VATS Lobectomy
State of the Art

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Atlanta, Georgia
VATS Lobectomy
Atlanta

COI – EES and Bard (Advisory Board)
VATS Lobectomy

Introduction

- 225,000 new cases of lung cancer in 2013
- One out of four patients have surgically resectable disease at the time of diagnosis
- Open lobectomy has been the standard of care for patients with NSCLC for over 60 years
- VATS lobectomy was introduced in 1992
- What is the current status of VATS lobectomy?
My Old Kentucky Home
Tobacco
VATS Lobectomy
CT Scan

Discover potentially resectable early stage lung cancer
Lung Cancer Screening

NLST

- 53,500 patients (Current or former smokers) – 33 sites
  - Emory 1250 patients; 620 pts CT scans ($1.2 million)
- RCT – CXR vs CT Scan (HR) – 3 years
- High Risk Patients - > 30 PYs, Smoked within 15 yrs, Age: 55 – 74 yo
- Results –
  - 20% reduction in lung cancer mortality
  - 7% reduction in overall mortality
- ACS, ALA, ATS, ACCP, NCI – Support Screening
- No insurance company currently pays for it
VATS Lobectomy

Definition

- Thoracotomy
  - Lobectomy
  - Lymph node evaluation
    - Sampling or Dissection

- VATS
  - Access incisions (non-rib spreading): 4 – 10 cm
  - Lobectomy - Anatomic dissection of the vessels & bronchus
  - Lymph node evaluation
    - Sampling or Dissection

- Mass hilar ligation “tourniquet lobectomy”
Outcomes of Lobectomy
Thoracotomy (Z0030 Study)

- Gold standard – multi-institutional study
- 920 lobectomy procedures in prospective randomized trial ACOSOG Z0030 (LNS vs LND)
- Mortality 11/920 (1.2%)
- Any complication 354/920 (38.5%)
- Mean LOS 6 days
- No cost data

Minimally Invasive Lobectomy Video-Assisted Thoracic Surgery

• First VATS lobectomy series published in 1992 (Khono-Japan, Kirby-US)
• 2012: 84,956 lobectomies performed in U.S.
• 18% of lobectomies in STS database performed by VATS in 2005; 37% in 2008; 46% in 2011
My Old Kentucky Home

Good Food
VATS Lobectomy
Coca-Cola - Emory Clinic
VATS Lobectomy

**Advantages**

<table>
<thead>
<tr>
<th>Advantage</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fewer complications</td>
<td>Hoksch et al</td>
</tr>
<tr>
<td>Shorter hospital stay</td>
<td>McKenna et al</td>
</tr>
<tr>
<td>Reduced cost</td>
<td>Swanson et al</td>
</tr>
<tr>
<td>Less pain</td>
<td>Walker et al</td>
</tr>
<tr>
<td>Better quality of life</td>
<td>Sugiura et al</td>
</tr>
<tr>
<td>Better PFTs</td>
<td>Nakata et al</td>
</tr>
<tr>
<td>Earlier recovery</td>
<td>Demmy et al</td>
</tr>
<tr>
<td>Easier for octogenarians</td>
<td>McVay et al</td>
</tr>
<tr>
<td>Faster time to treatment</td>
<td>D'Amico et al</td>
</tr>
<tr>
<td>Improved survival</td>
<td>Whitson et al</td>
</tr>
</tbody>
</table>
Potential Disadvantages of VATS

- Port site recurrence
- Control of bleeding
- LN evaluation
- Learning curve
  - Time
  - Experience
  - Surgeon age
- Variable definitions
  - Mini-thoracotomy
  - Simultaneous stapling
- Poor cancer operation
VATS Lobectomy
Atlanta Hartsfield Airport

ATL
95 Million Passengers

MCO
35 Million Passengers
**VATS Lobectomy**

**Type of Resection**

- **Wedge resection** removes a small portion of a lobe.
- **Segment resection** removes a larger portion of a lobe.
- **Lobectomy** removes an entire lobe.
- **Pneumonectomy** removes the entire lung.
VATS Lobectomy
Wrong Decision
VATS Wedge Resections

- Most commonly performed VATS procedure
- The majority for pathologic diagnosis
- Recent trend is to omit needle biopsy (TTNA or TBNA) or SDBX and proceed to VATS biopsy
  - 69% of Emory patients with IPN have no preop diagnosis
  - Cost and Complications less
- Inpatient or outpatient
- LOS 1 - 2 days
- High diagnostic accuracy
VATS Wedge Resections

