Incisional Hernia Surgery

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Previous Topics for Grand Rounds

(Carlson)

Nov 1998    Acute Wound Failure
Nov 1999    Complications of Laparoscopic Antireflux Procedures
Nov 2001    Difficult Abdominal Closure
Mar 2002    Research Update: Regulation of Fibroblast Survival in the Collagen Matrix
Apr 2003    Concepts of Growth
Sep 2003    Requirements of Cellular Survival and Proliferation
Feb 2005    Incisional Hernia Surgery
Incisional Hernia

Meshes: Benefits and Risks, 2004
Incisional Hernia: Definition

An incisional (fascial) defect that is apparent after postoperative day 30.

(A defect apparent prior to postoperative day 30 is a *dehiscence.*)
Scope of the Problem

Approximately 90,000 incisional herniorrhaphies per year in the U.S.
Pertinent questions on incisional hernia surgery

1. What is the incidence of incisional hernia after primary laparotomy?
2. What are the risk factors for incisional hernia?
3. What are the indications for repair of an incisional hernia?
4. Repair: mesh or not?
5. Repair: if mesh is used, what kind and how placed?
6. Repair: open vs. laparoscopic?
7. What can be done to minimize the incidence of incisional hernia?
8. What about parastomal hernias?
9. Conclusions
Incidence of incisional hernia after primary laparotomy

Reported incidence of incisional hernia depends on:

- Length of follow-up period (increased incidence with time)
- Type of follow-up (e.g., chart check vs. surgeon examination)
- Incision selection (e.g., inclusion of low-risk appendectomy incisions)
Question 1: What is the incidence of incisional hernia after primary laparotomy?

**Incidence of incisional hernia after primary laparotomy: a sampling**

<table>
<thead>
<tr>
<th>All patients</th>
<th>Specific patient groups</th>
</tr>
</thead>
<tbody>
<tr>
<td>18.7% (2,983 pts; 10 yrs)</td>
<td>4.9% (623 liver tx pts; 2-140 mos)</td>
</tr>
<tr>
<td>10.2% (5,638 pts; meta-analysis; 1 yr)</td>
<td>17% (290 liver tx pts; &gt;6 mos)</td>
</tr>
<tr>
<td>4.2% (1,000 pts; 2 yrs)</td>
<td>28.2% (177 AAA pts; 33 mos)</td>
</tr>
<tr>
<td>13% (1,081 pts; 5 yrs)</td>
<td></td>
</tr>
<tr>
<td>11% (337 pts; 10 yrs)</td>
<td></td>
</tr>
<tr>
<td>9.8% (771 pts; 5 yrs)</td>
<td></td>
</tr>
</tbody>
</table>

Aachen, DE 2004
Netherlands, 2002
Milwaukee, 1995
Paris 1988
Cardiff, UK 1985
London, 1983

Bologna, IT 2004
Essen, DE 2002
Boston, 2003
Question 2: What are the risk factors for incisional hernia?

**Risk factors for incisional hernia**

<table>
<thead>
<tr>
<th>“+++”</th>
<th>“+”</th>
</tr>
</thead>
<tbody>
<tr>
<td>obesity</td>
<td>incision type</td>
</tr>
<tr>
<td>steroids</td>
<td>trainee status</td>
</tr>
<tr>
<td>AAA repair</td>
<td>previous incision</td>
</tr>
<tr>
<td>dehiscence</td>
<td>smoking</td>
</tr>
<tr>
<td>open abdomen</td>
<td>jaundice</td>
</tr>
<tr>
<td>suture</td>
<td>cancer</td>
</tr>
<tr>
<td>closure technique</td>
<td>comorbidities/ASA class</td>
</tr>
<tr>
<td></td>
<td>nutritional deficiencies</td>
</tr>
<tr>
<td></td>
<td>age</td>
</tr>
</tbody>
</table>
Question 2: What are the risk factors for incisional hernia?

**Obesity**

20-40% incidence of incisional hernia in bariatric patients

(Healing defect vs. mechanical stress or both?)

*Fig. 20. Computed tomography (CT) scan of a giant incisional hernia with protruding bowels*

*Incisional Hernia, 1999*
Question 2: What are the risk factors for incisional hernia?

Steroids

- Specific increase in risk associated with steroid use not known
- General inhibition of inflammation results in slower, less vigorous healing response

Effect of steroids on fascial healing in rats

*(Ann Surg 1969;170:203)*
Question 2: What are the risk factors for incisional hernia?

