Incisional Negative Pressure Wound Therapy on Closed Surgical Incisions: a Systematic Review and Meta-analysis

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Introduction

Background
Postoperative incidence like wound infections and dehiscence or formation of hematomas and seromas complicate many surgical procedures, particularly in high-risk patients.

In recent years, Negative Pressure Wound therapy has been introduced to closed surgical incisions in order to reduce the risk of postoperative wound complications. The evidence is however limited.

Aim
The aim of this study was to assess the effect of incisional Negative Pressure Wound Therapy on closed surgical incisions.
Methods

Study design
A systematic review and meta-analysis of randomized controlled trials of incisional Negative Pressure Wound Therapy compared to standard postoperative dressings.

Search strategy
PubMed, Embase, Cinahl, the Cochrane Central Register of Controlled Trials and clinicaltrial.gov was searched.
No limits regarding language or study design was set.

Synthesis of results
To determine the risk of bias the adequacy of method and topic specific quality items were assessed.
The relative risk was calculated for each study and a pooled estimate of outcomes was calculated.

Flow chart for study selection

<table>
<thead>
<tr>
<th>Potentially relevant citations identified from searching of electronic databases and hand searching of other appropriate resources</th>
</tr>
</thead>
<tbody>
<tr>
<td>PubMed (n= 73)</td>
</tr>
<tr>
<td>Embase (n= 81)</td>
</tr>
<tr>
<td>Cinahl (n= 159)</td>
</tr>
<tr>
<td>Cochrane database (n= 231)</td>
</tr>
<tr>
<td>References (n= 1)</td>
</tr>
</tbody>
</table>

Citations after duplicates were removed (n = 516)

Irrelevant citations excluded after screening all titles and abstracts (n= 490)

Full-text articles assessed for eligibility (n= 26)

Studies included in the systematic review (n = 5)

Full-text articles excluded, with reasons (n = 21)
Retrospective studies, (11) Case-reports, (4) Prospective, not randomized trials, (1) Reviews, (3) Technical report, 2
Results

Five studies were included. Four of these (554 incisions) reported on wound infection.

Incisional Negative Pressure Wound Therapy was associated with a statistically significant 52% reduction in wound infection compared with standard care.

The numbers needed to treat was 13 (NNT 13; 95% CI 8–40)

There was no statistically significant reduction in the incidence of wound dehiscence, the formation of seroma, or ‘days to dry wound’

<table>
<thead>
<tr>
<th>Study</th>
<th>Events, intervention</th>
<th>Events, control</th>
<th>Risk Ratio (95% CI)</th>
<th>Weight (D-L)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grauham et al.</td>
<td>3/75</td>
<td>12/75</td>
<td>0.25 (0.07, 0.85)</td>
<td>16.88 %</td>
</tr>
<tr>
<td>Masden et al.</td>
<td>3/44</td>
<td>5/37</td>
<td>0.50 (0.13, 1.97)</td>
<td>13.62 %</td>
</tr>
<tr>
<td>Stannard et al.</td>
<td>14/141</td>
<td>23/122</td>
<td>0.53 (0.28, 0.98)</td>
<td>66.09 %</td>
</tr>
<tr>
<td>Howell et al.</td>
<td>1/24</td>
<td>1/36</td>
<td>1.50 (0.10, 22.84)</td>
<td>3.41 %</td>
</tr>
<tr>
<td>D-L Overall</td>
<td>21/284</td>
<td>41/270</td>
<td>0.48 (0.29, 0.79)</td>
<td>100.00 %</td>
</tr>
</tbody>
</table>

Heterogeneity chi-squared = 1.87, d.f. = 3 (P = 0.600); I-squared = 0.0%
Test for overall effect: Z = 2.87 (P = 0.004)

Meta-analysis of surgical wound infection rates for iNPWT compared with standard postoperative dressings on closed surgical incisions using the random-effects model by DerSimonian and Laird (D-L).
This systematic review and meta-analysis demonstrates that Incisional Negative Pressure Wound Therapy significantly reduces the rate of wound infection compared with standard postoperative dressings when used on closed incisional wounds in a population of surgical patients at high-risk of wound complications.

As the numbers needed to treat was 13, incisional Negative Pressure Wound Therapy is likely to be cost-effective when used on high-risk closed surgical wounds.

Because none of the included studies investigated the same type of patients it is not possible to draw any conclusions regarding which type of patients who will benefit the most from the treatment.

Diversity in clinical and methodological aspects of the included studies means that the results should be interpreted with caution.

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**Bar chart of study quality.** Quality presented as stacked bars

**Method specific quality items**
- Random sequence generation
- Allocation concealment
- Blinding of outcome assessment
- Incomplete outcome data (follow up)
- Intention to treat analysis
- Sample size calculation

**Topic specific quality items**
- Baseline comparison
- Similar treatment apart from intervention
- Predefined outcome description
- Follow up


