Intra-operative: Energy/Injury

**Energy Source**
- Monopolar: Capacitative coupling, Insulation failure, Direct coupling, Inadvertent reflection, Ignition of flammable gas, Operating room safety (e.g., eye injury)
- Laser: Lateral thermal spread
- Monopolar/bipolar/ultrasonic/laser

Only 10% of laparoscopic instruments are within the field of view of the laparoscope, and electrosurgical injuries are not immediately recognized.

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**Bipolar Electrosurgery**

developed to decrease the risk of stray current injury and offer the ability to seal larger vessels.

- In bipolar electrosurgery, electric current passes from one jaw of a grasper (the active electrode equivalent) to the other jaw (the return pad electrode equivalent).

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### Advantages

- Lower voltage requirement (alternating current) resulting in decreased lateral thermal
- No risk of stray current injury from capacitive coupling

### Disadvantages:

- Diminished ability to vary operational parameters, requiring “closed circuit”
- Continuous electrical waveform standard; and relatively large electrodes (lack of versatility of tissue effects)
- Tissue adherence to electrodes, and instrument tips may cause tissue trauma or tearing of blood vessels
- Need to change instruments to cut
**Laparoscopic Surgery: Keeping it safe!**

**Intra-operative: Energy**

**Advanced Bipolar Devices**

- Controlled by a proprietary electrosurgery generator unit, using a computer feedback response system (senses tissue impedance) designed to continuously adjust applied voltage and current.
- Optimized energy delivery using the lowest possible power setting for desired tissue effect.
- Audio "alert" when the desired tissue effect has been achieved (minimizing charring, grasper sticking during release and lateral thermal spread).
- Different sealing time, burst strength, smoke production.

**Ultrasonic Devices**

- Ultrasonic produce tissue effects by converting electrical energy into vibrations at more than 55,000 Hz.
- Vessel-sealing tissue effects are the same as those obtained with advanced bipolar electrosurgery, (desiccation and coagulation with resultant coaptation).

**Advantages**
- Less instrument traffic due to the combined vessel-sealing and tissue cutting.
- Less tissue charring.
- Reduced lateral thermal spread.
- Less smoke generation.

**Disadvantages**
- Higher post activation instrument tip temp.
- Limited dissection capability.
Intra-operative: Energy

Ultrasonic Devices

Advantages

- Less instrument traffic due to the combined vessel-sealing and tissue cutting
- Less tissue charring
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- Less smoke generation.

Disadvantages

- Higher post activation instrument tip temp
- Limited dissection capability

Lab based study of T at instrument tip (Thermal conductivity)

- Monopolar: 100.1°C
- Harmonic ACE (power setting 5): 71.3°C
- Bipolar and the LigaSure were 50.0°C
- Monopolar hook required 55 seconds for the tip of the instrument to cool to 42°C, with less time required for the other instruments.

Vital that surgeons allow adequate time for cooling of the instrument tips (fluid irrigation: 67%!!)

Instruments

- Disposable (9X costs)
- Reusable/Reprocessed
- Reposable

An operating room without incentives is VERY expensive!

Balance
Bundled care

Laparoscopic Surgery: Keeping it safe!

Intra-operative: Energy

<table>
<thead>
<tr>
<th>Ligasure</th>
<th>Ensure</th>
<th>Ultrasonic</th>
</tr>
</thead>
<tbody>
<tr>
<td>FDA vessel size</td>
<td>7mm</td>
<td>7mm</td>
</tr>
<tr>
<td>Lateral thermal spread</td>
<td>1.2-4.4 mm</td>
<td>0.98 mm</td>
</tr>
<tr>
<td>Mean T (°C), 2 mm lateral</td>
<td>55.5</td>
<td>58.9</td>
</tr>
<tr>
<td>Seal time (s)</td>
<td><strong>10.0</strong></td>
<td>19.2</td>
</tr>
<tr>
<td>Mean Burst mm Hg</td>
<td><strong>385</strong></td>
<td>255</td>
</tr>
<tr>
<td>Smoke ppm</td>
<td>12.5</td>
<td>21.6</td>
</tr>
</tbody>
</table>

* > 42°C may cause tissue damage

Safety
Sterility
Efficiency

Porosity detector to examine laparoscopic instruments used in 4 US hospitals: 15% insulation failure rate (Surg Endosc. 2010;24:462–465)

Australian hospitals*: overall prevalence of insulation failure of 27%

- 29% of monopolar instruments
- 15% of bipolar instruments
- 39% dedicated monopolar hooks and scissors

(J Minim Invasive Gynecol. 2007;14:228–232)

* <10% are “visible”
Laparoscopic Surgery: Keeping it safe!
Intra-operative: Energy

- Only 10% of instruments are in the field of view
- Electrosurgical injuries are typically not immediately recognized.
- Nonspecific symptoms, diagnosis delayed by 4 to 11 days
- Determination of the etiology of injury may be difficult, as an area of thermal coagulation necrosis may be difficult to diagnose histologically in the presence of prolonged inflammation and secondary infection (thermal injury may be mistakenly as mechanical or trocar-related injury).

