

Using Vacuum – Assisted Closure (V.A.C) In Neck Abscesses

Ngo CV^{1#}, Nguyen H^{2,3#}, Aklinski J^{4*}, Ngo LT⁵ and Tran TM^{6,7}

¹Staff Physician, The Deputy Head of Training, Department of Otolaryngology, Cho Ray Hospital, Ho Chi Minh City, Vietnam

²Assistant Professor of Basic Science, Nova Southeastern University, Dr. Kiran C. Patel College of Osteopathic Medicine, Clearwater, Florida, USA

³Assistant Professor of Medicine, University of California at Los Angeles/Charles R. Drew, School of Medicine, Department of Preventative Medicine, Los Angeles, California, USA

⁴Medical Student OM1, Nova Southeastern University, Dr. Kiran C. Patel College of Osteopathic Medicine, Clearwater, Florida, USA

⁵Staff Physician, Department of Otolaryngology, Cho Ray Hospital, Ho Chi Minh City, Vietnam

⁶The Vice of Director Cho Ray Hospital and Department Chairman, Department of Otolaryngology, Cho Ray Hospital, Ho Chi Minh, Vietnam

⁷Professor of Surgery, The University of Medicine and Pharmacy at HoChiMinh City, Department of Otolaryngology, Ho Chi Minh City, Vietnam

*Corresponding author:

Joseph Aklinski,
MS1, 3400 Gulf to Bay Blvd, Clearwater,
Florida 33759 (USA),
E-mail: ja2340@mynsu.nova.edu

Received: 02 Oct 2020

Accepted: 23 Oct 2020

Published: 28 Oct 2020

Copyright:

©2020 Aklinski J et al. This is an open access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and build upon your work non-commercially.

#Author Contributions:

Cong Van Ngo, Hoang Nguyen. These authors have contributed equally to this article.

Keywords:

Vacuum-assisted closure; V.A.C;
Deep neck infection/abscesses

Citation:

Aklinski J, Using Vacuum – Assisted Closure (V.A.C) In Neck Abscesses. Clinics of Surgery. 2020; 3(3): 1-6.

1. Abstract

1.1. Objectives: Evaluate the efficacy of using Vacuum – Assisted Closure therapy in neck abscesses at Cho Ray Hospital from September 2017 to August 2019.

1.2. Methods: Prospective case series of 42 patients using V.A.C therapy in treatment of neck abscesses at Otorhinolaryngology Department of Cho Ray Hospital.

1.3. Results: After using V.A.C therapy, tissue viability of the wound is improved (78.6%), pains, frequency of dressing changes are reduced and hospital stay is shortened.

1.4. Conclusions: The V.A.C therapy is useful in the treatment of neck abscesses with advantage of reducing pain, frequency of dressing changes, shortening of hospital stay.

2. Introduction

Neck abscesses is an infection in the neck potential spaces. This is an emergency situation with a high death rate due to complications: mediastinitis (40%), necrotizing fasciitis (30%) [2]. For effective

treatment of neck abscesse, aggressive medical therapy and drainage (when indicated) should be coordinated. In addition to the appropriate use of antibiotics, wound care is extremely essential, including necrotic tissue excision and wound cleaning. The number of dressing changes and excision of necrotic tissue depends on the condition of the wound, from 2 to 3 times per day [11]. Dressing changes and excision cause pain for the patients, especially for old patients, or patients with widespread infections. Additionally, repeated dressing changes can increase the risk of hospital acquired infections as well as prolonged antibiotic course.

Currently, at the Department of Otolaryngology of Cho Ray Hospital, there is an increasing incidence of neck abscesse. Antibiotic resistance is also a challenge for clinical doctors [11].

In 1993, Fleischmann introduced negative pressure wound therapy (NPWT or Vacuum-assisted wound closure (VAC)) with the principal was to create negative pressure on the surface of wounds which helps remove excess fluid, improves capillary circulation and shortens healing time. This technique is used in the care and treatment of many different types of wounds (infections, pressure

sores,..) on many body parts such as: chest, abdomen, upper limbs, lower extremities, buttocks,... with high therapeutic effect [9, 10]. However, up to now, no descriptive study on the application of negative pressure wound therapy in the head and neck area has been published. Therefore, we conduct the research: "using vacuum – assisted closure (v.a.c) in neck abscesse" with the following objectives.

