Energy-Based Platforms in Minimally Invasive Thoracic Surgery

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Good things are happening here
No Disclosures
Energy

William T. Bovie
(1882-1958)
Energy Devices...

- Coagulate small vessels
- Minimize blood loss in surgery

- In Minimally Invasive Surgery:
  - Critically important to facilitating MIS
  - Hemostatic division of tissue
  - Division of increasingly large blood vessels
## Types of Energy

<table>
<thead>
<tr>
<th>Electrical / RF</th>
<th>Vibrational</th>
<th>Others</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electrosurgery</td>
<td>Harmonic</td>
<td>CUSA</td>
</tr>
<tr>
<td>Ligasure</td>
<td>Thunderbeat</td>
<td>Hydrojet</td>
</tr>
<tr>
<td>Enseal</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Argon</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- tissue heating
- protein coagulation
- hemostasis
Electrosurgery

• Electrocautery ≠ Electrosurgery
• Electrocautery

• Electrosurgery
## Tissue vs Heat

<table>
<thead>
<tr>
<th>Temperature (°C)</th>
<th>Effect Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>45 C</td>
<td>Collagen uncoils, may reanneal with fusion</td>
</tr>
<tr>
<td>60 C</td>
<td>Coagulation necrosis</td>
</tr>
<tr>
<td>80 C</td>
<td>Carbonization, drying, shrinking</td>
</tr>
<tr>
<td>100 C</td>
<td>Complete cellular destruction and vaporization</td>
</tr>
<tr>
<td>125 C</td>
<td>Complete oxidation of protein and lipids</td>
</tr>
</tbody>
</table>
Electrosurgery Principles

\[ I = \frac{V}{R} \]

Current density
- heating effect

http://www.abc.net.au/science/articles/2010/07/07/2946773.htm
Electrosurgery Principles

Radio Frequency Energy
Electrosurgery Principles

Low Voltage
- Pure Cut: 100% on, 50% on, 50% off
- Blend 1: 50% on, 40% on, 25% on
- Blend 2: 60% off, 60% off, 75% off
- Blend 3: 75% off, 75% off, 94% off
- Coag: 6% on, 94% off

High Voltage
Electrosurgery Principles

Monopolar / Unipolar

Bipolar
Electrocautery in VATS
Risks: Monopolar in MIS
Modern Bipolar-Type devices

Do more with ENSEAL® G2 Articulating Tissue Sealers
Enseal

Positive Temperature Control

Thermal Spread for 5 mm Electrosurgical Instruments

<table>
<thead>
<tr>
<th>Instrument</th>
<th>Spread (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>ERBE EnSeal</td>
<td>1.10</td>
</tr>
<tr>
<td>Gyrus</td>
<td>2.78</td>
</tr>
<tr>
<td>SonoSurge</td>
<td>2.98</td>
</tr>
<tr>
<td>LigaSure</td>
<td>3.23</td>
</tr>
</tbody>
</table>
Ligasure
Ligasure
Harmonic Scalpel

Vibration: 55,500Hz
Tissue heating, coagulation
Cut/seal thicker tissue
Seal vessels ~7mm
Harmonic Scalpel

Compression ->

Active blade ->
Harmonic Scalpel
Combination instrument

The World’s Only Fully-Integrated Bipolar and Ultrasonic Technology

Surgeons no longer need to choose between rapid dissection and reliable hemostasis when selecting an advanced energy device.
Novel Energy and VATS

- Energy devices facilitate dissection
- Decrease blood loss, particularly in inflammatory and post-induction cases
- Facilitate a clean lymph node dissection

- What about vascular division?
Literature Summary

Usefulness of vessel-sealing devices for ≤7 mm diameter vessels: a randomized controlled trial for human thoracoscopic lobectomy in primary lung cancer

Results of Li-Tho trial: a prospective randomized study on effectiveness of LigaSure® in lung resections

Preliminary results of anatomic lung resection using energy-based tissue and vessel coagulative fusion technology

**Objective**: Mechanical stapling devices have been established as the mainstay of therapy in the selective isolation and division of bronchial and vascular structures during anatomic lung resection. Few data are available regarding the application of energy-based tissue fusion technology during anatomic lung resection. In the present study, we evaluated the use of energy-based instruments for the division of the pulmonary arterial and venous branches during anatomic lung resection.

**Methods**: Anatomic lung resection (segmentectomy or lobectomy) was performed using energy-based coagulative fusion technology. A low-profile jaw can be used to facilitate dissection in both open and video-assisted thoracic surgery cases, applying a seal 6 mm wide by 22 mm in length. Two energy applications were applied to the arterial and venous branches before vessel division.
Novel Energy and VATS
Argon Beam Coagulator

- Argon: inert gas which is easily ionized
- Limited penetration depth
- Cover large surface
- Uses: extrapleural dissection; re-operative adhesions
Summary

• Energy devices are critical to the safe performance of minimally invasive thoracic surgery
• Understand the limits and risks of each tool
• We will likely see increasing application of these tools in the future
Energy-Based Platforms

Southern Ohio Medical Center

Very Good things are happening here

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