Negative Pressure Wound Therapy Versus Conventional Therapy for the Treatment of Poststernotomy Mediastinitis: A Systematic Review

Lisa D. Bush
Pacific University

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Negative Pressure Wound Therapy Versus Conventional Therapy for the Treatment of Poststernotomy Mediastinitis: A Systematic Review

Abstract

Background: Poststernotomy mediastinitis (PM) is a rare but often fatal complication of surgeries that involve median sternotomy. Although incidence has been reported from 0.4-5%, mortality rates reported from 10-47% make this a potentially devastating complication. Initial treatment for mediastinitis includes administration of antibiotics, surgical debridement of infected tissues, and removal of sternal wires. After debridement, conventional treatment consists of reclosure of the sternum with or without closed irrigation, and surgery using omentum or muscle flap to correct tissue defects when needed. More recently, negative pressure wound therapy is becoming increasingly used as a method of treatment for mediastinitis. This review was performed to evaluate the effectiveness of negative pressure wound therapy versus conventional treatment of mediastinitis.

Methods: An exhaustive literature search using Ovid-Medline, CINAHL, and ISI Web of Science was conducted with the search terms: Negative pressure wound therapy, vacuum-assisted closure, mediastinitis, deep sternal wound infection (DSWI), surgical wound infection, sternum, wound vac, and sternotomy. Key words and subsidiary MeSH terms were selected where appropriate and where permitted by the search engine. The focus of this review was to assess the current literature for the last 10 years on all studies pertaining to the use of negative pressure wound therapy (NPWT) versus conventional treatment for poststernotomy mediastinitis.

Results: Four articles meeting search criteria were found and reviewed. The four studies reviewed included data on mortality, duration of treatment, length of hospitalization, and reinfection rates. Two of the reviewed studies showed significant reduction in mortality in the NPWT cohort. Three of the four studies looked at reinfection rate and all three showed a significant reduction in the NPWT group. All four studies looked at length of hospital stay after induction of PM treatment and only one showed a significant reduction in the NPWT group. No significant difference in treatment duration was seen between the cohorts.

Conclusion: Negative pressure wound therapy reduces reinfection rate during treatment of poststernotomy mediastinitis, and can reduce mortality and length of hospital stay associated with the infection.

Degree Type
Capstone Project

Degree Name
Master of Science in Physician Assistant Studies

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Rob Rosenow PharmD, OD

**Keywords**
Poststernotomy mediastinitis, deep sternal wound infection, vacuum-assisted closure, negative pressure wound therapy

**Subject Categories**
Medicine and Health Sciences

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Lisa D. Bush

A Clinical Graduate Project Submitted to the Faculty of the

School of Physician Assistant Studies

Pacific University

Hillsboro, OR

For the Masters of Science Degree, August 14, 2010

Faculty Advisor: James Ferguson
Clinical Graduate Project Coordinators: Annjanette Sommers MS, PAC & Rob Rosenow PharmD, OD
Biography

[Redacted for privacy]
Abstract

Background: Poststernotomy mediastinitis (PM) is a rare but often fatal complication of surgeries that involve median sternotomy. Although incidence has been reported from 0.4-5%, mortality rates reported from 10-47% make this a potentially devastating complication. Initial treatment for mediastinitis includes administration of antibiotics, surgical debridement of infected tissues, and removal of sternal wires. After debridement, conventional treatment consists of reclosure of the sternum with or without closed irrigation, and surgery using omentum or muscle flap to correct tissue defects when needed. More recently, negative pressure wound therapy is becoming increasingly used as a method of treatment for mediastinitis. This review was performed to evaluate the effectiveness of negative pressure wound therapy versus conventional treatment of mediastinitis.

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Keywords: Poststernotomy mediastinitis, deep sternal wound infection, vacuum-assisted closure, negative pressure wound therapy.
**Acknowledgements**

To *my parents*: Thank you for helping me to succeed and offering both support and tough love when I needed it.

To *Meghan Crowley, Lisa Bekins and Julie Cramer*: Thank you all for your love, support, and camaraderie. I would not have made it without you.

