Laparoscopic Entry: Are You In?

APOG: Principles of Endoscopic Surgery

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Objectives

• Review current options for laparoscopic entry techniques and technologies
• Examine evidence behind different entry techniques and technologies
• Propose best practice techniques from available evidence

History of Laparoscopy

• Gr: Laparo- abdomen, Scopein- to examine
• 1902 - First laparoscopic procedure performed
• 1910 - First laparoscopy in human subject by Hans Christian Jacobaeus of Sweden
• Laparoscopy introduced in Canada in 1970s

www.wikipedia.com
Introduction

- Laparoscopy is a very common procedure in gynecology
- Laparoscopy has significant benefits compared to laparotomy
- The majority of the complications associated with laparoscopy occur at the time of entry
  - Vascular injury (0.9 per 1000)
  - Bowel injury (1.8 per 1000)

Laparoscopic Port Placement

Laparoscopic Entry

- Primary Port Placement
- Secondary/Accessory Port Placement

Primary Port Entry Techniques

- Closed Entry (Veress Needle) Technique
- Open Entry (Hasson) Technique
- Direct Trocar Entry Technique
- Radially Expanding Access System
- Visual Entry System
János Veres (1903-1979)

- Respirologist
- At time, high prevalence of TB in Hungary
- 1932 – created special spring-loaded needle to create therapeutic pneumothorax

Veress Entry Sites

- Umbilical insertion site
- LUQ (Palmer's Point) insertion site
- Transuterine insertion
- Trans cul-de-sac insertion
- Nine or tenth intercostal space insertion

Umbilical Entry Preferred

- Thinnest point of abdominal wall
What can you do to minimize injury?

1. Alter Angle of Entry Depending on BMI

<table>
<thead>
<tr>
<th>Group</th>
<th>Distance From Umbilicus (cm)</th>
<th>Recommended angle of instrument placement</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>To Bifurcation</td>
<td>To Peritoneum at 45°</td>
</tr>
<tr>
<td>Non-Obese</td>
<td>0.4 ± 1.6</td>
<td>2 ± 2</td>
</tr>
<tr>
<td>Overweight</td>
<td>2.4 ± 1.9</td>
<td>2 ± 1</td>
</tr>
<tr>
<td>Obese</td>
<td>2.9 ± 2.5</td>
<td>12 (median)</td>
</tr>
</tbody>
</table>

Wourd BM et al. (1992)

2. Open Veress Stopcock

Figure 5. Right intraperitoneal route (A) and left extraperitoneal route (B) and the importance of having an open stopcock.

Hurd WW et al. (2001)
3. Ensure that Patients are Supine

4. High Pressure Entry

- Entry pressure 20-25mmHg
- Prospective cohort study to assess affect on cardiopulmonary function
  - n = 100
  - ↓ in pulmonary compliance (21%)
  - ↑ in MAP of 7mm Hg
  - Neither are clinically significant
- The respiratory effects do not differ from the effect of Trendelenburg position + intra-abdominal pressure of 15mm Hg

5. Safety Checks

<table>
<thead>
<tr>
<th></th>
<th>Sensitivity (%)</th>
<th>Specificity (%)</th>
<th>PPV (%)</th>
<th>NPV (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Double click test</td>
<td>39</td>
<td>69</td>
<td>19</td>
<td>86</td>
</tr>
<tr>
<td>Aspiration test</td>
<td>0</td>
<td>98</td>
<td>0</td>
<td>83</td>
</tr>
<tr>
<td>Hanging drop test</td>
<td>16</td>
<td>89</td>
<td>22</td>
<td>85</td>
</tr>
<tr>
<td>Pressures 0-9 mmHg</td>
<td>79</td>
<td>63</td>
<td>32</td>
<td>93</td>
</tr>
</tbody>
</table>
6. Abdominal Wall Lifting?

