Abdominal Wound Closure

Andrew Miller
Honorary Senior Lecturer & Consultant
Colorectal Surgeon
University Hospitals of Leicester NHS Trust

ACPGBI July 2016
Abdominal Wound Closure

• Why is this a topic of interest
• Wound healing
• Why I do what I do
  – Factors that a surgeon can influence
• How I close an abdominal wound
• Discussion
Why is this a topic of interest

• Primary reason

  • **INCISIONAL HERNIA**

• Secondary reason

  • **WOUND DEHISCENCE**
Why is this a topic of interest

• Recent Literature
  – 12.8% at 2 years (0-36)
  – 22.4% at 3 years

Why is this a topic of interest

- 348,000 repairs annually in the US (10% popn)
- 154,000 inpatient – ($15,9000)
- 194,000 day case - ($3,8000)
- $3.2 BILLION per year
Wound Healing Basics

- Wound healing occurs in 3 phases
- Inflammatory phase: 4 days ZERO strength
- Proliferative phase: 3 weeks 15-20% strength
- Maturation phase: 12 months

- 1 month 30-40%
- 2 months 40-70%
- 12 months 70-90%

50% strength after 4-6 weeks
Factors that the surgeon can influence

1. SUTURE TECHNIQUE
Factors that the surgeon can influence

– Continuous or Interrupted

– European Hernia Society guidelines recommend

– CONTINUOUS


2. KNOTTING TECHNIQUE

Factors that the surgeon can influence
Factors that the surgeon can influence

Knotting technique:

i. High Knot Security

ii. High knot Efficiency

iii. Minimal Volume
Factors that the surgeon can influence

- **SELF LOCKING KNOT:**
- Does not slip
- Minimal effect on suture strength
- Small in volume
Knot efficiency

Knot tensile strength: Straight tensile strength

<table>
<thead>
<tr>
<th>Tensile strength (USP1)</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Straight suture (*)</td>
<td>100%</td>
</tr>
<tr>
<td>Conventional knot (21)</td>
<td>58%</td>
</tr>
<tr>
<td>Self-locking knot (21)</td>
<td>94%</td>
</tr>
</tbody>
</table>

* DSL 12-311 Ethicon data on file.
Video of instrument tie
3. SUTURE/WOUND LENGTH RATIO

Factors that the surgeon can influence
Factors that the surgeon can influence

Suture length/Wound length

4:1
The burst abdominal wound: a mechanical approach

T. P. N. JENKINS

\[ TD = \sqrt{[(TB)^2 - (DB)^2]}, \]

Fig. 1. Geometric use of an individual stitch, \(AB\), in a continuous suture closure. \(AB\) is the stitch interval and \(TD\) comprises the two tissue bites.

<table>
<thead>
<tr>
<th>TD (cm)</th>
<th>1.94</th>
<th>0.87</th>
<th>0.4</th>
<th>1.09</th>
<th>0.76</th>
<th>0</th>
</tr>
</thead>
<tbody>
<tr>
<td>SL : WL</td>
<td>4 : 1</td>
<td>2 : 1</td>
<td>1 : 3</td>
<td>4 : 1</td>
<td>2 : 1</td>
<td>1 : 3 : 1</td>
</tr>
<tr>
<td>Suture length (cm)</td>
<td>40</td>
<td>20</td>
<td>13</td>
<td>40</td>
<td>20</td>
<td>13</td>
</tr>
<tr>
<td>Wound length (cm)</td>
<td>10</td>
<td>10</td>
<td>13.3</td>
<td>13.3</td>
<td>13.3</td>
<td>13.3</td>
</tr>
</tbody>
</table>
SL:WL ≥4 compensates for wound distension

- Wound distension may lengthen the wound up to 30%!
- SL:WL>4 compensates for wound distension, ensuring a minimal resulting rise in tension between the suture and the tissue

Factors that the surgeon can influence

4. MASS CLOSURE OR APONEUROSIS ONLY
Mass closure stitch

Intra abdominal pressure leads to suture cutting through fat and muscle (23)

Aponeurosis only

- Good approximation of the edges of aponeurosis \(^{(23)}\)
- No separation of wound edges \(^{(23)}\)
- No soft tissue necrosis \(^{(23)}\)

Factors that the surgeon can influence
Factors that the surgeon can influence

• Bite size:
  • Large or Small

• The literature suggests a higher wound strength and a lower complication rate

• European Hernia Society Guidelines:
  • SMALL

Deerenberg et al The Lancet 2015 Sep; 386:1254-1260.
Factors that the surgeon can influence

6. SUTURE TENSION
Factors that the surgeon can influence

Rule of thumb*: The stitches in aponeurosis should be visible.

The wound distension effect will lead to more tension.


* Rule of thumb used by the surgeons at Sundsvall hospital.
Factors that the surgeon can influence

7. SUTURE MATERIAL
Choice of suture material

Suture material

Non-Absorbable
- Braided (Ethibond)
- Monofilament (Prolene, Nylon)

Absorbable
- Medium term Wound support 3-4 weeks
  - Braided (Vicryl, Dexon)
  - Monofilament (Monocryl, Biosyn)
- Long term Wound support 6 weeks or more
  - Monofilament (PDS, Maxon)
Choice of suture material

Suture material

Non-Absorbable

Braided (Ethibond)

Monofilament (Prolene, Nylon)

Absorbable

Braided (Polyglactin 910, Polyglycolic acid)

Monofilament (Glycomer 631, Polyglyconate)

- Long term effective wound support
- Risk of sinus
- Patient discomfort and pain on longer term (26,27)

References:
Choice of suture material

- Medium term effective wound support
  - Higher risk on Incisional Hernia \(^{(26,38)}\)

Suture material

Absorbable

- Medium term Wound support 3-4 weeks
  - Braided (Vicryl, Dexon)

- Monofilament (Monocryl, Biosyn)

Long term Wound support 6 weeks or more

- Monofilament (PDS, Maxon)

Choice of suture material

Suture material

Non-Absorbable

+ Long term effective wound support
+ Less patient discomfort or pain on long term
+ IH risk similar to non-absorbing suture (Polydioxonone) \(^{(40)}\)

Absorbable

Braided (Vicryl, Dexon)

Monofilament (Monocryl, Biosyn)

Monofilament (PDS, Maxon)

Breaking strength retention profile of various leading polymers

- Normal aponeurosis healing (illustrative)
- Delayed aponeurosis healing (illustrative)

Graph showing the breaking strength retention over time for PDS, Maxon, Dexon, and Vicryl. The graph plots the percentage of original strength against weeks post-operative.
Summary

• Continuous Suture
• Self locking knots
• At least 4:1 ratio SL:WL
• Aponeurosis
• Small bites close together
• Remember tension — visible sutures
• Absorbable
HOW DO I CLOSE AN ABDOMINAL WOUND
Discussion

• No early dehiscence
• Incisional hernia rate 4.8% at 2 years

• Longer operating time – 11 minutes