High Yield Topics

- Equipment Troubleshooting
- Energy Sources
- Access
- Physiology of Pneumoperitoneum
- Potpurri
Laparoscopic Equipment

- Insufflation Equipment
- Video monitor
- Light source
Laparoscopic Equipment

Gas Supply

- **Insufflator**
  - controls the flow of gas from the cylinder to the abdomen
  - high-flow insufflators can deliver 10 or more liters of gas per minute and rate can be adjusted from low to high
Laparoscopic Equipment
Gas Supply

- Insufflator
- Control panel
  - indication system listing the preset abdominal pressure
  - the current abdominal pressure
  - the flow rate of gas
  - amount of gas used
Laparoscopic Equipment Troubleshooting

- Check that the carbon dioxide tank attached to the insufflator is full.
- Check that the gasket is securely positioned.
- Open the carbon dioxide tanks to ensure that the tanks are full, and there are no gas leaks.
- Check that a spare tank is available in the OR.
- Check that the gasket in use is not damaged and that a spare gasket is available in the OR.
## Impeded view

<table>
<thead>
<tr>
<th>Pressure</th>
<th>Flow</th>
<th>Cause</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low</td>
<td>High</td>
<td>Leak</td>
</tr>
<tr>
<td>Low</td>
<td>Low</td>
<td>Empty</td>
</tr>
<tr>
<td>High</td>
<td>Low</td>
<td>Relaxation / occlusion</td>
</tr>
<tr>
<td>High</td>
<td>High</td>
<td>Multifactorial / Malfunction</td>
</tr>
</tbody>
</table>
Laparoscopic Equipment

Video Tower

- 300 Watt xenon light source
Laparoscopic Equipment

Video Tower

- 300 Watt xenon light source
Laparoscopic Equipment
Troubleshooting

- Check the clock on the light source and replace the bulb if it is near the end of its life expectancy.
- Check that there is sufficient paper in the video printer.
- Check that all cables are connected correctly and securely.
- Check that there is enough videotape available for the duration of the procedure.
- Check the availability of ancillary and spare equipment.
Laparoscopic Equipment Troubleshooting

- Blank Video Screen
  - Imaging chain
  - Camera
  - Light source
  - Monitor
  - Printer
  - Recorder
  - Router

SAGES Troubleshooting Guide
Energy Sources
Energy Sources

- Electrosurgery
  - Monopolar cautery
  - Bipolar cautery
- Ultrasonic
Energy Sources

- Monopolar
Energy Sources

- Monopolar Circuit
Energy Sources

- Tissue Heating
  \[ T = \left( \frac{\text{amps}}{\text{cm}^2} \right)^2 \]

- Current Density
  \[ I = \frac{V}{R} \]
Energy Sources

- Cutting Mode
- Coagulating Mode
- Blend Mode
Energy Sources

- Hazards of Electrosurgery
Energy Sources

- Capacitive coupling injury may occur when a plastic screw anchor is used to hold a metal trocar.
Energy Sources

- Direct Coupling
Energy Sources

- Direct Coupling
Energy Sources

- Return Circuit
Energy Sources

- Return Circuit
Energy Sources

- Return Circuit
Energy Sources

- Bipolar Cautery
Energy Sources

- Bipolar Cautery
Energy Sources

- Ultrasonic Coagulation
Energy Sources

- Ultrasonic Coagulation
Energy Sources

- Ultrasonic Coagulation
  - Relies on mechanical energy to produce effects
  - Piezoelectric Transducer
  - Tissue Effects
Energy Sources

- Disadvantages of Ultrasonic Coagulation
  - Heat generation
  - Inadvertent thermal injury
Patient Selection and Pre-operative Assessment

- **Absolute Contraindications**
  1. Uncorrected coagulopathy
  2. Inability to tolerate laparotomy
  3. Inexperienced laparoscopic surgeon
  4. Hypovolemic shock
  5. Unable to tolerate general anesthesia
Patient Selection and Pre-operative Assessment

- Relative Contraindications
  1. Generalized Peritonitis
  2. Extensive prior surgery
  3. Ability to tolerate general anesthesia
  4. Large abdominal mass
  5. Loss of abdominal domain
  6. Intestinal obstruction
  7. Severe cardiopulmonary disease
Patient Selection and Pre-operative Assessment

- Pre-operative Precautions
  1. Visceral Arterial Aneurysm
  2. Previous Abdominal Surgery
  3. Umbilical Abnormalities
  4. Hepato-splenomegaly
Patient Selection and Pre-operative Assessment