- Precise risk elevation not known
- Open abdomen more common & accepted
Question 2: What are the risk factors for incisional hernia?

**Dehiscence**

If the patient survives (~25% 30-day mortality risk), then cumulative incidence of incisional hernia has been:

- 69% after 10 yrs (Netherlands, 2005)
- 43% after 12 mos (Norway, 1999)
- 48% after 6 mos (London, 1976)
Question 2: What are the risk factors for incisional hernia?

Suture

Does suture selection affect the incidence of incisional hernia?

Probably.
Question 2: What are the risk factors for incisional hernia?

**Wound disruption strength**

Gain of wound disruption strength in the postoperative period (rabbits)

*Fig. 86.*—Tensile strength of healing wounds in aponeurosis. Upper wound. Results expressed as percentage of control value.
Question 2: What are the risk factors for incisional hernia?

Fascial healing events

- Negligible inherent strength during the first week of healing
- Rapid increase during week two
- Reaches about 50% of unwounded fascia at 4-6 weeks
- Plateaus at 60-80% at one year
- Rarely if ever reaches 100%
Question 2: What are the risk factors for incisional hernia?

**Suture tensile half-life**

<table>
<thead>
<tr>
<th>Suture</th>
<th>t$_{1/2}$ (wks)</th>
</tr>
</thead>
<tbody>
<tr>
<td>polyglactin (Vicryl)</td>
<td>2</td>
</tr>
<tr>
<td>polyglycolic acid (Dexon)</td>
<td>2</td>
</tr>
<tr>
<td>polyglyconate (Maxon)</td>
<td>3</td>
</tr>
<tr>
<td>polydioxanone (PDS)</td>
<td>6</td>
</tr>
<tr>
<td>silk</td>
<td>3-4 mos</td>
</tr>
<tr>
<td>nylon</td>
<td>c. 2 yr</td>
</tr>
<tr>
<td>polypropylene, polyethylene, polybutester</td>
<td>probably indefinite</td>
</tr>
</tbody>
</table>
Question 2: What are the risk factors for incisional hernia?

Clinical trials with various sutures

<table>
<thead>
<tr>
<th>Location</th>
<th>Patients enrolled</th>
<th>sutures compared</th>
<th>dehiscence rates</th>
<th>hernia rates</th>
</tr>
</thead>
<tbody>
<tr>
<td>Netherlands</td>
<td>1156</td>
<td>Vicryl, PDS, nylon</td>
<td>1.9, 3.5, 2.1</td>
<td>18.8*, 13.2, 10.4*</td>
</tr>
<tr>
<td>Montreal</td>
<td>200</td>
<td>Dexon, Prolene</td>
<td>0, 1.0</td>
<td>4.2, 10.5</td>
</tr>
<tr>
<td>Aberdeen</td>
<td>757</td>
<td>PDS, Prolene</td>
<td>0.3, 0.3</td>
<td>3.5, 4.7</td>
</tr>
<tr>
<td>London</td>
<td>347</td>
<td>Dexon, Prolene</td>
<td>0.6, 0.6</td>
<td>6.1, 5.2</td>
</tr>
<tr>
<td>London</td>
<td>210</td>
<td>Dexon, nylon</td>
<td>1.0, 1.0</td>
<td>11.5*, 3.8*</td>
</tr>
<tr>
<td>Burlington, MA</td>
<td>161</td>
<td>Vicryl, Nurolon, Prolene</td>
<td>0, 0, 1.9</td>
<td>0, 8.9, 4.4</td>
</tr>
<tr>
<td>New Brunswick</td>
<td>229</td>
<td>PDS, Ethibond</td>
<td>0, 1.8</td>
<td>10*, 18*</td>
</tr>
<tr>
<td>Milwaukee</td>
<td>225</td>
<td>Maxon, nylon</td>
<td>0, 2.7</td>
<td>8.7, 4.4</td>
</tr>
</tbody>
</table>
Question 2: What are the risk factors for incisional hernia?

Meta-analyses of closure technique

   — Use slowly absorbable continuous sutures

   — Use nonabsorbable continuous sutures

???
Question 2: What are the risk factors for incisional hernia?

“Button hole” hernia

(also know as “Swiss cheese abdomen”)

Br J Surg 1987;74: 824
Question 2: What are the risk factors for incisional hernia?

