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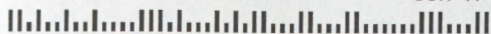
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-  • Maceration in the Periwound Skin
-  • Economics of Skin Damage Prevention: Moisture vs. Pressure
-  • Diaper Dermatitis in a Neonatal Unit
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Philosophy of the Wound, Ostomy and Continence Nurses Society

The WOCN believes that nursing as a profession enhances healthcare services to a multifaceted society and includes prevention, health maintenance, therapeutic intervention, and rehabilitation. Wound, ostomy, and continence care are areas of specialty practice within the framework of nursing that strive to advance the healthcare and quality of life of all affected individuals.

The WOCN believes that continuing education and research provide the basis for current comprehensive nursing practice for patients with wounds, ostomies, and incontinence. Learning may occur on a basic, advanced, or continuing educational level and combines the acquisition of theoretical knowledge and clinical expertise. The WOCN provides and approves quality continuing education for its members and for other healthcare professionals to enhance and improve wound, ostomy, and incontinence nursing practice.

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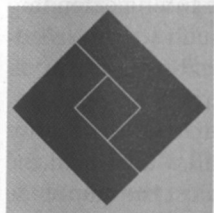
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WOUND CARE



Advances in Negative Pressure Wound Therapy

The VAC Instill

Donnalee Jerome

Acute and chronic wounds affect millions of patients. Negative pressure wound therapy (NPWT) has been available for several decades, and it has significantly impacted treatment of multiple types of wounds. The vacuum-assisted closure (VAC) system has recently been modified, allowing intermittent instillation of fluids into wounds. A description of the system, guidelines for use and novel application techniques developed by the author are discussed.

Negative pressure wound therapy (NPWT) is defined as the application of controlled subatmospheric pressure to a confined area of a wound via a feedback system. NPWT using the VAC system (KCI, San Antonio, TX) with reticulated foam has been in use for more than 10 years. WOC nurses now have extensive clinical experience using the VAC system for the management of complex chronic wounds and are familiar with techniques for applying reticulated black foam (GranuFoam, KCI, San Antonio, TX) and the more dense White Foam (KCI, San Antonio, TX) to deliver NPWT. Skilled application of reticulated foam is essential for NPWT using the VAC system. Saxena and associates¹ have demonstrated that a portion of the cells lining the wound are pulled into the foam by the negative pressure, increasing the surface area in the wound and causing strain on these cells resulting in cellular deformations. These "microdeformations" likely trigger genes in the cell nucleus, promoting mitosis, increasing angiogenesis, and decreasing Matrix Metalloproteinase (MMP) levels in a process that has been described as microdeformational wound therapy.²

The manufacturer recommends changing the foam every 48 hours. Negative pressure settings vary from -50 to -200 mmHg administered either continuously or intermittently. Research indicates that an intermittent setting can result in the formation of an increase in the amount of granulation tissue in some wounds.³ The Therapeutic Regulated Accurate Care (TRAC) (KCI, San Antonio, TX) pad system

allows the clinician to vary the intensity of the negative pressure and provides a more even distribution of negative pressure across the wound.

Standard NPWT

NPWT is often used because of its ability to reduce excess moisture in the wound, reducing bioburden and exposure to associated toxins.⁴ NPWT also increases cell proliferation (including proliferation of granulation tissue) and perfusion in the wound bed. NPWT also aids in contraction of the wound edges by gently stretching the skin. When applying a VAC dressing, it is important to assess the location, surface area, tissue type, color, odor, and drainage within the wound. It is necessary to cleanse the wound after dressing removal and before application of a new dressing. The periwound skin should be protected with a skin protectant, barrier film, or hydrocolloid dressing to maintain the air-tight seal essential for NPWT and to protect the periwound skin from moisture-associated skin damage. Placement involves cutting, fitting, and sealing the appropriate foam type (black reticulated foam or the more dense moist white foam) to the wound. Then the tubing is connected to the pump, which is activated and assessed for leakage of air. Large leaks can be heard by the unaided ear, but minute leaks may only be heard by auscultation of the wound edges. I recommend securing the tubing to the skin, taking care to avoid damage to the skin from pressure. Tape may be applied so that it forms a mesentery that allows the tube to be secured within the pleat of the tape without unduly restricting movement as the patient's body moves.

Protection of the skin at the wound edge and the periwound skin is essential. If the wound surface is small or

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narrow, the skin edges may be covered with a film or a hydrocolloid dressing to protect them. Bridging is an alternative technique, and it allows the clinician to manage two different wounds with NPWT, provided they are in proximity to one another. Bridging also prevents the suction tubing and TRAC pad from lying on a pressure or friction sensitive area. When bridging, it is important that the skin is protected under the foam and that the pieces of foam touch. The choice of foam is important. GranuFoam is hydrophobic and does not absorb fluid but will stay moist under the occlusive drape. It is black and less dense than the white foam, thus allowing for more flow. White Foam is white and denser (more hydrophilic) than the black foam. It is used for frail tissues, such as fistulas, tendon, exposed organs, blood vessels, or bone. I recommend using a piece of black foam over the top for the disk to sit on because this arrangement allows the suction to operate more efficiently.