- Conditions Commonly Mistaken as Contraindications to Laparoscopy
  1. diaphragm injury
  2. GI bleed
  3. perforated viscus
  4. bowel obstruction
  5. abdominal trauma
  6. ectopic pregnancy
  7. Obesity
  8. COPD
  9. renal insufficiency
Veress Needle
Establishing pneumoperitoneum

- Spring-loaded needle
- Sharp tip
- Blunt tipped portion is the conduit for the insufflation gas
Veress Needle
Establishing pneumoperitoneum

- Umbilicus
- Subcostal
  - Avoid prior scars
  - Consider open technique
- Incision length determined by site of port placement
Be vigilant

Complications of veress needle access

- Inspect the aspirate
- Inspect the area beneath trocar site
- Pneumothorax can occur (0.1-0.2%)
- Gas embolism
Be vigilant

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Open technique does not guarantee avoidance of inadvertent organ injury
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General Principles of Trochar placement

“Triangulation”
General Principles of Trochar placement

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General Principles of Trochar placement

“Triangulation”

6-8cm or one hand
Physiology of Pneumoperitoneum
Physiology of Pneumoperitoneum

- Chemical Effects of the CO$_2$ Pneumoperitoneum
- Pressure Effects of Pneumoperitoneum
- Alternative Gases
- Additional Concerns with Pneumoperitoneum
Physiologic Effects of CO$_2$ Pneumoperitoneum

- Carbon Dioxide
  - Rapidly absorbed
  - Easily eliminated
  - Suppress combustion
  - Available and inexpensive
Physiologic Effects of CO₂ Pneumoperitoneum

- Carbon Dioxide
  - Rapidly absorbed
  - Easily eliminated
  - Suppress combustion
  - Available and inexpensive
Alternate Gases

- Nitrous Oxide ($\text{N}_2\text{O}$)
  - Avoids acid-based disturbances
  - possibility for combustion
- Inert gases
  - Argon, Helium
    - Expensive
    - Poor solubility
Physiologic Parameters of Pneumoperitoneum
Physiologic Parameters of Pneumoperitoneum
Physiologic Effects of CO₂ Pneumoperitoneum

- Pressure effects
  - Arrhythmias
    - Tachycardia
    - Premature ventricular contractions
    - Bradycardia
Altered hemodynamics
Physiologic Parameters of Pneumoperitoneum

Volume Status
Physiologic Effects of CO2 Pneumoperitoneum

- Decreased return
  - 30% flow decrease
  - DVT
    - 0.5% incidence
- Influenced by
  - Volume status
  - Positioning
Physiologic Effects of CO₂ Pneumoperitoneum

- Therapeutic Maneuvers for Decreased Cardiac Output
  - Desufflate immediately
  - Check insufflator
  - Check patient’s degree of relaxation
  - Check patient’s volume status
  - Rule out other causes of hypotension
Physiologic Parameters of Pneumoperitoneum
Physiologic Effects of CO\textsubscript{2} Pneumoperitoneum

- **Chemical effects**
  - Hypercarbia
    - Intraperitoneal
    - Subcutaneous
  - Acidosis
    - Respiratory
    - Metabolic
Altered ventilation

Physiologic Parameters of Pneumoperitoneum

- Increased intra-abdominal pressure effects on the thorax
  - Reduced functional residual capacity
  - Increased airway pressure
  - Reduced thoracic compliance
  - Reduced diaphragmatic excursion

- Resulting in ventilation-perfusion mismatches
Physiologic Parameters of Pneumoperitoneum
Altered renal blood flow

Physiologic Parameters of Pneumoperitoneum

Renal vascular resistance

Glomerular filtration rate
Additional Considerations

Gas embolus

- Presenting signs
  - Hypotension
  - Jugular venous distention
  - Tachcardia
  - Mill Wheel Murmur
Additional Considerations

Gas embolus

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  - Hypotension
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Additional Considerations
Gas embolus

Treatment

- Evacuate pneumoperitoneum
- Left lateral decubitus position
- Introduce central venous catheter
- “Durant’s position”
Additional Considerations

Hypothermia

- Occurs in 90% of cases
- Heated, humidified gas for pneumoperitoneum
- Minimize patient's exposure to cold room temperature
Exiting the Abdomen
Ensure hemostasis

Causes of Missed Bleeding

- Tamponade of venous bleeding
  - Trochar
  - Peritoneum
  - Pneumoperitoneum
- Improper attribution of hypotension
- Bleeding into a “hidden” space
Potpurri
Diagnostic Laparoscopy
Examining the Intestines