To *Kim and Tom Brickley*: Thank you for providing the beautiful sanctuary in which to write this paper.
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List of Abbreviations

NPWT………………………………………………...Negative Pressure Wound Therapy
(in this paper also refers to vacuum-assisted closure and vacuum suction drainage)

PM…………………………………………..………………Poststernotomy Mediastinitis

CON……………………………………….……………………...Conventional Treatment

DM……………………….………………………………………………Diabetes Mellitus

BMI…………………………………………………………….Body Mass Index

DSWI……………………………………………………..Deep Sternal Wound Infection

COPD……………………………………………Chronic Obstructive Pulmonary Disease

CABG………………………………………………………Coronary Artery Bypass Graft

ICU…………………………………………………………………….Intensive Care Unit

CDC…………………………………………..Center for Disease Control and Prevention
Negative Pressure Wound Therapy Versus Conventional Therapy for the Treatment of Poststernotomy Mediastinitis: A Systematic Review

BACKGROUND

Mediastinitis

Poststernotomy mediastinitis is a rare but often fatal complication of surgeries that involve median sternotomy. Although incidence has been reported from 0.4-5%, mortality rates reported from 10-47% make this a potentially devastating complication. A definition of mediastinitis has been established by the Center for Disease Control and Prevention. According to the guidelines established, a diagnosis of mediastinitis must meet at least 1 of the following criteria:

1. Organisms cultured from mediastinal tissue or fluid.
2. Evidence of mediastinitis seen during a surgical operation or histopathologic examination.
3. One of the following signs or symptoms with no other recognized cause: fever (>38°C), chest pain, or sternal instability and at least one of the following:
   a. purulent discharge from the mediastinum
   b. organisms cultured from blood or mediastinal discharge
   c. mediastinal widening on x-ray

There are many risk factors that have been established for sternal wound infection, including, but not limited to: Obesity, DM or perioperative hyperglycemia, vascular disease, ejection fraction less than 30%, redo operation, prolonged intubation time, and COPD.

Several groups have developed risk indices for sternal wound infections after
cardiac surgery. Of note is a recent study that assigns points for risk factors. One point for diabetes, 1 point for BMI >29 but <35 kg/m2, and 2 points for a BMI ≥35 kg/m2. Risk for surgical site infection approximately doubles for each point assigned to the patient. The EuroSCORE can be used to evaluate risk of early mortality. It evaluates patient, cardiac, and operation-related factors, to predict whether a patient is low, medium, or high-risk for early mortality. In 1996, the El Oakley classification was established to identify time of first presentation of deep sternal wound infection, whether or not the patient had risk factors for infection, and whether there were previous failed attempts at treating the condition. They also suggest the appropriate treatment of the DWSI, guided by classification.

Poststernotomy mediastinitis has become a substantial clinical problem not because of a high case incidence, but because cardiac surgery via median sternotomy has become such a widely used procedure. With the American population increasingly becoming obese and diabetic, it could be expected to see increases in deep sternal wound infection (DSWI). DSWI can increase the cost of hospitalization post-CABG by up to 2.5 times.

**Treatment**

*Conventional treatment*—Initial treatment for mediastinitis includes administration of antibiotics, surgical debridement of infected tissues, and removal of sternal wires. This is then followed by open packing of the wound, reclosure of the sternum with or without closed irrigation, or removal of the sternum with immediate or
subsequent plastic surgery, using muscle flap or omentum, for tissue defects. More recently, negative pressure wound therapy, has been added to the pool of treatment modalities.

**Negative pressure wound therapy**—Negative pressure wound therapy (NPWT) has been referred to in several ways in the past, including vacuum-assisted closure, suction-assisted drainage, topical negative pressure therapy. This therapy uses polyurethane foam dressings placed within the wound. It is then covered with a transparent adhesive drape, to which an evacuation tube is connected. The evacuation tube is connected to a continuous vacuum source (-125mmHg). The wound filler is changed every 2-4 days with additional debridement as needed. NPWT has shown to enhance proliferation of granulation tissue, have beneficial effects on blood flow, and reduce accumulation of inflammatory mediators, resulting in faster healing times and more complete healing. Another benefit of NPWT in deep sternal wound infection cases is the immediate sternal stability. This has the effect of reducing the need for prolonged intubation, which has been shown to have an adverse effect on prognosis. In addition, the NPWT system is one that allows for immediate mobilization of the patient, as they are not bound to their bed, as is the case with a closed irrigation system.