Finger Palpation
VATS Wedge Resections
Nodule Localization

Dyes

Radiation Probes

Hook Wire

SD Bronchoscopy
CT– Guided Nodule Localization
Fiducial Placement
Indeterminate Pulmonary Nodule
Wedge Resection – Fiducial/Nodule
Indeterminate Pulmonary Nodule
Wedge Resection Incisions
56 patients had 63 nodules removed

Nodule removal successful - 55/56 pts (98%)

Mean size nodule 10 mm (3 - 24 mm)

Mean depth from VP 19 (2 - 59 mm)

51/63 (81%) nodules were cancer
  » 13 (25%) primary lung cancer (7s GGOs)
  » 12 nodules were benign
    – 5 granulomas, 3 pneumonia, 2 sarcoidosis, 2 hamartoma
Indeterminate Pulmonary Nodule
Fiducial Localization - Results

- Mean procedure time 59 min (30 - 120 mm)
- Mean length of stay 2 days (1 – 6 days)
- Complications – 3 pts (5%)
  » Fiducial embolization
  » Fiducial migration
  » Parenchymal hematoma
- In the last 32 patients; 23 pts (72%)
  » Single lumen ET
  » CO₂ insufflation
  » VATS Ports – two 5 mm, one 10 mm
### VATS Wedge Resection

**Cost - Premier Database**

- 25 million inpatient; 175 million outpatient Database
- Jan 2007 through Dec 2008
- Lung wedge excision for cancer; thoracic surgeon only
- 2051 procedures – 1052 via VATS; 999 via Open

<table>
<thead>
<tr>
<th></th>
<th>VATS</th>
<th>Open</th>
</tr>
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<tbody>
<tr>
<td>Hospital Cost</td>
<td>$14,795</td>
<td>$17,377*</td>
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<tr>
<td>OR Time</td>
<td>2.8 hrs</td>
<td>3.2 hrs*</td>
</tr>
<tr>
<td>Hospital Stay</td>
<td>4.4 dys</td>
<td>6.3 dys*</td>
</tr>
<tr>
<td>Adverse events</td>
<td>OR of 1.57</td>
<td>favoring VATS</td>
</tr>
</tbody>
</table>

*Chest 141:429-435 2012*
VATS Lobectomy
Georgia Dome
Atlanta Falcons
Super Bowl Champs 2013?
VATS Pulmonary Resections
Anatomical

Segmentectomy  Lobectomy  Pneumonectomy
VATS Lobectomy
Relative Contraindications

- Single lung ventilation intolerance (ENT Patients)
  - $\text{CO}_2$ Insuffilation with SLET (Wedge only)
- Tumor size > 6cm
- Sleeve resection
- Hilar lymphadenopathy
- Chest wall or mediastinal involvement
- Neoadjuvant radiation/chemotherapy
- Prior thoracotomy

- STS Poster (2011) – 42 patients – Cam McCoy MS
VATS Lobectomy
Contraindications

Histoplasmosis and Sarcoidosis
• Acceptable operation (Chicago) for lung cancer; currently limited to patients with poor pulmonary function or in clinical trial (CALGB 140503)

• Creating the segmental fissure and dissecting out the segmental vessels can be challenging VATS

• Most amenable segments are the superior segments of the lower lobe, lingula, posterior of the upper lobes, and left upper lobe tri-segmentectomy

• Not a large wedge excision!
  • Individual isolation of artery, vein and bronchus
• 41 segmentectomies (2003 – 2009)
• 26 Open; 15 VATS: 65% Lung cancer
• Preoperative demographics similar
• VATS OR time longer – 45 minutes
• VATS CT duration shorter - 2.2 days
• Major complications 19% Open; 0% VATS
• VATS hospital stay shorter - 2.9 days
• Early results favor VATS segmentectomy over open approach for smaller lung cancers

ATS 89:1571-1576, 2010
My Old Kentucky Home
Smooth Bourbon

Maker's Mark

First Bottle May 8, 1958
Signed By All Employees
VATS Lobectomy Technique

- Epidural catheter (No)
- Double Lumen ET
- 3/4 incisions (Access 4 cm)
- Inspection for metastasis
- Wedge excision of tumor (69%)
- Medial dissection (Isolation)
  - Pulmonary vein
  - Pulmonary artery
  - Bronchus
- Protective removal of lobe
- Lymph node dissection (Energy)
VATS Lobectomy

