Practical Anatomy for General Thoracic Surgery: The Stuff They Don’t Teach You in the Picture Books

Stephen C. Yang, MD
The Arthur B. and Patricia B. Modell Chair in Thoracic Surgery
Adjunct Vice-Chair of Faculty Development and Education, Department of Surgery
Professor of Surgery and Oncology
TSDA Boot Camp 9/15/17
Disclosures

- No financial disclosures
- Modest experience, don’t claim to know everything
- Conflict: I’m a Dukie
Objectives

- Review important anatomic landmarks in general thoracic surgery
- Recognize the common anatomic anomalies encountered during these procedures
- Describe the operative implications of these anomalies
Bronchoscopy

- Know your scope!
Bronchoscopy

- Know your scope!
- Tracheal RUL bronchus
Know your scope!
- Tracheal RUL bronchus
- Sup seg take off varies
Bronchoscopy

- Know your scope!
- Tracheal RUL bronchus
- Sup seg take off varies
- Troubleshooting malpositioned double lumen tubes
Bronchoscopy – Segmental Nomenclature (anatomic vs Boyden’s)
Mediastinoscopy
Sternotomy, tracheostomy

High riding innominate artery
Azygous lobe
1891 – Tuffier, first successful lung resection for TB
1908: Babcock, RLL lobectomy
1931: Churchill, dissection lobectomy
1933: Graham, left pneumonectomy for lung cancer
Lung Resections

- 3D vascular anatomy difficult via VATS (thus appreciate open experience)
- Anatomic anomalies are frequent
- Increasing number of (VATS) segmentectomies given screening programs picking up small lesions
Nodule Localization

- Increased incidence with CT screening
- Use 3-D recon
- Landmarks:
  - Xiphoid
  - Table position
  - Sup seg tip
  - IPV
  - Nipples
LLL
Pulmonary Collaterals: *Pores of Kohn*

- Interalveolar connections, Canals of Lambert
- Account for:
  - Ventilation across segments and fissures
  - Failure of endobronchial valves
  - Local recurrence after wedge resection
## Common PA Variants - Right

<table>
<thead>
<tr>
<th>Lobe</th>
<th>Common</th>
<th>Variant</th>
</tr>
</thead>
<tbody>
<tr>
<td>RUL</td>
<td>Truncus anterior Post asc branch</td>
<td>15% no post asc 5% post asc from sup seg</td>
</tr>
</tbody>
</table>

*Note: The image shows a map of the pulmonary arteries with labels for RUL (Right Upper Lobe) and RML (Right Middle Lobe), along with annotations for post seg (postsegmental) and sup seg (superial segmental).*
## Common PA Variants - Right

<table>
<thead>
<tr>
<th>Lobe</th>
<th>Common</th>
<th>Variant</th>
</tr>
</thead>
<tbody>
<tr>
<td>RUL</td>
<td>Truncus anterior Post asc branch</td>
<td>15% no post asc 5% post asc from sup seg</td>
</tr>
<tr>
<td>RML</td>
<td>55% one common trunk 45% two branches</td>
<td>5% &gt; 2 branches</td>
</tr>
</tbody>
</table>
## Common PA Variants - Right

<table>
<thead>
<tr>
<th>Lobe</th>
<th>Common</th>
<th>Variant</th>
</tr>
</thead>
<tbody>
<tr>
<td>RUL</td>
<td>Truncus anterior Post asc branch</td>
<td>15% no post asc 5% post asc from sup seg</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RML</td>
<td>55% one common trunk 45% two branches</td>
<td>5% &gt; 2 branches</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RLL</td>
<td>5 distinct branches or common trunk to basilar</td>
<td>20% have multiple sup seg</td>
</tr>
</tbody>
</table>
# Common PA Variants - *Left*

<table>
<thead>
<tr>
<th>Lobe</th>
<th>Common</th>
<th>Variant</th>
</tr>
</thead>
<tbody>
<tr>
<td>LUL</td>
<td>Random order of seg branches 2-8 may arise</td>
<td>10% lingular branches: none or arise proximally</td>
</tr>
</tbody>
</table>
Common PA Variants - *Left*

- Anomalous Lingular PA
- LUL bronchus
- Sup Seg PA
- Desc PA
- SPV
## Common PA Variants - Left

<table>
<thead>
<tr>
<th>Lobe</th>
<th>Common</th>
<th>Variant</th>
</tr>
</thead>
<tbody>
<tr>
<td>LUL</td>
<td>Random order of seg branches 2-7 may arise</td>
<td>10% lingular branches: none or arise proximally</td>
</tr>
<tr>
<td>LLL</td>
<td>70% sup seg branches off before lingula 60% single common basilar trunk</td>
<td>30% ≤ 2 branches to sup seg</td>
</tr>
</tbody>
</table>
Common PV Trunk

- L>R
- Reported 14% cases
- Identify both SPV and IPV
- If accidentally divided, convert to open, reanastomose to LA (not completion pneumonectomy)
Inferior Pulmonary Ligament

- Station 9 LN
- Vascularity increases with inflammation (esp cystic fibrosis)
- Pulmonary sequestration systemic arterial supply
- Chyle leak
Operative Pitfalls During VATS Lung Resections

- **RUL**: ligate RML PV, injury to PA during dissection behind RUL PV, azygous v. injury, dividing R mainstem bronchus
- **RML**: avulsion med seg branch
- **RLL**: dividing RML bronchus when completing lower oblique fissure, damage phrenic nerve
- **LUL/LLL**: multiple PA branches, dividing L mainstem bronchus, single PV
Intercostal Muscle Flap

Take down 1st after opening ICS

Do not wrap circumferentially!
Tissue Flaps of the Chest
Lymph Node Dissection/Sampling
VATS Ports

Scapular Tip

Scapula

Long thoracic nerve

Anterior working port

Posterior working port

Camera port
Injuries: nodal dissection, esophageal mobilization

20% with anomalous anatomy

Some advocate ligation during thoracic portion
4 points of narrowing
- Watch for aberrant or replaced L hepatic a. (25%)
- Upper path: R chest
- Lower path: L chest
- Replaced subclavian – special approaches
Esophageal Dissection
Esophageal Dissection

Esophagus

R Mainstem
Esophageal Dissection

- Esophagus
- Subcarinal LN packet
- Trachea
- R Mainstem
- Divided Azygous
Conclusion

- A number of common anomalies exist particularly for pulmonary resections
- Value open operations to aid in VATS/robotics approach
- Vary operative procedure to gain confidence in anatomy
- Study CT 3D reconstructions carefully
Thank you
syang@jhmi.edu