Use of VAC Therapy in Thoracic Surgery Infections

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No disclosures
Q58. Vacuum assisted closure is aimed at:

a. Increasing fibrotic tissue at the wound site
b. Stimulating arteriolar dilation at the wound site
c. Distributing local antibiotics at the wound site
d. Permanently obliterating the wound site
Essentials of management

• Effective drainage: chest tube to rib resection/ OWT

• Debridement and VATS/open decortication

• Control of BPF/ space obliteration with viable tissue
VAC as a bridge from infection to reconstructive surgery
Learning curve

- How to place foams
- Where to place foams
- Which suction pressure
- Treatment setting (in hospital/outpatient)
Basics of VAC therapy - 1

• Subatmospheric, negative pressure applied to the sponge which conforms to the wound

• Arteriolar dilatation and microcirculation is favored

• Improved local oxygenation and optimization of wound environment - proliferation of granulation tissue

Fleck TM et al Ann Thorac Surg 2002
Basics of VAC therapy - 2

• Granulation tissue increases with intermittent more than continuous therapy

• Low pressure to start – rapidly up to 125 mmHg (fourfold increase in blood supply) – no beneficial effect for higher pressures

• Dual power - Battery or Mains - contributes to select treatment setting (in hospital/outpatient) with variable treatment duration

Basics of VAC therapy - 3

- For intrathoracic use, it is advisable to interpose either a layer of sterile gauzes or a commercially available silicone membrane between foam and lung/mediastinal surface.

- The negative pressure reduces the interstitial edema and the cavity space.
Chest wall infections
Vacuum-Assisted Closure for the Treatment of Complex Chest Wounds

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- 17 patients with relatively limited (16x7cm) contaminated wounds (soft tissue necrosis, penetrating wounds and empyema)
- 90% ICU care; 50% requiring postop mechanical ventilation; 29% septic shock
- Debridement and VAC every 2-3 days
- Foam to adapt to the wound without interposition
- Average VAC duration: 9 days
- Wound healing without rotational muscle flaps
a) Previous surgery for partial thickness fibrosarcoma X3
b) Adjuvant RT
c) Local recurrence and infection
d) Redo-resection and + VAC for 3 weeks
a) Skin island based on latissimus dorsi

b) Anterior rotation to cover original defect

c) Primary closure of the donor site
a) Chondrosarcoma sternum G3  
b) Infected biopsy site  
c) Total sternectomy  
d) Cryopreserved rib homograft x 3  
e) Sandwich omental flap  
f) Skin flap necrosis  
g) Debridement+VAC  
h) V-Y reconstruction after 3 weeks
a) Infected pacing electrodes after valve replacement

b) Debridement/VAC prior to lower sternal resection

c) Approximation of pec major muscles (paletot technique)
Pleural/pulmonary infections
• Reopen original thoracotomy

• Open window thoracostomy

• Plastic retractor

Palmen 2009
Saadi, 2011
Hoffmann 2012
Vacuum-Assisted Closure Device: A Useful Tool in the Management of Severe Intrathoracic Infections

Alend Saadi, MD,* Jean Yannis Perentes, MD, PhD,* Michel Gonzalez, MD, Adrien Caliera Tempia, MD, Yabo Wang, MD, Nicolas Demartines, MD, Hans-Beat Ris, MD, and Thorsten Krueger, MD

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Table 1. Patient Characteristics, American Society of Anesthesiology (ASA) Risk Score, and Comorbidities

<table>
<thead>
<tr>
<th>Total</th>
<th>27</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age, years (median/range)</td>
<td>64 (37–77)</td>
</tr>
<tr>
<td>Female/male</td>
<td>12/15</td>
</tr>
<tr>
<td>ASA score</td>
<td></td>
</tr>
<tr>
<td>II</td>
<td>10</td>
</tr>
<tr>
<td>III</td>
<td>12</td>
</tr>
<tr>
<td>IV</td>
<td>5</td>
</tr>
<tr>
<td>Comorbidities</td>
<td></td>
</tr>
<tr>
<td>Coronary arterial disease</td>
<td>1</td>
</tr>
<tr>
<td>Cerebrovascular accident</td>
<td>3</td>
</tr>
<tr>
<td>Arterial hypertension</td>
<td>8</td>
</tr>
<tr>
<td>Diabetes mellitus</td>
<td>6</td>
</tr>
<tr>
<td>Dyslipidemia</td>
<td>5</td>
</tr>
<tr>
<td>Obesity</td>
<td>7</td>
</tr>
<tr>
<td>Tobacco use</td>
<td>10</td>
</tr>
<tr>
<td>Chronic obstructive pulmonary disease</td>
<td>8</td>
</tr>
<tr>
<td>Pulmonary hypertension</td>
<td>2</td>
</tr>
<tr>
<td>Former pulmonary embolism</td>
<td>3</td>
</tr>
<tr>
<td>Chronic alcoholism</td>
<td>5</td>
</tr>
<tr>
<td>Denutrition</td>
<td>3</td>
</tr>
</tbody>
</table>