Set-Up

Operating Room
VATS Lobectomy
Set-Up
Hyperflexion
VATS Lobectomy
Set-Up

Monitor 1
Front
Anesthesia

Monitor 2
Back

Patient

Surgeon

Assistant 1
Assistant 2
My Old Kentucky Home

Beautiful Horses
VATS Lobectomy
Access Incisions
VATS Lobectomy
Utility Incision

Utility Access Incision

(Range 3 – 5 cm)
Technical Points for VATS

- No trocars except for camera (No CO₂)
- Cotton tip swab clean camera trocar
- 0, 30, 45 degree HD camera / panoramic view
- A mobile lung is mostly palpable
- Conventional instruments
- Retract soft tissue (Weitlander or sleeve)
- Sponge stick available
- Arterial line for all segments and lobectomies
- Two units of blood in OR
Conventional Thoracotomy Instruments
(Familiar with and better tactile feedback)
Position bag in apex; Allow decompression of air but not fluid; Endobronchial suction if needed.
VATS Lobectomy
Postoperative Pain Control

- Pain Control
  - Local Anesthetic
    - Marcaine 0.5% + epi
  - Exparel – 90 cc (30 cc/incision)
  - IV Toradol preopt
  - No PCA
  - Epidural
    - Early experience; rare today

- Hospital stay
  - 2 - 4 days
My Old Kentucky Home

Great Basketball

2012 #8
VATS Lobectomy
Operative Concerns

Bleeding

Tumor Recurrence (VATS Sites)

Lymph Node Assessment
VATS Lobectomy

“Conversion to an open procedure is a measure of surgical awareness, NOT defeat!”
VATS Lobectomy
Georgia Aquarium
World’s Largest Aquarium
VATS LN Dissection
Lymph Node Evaluation
VATS LN Dissection

Number of LNs Evaluated

- Emory University review of SEER data 1990 – 2000
- 16,800 NSCLC patients underwent complete resection
- Grouped according to number LNs removed
  - 1 – 4
  - 5 – 8
  - 9 – 12
  - 13 – 16
  - > 16
- Survival increased with # of LNs removed (13 - 16)

Ludwig et al Chest 2005
VATS LN Dissection
LN Dissection - Prospective Study

- VATS lobectomy with Complete LN dissection
- VATS with LND; followed by thoracotomy LND
- 29 patients – 17 right, 12 left
  - **Right side**
    - VATS: average number - 40.3 LNs (10 gms)
    - Open: average number - 1.2 LNs (0.2 gms) more LNs
  - **Left side**
    - VATS: average number - 37.1 LNs (8.3 gms)
    - Open: average number - 1.2 LNs (0.2 gms) more LNs
- Less than 2% of LNs missed with VATS lobectomy

Sagawa et al ATS 2003
VATS LN Dissection

LN Dissection – Retrospective Study

- VATS lobectomy vs Open lobectomy
- 81 pts VATS; 79 pts Open
- VATS 5-year survival: 89%; Open – 78% (NS)

<table>
<thead>
<tr>
<th></th>
<th>VATS</th>
<th>Open</th>
<th>p Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>LN Metastasis</td>
<td>11%</td>
<td>18%</td>
<td>0.07</td>
</tr>
<tr>
<td>Mediastinal LNs</td>
<td>13.0</td>
<td>15.7</td>
<td>0.23</td>
</tr>
<tr>
<td>Total Recurrence</td>
<td>16.7%</td>
<td>19.2%</td>
<td>0.68</td>
</tr>
<tr>
<td>Locoregional Rec</td>
<td>10.2%</td>
<td>5.1%</td>
<td>0.23</td>
</tr>
</tbody>
</table>

- VATS lobectomy was not inferior to open lobectomy

Shiraishi et al Surg 2005
VATS LN Dissection

LN Dissection – Retrospective Study

- VATS lobectomy vs Open lobectomy (LND)
- 31 pts VATS; 31 pts Open

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<thead>
<tr>
<th></th>
<th>VATS</th>
<th>Open</th>
<th>p Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total # LNs</td>
<td>28.2</td>
<td>29.8</td>
<td>0.51</td>
</tr>
<tr>
<td># N1 LNs</td>
<td>9.5</td>
<td>8.4</td>
<td>0.33</td>
</tr>
<tr>
<td># N2 LNs</td>
<td>18.6</td>
<td>21.4%</td>
<td>0.21</td>
</tr>
<tr>
<td># Nodal Stations</td>
<td>6.8</td>
<td>6.7</td>
<td>0.74</td>
</tr>
</tbody>
</table>