Evaluate the entire operative field and document the absence of visible injury.

Law, Obstet Gynecol Survey 2014

Hemostatic “Tools”
- Surgical clip
- Loop suture
- Suture ligation
- Surgical stapler
- Electrosurgery
- Advanced bipolar sealing systems
- Ultrasonic desiccation
- Radiofrequency sealants
- Hemostatic agents

Categories Of “Bleeding”

Oozing
Direct access, gradual surgical bleeding. Needs to be controlled but without the high urgency in other bleeds.

Continued Risk
No immediate bleeding but may leak and cause significant post surgical complications if hemostasis not achieved.

Tight Spaces
Surgical bleeding in difficult to access areas (nooks & crannies)

High Pressure
High pressure vessel (aortic/vascular suture line) where post surgical leaks can have devastating effects.

Problematic
Direct access, brisk surgical bleeding. Typically requires a sequence of products and approaches to control.
### Intra-operative: Hemostatic Agents

<table>
<thead>
<tr>
<th>Physical agents</th>
<th>Mechanism of action</th>
<th>Caveats</th>
<th>Duration/ Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gelatin matrix (Gelfoam, Gelfilm, Surgifoam)</td>
<td>Provides physical matrix for clot formation</td>
<td>Material expansion may cause compression; Not used in closed spaces or near nerve</td>
<td>4-6 weeks/$</td>
</tr>
<tr>
<td>Oxidized regenerated cellulose (Surgicel Fibrillar, Surgicel Nu-Knit)</td>
<td>Provides physical matrix for clot formation; acidic pH hemolysis and local clot formation</td>
<td>Works best in a dry field. Acidic pH inactivates biologic agents, such as thrombin, may increase inflammation. Minimize material</td>
<td>2-4 weeks/$</td>
</tr>
<tr>
<td>Microfibrillar collagen (Avitene, Instat, Helitene Helistat)</td>
<td>Provides physical scaffold for platelet activation and clot initiation.</td>
<td>Rare allergic reactions: may contribute to granuloma formation</td>
<td>8-12 weeks/$$</td>
</tr>
</tbody>
</table>

### Biologically active agents

<table>
<thead>
<tr>
<th>Biologically active agents</th>
<th>Mechanism of action</th>
<th>Caveats</th>
<th>Duration/ Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Topical thrombin (Thrombin-JMI, Recothrom, Evithrom, rh Thrombin)</td>
<td>Promotes conversion of fibrinogen to fibrin</td>
<td>Risk of blood-borne infection with non-recombinant human thrombin; risk of anaphylaxis and antibody formation with bovine thrombin</td>
<td>$$</td>
</tr>
<tr>
<td>Hemostatic matrix (Floseal, Surgiflo)</td>
<td>Gelatin provide Expansion/compression while thrombin initiates clot</td>
<td>Requires contact with blood</td>
<td>6-8 weeks/$$$</td>
</tr>
<tr>
<td>Fibrin sealants (Evicel, Tisseel, Crosseal)</td>
<td>Fibrinogen and thrombin causes cleavage of fibrinogen to fibrin and resultant clot initiation</td>
<td>Contraindicated in patients who have a history of anaphylactic reaction to serum-derived products or IgA deficiency</td>
<td>10-14 days/$$$</td>
</tr>
</tbody>
</table>

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### Summary from National Organizations

- **AAGL, ACOG, ESGE, SGO, AUGS**
  - No morcellation in suspected or known uterine cancer
  - Morcellation of unsuspected cancer may reduce patient survival
  - Minimally invasive surgery reduces pain, infection, post op morbidity
  - Decision of LPM use should be made after informed consent between the physician and patient
  - Support for a prospective registry

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**Laparoscopic Power Morcellation in Hysterectomy and Myomectomy: FDA Safety Communication - Use Discouraged Due to Increased Risk in Women With Uterine Fibroids**

**UPDATED 11/24/2014.** FDA warns against using laparoscopic power morcellators in the removal of the uterus (hysterectomy) or fibroids (myomectomy) in the vast majority of women. In an Immediately in Effect (IIE) guidance, the FDA is also recommending that manufacturers of laparoscopic power morcellators include in their product labeling specific safety statements in the form of a boxed warning and two contraindications. to be cancerous.
SILS
Single incision laparoscopic surgery

NOTES
Natural orifice translumenal endoscopic surgery

Postoperative care

- Discharge instructions
- Staff has to keep an “open ear”
- Minimize phone management
- 2 phone calls are too many
- Pathology reports are shared

Seven Deadly Social Sins

- “Wealth without work”
- “Pleasure without conscience”
- “Science without humanity”
- “Knowledge without character”
- “Politics without principle”
- “Commerce without morality”
- “Worship without sacrifice”

Gandhi
“The human mind is like an umbrella- it functions best when open”

Walter Gropius, German-American architect (1883-1969)