**METHODS**

An exhaustive literature search using Ovid-Medline, CINAHL, and ISI Web of Science was conducted using the search terms: Negative pressure wound therapy, vacuum-assisted closure, mediastinitis, deep sternal wound infection (DSWI), surgical wound infection, sternum, wound vac, and sternotomy. Key words and subsidiary MeSH terms were selected where appropriate and where permitted by the search engine.
Literature from 2000 to the present was reviewed by title and abstract. The search was limited to English language publications and adult subjects. Articles that included negative pressure wound therapy compared to closed irrigation and surgery, or combinations of closed irrigation with other techniques, used in adults with poststernotomy mediastinitis were selected for. Studies with a focus on conventional treatments (CON) other than closed irrigation (i.e. open wound packing) were excluded. Also disqualified, were studies including pediatric populations. After these exclusions, three articles remained. Subsequent examination of bibliographic entries in retrieved works was performed, searching for other possible articles to be included in the review or for background information.

RESULTS

After applying the exclusion criteria, three articles remained. One additional article was located through the bibliographic search (Table 1). Because negative pressure wound therapy (NPWT) also provides instant stabilization of the chest wall, allows for early extubation, and more immediate mobilization of the patient due to decreased limitations on physical mobility Segers et al\textsuperscript{21} indicate that NPWT is the most effective therapy. Petzina et al\textsuperscript{22} recommended NPWT as first-line therapy.

Two of the reviewed studies showed significant reduction in mortality\textsuperscript{22,23}, although Petzina et al\textsuperscript{22} only looked at in-hospital mortality. Even though Segers et al\textsuperscript{21} showed a reduction in mortality at >1 year, the reduction was not statistically significant\textsuperscript{21}(Table 2). Three of the four studies looked at reinfection rate\textsuperscript{21-23} and all three showed significant reduction in the rate of reinfection in the NPWT group (Table
3). All four studies looked at length of hospital stay after induction of PM treatment.\textsuperscript{21-24} Only the study by Catarino et al\textsuperscript{24} showed a significant reduction in hospital stay (Table 4). They all looked at treatment duration and found no significant difference between cohorts\textsuperscript{21-24} (Table 5). Various risk factors were included in each study, diabetes mellitus and BMI being common for all studies, although only two tracked El Oakley classification of the mediastinitis.\textsuperscript{21,23}

In 2010, Petzina et al\textsuperscript{22} conducted a retrospective study in Germany, of 69 consecutive patients with mediastinitis treated with negative pressure wound therapy (NPWT), and 49 consecutive patients treated with conventional therapy, and showed a mortality for NPWT of 5.8% compared to 24.5% in the conventional therapy group (CON) (p = 0.005). Re-infection rate in the NPWT group was 2.9% compared to 18.3% in the conventional treatment group (p = 0.008). Hospital stay was a mean of 38 days (range 19-87) for the NPWT group as opposed to 41 days (range 28-150) for the CON group. No significant differences were found in the groups concerning risk factors for surgical wound infection other than BMI. The difference in BMI between the groups, was 27.9 in the NPWT group and conventional therapy group at 29.9 (p = 0.035).\textsuperscript{22}

In 2005, Sjögren et al\textsuperscript{23} performed a retrospective study of 101 Swedish patients undergoing vacuum-assisted closure (VAC) therapy or conventional treatment for poststernotomy mediastinitis. There were 61 patients in the VAC group, and 40 in the conventional treatment group. This study showed that the 90-day mortality for the VAC group was 0%, and 15% (6 patients p < 0.01) in the CON group. The failure rate (re-infection) for first line treatment in VAC and conventional treatment was 0% and 37.5%, respectively (p < 0.001). Overall survival in the VAC group, was significantly better
than in the CON group (p < 0.05). The survival rate for VAC versus CON, respectively was 97% versus 84% (at 6 months), 93% versus 82% (at 1 year), and 83% versus 59% (at 5 years).23