- No differences in OR time, Blood loss, CT duration, LOS or Complications

Yang et al TCVS 2013
1,111 patients – lobectomy (randomized into LN sampling vs LN dissection): 7/1999 – 2/2004

- LN sampling - 498 pts; LN dissection – 525 pts
- Operative mortality : LNS 2.0%; LND – 0.76%
- Complications – 38% in each group

Differences

- LND had longer operative time – 15 minutes
- LND had greater CT drainage – 121 cc

- LND adds insignificant morbidity with pulmonary resection

Allen et al ATS 2006
VATS Lobectomy
Z0030 Trial - Survival

- LN sampling - 498 pts; LN dissection – 525 pts
- Right - 2R, 4R, 7, 10R; Left – 5, 6, 7, 10L
- No difference – Resection, Stage or Pathology

At Time of LN Dissection
- 21 pts (4.0%) had occult N2 disease
- Median survival: LNS - 8.1 yrs; LND – 8.5 yrs
- Time to recurrence: LNS - 5.7 yrs; LND – 6.1 yrs
- No difference in local or regional recurrence
- 5-year DFS 69% in LNS; 68% in LND patients
- LND did not improve survival or decrease recurrence

Darling et al JTCVS 2010
VATS LN Dissection
Z0030 Trial – VATS vs Open

- 752 patients: 66 pts VATS and 686 Open Lobectomy
- Operating Time: VATS - 118 min vs Open - 172 min (p = 0.01)
- Total LNs: VATS - 15 vs Open - 19 (p = 0.147)
- LN stations: VATS - 7 vs Open - 7 (p = 0.418)
- R1/R2 Resections: VATS – 0% vs Open 2.3% (p = 0.368)
- VATS Patients
  - Less FOB procedures
  - Fewer CTs > 7 days
  - Shorter hospital stay
- No difference in mortality: VATS – 0% vs Open – 1.6% (p = 1.0)

Scott et al JTCVS 2010
VATS LN Dissection
Washington University Study

  - 79 VATS and 464 Open Lobectomy or Segmentectomy
- Total LNs: VATS - 7.4 vs Open - 8.9 (p = 0.029)*
- N2 LNs: VATS – 2.5 vs Open – 3.7 (p = 0.004)*
  - Station #7: VATS – 0.6 vs Open – 1.2 (0.002) *
- Right-sided: No difference in Stations
- Left-sided:
  - Station #7: VATS - 0.4 vs Open 1.0 (p = 0.001)*
  - Station #5/6: VATS - 0.5 vs Open 1.1 (p = 0.04)*
- 2-year Survival: VATS – 83% vs Open 81% (NS)

Denlinger et al ATS 2010
VATS LN Dissection
NCCN NSCLC Database Study

- Retrospective Review – 388 patients (2007 - 2010)
  » 199 VATS and 189 Open Lobectomy
- Total LNs: VATS – 4.0 vs Open – 4.0 (p = 0.6)
- N2 LNs: VATS – 3.15 vs Open – 2.91 (p = 0.12)
- >Three N2 Stations: VATS – 66% vs Open – 58% (0.12)
- VATS Upstaging (N1/N2) – 8.8% vs Open – 14.5% (0.12)
- VATS Downstaging (N0/N1) – 28.6% vs Open – 26.1% (0.9)
- No difference in the efficacy of VATS MLN dissection

D’Amico et al ATS 2011
VATS LN Dissection
Society Thoracic Surgeons Database

- 11,531 stage I operations; VATS - 4394; Open – 7137
- Clinical N0 Lung Cancer Patients
  - pN0  VATS - 88.4%  Open - 85.7%  Total - 86.7%
  - pN1  VATS - 6.7%  Open - 9.3%  Total - 8.3%
  - pN2  VATS - 4.9%  Open - 5.0%  Total - 5.0%
- Overall LN upstaging Open - 14.3% vs VATS - 11.6%*
- Mediastinal LN evaluation by VATS and Open was equivalent for both segmentectomy and lobectomy
- Lower rates of N1 upstaging was seen in the VATS