Addition of medication on the wound under the VAC foam has only been anecdotally reported in the literature.⁵ However, my clinical experience suggests that this technique is increasing in popularity. Typically, an enzymatic debrider, such as a papain-urea ointment or spray (Accuzyme, HealthPoint, Fort Worth, TX), silver sulfadiazine (Silvadene, Aventis Pharmaceuticals, Bridgewater, NJ), or topical anesthetics, is being used at the time of the dressing change to enhance the efficiency of the NPWT.

■ VAC Instill

The VAC Instill (KCI, San Antonio, TX) was introduced in 2003. It differs from traditional VAC therapy because it allows the clinician to add solutions to the wound, as well as apply negative pressure. It is presently available for use in the acute care setting and some extended care facilities. Wolvos⁶ and Bernstein⁷ provide excellent discussions concerning indications for NPWT using the VAC system. In our experience, the VAC Instill is useful for wounds that are not responding to conventional NPWT. It has also been advocated for initial management of selected high-risk wounds.⁶ However, not all wounds are appropriate for the VAC system, and relative or absolute contraindications for the VAC Instill are no different from those for traditional VAC.^{8,9} Contraindications include a malignancy in the wound, untreated osteomyelitis, nonenteric and unexplored fistula, necrotic tissue with eschar, and never placing the black foam over exposed organs or blood vessels.^{5,9,10} When establishing policies for VAC use, it is important to consider guidelines for use established by the manufacturer. Adding the VAC Instill to traditional NPWT will require development of some additional policy in most institutions.

The equipment appears similar to the VAC ATS pump, with additional features. For example, it allows automated infusion of fluids into the wound at set intervals without compromising the integrity of the occlusive dressing. In addition, it has two orange clamps on top of the pump and

a hole for a short IV pole. The left clamp is designed to secure tubing from an irrigation bag to the wound, and the right clamp is meant to secure drainage tubing extending from the patient to the canister. The touch screen is similar to the VAC ATS, with some modifications; it now allows 3 functions: (1) utilities, (2) therapy, and (3) on-off. The therapy function allows the clinician to select continuous or intermittent NPWT or to instill a fluid into the wound. It also allows the clinician to adjust the amplitude of negative pressure, usually between -50 and -200 mmHg. This system is programmed so that a repetitive cycle of NPWT, instillation of a solution, and holding time (when neither instillation nor negative pressure are applied) are used to deliver wound therapy. For example, the system may be programmed to instill a solution for 1 to 2 minutes (long enough to saturate the sponge), followed by a hold time of 5 minutes (range of 1 second to 1 hour), and continuous NPWT for 3 hours (vacuum setting range of 1 minute to 12 hours) followed by a repeat cycle. These settings are usually determined by a physician in collaboration with the wound care team (Box 1).

Apply VAC Instill:
Instill 20 sec
Hold 5 min
Pressure 125 mmHg
Repeat every 3 hours

BOX 1. Typical Instill order sheet.

A wound culture may be obtained prior to starting the VAC Instill to select an optimal solution for a specific patient.⁶ The pharmacy at our facility has several solutions on formulary, and we have recently begun using Dermacyn (Oculus, Petaluma, CA), a super-oxide water that has received approval by the US Food and Drug Administration as a topical wound irrigation solution. Selection of the optimal irrigation solution for a specific wound is determined by a multispecialty team that may include wound care specialists, an infectious clinician, and pharmacist.

Instillation is designed to reduce the bioburden within the wound or for pain control. Reduction of bioburden promotes healing, and it may reduce wound pain in selected cases.^{6,11,12} Pain relief is a particularly important goal for nurses when caring for chronic wounds. Often referred to as the fifth vital sign,¹³ effective pain management indirectly promotes wound healing and significantly impact patient satisfaction with professional healthcare.¹⁴⁻¹⁶ In addition to reducing bioburden, intermittent instillation of analgesic solutions using the VAC Instill has been hypothesized as a strategy to provide localized pain management, especially during and after dressing changes.

The optimal volume of fluid infused into a wound over a 24-hour period varies based on the solution and goals of treatment. We administer enough solution to minimally moisten the sponge and bathe the wound, but this volume

varies depending on the size and depth of the wound. The instill time also must be individually adjusted as therapy progresses. The patient's position affects the optimal instillation volume, since instillation is driven by gravity rather than active or positive pressure or force. I also recommend remaining aware of the patient's instill cycles, since they need to be coordinated with other activities, such as physical therapy or visits with consulting physicians. Patients may be ambulated during NPWT or hold time periods. Ideally, the VAC system should be attached continuously, but it is important not to disconnect it for more than 2 hours in a 24-hour period.

