An Aid to Wound Healing:
Vacuum-Assisted Wound Closure
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Key points
• Negative pressure wound therapy (NPWT) does not achieve wound debridement and cannot be used without removal of necrotic tissue
• NPWT is most beneficial in the early stages of wound healing, increasing the speed of granulation tissue formation. After granulation, NPWT should be discontinued.
• NPWT bandages should be changed every 48-72 hours, but more often if there is a need for repeated debridement at shorter intervals.
• NPWT typically requires hospitalization for veterinary patients.

Background
Negative pressure wound therapy was originally developed by Morykwas and other in the 1990’s.
Application of subatmospheric pressure to a wound using open cell foam led to a variety of advantages in wound management, including fluid removal, application of microstrain to encourage cell migration and proliferation, improved vascularization and decreased bacterial counts. In a pig model, this group demonstrated that granulation tissue formed more quickly than with traditional bandaging techniques. The VAC™ technique was patented by a medical equipment company (KCI) and proprietary foam bandages, suction tubing, fluid reservoirs and portable suction machines were designed specifically for application in human beings with open wounds. Subsequent clinical application in human beings was became widespread approximately 10 years ago, with many studies confirming the beneficial effects on wound healing in human beings. Interestingly, one of the main advantages of this system in human beings is the decrease in associated cost for wound care when compared to traditional bandaging, due to the lower frequency of bandage changes and ability to discharge patients sooner by providing them with a portable suction pump.

Use in veterinary medicine
Initial use of NPWT therapy in veterinary medicine occurred at the University of Florida, when a veterinary resident consulted with the human burn unit regarding management of a tiger cub with massive wounds after being mauled by an adult. After that initial application, use of NPWT spread rapidly throughout several referral centers in the US and veterinary VAC™ units and proprietary bandage material are now being marketed to veterinary hospitals by KCI. An initial publication described successful application in distal limb wounds of dogs, with subsequent small case series describing open peritoneal drainage and other application of NPWT.

Evidence-based approach
While experimental models have shown benefits of NPWT in animals, meta analyses of the literature on NPWT in human patients do not definitively support this claim, and information in veterinary medicine is so limited that no conclusions can be drawn at this time. Regardless of difficulty in proving clinical benefits in the rate of wound healing, my clinical experience is that this technique is at least as effective as wet/dry bandaging techniques and is less labor-intensive.

Equipment
The essential elements of a VAC bandage are:
1. Open cell foam (400-600uM)
2. Adherent, occlusive bandage material
3. Suction tubing and perforated catheter
4. Fluid reservoir
5. Adhesive spray
6. Suction unit with pressure regulator

Originally, veterinarians performed VAC therapy using a standard mobile suction unit, suction tubing and fluid reservoirs that were intended for intraoperative use. Bandages were constructed from open cell foam that was purchased from non-medical suppliers and sterilized by ethylene oxide. Adherent surgical draping material was adapted to complete the bandage and to form an occlusive seal.
Currently available suction units made by KCI and other manufacturers have the added ability to measure pressure at the wound site, allowing detection of leaks due to incomplete seal by the adherent bandage. This advantage, along with the convenience and
reliability of the pre-sterilized sterile bandage materials have prompted our institution to convert to use of proprietary VAC™ bandage supplies and suction units.

**Indications**
- Clean, debrided, open wounds in early or granulation stages of healing
- Immediate postop incisions
- Immediate postop skin grafts
- “Open” peritoneal drainage

**Contraindications**
- Exposed blood vessels or intestine
- Coagulopathy
- Malignant contamination of the wound
- Incompletely debrided wound
- Osteomyelitis

**Bandage application**
1. All steps should be carried out using aseptic technique (sterile gloves and instruments). General anesthesia is required for the initial debridement and VAC placement in most cases, but
2. A large area around the wound is shaved and aseptically prepared.
3. The wound is debrided and lavaged, completely removing gross contamination and all necrotic tissue.
4. Open cell foam is cut to fit the shape of the wound, including subcutaneous dead space areas into which the foam will be inserted.
5. The foam is placed into the wound, including areas of dead-space and degloving.
6. The skin around the wound is dried and, if needed, sprayed with adhesive spray to accentuate bandage seal.
7. An adherent occlusive bandage is applied over the foam and extending to the surrounding skin in order to create a 360 degree seal around the wound border.
8. A small hole is cut into the bandage and the suction pad/tubing kit is applied directly to the area of exposed foam, then sealed to the bandage with a second piece of adhesive drape.
9. The suction tubing is connected and the machine is activated, setting suction to constant mode and -125mmHg. The foam should be seen to contract, indicating complete seal and application of negative pressure. Any leaks that are present are addressed by application of additional adhesive drape material. The bandage may be left uncovered, or an additional light (modified) Robert Jones bandage can be applied to help immobilize the area or protect it from self-trauma.

**Patient care**
An Elizabethan collar is recommended in most animals to prevent the animals from damaging the bandage.

While activity should be limited to prevent the bandage from being dislodged, the suction units have battery capability and animals can typically be walked outside without interrupting NPWT. VAC bandages must be changed every 48-72 hours or tissue can grow into the foam requiring surgical removal of the material. After debridement is completed, we typically perform bandage changes under sedation and opioid analgesia. Although units are mobile, we maintain animals in hospital during NPWT to allow for direct monitoring and troubleshooting of the bandage.

**Tips**
If no leaks are occurring, bandage changes can be facilitated by removing only the center of the bandage (including the foam), and leaving the adherent drape applied to the skin. New adherent drape is then applied over the old adherent drape so that you do not subject the animal (and clinician) to peeling the adherent material off at every bandage change.

Discontinue VAC therapy after granulation is complete. Continued VAC therapy will actually delay epithelialization and wound contraction.

**References**
http://www.kci1.com/KCI1/vactherapy