Also in 2005, Segers et al21 conducted a retrospective study involving 63 patients in Amsterdam with poststernotomy mediastinitis (PM). Thirty-four underwent conventional treatment (CON) consisting of closed drainage techniques, and 29 were treated with topical negative pressure wound therapy (NPWT). There was no significant difference in mortality due to mediastinitis between the two groups (17.5% for NPWT vs. 20.6% for CON). Also tracked was hospital stay, which demonstrated no difference between the cohorts. In this study, therapeutic failure, defined as recurrence of wound infection, a change to other treatment techniques and the need for multiple surgical interventions to control infection or mortality caused primarily by the surgical site infection, was measured.21 This occurred in 27.6% of NPWT patients and 58.9% of CON patients (p = 0.01). Recurrence of wound infection was seen in 27.6% of the NPWT group as opposed to 52.9% in the conventional treatment group (p = 0.04). Also significant in this study was a greater incidence of females in the negative pressure wound therapy group, the later cohort.21

Catarino et al,24 in 2000, conducted a retrospective study looking at the treatment of 19 patients in the United Kingdom with poststernotomy mediastinitis (PM). Nine patients from group A (NPWT group) were treated with high-pressure suction drainage. Two of them had been previously treated with closed irrigation, but were switched to vacuum drainage after treatment failure. The 10 patients from group B (conventional treatment group), were treated with closed drainage and irrigation followed by various
methods of surgical closure and/or reconstruction if treatment failed. There was no difference in duration of treatment between the groups; however, there was a difference in length of hospitalization after treatment, in total duration of hospitalization, and in treatment failure. Length of hospitalization for the NPWT group was a median of 15 days (range 12-34), with the closed irrigation group being a median of 40.5 days (range 14-89, p = 0.02). Total length of hospitalization for the vacuum group was a median of 35 days (range 22-88). The study found that if the calculation was made eliminating the first two patients that were initially treated with closed irrigation, the median went down to 27 days (range 22-49) as compared to a median of 50 days (range 27-98) in the irrigation group (p = 0.04). Furthermore, it was found that treatment failure, was 0% on the vacuum drainage group and 50% (58% if the two in group A that previously failed irrigation were counted) (p = 0.03). 

DISCUSSION

Petzina and Sjögren\textsuperscript{22,23} showed a significant decrease in mortality with negative pressure wound therapy (NPWT). Segers\textsuperscript{21} showed a trend in decreased mortality in the NPWT group, but not one that was statistically significant. Catarino\textsuperscript{24} did not indicate any difference in mortality between the treatment groups (Table 2). Petzina, Sjögren, and Segers\textsuperscript{21-23} all showed a significant decrease in the rate of reinfection of the NPWT group (Table 3). All 4 groups\textsuperscript{21-24} looked at length of hospital stay for treatment of poststernotomy mediastinitis (PM), but only Catarino et al showed a significant decrease in stay for the NPWT group. Segers et al\textsuperscript{21} indicate that NPWT is the most effective therapy. Petzina et al\textsuperscript{22} recommended NPWT as first-line therapy.
Limitations that were common in all four papers were the small sample-size, the fact that they were retrospective, non-randomized, single-center studies with a difference in time between the cohorts. One of the reasons for the time differences between the cohorts is that the instance of PM is so low that it takes a significant amount of time for a single center to acquire a number that is fit for analysis. Not all papers provided El Oakley classification. El Oakley classification indicates the time period after surgery when diagnosis of poststernotomy mediastinitis (PM) is made, and addresses whether or not the patient had one or more risk factors for infection. All of the papers evaluated various risk factors, the only two in common between all of the papers being diabetes mellitus and body mass index. Striking, is that at least 30% of all patients in every study were diabetic, and this was not specifically selected for (Table 6). In fact, the Catarino et al study, had as many as 7/9 patients in one arm who were diabetic.24 As confounding factors can affect the course of and outcome for infection, it is important that these be tracked.