3. Research Methods

3.1. Research Subject

The patients who were diagnosed and treated for neck abscesse at the Department of Otolaryngology, Cho Ray Hospital from September 2017 to August 2019.

3.2. Sampling Criteria

Patients who underwent incision and drainage surgery to treat neck abscesse through external pathways and applied negative pressure wound therapy.

3.3. Exclusion Criteria

- Abscess has not been revealed or drained.
- Malignancy at the wound.
- Neck abscesse with complications: mediastinitis, vascular complications.
- Unstable medical condition, which makes it difficult to maintain negative pressure suction technique: coagulation disorders, epilepsy, dermatitis.
- Patients do not agree or continue to participate in the research.

3.4. Research Methods

Prospective case series

- Processing data using SPSS 20.0 software

3.5. Research Conducting

Patients who meet the sampling and exclusion criteria:

- Record information and variables:
 - + General information: age, gender, comorbidities, habits.
 - + Clinical features: symptoms (fever, pain, swelling, shortness of breath, stiff jaw, ...), aspiration.
 - + Laboratory features: complete blood count, CTscan (neck abscess, number of foci), ...
- Evaluation of drainage wounds of neck abscesses according to TIME [5, 8]
 - + Tissue status: necrotic tissue, granulation tissue.

- + Infection status: classified into 4 stages.
- + Excess status: cloudy discharge, blood, clear, clear, saliva.
- + The condition of soft tissue around the wound: the wound edge (normal, scar, necrotic tissue), the skin around the wound (normal, redness, edema).
- + Disclosure of structures in the neck: clear throat, large blood vessels, trachea, esophagus.
- Check the cavities in the wound carefully, not missing the abscess pocket by referring to contrast CTscan.
- Evaluation of vital organs exposed: vascular (attention to carotid artery and veins), trachea, esophagus, salivary glands, bones, throat-oral cavity clearance.

3.6. Criteria for Evaluating the Effectiveness of Negative Pressure Suction Technique in The Treatment of Neck Abscesse

- After 72 hours of applying negative pressure suction, remove negative pressure to re-evaluate the wound
- Proceed to remove the negative pressure suction system
 - + Stop suction system: reduce suction pressure (locking valve).
 - + After 30 minutes, proceed to remove V.A.C:
 - Cut transparent tape around suction heads and wounds.
 - Irrigate the sponge with water to relieve pain for the patient.
 - Remove gently, avoid damaging granulation tissue at wound site as well as exposed organs.
 - Check for any sponges in the wound.
- Assess the wound after applying V.A.C and the solution.

Table

Clean wound: good granulation tissue, no cloudy discharge, no infection, no pain	End of V.A.C
Less than expected ranulation tissue ± necrotic tissue, improved infection status, decreased pain.	Continue V.A.C ± necrotic tissue removal
Systemic infection from wounds. Patients do not tolerate suction system: develop allergy patch, too uncomfortable when covering wounds,	Stop V.A.C

- Complications are recorded and managed (if any).
- Monitoring and evaluating post-discharge (1 week or 1 month)

- + Evaluate the wounds according to TIME
- + Note to the healing method: self-healing, stitch 2, swing in place, skin grafts.

4. Results

Assessing 42 cases applying negative pressure suction technique to treat neck abscesse, we recorded the following results:

4.1. Clinical Characteristics and Workup of Neck Abscesse

- Age: 27 - 87 years old, average age 55.3 ± 15.3 .
- Gender: male / female = 1.8 / 1. Risk factors: Type 2 diabetes (52.4%).
- Clinical symptoms: pain (100%), fever (85.7%), swelling of the painful area (76.2%).
- Abscess characteristics on CTscan: ≥ 2 compartments (52.4%), mainly in the lower compartment (54.76%).
- Causes: Tooth decays (45.2%), inflammation of the mouth and throat (16.8%).

4.2. Effectiveness of Negative Pressure Suction Technique in Neck Abscesse Treatment

All cases in this research received intensive medical treatment.

- Antibiotic therapy: combined antibiotics from the beginning with empiric antimicrobial therapy for similar wounds and then adjusted based on antibiotic susceptibility testing results.
- Supportive care: fluid and dietary compensation.
- Treatment of comorbidities: stabilizing blood sugar, uric acid...