www.aats.org
Reopen and VAC

- 27 critically ill patients; 82% success rate
- Surgical management first (ie, debridement, decortication, muscle flap transposition)
- Median length of VAC therapy: 22 days
- Median interval between VAC changes: 3.9 days
- Median hospitalization: 44 days

(Ann Thorac Surg 2011;91:1582–90)
Open Window Thoracostomy for Pleural Empyema Complicating Partial Lung Resection

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Open Window Thoracostomy Treatment of Empyema Is Accelerated by Vacuum-Assisted Closure

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OWT and VAC

• Retrospective review of OWT for complicated intrathoracic infections
• 19 patients: 8 conventional (OWT) and 11 VAC after OWT
• (OWT+VAC) Mean treatment duration: 70 days; success in OWT closure: 100%
• (OWT only) Mean treatment duration: 933 days; success in OWT closure: 25%

Amplatzer Device for Vacuum-Assisted Bronchopleural Fistula to Treat a Thoracic Bronchopleural Fistula

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We present a case of large bronchopleural fistula with vacuum-assisted closure following primary surgery. The patient underwent an open window thoracostomy and insertion of an Amplatzer Septal Occluder (AGA Medical Corporation, Plymouth, MN) was positioned at the fistula site. After, the thoracostomy was removed with vacuum-assisted closure therapy.

(Ann Thorac Surg 2011;92:e23–5)
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Postpneumonectomy space
Predictors of Successful Closure of Open Window Thoracostomy for Postpneumonectomy Empyema

Fabio Massera, MD, Mario Robustellini, MD, Claudio Della Pona, MD, Gerolamo Rossi, MD, Adriano Rizzi, MD, and Gaetano Rocco, MD, FRCS (Ed)

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Conclusions. Late onset of PPE and immediate OWT creation are significant predictors of OWT closure. Smaller dimensions of the pleural cavity appeared to increase the likelihood of closure. When the pleural cavity shows healthy granulation tissue and no broncho-pleural fistula, the Clagett’s procedure is safe and effective to obliterate the pleural cavity. Obliteration by muscle flap transposition can be reserved for patients with persistent or recurrent bronchopleural fistula.
Intrathoracic Insertion of the VAC Device in a Case of Pleural Empyema 20 Years After Pneumonectomy

Veronika Matzi, MD, Joerg Lindenmann, MD, Christian Porubsky, MD, Nicole Neuboeck, MD, Alfred Maier, MD, and Freyja Maria Smolle-Juettner, MD

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(Ann Thorac Surg 2007;84:1762–4)
Caveats in using vacuum-assisted closure for post-pneumonectomy empyema

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b Department of Thoracic Surgery, Federico II University of Naples, Naples, Italy

Table 1: Clinical features of post-pneumonectomy patients treated with VAC therapy

<table>
<thead>
<tr>
<th>Patient (age)</th>
<th>Side and stage</th>
<th>Time to BPF (days)</th>
<th>Previous attempts at closure of BPF</th>
<th>Survival from pneumonectomy</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 (53) R and IV (ipsilateral axillary nodes)</td>
<td>23</td>
<td>SS, CS</td>
<td>11 months deceased MET</td>
<td>Necadjuvant chemotherapy PE/MV</td>
<td></td>
</tr>
<tr>
<td>2 (62) R and II B</td>
<td>35</td>
<td>IMF, OET, RR, SS, CS, ACEI, AMP</td>
<td>25 months NED</td>
<td>Concurrent metastatic papillary thyroid cancer</td>
<td></td>
</tr>
<tr>
<td>3 (64) R and III B</td>
<td>113</td>
<td>IMF, CS</td>
<td>14 months deceased MET</td>
<td>Adjuvant chemotherapy</td>
<td></td>
</tr>
</tbody>
</table>