Closure technique

Closure technique issues

- Closing the peritoneum as a separate layer
- Layered vs. mass closure
- Interrupted vs. running closure
- Knot security
- Prophylactic retention sutures
- Suture choice (absorbable vs. nonabsorbable)

- Suture technique
Question 2: What are the risk factors for incisional hernia?

Risk factors for incisional hernia

***Suture technique***

- Single most important task
- Wide fascial bites (>1 cm)
- Short stitch interval (< 1 cm)
- Suture:wound length ratio (SL:WL) 4 to 1 or higher
- Nonstrangulating tension

Sweden, 1996: nonrandomized prospective study of midline incisions with >1 yr F/U

- SL:WL 3.6, 19% (68/363)
- SL:WL 4.9, 11% (35/320)
Question 2: What are the risk factors for incisional hernia?

Tight vs. loose closure

Midline incision in rats

Surg Gynecol Obstet 1986;163: 448
Question 2: What are the risk factors for incisional hernia?

**Incision Type**

Incision characteristics

- Orientation (vertical, transverse, oblique)
- Location (e.g., upper vs. lower abdomen, midline vs. paramedian)
- Size or length

Bottom line: no definite associations.
Question 3: What are the indications for repair of an incisional hernia?

Indication for repair of incisional hernia

(~90,000 incisional herniorrhaphies per year in the U.S.)

1. Because it is there?

2. When complications develop?

3. Somewhere between #1 & 2?

Mt. Everest

Strangulation
The use of prosthetic mesh during incisional hernia repair

Results of Repair

- 10 year cumulative recurrence rate (randomized trial; Netherlands, 2004):
  - suture only: 63%
  - mesh: 32%

- Review of published data (Inverness, UK 2002):
  - suture only: 31-49%
  - mesh: 0-10%

- Suture only repair, one surgeon, massive SL:WL, 1-32 yr F/U (TPN Jenkins, 1976):
  - Recurrence rate: 8% (all buttonholes)
Question 4: Repair: mesh or not?

Mesh or Not?

Yes, Mesh.
Question 4: Repair: mesh or not?

Salutary results without mesh?

Separation of Components
Question 4: Repair: mesh or not?

Results: Separation of Components

Combined results of 6 series:

22 recurrences in 198 patients = 11%

(J Am Coll Surg 2003;196:32)

— Consider in a contaminated field
Hernia mesh currently available in the United States: a sampling

- heavyweight polypropylene (Marlex, Prolene)
- lightweight polypropylene (Ultrapro)
- polytetrafluoroethylene (DualMesh)
- polyester (Parietex)
- bioabsorbable mesh (SurgiSIS, Alloderm)
- composites
  - PPE + PTFE = Composix
  - PPE + Vicryl = Vypro
  - Seprafilm + PPE = Sepramesh
Question 5: Repair: if mesh is used, what kind and how placed?

Complications associated with mesh use

- Mesh migration
- Fistulization/erosion
- Infection/sinus
- Pain
- Shrinkage/ "meshoma"

Incidence?

heavyweight mesh
Question 5: Repair: if mesh is used, what kind and how placed?

Lightweight mesh

<table>
<thead>
<tr>
<th>Type</th>
<th>Pore Size</th>
<th>g/m²</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lightweight</td>
<td>3-4 mm</td>
<td>30</td>
</tr>
<tr>
<td>Heavyweight</td>
<td>1 mm</td>
<td>80</td>
</tr>
</tbody>
</table>

*Meshes: Benefits and Risks, 2004*
Question 5: Repair: if mesh is used, what kind and how placed?

Preferred mesh position: sublay (beneath the fascia)
Question 5: Repair: if mesh is used, what kind and how placed?

Mesh sublay/underlay position

- Underlap
- Tacking suture

Open incisional herniorrhaphy

_Hernia_, 4th ed., 1995
Question 5: Repair: if mesh is used, what kind and how placed?

Open retromuscular incisional herniorrhaphy

Stoppa, Rives, Flament (France)
Wantz (U.S.)

→ 3/206 recurrence rate (1.5%)
Question 5: Repair: if mesh is used, what kind and how placed?

Open bilayer repair

PTFE sublay + PPE onlay

Hernia, 4th ed., 1995
Question 5: Repair: if mesh is used, what kind and how placed?