<table>
<thead>
<tr>
<th>Method of lifting</th>
<th>Mean distance (cm)</th>
<th>Reduction with force</th>
</tr>
</thead>
<tbody>
<tr>
<td>Manually</td>
<td>3.5 +/- 1.14</td>
<td>2.1 +/- 0.91</td>
</tr>
<tr>
<td>Towel clips &lt; 2cm from umb</td>
<td>6.8 +/- 0.94</td>
<td>0</td>
</tr>
<tr>
<td>Towel clips &gt; 2cm from umb</td>
<td>5.14 +/- 1.04</td>
<td>1.03 +/- 0.32</td>
</tr>
</tbody>
</table>

Roy et al. (2001)

Increase Risk of Complications with Increase Attempts

<table>
<thead>
<tr>
<th>Attempts</th>
<th># women</th>
<th>Complications</th>
<th>Complication rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>295</td>
<td>48</td>
<td>16.3%</td>
</tr>
<tr>
<td>2</td>
<td>40</td>
<td>11</td>
<td>27.5%</td>
</tr>
<tr>
<td>3</td>
<td>9</td>
<td>4</td>
<td>44.4%</td>
</tr>
<tr>
<td>4</td>
<td>1</td>
<td>1</td>
<td>100%</td>
</tr>
</tbody>
</table>

Seth et al. (2006)

Harrith Hasson (1931 – 2012)

- First described open entry technique in 1971
- Founded the Society for the Advancement of Contraception (SAC)
- Served as Director of the American Association of Gynecologic Laparoscopists (AAGL)
- Served as President of the Society of Laparoendoscopic Surgeons (SLS) and the Accreditation Council of Gynecological Endoscopy (ACGE)

www.wikipedia.com
**Open Entry (Hasson) Technique**

- Skin incision
- Fascial incision
- Secure Fascia with heavy suture
- Open peritoneum
- Advance blunt trocar in cannula
- Secure Suture to cannula

**Advantages**
- ↓ Major vascular injury
- ↓ Visceral injury (?)
- ↓ Preperitoneal insufflation
- ↓ Gas embolism

**Disadvantages**
- ↑ Time (?)
- Visceral/bowel injuries unchanged (?)

Vilos G A et al. (2007)

**Direct Entry Technique**

- Only one blind step (trocar) instead of three (Veress needle, insufflation, trocar).
- The direct entry method is faster than any other method of entry
- Suggested advantages = avoidance of:
  - Failed pneumoperitoneum
  - Preperitoneal insufflation
  - Intestinal insufflation
  - CO2 embolism

*The least performed laparoscopic technique in clinical practice today*

Vilos G A et al. (2007)

**Disposable Shielded Trocars**

- Introduced 1984
- Partially retracting shield to expose sharp tip as resistance encountered
- Once shield enters cavity, it springs forward to cover sharp tip
  - Brief moment of sharp trocar tip exposure
- SOGC
  - No evidence of fewer visceral and vascular injuries during laparoscopic access
Radially Expanding Access

Visual Entry Systems

- SOGC
  - Visual entry cannula system advantage?
  - VEC trocars minimize entry wound size and insertion force
  - Not shown to avoid visceral / vascular injury

EndoTip (Storz)

Comparing Laparoscopic Entry Techniques

- Reviewed 28 RCT with 4860 individuals
- No evidence of advantage of using any single technique to prevent major vascular or visceral complication
  - Open entry vs Veress Needle
    - Open entry had reduced incidence of failed entry
  - Direct entry vs Veress Needle
    - Direct entry had lower rates of failed entry
    - Direct entry had lower rates of extraperitoneal insufflation
    - Direct entry had lower rates of omental injury
  - Radially expanding access system (STEP) vs standard trocar entry
    - STEP had reduce trocar site bleeding
  - No Lifting vs lifting for Veress Needle
    - No lifting had reduce rates of failed entry
    - No difference in complication rates
Abdominal Wall Adhesions