Lund University Hospital which hosted Petzina et al22 study, now considers NPWT to be first-line therapy for poststernotomy mediastinitis at their center. Limitations of the Petzina et al22 study are its size, the difference in time periods of the treatment groups, and the lack of El Oakley classification. The conventional group consisted of patients that were treated before 2006, with the NPWT group all being treated after 2006. Although the study indicates that the in-hospital mortality rate is lower in the NPWT group, there is no indication of the cause of mortality in those patients, and whether or not it was even related to mediastinitis. Also omitted is a time-point for the duration of follow up with these patients. Preoperative data was similar
between the groups, except that those in the conventional group had higher BMIs. Otherwise groups were similar with regards to EuroSCORE, risk factors, and surgeries performed.

In the Sjögren et al\textsuperscript{23} study, conventional treatment was used between 1994 and 1998 and VAC was used between 1999 and 2003. There was also a significantly higher EuroSCORE and number of women in the vacuum cohort. This study includes, not only closed irrigation as a means of conventional treatment, but rewiring, open dressings, pectoral flaps, or omentoplasty. The type of conventional treatment used was according to surgeon’s preference and neither standardized, nor randomized. Several of the patients were treated with open dressings, either prior to closed irrigation, or prior to flap procedure. Open dressings have been previously shown to have mortality rates as high as 45\%.\textsuperscript{25} The groups that were compared were similar with regards to risk factors. Follow up was performed in April 2004, 4 months after the date of conclusion on the VAC arm of the study, and was 100\% complete. This potentially provides more long-term follow-up data for the conventional treatment arm.

The study by Segers et al\textsuperscript{21} indicated a greater number of females in the negative pressure wound therapy group. Whether this is due to an increase in diagnosis of heart disease in females or whether being female is an independent risk factor, is not addressed. Although there were trends towards longer surgical times, delay in diagnosis, and higher EuroSCOREs in the NPWT group, which contained older patients, this did not result in a significant increase in hospital stay after wound infection. There was also a trend toward decreased mortality in this group although not statistically significant. This study was incredibly thorough as to the tracking of confounding factors. Care was taken to track
numerous patient characteristics, such as El Oakley classification, cultured organisms, and post-operative complications not related to the mediastinitis. Any further research should take care to be this exacting as far as tracking results.

In the Catarino et al\textsuperscript{24} study, the team had success with secondary treatment with NPWT for two patients previously treated with conventional means, and decided to treat each subsequent patient with this method. They then used patients from an earlier period as a group of historical controls. Although group A (NPWT group) had more diabetics, more patients with high BMI, and more patients with multiple pathogens, but still fared better than the conventional treatment arm with regards to length of hospitalization and incidence of treatment failure. This may have been more meaningful, had a clear definition of treatment failure been provided.

**CONCLUSION**

Two of the four studies showed a significant reduction in mortality.\textsuperscript{22,23} Three of the four studies found a significant reduction in reinfection rate of the deep sternal wound infection (DSWI).\textsuperscript{21-23} Only one study showed a significant reduction in hospital stay for PM treatment.\textsuperscript{24} Catarino and Segers\textsuperscript{21,24} indicated that none of the NWPT patients required flap reconstruction which increases the potential for fewer long-term complications associated with a flap procedure. Because the NPWT also provides instant stabilization of the chest wall, allows for early extubation, and more immediate mobilization of the patient due to decreased limitations on physical mobility,\textsuperscript{21} it is recommended as first-line therapy.\textsuperscript{22} Because large numbers of patients in all of the
studies are diabetic and/or obese, closer monitoring of these patients should be recommended in an attempt to diagnose any infection as early as possible.

A prospective, randomized, international multi-center trial would be recommended to gather a larger pool of participants. Because the instance of deep sternal wound infection is so low, any study would likely be drawn out over a long time period, as was the case with the studies reviewed here. At this point, with so many studies proving the superiority of NPWT, there may be ethical concerns in withholding this highly recommended treatment from patients.

