Negative pressure wound dressings

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North Carolina plastic surgeon Dr Louis Argenta and scientist Dr Michael Morykwas put negative pressure dressings on the map in the mid 1990s. Since then, there has been an increased acceptance of the technology by all areas of medicine and nursing. While for many years closed wound healing has been enhanced by negative pressure drains that remove excess fluid, negative pressure applied to open wound dressings to expedite wound closure and improve skin graft "take" is a relatively new concept. The negative pressure dressing (NPD) is an important weapon in wound management but its use does not override good surgical principles and reconstructive techniques.

The basic concept

A vacuum pump is connected by a tube to a negative pressure dressing. The dressing is designed to distribute the negative pressure as evenly as possible across the wound, while maintaining a seal with surrounding normal skin to prevent leakage. Wound exudate is visible as it collects within an in-line receptacle. The delivery of negative pressure is usually programmable, and may be intermittent or constant, with alarm systems to notify leakage or blockage. Pressure settings for optimal therapy vary between devices.

Various portable devices and corresponding dressings are marketed as 'negative pressure wound therapy' units, by KCI International (V.A.C.™), Smith and Nephew (RENASYS™) and ArjoHuntleigh (WoundASSIST™). At the wound interface, both foam and gauze dressings are used.

Clinical use

NPD is used where there are open wound problems, including decubitus ulcers, traumatic wounds, diabetic leg ulcers, sternal wound dehiscence, burst abdomen, enterocutaneous fistulae, and securing of skin grafts.

Wounds particularly amenable to NPD: have significant surrounding lax tissues; are particularly deep; have high wound exudate; and delayed primary surgical closure is in doubt.

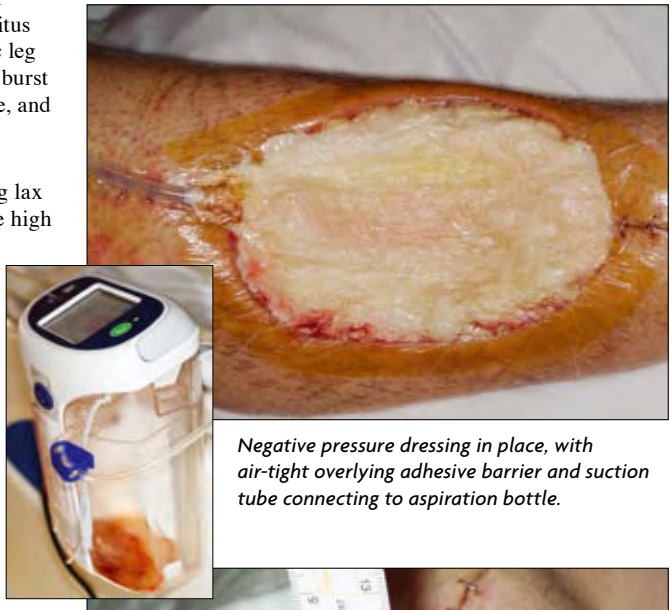
Generally, acute or traumatic wounds are more conducive to NPD, while chronic wounds rarely benefit significantly. Within one week of use (i.e. about the time of the third dressing change), the clinician can determine if NPD is having a desirable effect and if not, change the management strategy (such as surgical intervention). Complete wound closure is rarely the end-point and NPD is discontinued when the wound is small enough to be managed with standard available dressings.

NPD is thought to work through different but related actions. These include:

- exudate removal (including bacteria and toxic tissue factors),
- improved local tissue perfusion,
- removal of interstitial fluid (excess oedema), and
- stretching of the local tissues.

Nurses and surgeons have become quite proficient at placing the devices, which can be a little tricky to start. The dressing is replaced between every one to four days (second daily, on average). Although device rental and consumables are relatively expensive, NPD has been shown by independent assessors to be very cost effective in saving nursing and hospital time by speeding up wound healing.

Large leg wound, following surgical debridement.



Negative pressure dressing in place, with air-tight overlying adhesive barrier and suction tube connecting to aspiration bottle.

Same wound a week later, showing early granulation and decreased depth.

Surgery vs negative pressure

As with many technologies, NPD can be used inappropriately. A dressing can never be a substitute for sound surgical principles.

Debridement. These dressings, like all other dressings, work poorly in under-debrided wounds.

Closure using grafts and flaps. Where they are possible, tried and tested reconstructive techniques such as skin grafts and flaps generally have high success rates. For example, a surgeon concerned about morbidity may be tempted to use a negative pressure dressing in a situation where the success rate is 40-60% versus a flap reconstruction that may have a >90% success rate. This is rarely beneficial for the patient.

In general terms, well established surgical techniques for wound healing should be used instead of NPD. On the other hand, some reconstructive techniques have been made obsolete by the use of the negative pressure dressing. For example, in the morbidly obese patient, the NPD will often remove the need for flap reconstruction or skin graft for a dehisced surgical wound.

Other considerations

Convenience is a factor. As the dressing is difficult and time consuming to replace, surgeons and physicians have been less eager to review wounds under negative pressure dressings. Regular wound review is important to management. For example, a trauma patient in ICU with worsening sepsis may have wound sepsis overlooked by surgeons faced with the hassle of a dressing change. In this scenario, when multiple specialties may need to review a wound (intensivist, orthopaedic surgeon, plastic surgeon, microbiologist), it may be more appropriate to use a regular dressing such as moist gauze.

Cost can influence. As a general principle, regular wound review is important and should not be overridden by concerns over the cost of the dressing. While hospitals generally cover dressing costs for inpatients, finding funding for outpatient use can be difficult. 'Hospital in the Home' programs cover the costs for those discharged early from public hospitals and it is hoped that all health funds will soon cover the use of the negative pressure dressings for privately insured patients. ■