

Instill instead: Negative pressure wound therapy with instillation for complex wounds

This option may be just what's needed for a patient with a complex wound.

By Ron Rock, MSN, RN, ACNS-BC

Negative pressure wound therapy (NPWT) uses negative pressure to draw wound edges together, remove edema and infectious material, and promote perfusion and granulation tissue development. The tissue stretch and compression created by negative pressure during NPWT promotes tissue perfusion and granulation tissue development through angiogenesis, cellular proliferation, fibroblast migration, increased production of wound healing proteins, and reduction of wound area. NPWT has been used to improve healing in a variety of wounds, including traumatic injuries, surgical wounds, pressure ulcers, diabetic foot ulcers, and venous stasis ulcers.

NPWT has now evolved to include automated instillation with dwell time (NPWTi-d, V.A.C. VERAFLORTM Therapy, KCI, an ACELITY Company, San Antonio, TX) that provides wounds with the benefits of both NPWT and wound irrigation. Wound irrigation is an effective, commonly used method to remove debris and infectious material as a means to promote wound healing. This article provides an overview of NPWTi-d.

Support for NPWTi-d

NPWTi-d has been used to treat many different wound types, including traumatic injuries, dehisced surgical wounds, pressure ulcers, diabetic foot ulcers, venous

stasis ulcers, and burns. Studies report that NPWTi-d, compared to NPWT alone, decreases the number of surgical debridements, length of hospital stay, and length of treatment. These studies also report improved granulation tissue production and filling of undermined cavities. One study detailed the use of NPWTi-d as adjunctive treatment for bioburden management.

When to use (and not use)

NPWTi-d is primarily indicated for wound cleansing or to promote granulation tissue formation. (See *Wound characteristics and NPWTi-d therapy goals*.)

NPWTi-d is contraindicated for patients with:

- a wound malignancy
- untreated osteomyelitis
- nonenteric and unexplored fistula
- necrotic tissue with eschar.

The treatment also shouldn't be used with Octenisept[®] (Schülke and Mayr GmbH, Norderstedt, Germany), hydrogen peroxide, or alcohol-based solutions, or to deliver fluid into the thoracic or abdominal cavity because of the risk to alter core body temperature and cause fluid retention within the cavity. In addition, each wound should be thoroughly explored for intactness before starting NPWTi-d to avoid instilling topical solutions into adjacent body cavities.

Clinical considerations

Several wound irrigation solutions have been recommended for use with NPWTi-d. (See *Instillation therapy settings*). Common wound cleansers include normal saline, quarter strength (0.125%) or 0.0125% (one-tenth the concentration of quarter strength due to cytotoxicity) Dakin's solution, super-oxidized water with neutral pH (Microcyn®, Oculus Innovative Sciences, Petaluma, CA), 0.5% silver nitrate, and 0.01% polyhexanide (Prontosan® Wound Irrigation Solution, B. Braun Medical, Bethlehem, PA).

Concerns have been raised in Europe regarding polyhexamethylene biguanide (PHMB), a component of 0.01% polyhexanide. It was classified as a cancer-causing agent in concentrations of 1.0% or higher. However, 0.01% polyhexanide contains PHMB in extremely low concentrations (0.1%) diluted with betaine and purified water, so the carcinogenic classification does not apply.

Here are tips to ensure patients receive the optimal benefit from NPWTi-d:

- Become familiar with how to operate the pump. Getting used to the format may require a learning curve.
- Understand that NPWTi-d foam has higher tensile strength than traditional black NPWT foam to facilitate its easier removal from the wound bed and un-

Wound characteristics and NPWTi-d therapy goals

Wound characteristic	NPWTi-d therapy goal
Exudative	Cleanse
Necrotic	Cleanse
Infected	Cleanse
Contaminated/colonized	Cleanse
Malodorous	Cleanse
Stalled healing	Cleanse
Pain	Cleanse
Tissue loss	Granulation
Tunneling	Granulation
Desiccated	Granulation
Hypoxic wound bed	Granulation
Edematous	Granulation

Adapted from Gupta S, Gabriel A, Lantis J, et al. Clinical recommendations and practical guide for negative pressure wound therapy with instillation. *Int Wound J.* 2016;13(2):159-74.

Instillation therapy settings

Solution type	Solution	Instillation therapy settings		
		Dwell time (per day)	Dwell frequency	NPWT
Biguanides	Polyhexanide 0.01% (Prontosan)	1-60 seconds	12-24 times	1-2 hours
Isotonic	Normal saline (Sodium chloride 0.9%)	1 second-10 minutes	2-24 times	1-12 hours
Hypochlorite based	Dakin's solution (Quarter strength, 0.125%)	5-10 minutes	6-24 times	50 minutes-4 hours
Hypochlorous acid	Super-oxidized water with Neutral pH (Microcyn)	5-10 minutes	6-12 times	2-4 hours
Silver nitrate	Silver nitrate (0.5%)	1 second	12 times	2 hours

Adapted from Gupta S, Gabriel A, Lantis J, et al. Clinical recommendations and practical guide for negative pressure wound therapy with instillation. *Int Wound J.* 2016;13(2):159-74

Case study of NPWTi-d

Mary Johnson*, a 51-year-old woman, developed a large abdominal wound after a prolonged hospital stay and multiple surgeries. Ms. Johnson had a history of ulcerative colitis, proctitis, morbid obesity (body mass index > 60 kg/m²), acute kidney injury, deep vein thrombosis, and rectal cancer. (Note: Malignancy is a contraindication for NPWT unless the site is known to be free of cancer. This was an abdominal wound with no malignancy, so it was safe to treat with NPWTi-d).