An interesting study by Atkins et al\textsuperscript{26} was published in 2009 that looked at topical NPWT, after initial closure, as a means of prevention of DSWI in high-risk patients and saw a significant reduction in the occurrence of deep sternal wound infection.\textsuperscript{26} A multi-center, prospective, randomized clinical trial assessing the effectiveness of NPWT as a means of prevention of PM in high-risk patients may provide more useful data since NPWT is increasingly being used as first-line therapy for PM. Any further research should take care to be as thorough as Segers and colleagues\textsuperscript{21} as far as tracking patient data and results.
REFERENCES


# TABLES

## Table 1. Summary of Reviewed Literature

<table>
<thead>
<tr>
<th>Study/Design</th>
<th>Patients/Population</th>
<th>Intervention</th>
<th>Comparison</th>
<th>Outcome(s) Measured</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Petzina et al&lt;sup&gt;22&lt;/sup&gt; (2010)</td>
<td>118 patients with post-sternotomy mediastinitis</td>
<td>NPWT</td>
<td>Surgical debridement, drainage, irrigation, transposition of the greater omentum or muscle flap.</td>
<td>Mortality rate, sternal re-infection rate, and length of hospital stay.</td>
<td>Small sample size. Cohorts were from different time periods. Mortality does not comment on whether or not deaths were related to wound infection or some other cause. Does not indicate length of follow-up, or if there was any post-hospitalization follow-up. Does not provide El Oakley classification for the respective groups.</td>
</tr>
<tr>
<td>Sjögren et al&lt;sup&gt;23&lt;/sup&gt; (2005)</td>
<td>101 patients with post-sternotomy mediastinitis</td>
<td>NPWT</td>
<td>Surgical revision, open dressings, closed irrigation, pectoral muscle flaps, or omentum flaps</td>
<td>Mortality rate, failure rate, treatment duration, additional procedures required.</td>
<td>Small sample size. Cohorts were from different time periods.</td>
</tr>
<tr>
<td>Segers et al&lt;sup&gt;21&lt;/sup&gt; (2005)</td>
<td>63 patients with post-sternotomy mediastinitis</td>
<td>NPWT</td>
<td>Surgical debridement, drainage, irrigation, transposition of the greater omentum or muscle flap.</td>
<td>Treatment modalities, mortality, surgical site infection recurrence, duration of therapy and hospital stay.</td>
<td>Small sample size. Cohorts were from different time periods.</td>
</tr>
<tr>
<td>Catarino et al&lt;sup&gt;24&lt;/sup&gt; (2000)</td>
<td>20 patients with post-sternotomy mediastinitis</td>
<td>NPWT</td>
<td>Surgical debridement, drainage, irrigation, transposition of the greater omentum or muscle flap.</td>
<td>Mortality, primary treatment failure,</td>
<td>Small sample size. Cohorts were from different time periods. Two patients in NPWT cohort were originally treated with conventional means, then NPWT, after primary treatment failure. Does not provide El Oakley classification for the respective groups.</td>
</tr>
<tr>
<td>Study</td>
<td>NPWT Mortality</td>
<td>Conventional Treatment Mortality</td>
<td>P value</td>
<td>Follow-up duration</td>
<td>Comments</td>
</tr>
<tr>
<td>---------------</td>
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<td>---------</td>
<td>-------------------</td>
<td>-----------------------------------------------</td>
</tr>
<tr>
<td>n</td>
<td>Deaths (%)</td>
<td>n</td>
<td>Deaths (%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Petzina et al(^{22})</td>
<td>69 4/69 (5.8%)</td>
<td>49 12/49 (24.5%)</td>
<td>0.005</td>
<td>Not provided</td>
<td>In-hospital mortality only.</td>
</tr>
<tr>
<td>Sjögren et al(^{23})</td>
<td>61 0/61 (0%)</td>
<td>40 6/40 (15.0%)</td>
<td>&lt; 0.01</td>
<td>90 days</td>
<td></td>
</tr>
<tr>
<td>Segers et al(^{21})</td>
<td>29 4/29 (13.8%)</td>
<td>34 7/34 (20.6%)</td>
<td>Ns</td>
<td>&gt;1 year</td>
<td>Eleven deaths related to SSI. Seven more deaths unrelated to SSI that are not included in this calculation.</td>
</tr>
<tr>
<td>Catarino et al(^{24})</td>
<td>9 0/9 (0%)</td>
<td>11 0/11 (0%)</td>
<td>Ns</td>
<td>6 months</td>
<td>One death in VAC group at five months, unrelated to infection, that is not included in this calculation.</td>
</tr>
</tbody>
</table>