■ Application Techniques

Having used the VAC Instill numerous times, I have developed numerous useful application techniques. I advise reviewing medication and equipment use with the staff caring for the patient. The possibility for administering a medication or solution via an incorrect route (for example, intravenously) that was intended for instillation into a wound has been raised as a potential safety concern. Instillation solutions are typically mixed in either 250 mL or 500 mL bags for administration over a 24-hour period that may resemble IV solution bags to some. To prevent errors, our pharmacy clearly marks bags intended for wound instillation for "irrigation only" using a bright red tag. In addition, the manufacturer has modified instill tubing with distinctive markings and connections to reduce the risk of inadvertent administration as an IV solution. Specifically, the VAC Instill tubing is labeled with orange tags, and its luer-lock connectors do not fit standard IV tubing. We also hang the medication and VAC pump on a different IV pole than that used for delivery of IV solutions and medications. Hanging the solution from a separate pole helps to keep the solution above the wound, allowing a more consistent instillation. I also recommend securing the tubing in a manner that does not allow it to lie directly on the skin. I combine a film dressing with an extra piece of foam to prevent the tubing from being dislodged or lying directly on the periwound skin.

The irrigation solution is checked to ensure that the correct solution or medication is being administered and the patient assessed for hypersensitivity responses during administration. Reactions can range from a rash, burning sensation, or increased pain from the solution, to anaphylaxis. We have not seen any adverse drug reactions with the VAC Instill irrigation solutions that have been used, but we remain cognizant of the potential for adverse reaction to instillation.

Nurses caring for the patient using a VAC Instill system should measure and document the volume of fluids instilled and those drained during treatment. The canister typically requires more frequent changing than traditional VAC because of the added volume of the irrigation fluid.

Placing the dressing also requires careful planning. I recommend picture framing the wound with hydrocolloid



FIGURE 1. Extensive leg wound requiring application of additional film dressing to ensure an airtight seal. Note the presence of two tubes for NPWT and instillation/irrigation of fluids or medications.

dressing to protect the periwound skin and prevent maceration when the wound is small or narrow. Whereas standard VAC therapy requires placement of a single TRAC pad, the VAC Instill system requires that two must be placed. Therefore, it is necessary to ensure that enough sponge is available so that the TRAC pad and irrigator pad provide NPWT and irrigation to both wounds appropriately. I prefer to apply a hydrocolloid dressing in this case because of its ability to handle the extra moisture and protect the periwound skin. Wounds that are larger than the film dressing packaged with the VAC foam will require additional film dressing (Figure 1). After a dressing is applied to protect the periwound skin, the black foam is cut to fit, placed in the wound, and sealed with film dressing. If any portion of the wound is dependent, I recommend placing the instillation pad at the highest (nondependent) aspect of the wound bed and the vacuum pad in its more dependent aspect.

Bridging two wounds may not be feasible, owing to the technical challenges encountered when attempting to provide irrigation for each wound. If the wound is narrow and deep, it may be possible to bore a small hole deep into the foam, place the tip of the track tubing into this hole, and achieve a good seal. As with all modifications of standard application, this should be done in consultation with other members of the wound care team. The VAC Instill has a TRAC pad with an extension, which has a luer-lock connection with a cap, located about 10 cm from the pad. The specialized tubing needed to connect to the solution bag is also included in the kit, which is labeled and has the corresponding luer-locking end on it. I have had success securing the extension tubing with tape to the TRAC pad, so that it is only necessary to disconnect at the upper or distal end of the extension tubing. This prevents inadvertent manipulation of the tubing, which may lose its seal when manipulated.

After the dressing is placed, a test run with vacuum to check for the seal should be done, followed next by a trial irrigation to determine how much solution is required to saturate the sponge and bathe the wound. The dressing is also checking for any leaks. A few test "instill" and "vacuum" runs may be required to achieve the desired balance. Initially it is best to check the patient daily to make sure the desired amount of solution is instilling and to review with staff on the use of the pump and its features.

Staff who work with the VAC Instill frequently express concern that the instill fluid is not infusing into the wound. Although fluid may not infuse rapidly into the wound as it does during IV therapy, staff may be reassured that the intermittent timed irrigation provides a much slower infusion rate. Staff should also be informed that the VAC Instill uses gravity alone to deliver fluid into the wound. Therefore, they should regularly monitor the infusion and change the bag as indicated. The staff should also be informed about normal operation of the vacuum pump and be able to contact wound care team members and KCI (the manufacturer) for technical questions when wound team members are not available.

■ Summary

The VAC Instill combines NPWT with the ability to instill solutions to reduce bioburden or provide ongoing analgesia. Indications for the procedure continue to involve, as do techniques for applying and maintaining the system in wounds with challenging shapes, sizes, and locations. Teaching staff to monitor the system is essential to successful function and to prevent errors when differentiating instillation of solutions into the wound vs ongoing IV therapy.

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