The VAC and New-Fangled Strategies for Wound Management: Valuable vs. Worthless

Jim Wood
Grand Rounds Debate
14 March 2011
Historical Perspective

- Ebers Papyrus (1550 BC): lint, animal grease, honey.

- Berlin Papyrus: open wounds expose the wounded person to "infernal beings."

- Greeks differentiated b/w acute and chronic wounds
Historical Perspective

• Galen: 2nd Century AD
  – Roman surgeon
  – Described importance of moist wound environment.

• Wound care largely unchanged until the 19th Century with Lister
Wound-Care in the “New-fangled” Age

• Definition:
  1. Has a name (which is likely trademarked)
  2. Involves equipment
  3. Likely has a patent
  4. Not available in the 15\textsuperscript{th} Century BC
Principles of Wound Care

• Optimize wound closure
• Control Contamination
• Convenient for patients and providers
• Cost effective
Test-taking Skills Aside:

• __________ is either:

A. Worthless
B. Universally useful
C. _______
Mechanisms of wound-healing

- Local factors normally interfering with healing:
  - Dessication
  - Edema
  - Exudate
  - Poor aposition
  - Infection

- Negative pressure dressings improve healing by direct and indirect effects
Direct Effects of NPWT

- Maintains warm and moist environment
- Removes excessive exudative fluids
- Reduces edema from interstitium
- Decreases size of wound
- Apposes grafts and flaps

Venturi AM J Clin Dermatol 2005
Urschel Br J Plast Surg 1988
Nishimura Wound Repair Regen 2007
Indirect Effects of NPWT

- Increased blood flow [1]
- Diminished inflammatory response [2]
- Altered bacterial environment [3]
- Celluar and biochemical changes—increased fibroblast activity, collagen reorganization, VEGF, and FGF-2 [4]

Cumulative Clinical Effect


- Cochrane Review 2007: 8 clinical studies reviewed—chronic wound, randomized study, specific endpoints.
  - Time to complete healing
  - Days to reach 50% wound volume
  - Reduction in wound surface area
  - Decrease in wound length, width, depth or volume
  - Time until ready for operation

- Only one study available for each ➔ no comparisons possible
# Negative Pressure Wound Therapy

## A Vacuum of Evidence?

Sven Gregor, MD; Marc Maegele, MD; Stefan Sauerland, MD, MPH; Jan F. Krahn, MD; Frank Peinemann, MD; Stefan Lange, MD, PhD

## Table

<table>
<thead>
<tr>
<th>Source</th>
<th>NPWT</th>
<th>Control</th>
<th>SMD (95% CI)</th>
<th>Favors NPWT</th>
<th>Favors Control</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>RCTs</strong></td>
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<tr>
<td>Ford et al, 2002</td>
<td>20</td>
<td>-51.8 (38.0)</td>
<td>-42.1 (38.0)</td>
<td>-0.25 (-0.92 to 0.42)</td>
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<td>Joseph et al, 2000</td>
<td>18</td>
<td>-78.0 (72.0)</td>
<td>-30.0 (61.0)</td>
<td>-0.70 (-1.38 to -0.03)</td>
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<tr>
<td>Mouës et al, 2004</td>
<td>15</td>
<td>-3.8 (1.9)</td>
<td>-1.7 (2.2)</td>
<td>-1.00 (-1.79 to -0.20)</td>
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<td>Wanner et al, 2003</td>
<td>11</td>
<td>-25.0 (26.0)</td>
<td>-14.0 (30.2)</td>
<td>-0.38 (-1.22 to 0.47)</td>
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<tr>
<td><strong>Subtotal (95% CI)</strong></td>
<td>64</td>
<td>57</td>
<td>-0.57 (-0.94 to -0.20)</td>
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<td>Test for heterogeneity: $X^2 = 2.34; P = .11; I^2 = 0%$</td>
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<td>Test for effect: $z = 3.03 (P = .002)$</td>
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<td><strong>Non-RCTs</strong></td>
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<tr>
<td>Etóz et al, 2004</td>
<td>12</td>
<td>-20.5 (11.9)</td>
<td>-9.5 (4.1)</td>
<td>-1.19 (-2.07 to -0.31)</td>
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<td>McCallon et al, 2000</td>
<td>5</td>
<td>-28.4 (24.3)</td>
<td>9.5 (16.9)</td>
<td>-1.64 (-3.18 to -0.09)</td>
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<tr>
<td><strong>Subtotal (95% CI)</strong></td>
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<td>17</td>
<td>-1.30 (-2.07 to -0.54)</td>
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<tr>
<td>Test for heterogeneity: $X^2 = 0.24; P = .63; I^2 = 0%$</td>
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<td>Test for effect: $z = 3.33 (P &lt; .001)$</td>
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</table>

Arch Surg. 2008 Feb;143(2):189-96
Advantages over Traditional

- Fewer dressing changes
  - Less pain for patients
  - Less nursing time
- Management of complex wounds in unusual configurations [1]
- Improved wound healing rate in select populations [2]

2. Blume PA. Diabetes Care 2008
Applications

• Acute Wounds:
  – Helps with management of complex wounds [1]
  – In trauma patients: [2]
    • Decreased # of dressing changes
    • Easier application
    • Reduced complexity of subsequent reconstruction
  – Burns: ease of positioning without splints [3]

2. DeFranzo AJ. J Wound Care 2009; Plast Reconstr Surg 2001; Maera JG. Plast Reconstr surg 1999
3. Kamolz LP. Burns 2004
Applications

• Chronic Wounds
  – Diabetic foot ulcers– reduced time to closure [1]
  – Pressure ulcers– improved patient comfort and less labor intensive [2]

Cost-effectiveness of Negative Pressure Wound Therapy for Postsurgical Patients in Long-term Acute Care
Jean M. de Leon, MD; Sunni Barnes, PhD; Melody Nagel, PT; Michelle Fudge, PT; Adora Luclus, RN, CWOCN; and Betty Garcia

Advances in Skin & Wound Care. 22(3):122-127, March 2009
  – Faster rates of closure
  – Lower cost per cm²

1. Blume PA. Diabetes Care 2008
Applications

• Skin grafts / Flap fixation (2 RCT’s) [1]
  – Improved graft take
  – Decreased need for re-grafting
  – Improved length of hospitalization

• Open Abdomen [2]
  – Improved rates early and late (>9d) fascial closure

• Open Sternum [3]
  – Decreased in LOS

2. Rotondo MF. J Trauma 1993
Disadvantages?

• Bulky Vacuum Pump?

• More costly?
Conclusions

• Optimizes wound closure
• Controls Contamination
• Convenient for patients and providers
• Cost effective
The way forward is forward.