NS = not significant statistically
<table>
<thead>
<tr>
<th>Study Authors</th>
<th>NPWT n</th>
<th>Reinfection (%)</th>
<th>Conventional Treatment n</th>
<th>Reinfection (%)</th>
<th>P value</th>
<th>Notes/Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Petzina et al(^\text{22})</td>
<td>69</td>
<td>2/69 (2.9%)</td>
<td>49</td>
<td>9/49 (18.3%)</td>
<td>0.008</td>
<td>In-hospital reinfection rate after mediastinitis treatment.</td>
</tr>
<tr>
<td>Sjögren et al(^\text{23})</td>
<td>61</td>
<td>0/61 (0%)</td>
<td>40</td>
<td>15/40 (34.5%)</td>
<td>&lt;0.001</td>
<td></td>
</tr>
<tr>
<td>Segers et al(^\text{21})</td>
<td>29</td>
<td>8/29 (27.6%)</td>
<td>34</td>
<td>18/34 (52.9%)</td>
<td>0.01</td>
<td></td>
</tr>
<tr>
<td>Catarino et al(^\text{24})</td>
<td>9</td>
<td>Not Provided</td>
<td>11</td>
<td>Not provided</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Table 4. Comparison of Length of Hospital Stay After Treatment for PM

<table>
<thead>
<tr>
<th></th>
<th>NPWT</th>
<th>Conventional Tx</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Petzina et al22</td>
<td>38 (19-87)</td>
<td>41 (28-150)</td>
<td>0.08, ns</td>
</tr>
<tr>
<td>Median (range)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sjögren et al23</td>
<td>25 ± 17 (7-103)</td>
<td>25 ± 20 (1-87)</td>
<td>ns</td>
</tr>
<tr>
<td>Mean (range)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Segers et al21</td>
<td>46.1 (10-74)</td>
<td>35.7 (10-165)</td>
<td>ns</td>
</tr>
<tr>
<td>Median (range)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Catarino et al24</td>
<td>15 (12-34)</td>
<td>40.5 (14-89)</td>
<td>0.02</td>
</tr>
</tbody>
</table>

* Data from the first two NPWT patients eliminated, leaving only patients primarily treated with suction dressing.

ns = not significant
<table>
<thead>
<tr>
<th></th>
<th>NPWT</th>
<th>Conventional Tx</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Petzina et al\textsuperscript{22}</td>
<td>Not Provided</td>
<td>Not provided</td>
<td>Not provided</td>
</tr>
<tr>
<td>Sjögren et al\textsuperscript{23}</td>
<td>16 ± 10 (3-71)</td>
<td>17 ± 16 (3-97)</td>
<td>ns</td>
</tr>
<tr>
<td>Segers et al\textsuperscript{24}</td>
<td>22.8 (4-68)</td>
<td>16.5 (2-38)</td>
<td>ns</td>
</tr>
<tr>
<td>Catarino et al\textsuperscript{24}</td>
<td>11 (6-26)</td>
<td>13 (8-20)</td>
<td>ns</td>
</tr>
</tbody>
</table>

\textit{ns} = not significant
<table>
<thead>
<tr>
<th>Study</th>
<th>n</th>
<th>(%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Petzina et al\textsuperscript{22}</td>
<td>52/118</td>
<td>44.1%</td>
</tr>
<tr>
<td>Sjögren et al\textsuperscript{23}</td>
<td>38/101</td>
<td>37.6%</td>
</tr>
<tr>
<td>Segers et al\textsuperscript{21}</td>
<td>19/63</td>
<td>30.2%</td>
</tr>
<tr>
<td>Catarino et al\textsuperscript{24}</td>
<td>12/19</td>
<td>63.2%</td>
</tr>
</tbody>
</table>

Table 6. Literature Overview for Incidence of DM in Patients Studied