from first procedure.
Robotic Anterior Basilar Segmentectomy
Robotic Anterior Basilar Segmentectomy - Postop

- Left lower lobe anterior basilar segment: 3 cm metastatic colon adenocarcinoma; margin negative
Robotic Segmentectomy

Conclusions

• Robotic technology may facilitate less common pulmonary resections such as sleeve resection and uncommon segmental resection

• Robotic approach is feasible, safe and reproducible
Thank You!