Boffa et al ATS 2012
VATS LN Dissection
Operative Technique
Lymph Node Removal

Suction Technique

Cautery Technique

Energy Technique
VATS Lobectomy
Enseal Articulating Tip
VATS LN Dissection
Operative Technique – Energy Devices

- Harmonic Ace – 5 mm vessels; 5 mm TS
- LigaSure Device – 7 mm vessels, 3 mm TS
- Enseal Device – 7 mm vessels, 1 mm TS

- Thermal Spread (1 – 5 mm)
  » Reduce associated structure damage

- Lymphatic and vessel control (Emory)
  » Decrease CT duration
  » Decrease hospital stay
  » Divide pulmonary artery branches
VATS LN Dissection
Operative Technique – Nodal location

- Hilar nodes (N1)
  - Dissected and removed with vessel isolation
  - Included with anatomical lung removed
    - Lobe
    - Segment

- Mediastinal nodes (N2)
  - Left and right paratracheal (Station 4L and 4R)
  - AP window (Station 5 and 6)
  - Subcarnial (Station 7)
  - Inferior LNs (Station 8 and 9)
VAT Lobectomy
Energy-assisted LN Dissection

- 226 pts EALND (65%) vs 124 CALND
- # LN Stations: EALND – 4.2; CALND – 4.1
- Total LNs: EALND – 17.5; CALND – 18.0
- CT duration: EALND – 2.9 days; CALND – 4.1 days
- Pleural Drainage: EALND 610 cc; CALND – 906cc
- Hospital stay: EALND – 3.8 days; CALND – 5.3 days
- Energy-assisted LND decreases CT days and LOS
VATS LN Dissection
Operative Technique – Improvements

- **Learning curve:** 25 – 50 cases
  - Video review – LN dissection

- **Visualization** – 0, 30, 45 degree thoracoscope

- **Station #7 issues:** Associated structures
  - Esophagus/Vagus nerve
  - Lymphatics/Thoracic duct
  - Pericardium/Heart/Aorta
  - **Nodal Depth: Left > Right**
    - Increase tidal volume (double) and use 45 degree scope

- **Energy Devices**
# VATS Lobectomy Results

<table>
<thead>
<tr>
<th>Series</th>
<th>Number</th>
<th>Cancer</th>
<th>Mortality</th>
<th>Stay</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lewis 1998</td>
<td>200</td>
<td>171</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>Yim 1998</td>
<td>214</td>
<td>168</td>
<td>1 (0.4%)</td>
<td>7</td>
</tr>
<tr>
<td>Kaseda 1998</td>
<td>145</td>
<td>103</td>
<td>1 (0.8%)</td>
<td>NA</td>
</tr>
<tr>
<td>Hermansson 1998</td>
<td>30</td>
<td>15</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>Ohtsuka 2004</td>
<td>95</td>
<td>95</td>
<td>1 (1.0%)</td>
<td>8</td>
</tr>
<tr>
<td>Walker 2003</td>
<td>159</td>
<td>159</td>
<td>3 (1.8%)</td>
<td>6</td>
</tr>
<tr>
<td>Gharagozloo 2003</td>
<td>179</td>
<td>179</td>
<td>1 (0.5%)</td>
<td>4</td>
</tr>
<tr>
<td>Rovarion 2004</td>
<td>193</td>
<td>118</td>
<td>0</td>
<td>NA</td>
</tr>
<tr>
<td>Solaini 2001</td>
<td>112</td>
<td>87</td>
<td>0</td>
<td>6</td>
</tr>
<tr>
<td>Tatsumi 2003</td>
<td>118</td>
<td>118</td>
<td>0</td>
<td>16</td>
</tr>
<tr>
<td>McKenna 2005</td>
<td>1100</td>
<td>1015</td>
<td>9 (0.8%)</td>
<td>3</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>2545</strong></td>
<td><strong>2228 (88%)</strong></td>
<td><strong>16 (0.7%)</strong></td>
<td><strong>6</strong></td>
</tr>
</tbody>
</table>
VATS Lobectomy

Pain

Retrospective Series

- **Landreneau 93** - VATS (7 pts) vs Open (38 pts)
  - VATS less narcotic use and lower pain index
  - Shoulder function better after VATS

- **Nagahiro 01** - VATS (13 pts) vs Open (9 pts)
  - VATS associated with less pain on POD 0, 1, 7 and 14