IMF: Intrathoracic muscle flap; OET: Omental flap transposition; CS: Covered stent; RR: Rib resection; SS: Surgical sealant; ACEI: Acellular matrix patch bronchial closure; AMP: Amplatzer device; MET: Metastatic disease; PE: pulmonary embolism; MV: Mechanical ventilation; NED: No evidence of disease.
a) Status post R pneumonectomy
b) Full bore BPF
c) Several BPF control strategies
d) Amplatzer
Morbidity of VAC

- **Hypotension**: direct application on mediastinum/vagus nerve
- **Pleurogenic pain**: direct application on parietal pleura
- **Bleeding**: ie, direct application on mammary vein/raw lung surface

Saadi A et al, ATS 2011
Rocco G et al, EJCTS 2012
Hemodynamic effects of vacuum-assisted closure therapy in cardiac surgery: Assessment using magnetic resonance imaging

Rainer Petzina, MD, a Martin Ugander, MD, PhD, a Lotta Gustafsson, MD, PhD, b Henrik Engblom, MD, PhD, b Johan Sjögren, MD, PhD, c Roland Hetzer, MD, PhD, d Richard Ingemansson, MD, PhD, c Håkan Arheden, MD, PhD, c and Malin Malmsjö, MD, PhD a

Objective: The hemodynamic effects of vacuum-assisted closure therapy in cardiac surgery are debated. The aim of the present study was to quantify cardiac output and left ventricular chamber volumes after vacuum-assisted closure using magnetic resonance imaging, which is known to be the most accurate method for quantifying these measures.

Methods: Six pigs had median sternotomy followed by vacuum-assisted closure treatment in the presence and absence of a paraffin gauze interface dressing. Cardiac output and stroke volume were examined using magnetic resonance imaging flow quantification (breath-hold and real-time). Chamber volumes were assessed using cine magnetic resonance imaging.

Results: Cardiac output and stroke volume decreased immediately after application of negative pressures of 75, 125, and 175 mm Hg (13% ± 1% decrease in cardiac output). Interposition of 4 layers of paraffin gauze dressing over the heart during vacuum-assisted closure therapy resulted in a smaller decrease in cardiac output (8% ± 1%).

Conclusions: Vacuum-assisted closure therapy results in an immediate decrease in cardiac output, although to a lesser extent than shown previously. Covering the heart with a wound interface dressing lessens the hemodynamic effects of vacuum-assisted closure.
Intrathoracic Vacuum-Assisted Management of Persistent and Infected Pleural Spaces


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Technique

The VAC sponges were inserted in the residual pleural space through an open window thoracostomy at the time of resection or after a failed primary closure. The oval thick sponges and the long strips were both used with one end protruding outside the skin to prevent losing one of them in the recesses of the wound. The entire cavity was filled with sponges. Suction was set to −125 mm Hg from the start, except for patient 3, who underwent a pneumonectomy, in whom it was initially started at −50 mm Hg. The sponges were changed once or twice a week, depending on the ingrowth of the granulation tissue into the sponges. When the entire cavity was covered with healthy granulation tissue, a space-filling procedure was used, if necessary, or the patient was switched to home or ambulatory VAC dressing changes.
a) Status post Pneumonectomy with BPF
b) Open window thoracostomy
c) Outpatient treatment for 2 weeks every 2-3 days
d) Evidence of encased foam into the inflamed parietal pleura
Prevention

- Avoidance of sensitive sites
- Hemodynamically stable patients
- Interposition of gauzes, silicone sheet
- Increasing suction pressure starting from -50 mmHg
- At least 24 hours of effective VAC therapy prior to dismissal
- Complete replacement of foams every 2-3 days
Conclusions

• VAC system is a valuable adjunct to the surgical armamentarium for complex thoracic infections – useful in critically ill as well in an outpatient setting

• VAC can contribute to control sepsis, shorten hospitalization, facilitate outpatient care while improving patient discomfort and quality of life

• There is a learning curve to avoid morbidity