

Initial experience with negative-pressure wound therapy with instillation in complex wounds

Experiência inicial com terapia por pressão negativa por instilação em feridas complexas

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ABSTRACT

Objective: to report the initial experience with Negative-Pressure Wound Therapy with instillation in infected or contaminated complex wounds. **Methods:** the negative-pressure wound therapy with instillation used was V.A.C. Ulta with Veraflo instillation (Kinetic Concepts, Inc). The mode of operation was continuous with negative pressure set at 125 mmHg for two hours and instillation between the pauses. The instillation time was 20 minutes (contact time of the topical agent with the wound) and the instilled substance was 0.9% normal saline. After adequate preparation of the wound, it was covered with graft or flap. **Results:** ten patients with complex or contaminated wounds were operated on. The mean number of NPWTi changes was 1.4, the mean number of surgeries was 2.4, the interval until complete wound coverage was 6.3 days, and the interval up to the time of discharge was 11.4 days. **Conclusion:** the comparison of the negative-pressure wound therapy with instillation with two previous studies (historical control) evidenced a shorter hospitalization time, favoring TPNI. This study had an initial character, making it necessary to conduct a randomized and controlled trial to confirm the efficacy of this therapy and verify its cost-effectiveness.

Keywords: negative-pressure wound therapy. wound closure techniques. occlusive dressings. Surgery, Plastic.

INTRODUCTION

Negative pressure therapy (NPT) has been used successfully for decades on a global level. It has simplified and shortened the treatment of complex wounds, constituting a valuable tool in the preparation of the wound bed until its final closure¹. We use it in our service since 2001. More recently, a variation of this therapy has been introduced, the combination of the negative pressure with instillation (NPWTi) of topical agents, which is now being introduced in our environment^{2,3}.

Complex wounds are a major problem due to the difficulty of resolution, prolonged hospitalization, high treatment cost and partial or definitive loss of work capacity. NPT properties are multiple, such as stimulation of wound granulation, reduction of edema, reduction of excess fluid and wound debris, and reduction of bacterial contamination in the wound⁴.

Topical agents are beneficial in the treatment of infected wounds and are the standard

treatment for extensive wounds resulting from burns. Thus, it seems appropriate and desirable to combine these two mechanisms with the potential to act as adjuvant treatment of complex wounds and in the preparation of the wound for its definitive closure with grafts and flaps.

There are already some international studies addressing this new therapy, but in our country there is still no available literature^{6,7,8}. The objective of this study was to report the initial experience of the Complex Wounds Group of the Clinics Hospital with negative pressure therapy by instillation in 10 treated cases of infected or contaminated complex wounds.

METHODS

The present study has a prospective designed and was carried out by the Complex Wounds Group of the Discipline of Plastic Surgery, Clinics Hospital, Faculty of Medicine, University of São Paulo, between March and August 2016. The study was approved

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by the Ethics Committee of the institution under the Number 59787516.7.0000.0068.

The negative pressure therapy with instillation used was the V.A.C. Ulta with Veraflo instillation (Kinetic Concepts, Inc). The mode of operation was continuous, with sub-atmospheric pressure set at 125 mmHg for two hours and instillation between the pauses. The instillation time was 20 minutes (contact time of the topical agent with the wound) and the instilled substance was standard 0.9% saline. We measured the following variables: time elapsed between admission and wound closure (days), qualitative cultures in each surgical procedure, number of surgical procedures performed, wound preparation time (from admission up to the day of the final closure surgery), and length of hospital stay (days).

The parameters used to characterize the wound as infected were: evident clinical signs (pain, heat, redness, purulent secretion and fever), laboratorial evidence (high leukocytosis and CRP), and positive deep wound culture (after wound cleansing and debridement).

We followed the internal guidelines of the Complex Wound Group, usually consisting of wound debridement until obtaining viable tissue and installation of NPT. The interval between procedures ranged from three to five days, depending on clinical parameters that might indicate the change in the NPWTi system, such as clinical impression, fever, leukocytosis, increased inflammatory markers or equipment failure (leakage).