- Anterior abdominal wall adhesions
  - Adhesions at umbilical area found in 0-10% of all laparoscopies
  - Prior laparoscopic surgery → 0-15%
  - Prior laparotomy w horizontal suprapubic incision → 20-30%
  - Prior laparotomy w longitudinal incision → 50-60%
  - Prior midline for gynecologic indication → 42%
  - Prior incision of all types for OB indication → 22%

Raoul Palmer (1904 – 1985)

- Swedish-born French gynecologist
- Suggested CO2 for insufflation and Trendelenburg position
- 1974 – published on safety in 250 patients
- Changed laparoscopic approach from upper abdomen to lower abdomen
- Considered LUQ insertion in cases of previous abdominal surgery
- First film of live gynecological laparoscopic procedure

LUQ (Palmer’s Point) Entry Technique

- 3 cm below left subcostal border in midclavicular line
- Empty stomach by OG/NG suction
- Introduction of Veress at 90 degree angle
- Indications: Periumbilical adhesions, or in obese/very thin patients
- Contraindications: previous splenic or gastric surgery, HSM, portal HTN or gastropancreatic masses
Anatomy of the left upper quadrant for cannula insertion

- Reviewed 63 CT Scans
- LUQ entry site: epithelium 2 cm below subcostal arch at midclavicular line
- Closest structures to LUQ are left lobe of liver & stomach

<table>
<thead>
<tr>
<th>Structure</th>
<th>Minimum (cm)</th>
<th>Median (cm)</th>
</tr>
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<tbody>
<tr>
<td>Aorta</td>
<td>7.40</td>
<td>11.50</td>
</tr>
<tr>
<td>Vena Cava</td>
<td>9.30</td>
<td>12.80</td>
</tr>
<tr>
<td>Spleen</td>
<td>5.20</td>
<td>12.00</td>
</tr>
<tr>
<td>Stomach</td>
<td>1.50</td>
<td>4.00</td>
</tr>
<tr>
<td>Pancreas</td>
<td>4.50</td>
<td>8.00</td>
</tr>
<tr>
<td>Liver</td>
<td>1.60</td>
<td>4.00</td>
</tr>
<tr>
<td>Left Kidney</td>
<td>10.00</td>
<td>13.15</td>
</tr>
</tbody>
</table>

Tulikangas PK et al. (2003)

Secondary Ports: Finding Your Landmarks

- Anterior superior iliac spines (ASIS)
- Superficial epigastric artery
- Deep inferior epigastric artery
- Iliinguinal and iliohypogastric nerves

The location of abdominal wall blood vessels in relationship to abdominal landmarks apparent at laparoscopy

- Superficial epigastric & inferior epigastric are most lateral at symphysis
- SE can be visualized with transillumination
- IE can be visualized laparoscopically lateral to obliterated umbilical artery (median umbilical ligament)

Hurd WW et al. (1994)
Finding the Superficial Epigastric Artery

- Transillumination

Finding the Inferior Epigastric Artery

- Arises from inguinal canal
- Medial to round ligament
- Lateral to medial umbilical ligament

Ilioinguinal and iliohypogastric nerves in relation to trocar placement

- 2cm above ASIS would minimize ilioinguinal & iliohypogastric injury
- Trocars placed within 1cm of midline would minimize injury
- No lower abdominal transverse incision can avoid potential injury to ilioinguinal & iliohypogastric nerves

Take Home Points

• There is no evidence that any type of abdominal entry is better than the other.

• No angle of entry at the umbilicus is “safe.” All angles are at risk of a vascular injury (arterial or venous from left common iliac vein).

• LUQ entry is a safe method of entry, if no history of hepatosplenomegaly.
  – Always insert an NG or OG tube prior to Veress insertion.

• Use visual landmarks when possible to void vascular injury on the anterior abdominal wall.

• Place accessory ports at least 2cm above and 2cm medial ASIS to avoid nerve injury and entrapment during fascial closure.