Robotic Lobectomy

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Robotic Thoracic Surgery

Disclosures

- Bard: Speaker
- Baxter: Consulting
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Consensus VATS Technique

- CALGB 39802: multi-institutional registry study to assess feasibility and establish uniform criteria for VATS lobectomy
- Standardized definition: 3-incision technique with access incision no larger than 8 cm, videoscopic guidance, no rib spreading and traditional hilar dissection
- 127 patients: perioperative mortality 2.7%, grade 3 or higher morbidity 7.4%

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Status of VATS in U.S.

• Despite evidence of patient benefit and acceptable oncologic outcomes of VATS lobectomy in early lung cancer...

• Between 1999-2006, only 20% of all lobectomies done in the U.S. was by VATS*

• Utilization was increasing (32% in 2006)

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Status of VATS in U.S.

- All lung resections done in STS database between 2000 - 2010
- 12,255 (94.5%) patients underwent lobectomy (n = 7877 thoracotomy; n = 4378 VATS)
- Overall rate of VATS 35.7%, but trend toward increased

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Status of VATS in U.S.

- Nationwide Inpatient Sample database (non-voluntary) of 13,619 patients undergoing lobectomy at non-federal facilities between 2004 - 2006
- Only 759 (5.6%) by VATS
- No difference between groups with respect to length of stay, cost, complications
- VATS 1.6 times more likely to have intraop complications

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Why Poor Adoption of VATS?

• Wide variation in practitioners (general surgeons, cardiac surgeons)
• Not board requirement until recently
• Poor access to training, particularly post-graduate
• Higher perceived risk profile with closed chest (bleeding)
• Limited instrumentation
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Disadvantages of VATS

- Despite high definition optics, loss of binocular vision
- Unstable camera platform
- Limited instrumentation
- Poor ergonomics
- Reliance on experienced assistants
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Telerobotic Surgery

- 3D binocular visual system
- Wristed instrumentation
- Initial FDA-approved indication: cardiothoracic surgery
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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
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Influences
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**VATS Approach**

- Thoracoscopic lobectomy with 3 – 4 non-rib-spreading incisions consistent with CALGB 39802 consensus criteria
- Robotic visual system and instrumentation employed for entire hilar and mediastinal dissection
- Systematic mediastinal lymphadenectomy
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Technique

• 3 or 4 incisions
• 4 cm non-rib spreading utility incision
• Individual dissection and ligation of hilar structures
• Isolated lung lesions
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Docking - Standard
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*da Vinci® S*
Robotic Pulmonary Resection

Docking
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4-arm VATS Approach

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Total Port Technique

- 4-arm
- Robot docked over the patient’s head
- No utility incision
- CO2 insufflation
- Subdiaphragmatic removal of specimen

Robotic Pulmonary Resection

**CPRL-4**

- “Total port” technique
- Robot docked over the patient’s head
- View replicates classic thoracotomy view
- Five total incisions

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Robotic Pulmonary Resection

观 from above after trocar placement for a CPRL-4, right-sided operation
Robotic Pulmonary Resection

Long Term Results

Robotic lobectomy for non–small cell lung cancer (NSCLC):
Long-term oncologic results

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*daVinci® Si*
Robotic Thoracic Surgery
4-arm Si
Robotic Thoracic Surgery

4-arm Si
Robotic Thoracic Surgery

daVinci® Xi
Robotic Thoracic Surgery
*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
Xi Incision Strategy
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Robotic Staplers

- Prior to Si system no robotic staplers commercially available.
- October 2012 Si stapler 510K cleared.
- Green (45 mm) and blue (35 mm) loads FDA approved for Gyn, General and GU ONLY. NO THORACIC!
- April 2014: DaVinci Xi system is released.
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Robotic Staplers

• July 2014: Green, blue and white (vascular) Xi stapler loads FDA-approved – thoracic indication included

• April 2015: Xi vascular stapler released for thoracic indication to a limited (8) number of centers

• Current: All stapler loads available on all Xi systems

• >3000 vascular load firings to date
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Steps for Firing Stapler
PORT CONSIDERATIONS FOR ROBOTIC STAPLER
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Stapling Port
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*RUL truncus branches*
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Alternatives – Telelap ALF-X (Sofar)
Robotic Thoracic Surgery Alternatives – Sport (Titan)
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Limitations of Robotics

• No tactile feedback
• Camera view more magnified than standard thoracoscope – less global perspective
• Arms are in a fixed location
• Learning curve
• Operating surgeon not at the bedside
• Large purchase cost of the system = ACCESS

Memorial Sloan Kettering Cancer Center
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*Unresolved Issues*

- Influence of bundled payments
- Potential for decreased robotic costs – alternative systems, influence of competition
- Global utilization
- ??? Prospective trials
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Conclusions

• There are technologically superior aspects of robotics that benefit the surgeon
• Perioperative outcomes of VATS and robotic pulmonary resection are similar – patient benefits are less clear
• The technological advantages of robotics MAY allow more complex cases to be performed minimally invasively more easily than by VATS alone
• Cost (Access) remains a significant issue/barrier
Thank You!