4.3. Characteristics of Neck Abscesse Drainage Wound

Surgical incision: mainly the lower line of the jaw and the neck-line ($\geq 42.8\%$) and ≥ 2 wounds (21.5%).

Evaluate wounds using TIME

- + Tissue condition: necrotic tissue accounts for 80.9%.
- + Infection status: stage 2 (19.1%), stage 3 (59.5%), stage 4 (21.4%).
- + The discharged characteristics: opaque white (80.9%), clear gold (14.3%), cloudy mixed with saliva (4.8%).
- + Soft tissue condition around the wound: the wound edge (100% normal), the skin around the wound (edema (57.1%), redness (23.8%), normal (19.1%)).
- + Exposed important structures in the neck: salivary glands (64.3%), lower jaw bone (14.3%), throat clearance (7.1%).

4.4. V.A.C Care and Follow-Up

- Vital signs: 01 case with high body temperature (38°C) (on the second day of V.A.C application). The remaining cases are within normal ranges.

Table 4.1: Suction fluid characteristics when applying V.A.C by day

Characteristics of suction fluid	Day 1	Day 2	Day 3
Opaque pus	16	7	0
light pink	4	1	0
Clear Yellow	22	34	40

Table 4.2: Amount of suction fluid when applying V.A.C by days

	Day 1	Day 2	Day 3
Amount of suction fluid (ml)	$24,4 \pm 10,7$	$17,9 \pm 9,2$	$12,4 \pm 8,9$

Table 4.3: Properties of the skin around the wound when applying V.A.C by days

	Before V.A.C	Day 1	Day 2	Day 3
Edema	24	13	8	4
Swelling	10	4	2	1
Normal	8	15	32	37

4.5. Characteristics of Neck Abscesse Drainage Wound After Applying V.A.C

- *Condition of secretion: In all cases, there was a small amount of bleeding, self-limited or stoped by putting pressure*

Table 4.4: Condition of the tissue at the wound before and after applying V.A.C

Tissue condition	Before V.A.C(N=42)	After V.A.C
Necrotic tissue	42 (100%)	0
Granulation tissue	Average	9 (21,4)
	Good	33 (78,6)



Necrotic tissue



Good granulation tissue

Figure 1: the wound before and after applying V.A.C (72h)

Table 4.5: Infections at wounds before and after applying V.A.C

Infection Status	Before V.A.C (n=42)	After V.A.C
Infection	42 (100%)	0

- Number of times the application of negative pressure suction therapy: once (95,2); twice (4,8%).
- Time from applying V.A.C to discharge from the hospital: the average of 5 days, from 4 – 8 days.
- The healing method: 02 cases of skin graft (right after the end of V.A.C). The other cases: 83,3% is self-healing, 05 cases of delayed primary closure.

Table 4.6: The condition of excretion at wounds before and after applying V.A.C

Secretion Status	Before V.A.C (n=42)	After V.A.C
Opalescent	34 (80,9%)	0
Clear Yellow	6 (14,3%)	0
Perforated with saliva	2 (4,8%)	0



Figure 2: the wound before and after applying V.A.C

Table 4.7: The surrounding soft tissue condition before and after using V.A.C

		Before V.A.C (n=42)	After V.A.C
Shore of wound	Normal	42 (100%)	42 (100%)
	Edema	24 (57,1%)	4 (9,5%)
The surrounding Skin	Swelling	10 (23,8%)	1 (2,4%)
	Normal	8 (19,1%)	37 (88,1%)

Table 4.8: Exposed structures of neck before and after placement V.A.C

The exposed structure	Before V.A.C (n=42)	After V.A.C
Communication with the pharynx	3	0
Salivary glands	27	27
Lower mandibular	6	6

4.6. Complications, Side Effects and Technical Issues

- *Complications:* 01 case of bleeding during placement of V.A.C. Solution: Stop V.A.C, apply pressure bandage. After 2 hours, bleeding was stopped, continue to proceed negative pressure therapy.
- *Side effects:*
 - + Pain: it is most painful when applying and removing V.A.C, average VAS pain scale 4/10–5/10, the highest is 6, can be alleviate using pain reliever, tend to decrease.
 - + Infections of the surrounding skin: 01 case (2,4%). Solution: abscess drainage.
 - + Surrounding skin congestion: 42,9%, self-limited.
- Technical problems: leaked suction: 4,8%.

