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EDITORIAL

Negative Pressure Wound Therapy: 3500 Years of Revolution and Evolution

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Introduction

Of all the options available for wound treatment, few have been as transformative as negative pressure wound therapy (NPWT) (1–3). From the earliest descriptions of applying suction to wound surfaces, such as cupping therapy in Egypt around 1550 BC and later by Hippocrates (ca. 400 BC) (4), through suction drainage systems for exudate management described by Raffel and Silvis et al. in the 1950s (5,6), to the multiple formats and indications we use today, NPWT has redefined the care of complex wounds. In this editorial, we discuss the value of negative pressure wound therapy in wound management and highlight future perspectives for the method.

It's about time: Wound closure and length of hospitalization

After the concept of using negative pressure therapy was revived at the end of the 19th century with the "Junod boot"—an airtight capsule used to temporarily divert central blood flow to the lower limb and promote healing (4)—multiple forms of the technique began to emerge. The first examples resembling those currently in use appeared in Germany and Russia in the 1970s and 80s, with Russian researchers presenting the first works demonstrating real success in optimizing the management of complex wounds (7).Following this initial boom, the emergence of scientific studies testing the hypothesis that vacuum therapy was superior to conventional treatments began to demonstrate a significant reduction in the time required for treatment across a wide variety of pathologies. These ranged from diabetic foot (8) to wounds following stoma reversal (9), and even trauma-related wounds, while concurrently demonstrating a reduction in deep infections (10).

In more extreme situations involving high risks of infection and other morbidities, such as massive traumatic wounds and tissue destruction, Dimas et al. point out in their randomized clinical trial that the use of modern vacuum therapies—such as intermittent instillation—reduces the number of surgical procedures and the time required for wound closure, and may even reduce the length of hospital stay (11).

It's about value: from device cost to cost-effectiveness

As the use of vacuum therapy became popular, the inevitable question arose: What about the cost-effectiveness of the method? Do the results justify the necessary investment in pumps, materials, and staff training? The answer is usually yes. Whether the parameter is "cost per cm^3 of wound" (12), savings from avoided complications and treatments (13), or specific situations such as open fractures of the lower limbs or extensive wounds in long-term care units, the reduction of serious infectious complications and additional procedures contributes significantly to the economic justification of the method (14). Thus, the use of NPWT has proven to be a valuable tool for both the surgeon applying the method and the resource manager who learns to appreciate its value.

More recently, the discussion on value has expanded to the prophylactic use of negative pressure therapy on high-risk incisions. Clinical trials and economic analyses in vascular, orthopedic, and obstetric surgeries demonstrate that incisional negative pressure therapy can decrease the incidence of surgical site infection and dehiscence in selected patients, with a relevant impact on length of stay and the need for reinterventions (15–17). In these populations, the additional cost of the device tends to be offset by the prevention of costly complications.

It's about the future: instillation, closed-incision therapy, and beyond

Three decades after the consolidation of negative pressure foam systems, the traditional "vacuum dressing" is undergoing a new phase of evolution.

The first phase of this second generation is characterized by negative pressure wound therapy with instillation and dwell time (NPWTi-d). By adding the temporary instillation of various solutions, ranging from saline to antibiotics, a window of new possibilities opens. Studies have shown its utility in complex wounds with exposed prosthetic material, demonstrating significant increases in prosthesis salvage rates and reductions in the number of procedures required to treat the patient, thereby reducing hospitalization costs and associated morbidity (18-20).

Another striking trend is the miniaturization and portability of systems, with the advent of disposable single-use devices and increasingly smaller pumps that facilitate outpatient and home management. These systems broaden access to negative pressure therapy and allow its use in patients who would otherwise remain hospitalized solely due to the need for complex wound care (20).

Conclusion

Over the course of 3,500 years, negative pressure therapy has evolved significantly. Today, the available evidence reinforces that, when properly indicated, NPWT is capable of shortening wound closure time, reducing complications, and, in many scenarios, adding value to care by optimizing resource use.

The challenge for the coming decades is not only to incorporate new technologies but to use them judiciously: reserving NPWT for situations where it truly changes the patient's clinical trajectory and ensuring that access to these resources is aligned with the reality of each health system. In this way, the popular vacuum-assisted closure will become a symbol of how the combination of pathophysiology, technology, and sound clinical judgment can transform the care of complex wounds.

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