- Lysis of adhesions
- Traction
- Sharp & blunt dissection
- Sparing use of energy sources
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Examining the Intestines

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Dermoid Cyst

Diagnostic Laparoscopy
Intra-abdominal Pathology

Dermoid Cyst
Diagnostic Laparoscopy
Intra-abdominal Pathology

Ovarian Torsion
Right Groin: Direct Inguinal Hernia
Diagnostic Laparoscopy
Intra-abdominal Pathology

Right Groin: Recurrent Inguinal Hernia
Diagnostic Laparoscopy
Intra-abdominal Pathology

Spigelian Hernia
Diagnostic Laparoscopy
Intra-abdominal Pathology

Port Site Hernia
Diagnostic Laparoscopy
Intra-abdominal Pathology

Carcinomatosis/Peritoneal Implants
Appendicitis
Diagnostic Laparoscopy
Intra-abdominal Pathology

Crohn’s Disease
Diagnostic Laparoscopy
Intra-abdominal Pathology

Ischemic Bowel
Diagnostic Laparoscopy
Intra-abdominal Pathology

Cirrhosis
Diagnostic Laparoscopy
Intra-abdominal Pathology

Hemangioma
Laparoscopic Biopsy
Peritoneal Fluid Collection

- Early in procedure
- 300 cc of normal saline
- Agitate/tilt
- Aspirate using a trap
Laparoscopic Biopsy
Peritoneal Fluid Collection

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Laparoscopic Biopsy

Biopsy Methods

- Fine needle aspiration: 20-25 Ga
- Core needle: 14-18 Ga
- Biopsy forceps
- Wedge or excisional biopsy
- Avoid energy during specimen collection
Laparoscopic Biopsy

Hemostasis

- Energy sources
  - Cautery
  - Ultrasonic shears
  - Argon

- Direct pressure
  - Sponge

- Hemostatic agents
  - Cellulose
  - Fibrin sealant

- Suture
- Clips
- Endoloops
- Staplers
Laparoscopic Biopsy

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Laparoscopic Biopsy Extraction

- Minimize contact with the wound
- Port extraction
- Retrieval sac
- Wound protection
Laparoscopic Biopsy Extraction

- Minimize contact with the wound
- Port extraction
- Retrieval sac
- Wound protection
Hemorrhage and Hemostasis
Hemorrhage and Hemostasis

Port Site

- Inferior epigastric vessels
  - Stay lateral to rectus muscles
  - Place ports after vessels have been visualized

- Hemostasis
  - Cautery
  - Foley tamponade
  - Direct cut down
  - Laparoscopic assisted ligation
Hemorrhage and Hemostasis

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Hemorrhage and Hemostasis
Retroperitoneal

- Appropriate technique
  - Veress needle placement
  - Trocar insertion
- Convert to open
  - Extent of injury is unclear
  - Severe hemorrhage
Hemorrhage and Hemostasis
Retroperitoneal

- Appropriate technique
  - Veress needle placement
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Hemorrhage and Hemostasis
General Strategies

- Keep the tip of the scope clean to maintain visualization
- Control bleeding using a grasper
- Place additional ports
- Perform additional dissection to improve control
- Convert to open if indicated
Postoperative Nausea

- Treat early, treat often
- Disruption of anastomosis
- Band herniation
Postoperative Nausea

- Propofol
  - Induction agent

- Ondansetron (Zofran), Dolasetron (Anzemet)
  - 5-HT3 serotonin inhibitors, non-sedating

- Dexamethasone
  - Steroid, long half life, start of case, cheap

- Antiemetics (hx nausea)
  - Phenothiazines – Phenergan, Compazine
  - Serotonin blocker - Zofran
Prevention of Narcotic Induced Nausea

- Preemptive analgesia
  - COX 2 ? (Vioxx -MI in long term use)

- Intraoperative local analgesia
  - Before incision

- Non narcotic pain medications
  - Ketorolac (Torodol) ? renal, platelet
Bupivicaine (Marcaine .25%)

- 2.5 mg/kg –
  (70 cc in 70 kg person)

Large intravascular injection can be catastrophic due to cardiac side effects
Non Narcotic

- Ketorlac (IV, IM, PO)
- Non-selective cyclooxygenase (COX) inhibitors (PO)
  - Ibuprofen (Motrin)
  - Naproxen
- Selective COX-2 Inhibitors
  - Vioxx
  - Celebrex
- Acetaminophen (PO,PR)
  - Tylenol
Postoperative Pain

- Referred pain to shoulder
- 50% shoulder discomfort
- Diaphragmatic irritation
- Lasts 1-3 days