- **Nomori 00** - VATS (33 pts) vs Open (33 pts)
  - VATS associated with less pain and analgesic use on POD 1 - 7
  - No significant pain difference at POD 14
VATS Lobectomy
Pulmonary Function

Retrospective Series

- **Nakata 00 - VATS (10 pts) vs Open (11 pts)**
  - PaO₂, O₂ Sat, FVC, FEV₁ better after VATS on POD 7
  - Peak flow rate better after VATS on POD 7 and 14

- **Nomori 03 - VATS (28 pts) vs Open (84 pts)**
  - PaO₂, O₂ Sat, FVC, FEV₁ better after VATS on POD 7
  - VC and 6 min walk better after VATS on POD 7 and 168

- **Kaseda 00 - VATS (103 pts) vs Open (150 pts)**
  - FVC, FEV₁, and VC better after VATS on POD 21
**VATS Lobectomy**

**Discharge Independence**

- 20 VATS vs 38 open lobectomy
- Transfer to home with care
  - Open – 63%; VATS – 20%
- Personal care
  - Open - 21%; VATS – 10%
- Incision/medical care
  - Open – 13%; VATS – 0%
- Physical therapy
  - Open – 13%; VATS – 0%
- Home support
  - Open – 18%; VATS – 5%

Demmy et al AM J Surg 2004
VATS Lobectomy
Quality of Life

Consecutive Case Series

- VATS lobectomy (22) vs Open Lobectomy (22)
- QOL assessed by patient surveys
- VATS lobectomy pts had significant decrease in acute and chronic chest pain
- VATS lobectomy pts had decrease in time until return to preoperative activity
- VATS lobectomy associated with long-term benefits for the QOL in patients with lung cancer

Suriura et al Surg Laparosc 1999
My Old Kentucky Home

Great Cars

Corvette Factory – Bowling Green, KY
VATS Lobectomy
Survival

Cancer Survivor
## VATS Lobectomy Survival

<table>
<thead>
<tr>
<th>Series</th>
<th>Number</th>
<th>Cancer</th>
<th>Survival</th>
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<tbody>
<tr>
<td>Gharagozloo 2003</td>
<td>179</td>
<td>179</td>
<td>85%</td>
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<tr>
<td>Kaseda 1998</td>
<td>128</td>
<td>62</td>
<td>94 (4)</td>
</tr>
<tr>
<td>Ohtsuka 2004</td>
<td>95</td>
<td>95</td>
<td>97(3)</td>
</tr>
<tr>
<td>Walker 2003</td>
<td>159</td>
<td>159</td>
<td>78%</td>
</tr>
<tr>
<td>Rovarion 2004</td>
<td>193</td>
<td>118</td>
<td>73%</td>
</tr>
<tr>
<td>Solaini 2001</td>
<td>112</td>
<td>87</td>
<td>85 (3)</td>
</tr>
<tr>
<td>Tatsumi 2003</td>
<td>118</td>
<td>118</td>
<td>92%</td>
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<tr>
<td>Sugi 2000</td>
<td>48</td>
<td>48</td>
<td>90%</td>
</tr>
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<td>McKenna 2005</td>
<td>1100</td>
<td>1015</td>
<td>84%</td>
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<tr>
<td><strong>Total</strong></td>
<td><strong>1765</strong></td>
<td><strong>1721 (98%)</strong></td>
<td><strong>84%</strong></td>
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# VATS Lobectomy Results – 5 year Survival

<table>
<thead>
<tr>
<th>Author</th>
<th>Study Type</th>
<th>VATS Pts</th>
<th>OPEN Pts</th>
<th>VATS Survival</th>
<th>OPEN Survival</th>
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</thead>
<tbody>
<tr>
<td>Sugi 2000</td>
<td>Prospective</td>
<td>48</td>
<td>52</td>
<td>90%</td>
<td>85%</td>
</tr>
<tr>
<td>Shiraishi 2006</td>
<td>Retrospective</td>
<td>81</td>
<td>79</td>
<td>89%</td>
<td>78%</td>
</tr>
<tr>
<td>Whitson 2008</td>
<td>Review</td>
<td>3114</td>
<td>3256</td>
<td>80%</td>
<td>66%</td>
</tr>
<tr>
<td>Flores 2009</td>
<td>Retrospective</td>
<td>398</td>
<td>43</td>
<td>79%</td>
<td>75%</td>
</tr>
<tr>
<td>Yang 2009</td>
<td>Retrospective</td>
<td>113</td>
<td>508</td>
<td>79%</td>
<td>82%</td>
</tr>
</tbody>
</table>
# Meta-Analysis of VATS Lobectomy vs Open Lobectomy

