Chapter 4

Wound Closure with Vacuum Assisted Closure (VAC)

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Vacuum Assisted wound Closure (VAC) or Negative Pressure Wound Therapy (NPWT)
The application of controlled negative pressure may be used to create a controlled hypoxic wound environment which has been shown to:

- stimulate angiogenesis
- promote formation of healthy granulation tissue
- remove tissue edema
- increase local blood flow
- provide a moist environment ideal for wound healing

The risk of excessive bacterial colonization of the wound bed is reduced as VAC therapy eliminates excess and stagnant exudative fluid and thereby reduces the bacterial burden. The accepted mode of delivery involves intermittent or continuous (preferable) suction, applied at approximately 75-125 mm Hg. VAC therapy may be used for both pediatric and adult patients with diverse wounds resulting from infection, vascular insufficiency, trauma, etc. VAC thus offers a safe and reliable alternative to traditional methods of treatment of complex soft tissue defects, including those with exposed tendons, bone, cartilage, and orthopedic hardware, while awaiting definitive wound closure.

Suggestions and tips:

1. Commercially available VAC units are extremely expensive, way above the reach of most patients treated in sub-Saharan Africa.

2. The author uses locally available material for the assembling of affordable VAC ‘units.’ See figures below.
Wound débrided well and VAC used. In this case gauze was used.

Suction tubing inserted, wound wrapped with food wrap, final result before grafting.

A. Supplies and equipment needed:
   1. Sterile gauzes or medium density mattress material (foam) that is cut into various sizes and sterilized. This foam rubber is found in chair cushions around the world. In most cases it is too thick and will need to be divided and thinned. This foam is very close to the material used commercially.
   2. Naso-gastric tubing or other non-collapsible sterile tubing
   3. ‘Cling film’ (food wrap) – available in most groceries/supermarkets
   4. Tape to use for wrapping around the each end of food wrap to provide a sealed wound
   5. Access to either wall suction or a suction unit (disadvantage is the noise) and an effluent collecting bottle.
B. After wound débridement and hemostasis, Vaseline gauze is applied on the wound. Three to 4 layers of gauze are applied over the Vaseline gauze, and the nasogastric tubing is placed just below the topmost gauze layer. This prevents tube obstruction from the overlying Cling. Sterilized mattress foam may also be applied directly to the wound or over the Vaseline gauze. If foam is used, then the naso-gastric tube may be passed into the middle of the foam through a hole. The hole can be made with either a hemostat or knife.

Some home-made Vaseline gauze is very thick and may not allow fluid escape. If this is all that is available, then just use plain gauze or apply the foam rubber directly to the wound. However, briskly rubbing the Vaseline gauze with a sterile towel can remove much of the petroleum jelly.

C. Kling film is wrapped around the gauze, (foam) and tubing, completely covering them. Tape is applied to either end of the Kling film to provide a seal.

D. Keep the foam within the wound bed and off of the surrounding intact skin as this can lead to excoriation and maceration of the healthy skin.

E. Suction pressure is applied through the tubing, and checked to ensure that there is no leakage. The gauze/foam should become hard and mold to the wound immediately after suction is applied.
3. The VAC may be used for 2-3 days before changing the dressing, depending on the type of wound, effluent and sometimes the length of time it takes for the suction unit to malfunction. The VAC may be continued for as long as necessary to obtain a well vascularized wound ready for closure, graft or flap.
External fixator, then VAC-like dressing is applied using foam from a seat cushion directly on wound. VAC was changed every 2-3 days and used for 3 weeks before ready for STSG

**Caution:**

While a functioning VAC system is an excellent tool for varied and complex wound closure, the user must note the following:

1. Adequate hemostasis should be obtained before the application of VAC therapy – avoid direct application over naked or repaired vessels or viscera. Viscera may be covered with Cling wrap for protection before coverage with sterile towels or foam.
2. VACs must NOT be applied on dirty, purulent wounds or wounds with ongoing soft tissue necrosis; it is not a substitute for adequate débridement, but rather WILL permit complete débridement, even with the exposure of tendons, bone or hardware, without risking desiccation. I CANNOT EMPHASIZE THIS POINT ENOUGH.
3. VACs are contraindicated in malignant and necrotic ulcers – these require appropriate treatment before the application of VAC therapy.
4. VACs must function at all times, as long as applied to a wound. When working, the gauzes or mattress foam material should feel ‘hard’ or firm to touch, and will be well molded to the body part to which it is applied. A non-functional VAC that is left applied to a patient is dangerous, as it may allow for rapid development of pus and tissue death. All VACs should be checked at least twice a day to ensure that they are in functional order. Over weekends, someone must check the VACs regularly. Otherwise, simple dressing changes may need to replace a VAC dressing in order to avoid the disaster of a VAC that stops working and is not checked for 2-3 days. DO NOT LEAVE THIS TO A NURSE.
a. VACs that are not functioning will feel ‘soft’, and exudate may be visible on the applied gauzes, or even leak from the edges of the VAC dressing.

b. A foul odor will emanate from a VAC that is not working.

5. The VAC may be applied over the Vaseline gauze when it is placed over freshly meshed skin grafts in order to increase skin graft take. Applying the foam directly on the skin graft is not advised as the foam may become adherent within the interstices of the graft leading to graft failure as it the foam is pulled from the wound bed at initial graft evaluation.

When to Discontinue

1. The VAC should be discontinued temporarily when the wound needs repeat débridement

2. The VAC should not be left on more than 2-4 days before changing.

3. When the wound is clean with a healthy granulation bed and ready for delayed closure, graft or flap.

3. If ameshed graft is applied, the VAC could be used for several more days to ensure graft take. Initial graft evaluation typically ranges from 3-5 days after VAC placement unless a mechanical problem occurs.

(Editors note: There are several companies that are developing portable non-electric vacuum suctions. Whether or not these will become cost effective for Africa is unknown at this time. One such company is Spiracur. Internet contact information at: info@spiracur.com. Unfortunately these are small battery powered, disposable units which are not practical for large draining wounds at this time. KCI and Smith Nephew manufacture the commercial types. These are excellent though expensive products. There suction machines are small and quiet and investing in several of these would be helpful for any mission hospital where patients are on general wards where noise from regular suction machines may keep others awake.)