A. Ms. Johnson's wound on presentation. The wound was examined with the patient under anesthesia and multiple debridements were performed. Blood and wound cultures were obtained and were positive for infection. Systemic antibiotic therapy and NPWTi-d were initiated.



B. NPWTi-d in place on the wound. The NPWTi-d settings were as follows: 55 mL of quarter strength Dakin's solution was used with a 10-minute soak, followed by 3.5 hours of NPWT at -125 mm Hg. Ms. Johnson received 2 weeks of therapy.



C. Note the extent of Ms. Johnson's nonviable tissue. After NPWTi-d therapy, she was discharged to a long-term acute care center with conventional NPWT (continuous NPWT at -125 mm Hg).

*Name is fictitious.

dermined cavities. It's also less hydrophobic, which helps to evenly distribute the wound irrigation solutions.

- For very large wounds, traditional black foam may be used in addition to the NPWTi-d foam to fill large wound cavities. If an additional drape is needed, a traditional drape may be used; however, the NPWTi-d drape is specifically designed to provide enhanced moisture-resistant adhesion along the wound edges to minimize irrigation solution leakage.
- In large wounds, it's important to keep a running tally of the number of foams used. This will ensure their complete removal during dressing changes and when treatment has been completed.
- Periwound skin is fragile, so take care to protect it before treatment is started. Foam dressings should not come into contact with intact skin. Application of skin preparation products, an additional drape, hydrocolloid dressings, or transparent film over the periwound skin is recommended.
- Know that NPWTi-d can be used with bridging techniques if needed. Use careful attention to ensure the wound cavity is not overfilled, as additional irrigation solution will be required.
- Ensure a good seal because leaks could alter the amount of instillation volume and the negative pressure delivered to the wound and lead to a leak alarm. Apply gentle traction to skin creases and folds to obtain a flat surface for optimal drape adhesion. Apply the drape carefully, avoiding creases or puckering of the drape even in areas where they may overlap. Drape wrinkles may create small, unidentifiable passages for air to enter along the skin or in sections where the drape is overlapped into the foam as the negative pressure is initiated, which could cause a leak alarm. Applying a thin strip of additional drape along the existing edges or a silicone-based skin prep on the overlapped sec-

tions of drape may help achieve a good seal.

- Confirm that both the NPWTi-d cassette and canister are fully engaged and latched. Inappropriate placement or latching of the cassette and canister will cause errors in treatment application.
- Check that the NPWTi-d cassette tubing is not kinked, crimped, or blocked and that all clamps are open. This will allow the instillation fluid to be delivered easily into the wound bed.
- Remember that NPWTi-d canisters usually fill more quickly when combining wound drainage with the instilled solutions, so have extra canisters on hand to alleviate this problem. The unit will alarm when the canister is full.
- As the wound improves and the wound dimensions decrease, reduce the amount of solution instilled accordingly. Overfilling the wound may lead to a compromised seal and solution leakage.
- If possible, have an extra bag of prescribed irrigation solution on hand. Solutions other than normal saline will come from the pharmacy. Use quarter strength (0.125%) Dakin's solution to minimize cytotoxicity. The pump will alarm when the solution bag is empty.
- Remember that you do *not* need to prime the line when spiking a new solution bag.
- Become familiar with the settings. The home screen on the unit will display the current NPWTi-d phase (Instill, Soak, or NPWT) with a timer indicating time remaining in that particular phase.
- Be aware of any discrepancy between the amount of prescribed solution instilled into the wound and the amount of solution returning into the drainage canister. Decreased or no return of solution may indicate transmission into an internal cavity. If this is the case, immediately stop instillation and notify the prescribing clinician.
- Understand that there is a learning

curve with using NPWTi-d. Estimating the amount of solution to be instilled will vary. I have noticed a slight predisposition to overfilling. As such, I have taken 20% off the suggested instillation volume and continue to have success.

See *Case study of NPWTi-d* for an example of how this treatment can benefit patients.

An optimal patient experience

NPWTi-d helps remove infectious materials and promotes a wound-healing environment by combining the wound management benefits of NPWT and wound irrigation. Obtaining a complete drape seal, achieving appropriate attachment of canisters and cassettes, maintaining an open instillation solution line, and monitoring levels of fluid instilled and returned can contribute to a more comfortable patient treatment experience. ■

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