**Table 3. Univariate Comparison of Surgical Approach to Lobectomy**

<table>
<thead>
<tr>
<th>Variable</th>
<th>VATS</th>
<th>Thoracotomy</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Studies, No.</td>
<td>Patients, No.</td>
</tr>
<tr>
<td>Overall survival, %</td>
<td>9</td>
<td>867</td>
</tr>
<tr>
<td>1-year</td>
<td>11</td>
<td>1486</td>
</tr>
<tr>
<td>2-year</td>
<td>13</td>
<td>1623</td>
</tr>
<tr>
<td>3-year</td>
<td>8</td>
<td>759</td>
</tr>
<tr>
<td>4-year</td>
<td>5</td>
<td>531</td>
</tr>
<tr>
<td>5-year</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Overall complications, %</td>
<td>11</td>
<td>2149</td>
</tr>
<tr>
<td>Atrial fibrillation, %</td>
<td>7</td>
<td>1095</td>
</tr>
<tr>
<td>Pneumonia, %</td>
<td>7</td>
<td>1095</td>
</tr>
<tr>
<td>Persistent air leak, %</td>
<td>8</td>
<td>1120</td>
</tr>
<tr>
<td>Chest tube duration, d</td>
<td>9</td>
<td>713</td>
</tr>
</tbody>
</table>

CI = confidence interval; VATS = video-assisted thoracoscopic surgery.

VATS Lobectomy Cost - Premier Database

- 25 million inpatient DC; 175 million outpatient DC Database
- July 2007 through Dec 2008
- Lobectomy for lung cancer by thoracic surgeon
- 3961 procedures – 1054 via VATS; 2905 via Open

<table>
<thead>
<tr>
<th>Procedure</th>
<th>VATS</th>
<th>Open</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hospital Cost</td>
<td>$20,316</td>
<td>$21,016*</td>
</tr>
<tr>
<td>- Experienced Surgeon</td>
<td>$18,133</td>
<td></td>
</tr>
<tr>
<td>- Beginner Surgeon</td>
<td>$22,050</td>
<td></td>
</tr>
<tr>
<td>OR Time</td>
<td>4.1 hrs</td>
<td>3.8 hrs*</td>
</tr>
<tr>
<td>Hospital Stay</td>
<td>6.1 dys</td>
<td>7.8 dys*</td>
</tr>
<tr>
<td>Adverse events OR of 1.22 favoring VATS Lobectomy</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

ATS 93:1027-1032 2012
VATS Lobectomy
Emory Series (2004 – 2012)

- 913 VATS Lobectomies; 858 (94%) for cancer
- No operating room mortalities
- Median operative time - 85 minutes (range, 45 – 242)
- Operative mortality - 9 pts (0.9%)
- 328 pts (36%) had no complications
- Median length of stay - 3 days (range, 2 – 12)
- Conversion to thoracotomy occurred in 51 pts (6%)
- No incisional recurrence
- In 2012, 87% of lobectomies via VATS approach
VATS Lobectomy
CALGB 140503

- Phase III randomized study of lobectomy versus sublobar resection for small (≤ 2 cm) peripheral NSCLC.
- Lobectomy (Open or VATS).
- Limited resection (Open or VATS)
  » Wedge
  » Segmentectomy
- 5 year Follow-up
- 1297 patients (626 pts); 259 pts/ year for 5 years
  » 30% ineligibility – 908 patients
- 405 patients randomized; 246 enrolled; (Cornell – 1st, Pittsburgh – 2nd, Emory – 3rd)
VATS Lobectomy

Disadvantages

Learning Curve
VATS Lobectomy

Summary

- VATS lobectomy can be performed safely with low morbidity and mortality
- VATS and open lobectomy are comparable
- VATS lobectomy may be a better oncologic procedure than open thoracotomy
- Prospective randomized studies (CALGB) ongoing
- Cost effective surgery (hospital and postoperative care)
- Low threshold to open; procedure time limit
- Stepwise learning (open and VATS) process
- Mentorship/ Proctorships/ VATS Courses
VATS Lobectomy
National Champions
Roll Tide

“The Process is a Continuum” - Nick Saban