Results of open herniorrhaphy (all methods)

- Many, many series
- Few randomized trials
- Recurrence rates vary from 0-40%

Series of 10,822 incisional hernia repairs WA state, 5 yr F/U

1st reoperation rate: 12.3% (23.1% after 13 yrs)
2nd reoperation rate: 23.8%
3rd reoperation rate: 35.3%
4th reoperation rate: 38.7%


- Operator dependence?
- Specific recommendations few
Question 6: Repair: open vs. laparoscopic?

laparoscopic incisional herniorrhaphy

Surgical Endoscopy, 2004
Question 6: Repair: open vs. laparoscopic?

Open vs. laparoscopic incisional hernia repair

Comparison of series data (no RCT available); lap approach results in:

- Lower complication rate
- Lower mesh infection rate (0.6% in 3,276 cases)
- Shorter hospitalization/quicker recovery times
- Lower recurrence rate?

*Br J Surg* 2002;89: 534
Question 6: Repair: open vs. laparoscopic?

Results of laparoscopic incisional herniorrhaphy

<table>
<thead>
<tr>
<th>Location</th>
<th>date</th>
<th>patients</th>
<th>F/U (mos)</th>
<th>recurrence rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baltimore</td>
<td>2004</td>
<td>101</td>
<td>27</td>
<td>5%</td>
</tr>
<tr>
<td>Chicago</td>
<td>2004</td>
<td>97</td>
<td>3</td>
<td>4%</td>
</tr>
<tr>
<td>Evanston</td>
<td>2004</td>
<td>208</td>
<td>24</td>
<td>1%</td>
</tr>
<tr>
<td>San Antonio</td>
<td>2004</td>
<td>384</td>
<td>47</td>
<td>3%</td>
</tr>
<tr>
<td>Spain</td>
<td>2004</td>
<td>86</td>
<td>42</td>
<td>4%</td>
</tr>
<tr>
<td>Charlotte</td>
<td>2003</td>
<td>819</td>
<td>20</td>
<td>5%</td>
</tr>
<tr>
<td>Cleveland</td>
<td>2003</td>
<td>96</td>
<td>30</td>
<td>17%</td>
</tr>
<tr>
<td>Valladolid, Spain</td>
<td>2003</td>
<td>270</td>
<td>44</td>
<td>4%</td>
</tr>
<tr>
<td>France</td>
<td>2002</td>
<td>138</td>
<td>49</td>
<td>16%</td>
</tr>
<tr>
<td>Israel</td>
<td>2002</td>
<td>100</td>
<td>1 to 49</td>
<td>4%</td>
</tr>
<tr>
<td>Baton Rouge</td>
<td>2000</td>
<td>96</td>
<td>51</td>
<td>9%</td>
</tr>
</tbody>
</table>

Only one RCT of laparoscopic vs. open incisional herniorrhaphy: 60 pts, 27 mos F/U (Spain, 1999).

Too small to make any firm conclusions.
Question 6: Repair: open vs. laparoscopic?

Should open incisional herniorrhaphy be abandoned?

Dmitry Oleynikov, M.D.
Question 7: What about parastomal hernias?

- Relatively small population of patients with a difficult problem
- Repair is done with primary suture, relocation...or mesh (!)
- Rate of recurrence after repair 30-50%
Question 7: What about parastomal hernias?

Mesh-reinforced parastomal herniorrhaphy

Open repair with heavyweight PPE mesh
Question 7: What about parastomal hernias?

**Primary mesh placement at stomal formation**

- Retromuscular placement of lightweight polypropylene mesh
- Randomized trial
- 13/26 without mesh recurred; 1/21 with mesh (12 mos min F/U)
- No infections or erosions

*Arch Surg* 2004;139:1356

*Meshes: Benefits and Risks, 2004*
Minimizing the risk of incisional hernia

1. Perform operation laparoscopically (maximize 5 mm ports; close all ports > 5 mm)

2. Suture technique
   - Wide bites
   - Narrow interval
   - Loose closure
   - Running (not interrupted)

3. Either use a permanent or slowly-absorbable suture

4. Retention sutures, prophylactic mesh of unproven benefit

5. Look for risk factors that can be modified
Conclusions

- Incidence of primary incisional hernia is 10-20% (depends on F/U)
- Incisional hernia repair without mesh results in a 30-50% recurrence rate
- Utilization of mesh in incisional hernia repair reduces the recurrence rate
- Mesh repair of incisional hernia is superior to suture-only repair
- If open procedure performed, then closure technique is important
- Technique of mesh placement is important (underlap & anchorage)
- Will laparoscopic incisional hernia repair supplant open repair?