5. Discussion

5.1. Effectiveness of Negative Pressure Suction in Neck Abscesse Treatment

- *Clinical Characteristics and Workup of Neck Abscesse*
 In the study we recorded the majority of neck abscesses are male (64.3%), the male/female ratio = 1.8/1. The average age is 55,3 ± 15,3, mostly from 50 – 59 years old (35,7%). Most of the cases have comorbidity (76.2%), diabetes is the highest (52.4%). This is a favorable factor to severe the progression of the infection, creating a pathological spiral [10].
 Pain and fever are the most common onset symptoms. The main cause is tooth decay (45,2%). Need to proactively examine teeth and tooth decay (if indicated) when possible to address the cause to effectively treat the infection.
 Among researched patients, the majority of neck abscesses affected more than 1 compartments. Therefore, it is suggested to always pay attention not to miss any abscess pocket before applying V.A.C
- *Effectiveness of Negative Pressure Suction in Neck Abscesse Treatment*
 In the study, most of the initial wounds had necrotic tissue (80.9%), no granulation tissue. Necrotic or

potentially necrotic tissue should be removed before applying V.A.C. This is the most important step when applying V.A.C [9]. After the end of therapy, all wounds had no necrotic tissue, developed granulation tissue (fine granulation tissue (78.6%)).

The V.A.C treatment helps continuously drain the entire stagnant fluid with proteins that hinder healing. Especially the mechanism of suction – keep fluids, V.A.C creates a moist environment to help stabilize wounds, create favorable conditions for neovascularization and epithelialization [10]. The majority of wounds were noted for cloudy discharge (80.9%), which means the presence of bacteria and inflammatory cells. There are 6 cases of clear yellow-drained wounds but there is an increased secretion, there may still be bacteria in the fluid and cause infection if accompanied by fluid stagnation [8]. After applying V.A.C, all wounds recorded only a small amount of bleeding but self-limited. There was no pus secretion.

With the mechanism of continuous drainage of excess fluid, at the same time increasing blood circulation in the wound bed, V.A.C and effective antibiotic therapy helps to improve wound infection very effectively. The majority of wounds are in stages 3 and 4 (80.9%), that is, the wound clearly has local infection, with or without systemic infection; Following the application of V.A.C, all wounds did not show signs of local infection.

According to the process of caring for the drainage of the abscess in the neck at Cho Ray Hospital, it is necessary to change the dressing and wound cleansing 2-3 times / day, which can be increased depending on the situation of the wound [5, 7]. Meanwhile, with each application of V.A.C, patients will be taken good care of their injury (excision, rinse) before placing V.A.C and closely monitoring. Apparently, the number of dressing changes decreased significantly while the wound was still monitored and evaluated continuously. Wounds are less exposed to the hospital environment, reducing the frequency of pain when changing bandages are the benefits that can be seen from reducing the number of dressing changes.

Leaking is a common technical problem (4.8%). The position of the head and neck area is the "difficult anatomy" area where VAC is applied due to many factors: high movement, skin folds, many angles, etc. so closed monitoring and fixing any technical problems as soon as possible are important [4].

When applying V.A.C, no serious complications have been recorded during the study, discharged from the hospital after 5 days on average (4-8 days), and self-healing wounds (83.3%) 1 week after discharge. Only 1 case of local infection of the surrounding skin, management is incision of the small abscess (<1mm), discharged after 2 days.

5.2. The Process of Applying Negative Pressure Suction Technique To Treat Neck Abscesse

From the above research results, we propose the process of applying negative pressure suction technique to treat neck abscesse at Cho Ray Hospital as follows

- *Step 1: Prepare The Wound and The Surrounding Area*
 - + Necrotic tissue excision: local numbness ± analgesic therapy, removal of necrotic tissue until reaching healthy tissue.
 - + Cleanse wounds: using physiological saline and diluted betadine to cleanse the wound several times. Make sure there is no bleeding.
 - + Dry the skin around the wound (shaving if necessary): 2-3cm from the edge of the wound and the protruding bone, ears, around the mouth
- *Step 2: Put The Sponge On the Wound*
 - + Measure the size and shape of wounds.
 - + Cover exposed vital organs (if any): cover with vaseline gauze to avoid direct suction, limiting organ damage.
 - + Cut and place the sponge on the wound, covering the just enough entire surface of the wound (you can put multiple pieces of sponge into the wound, recording the number of sponge used)
- *Step 3: Cover The Wound and Sponge with Transparent Tape.*
 - + The neck region is characterized by numerous folds of skin and protruding areas (angle of the jaw, chin) and ears. Therefore, when applying, keep the patch close to the skin around the wound and cover 3cm-4cm from the edge of the wound and over the protruding areas.
 - + Reinforcing in difficult, open positions: near the ears, mouth, and hair.
- *Step 4: Connect The Suction System.*
 - + A tip is placed on the sponge at the center of the wound. Make sure that the sponges are visible during wound care period.

- + Use a suction tube to connect the suction tip to the vacuum.
- *Step 5: Install The Vacuum and Check.*
- + Set up continuous suction mode, suction pressure -50mmHg to -125mmHg (customized for each patient)
- + Check the suction system again:
 - Suction system is properly sealed (flat sponge, machine does not indicate open suction).
 - The patient is not uncomfortable.
- + Record the following information: start date, the estimated date of removing V.A.C, suction pressure, number of sponge used.

5.3. Care Process, Tracking Technique of Negative Pressure Suction Neck Abscesse Treatment:

- *Overall Condition:*
- + Vital signs: body temperature, pulse (twice per day)
- + Pay attention to the following signs and symptoms: shortness of breath, chest tightness (abscess spread into the mediastinum)
- *Wound Condition:*
 - Suction system is properly sealed
 - Operating in the right setting mode: continuous suction mode (first 24 hours), then switch to intermittent mode; suction pressure -50mmHg to -125mmHg (customized by patient)
- *Drainage Status:*
 - A mount of fluid increase per day.
 - Colors: red (bleeding), brown, cloudy yellow (infection), clear yellow, clear
 - + Record the condition of surrounding skin and soft tissue: swelling, redness.
 - + Record pain points 2 times / day using VAS scale, time of pain, pain management.
- Complications or technical errors are detected early and handled promptly.

6. Conclusion

Research results show that negative pressure suction technique in the treatment of neck abscesses has many benefits: improving the wound bed, reducing pain, reducing the number of dressing changes, contributing to reducing hospital stay, highly effective in treating neck abscesse.

References

1. Asher SA, White HN, Golden JB, Magnuson JS, Carroll WR, Rosenthal EL. "Negative pressure wound therapy in head and neck surgery", *JAMA facial plastic surgery*. 2014; 16 (2): 120-126.
2. Behrad BAI, Har-El G. "Neck abscesses", *Bailey's Head & Neck Surgery Otolaryngology*. 2014; 794 – 813.
3. Benbow M. "Best practice in wound assessment", *Nursing Standard*. 2016; 30(27): 40.
4. Dhir K, Reino AJ, Lipana J. "V.A.Cuum-assisted closure therapy in the management of head and neck wounds", *The Laryngoscope*. 2009; 119(1): 54-61.
5. Dowsett C, Newton H. "Wound bed preparation: TIME in practice", *WOUNDS UK*. 2005; 1(3): 58.
6. Govea-Camacho LH, Astudillo-Carrera A, Hermosillo-Sandoval JM, Rodríguez-Reynoso S, González-Ojeda A, Fuentes-Orozco C. "Impact of V.A.Cuum-assisted closure management in neck abscesses", *Cirugía y Cirujanos (English Edition)*. 2016; 84(4): 275-281.
7. Houlton JJ, Hom DB. "Approaching delayed-healing wounds on the face and neck", *Facial Plastic Surgery Clinics*. 2013; 21(1): 81-93.
8. Marks MW, Argenta LC, DeFranzo AJ. "Principles and Applications of V.A.Cuum-Assisted Closure (V.A.C)", *Plastic Surgery Secrets Plus (Second Edition)*, Elsevier. 2010; 38-44.
9. Nguyen Truong Giang. "Evaluating outcome of wound care and treatment by V.AC", *Medical Journal of Military*. 2012; 3: 85-90.
10. Nguyen Van Thanh. "Applying VAC to treat serious ulcers of sacrum area (grade III, IV)", *Medical Journal of Vietnam*. 2015; 5(1): 17-22.
11. Tran Minh Truong. "Deep neck infections", *Ear, Nose and Throat Department, University of Medicine and Pharmacy at Ho Chi Minh*. 2018; 7-38.