We surgically closed the wounds according to the usual institutional protocols used by the Complex Wounds Group. We performed wound coverage through skin grafting or surgical flaps after the adequate preparation of the wound bed.

Inclusion criteria were complex wound, contamination or presence of infection criteria, age between 18 and 65 years. Exclusion criteria were disagreement in signing the informed consent form, failure to collect intraoperative cultures, change of conduct, and decompensated systemic disease.

RESULTS

We operated on ten patients. All had contaminated or infected wounds and were treated according to the protocols of the institution's Wound Group, consisting of global clinical evaluation, surgical debridement, NPT use and graft and patch coverage. The only change in conduct was the replacement of traditional NPT by NPT with instillation (NPWTi). Table 1 shows the epidemiological and clinical data of the treated patients. Figures 1, 2 and 3 demonstrate the conduct used for the treatment of complex wounds.

Table 2 shows the results obtained. The mean time of outpatient follow-up was six months (ranging from three to nine). We observed no relevant clinical or surgical complications. Only one case had

Table 1. Epidemiological and Clinical Data of the ten operated patients.

	Age	Gender	Wound Etiology	Location	Condition
Patient 1	25	Male	Trauma	Lower Limb	Contaminated
Patient 2	54	Female	Necrotizing	Trunk	Infected
Patient 3	67	Female	Vasculitis	Lower Limb	Contaminated
Patient 4	45	Female	Inflammatory	Perineum	Infected
Patient 5	39	Female	Vasculitis	Lower Limb	Contaminated
Patient 6	32	Female	Necrotizing	Trunk	Infected
Patient 7	28	Female	Pressure Ulcer	Trunk	Infected
Patient 8	50	Male	Trauma	Lower Limb	Contaminated
Patient 9	23	Male	Necrotizing	Lower Limb	Infected
Patient 10	44	Male	Pressure Ulcer	Ischium	Infected

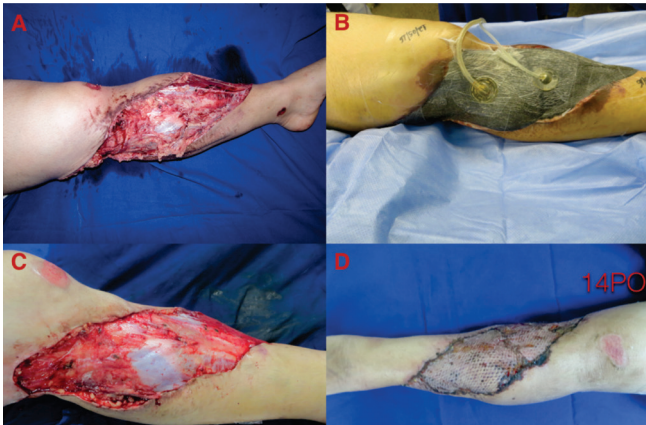


Figure 1. Contaminated, degloving wound on left leg.

a partial dehiscence of the flap suture (case 9). There was no partial or total loss of graft or flap.

DISCUSSION

The properties of traditional NPT are multiple, such as stimulation of wound granulation, reduction of edema, reduction of excess fluid and wound debris and reduction of bacterial colonization in the wound^{4,5}. The association of NPT with solution instillation has the potential to increase wound cleaning by debris removal, help in infectious combat by dilution of microorganisms and destruction of the biofilm^{2,9-12}. In addition, the solution evenly distributes through the wound, in all its recesses. NPWTi is poorly adherent to the wound bed, being less painful than conventional NPT and easily removed. When compared with traditional NPT, NPWTi presents greater potential for wound bed granulation. An experimental study by Lessing *et al.*¹³ showed that NPWTi increases the thickness of the granulation tissue by 2mm when compared with traditional continuous or intermittent NPT. This has the potential effect of expediting the preparation of the wound bed, allowing earlier closure.

As a negative aspect, NPWTi needs better sealing to avoid leakage when it is in instillation mode, which can pose problems in some more difficult anatomical areas. Moreover, it must be changed earlier, between two to five days, to prevent sponge saturation. Local (visual), clinical and laboratory parameters (leukogram and inflammatory tests such

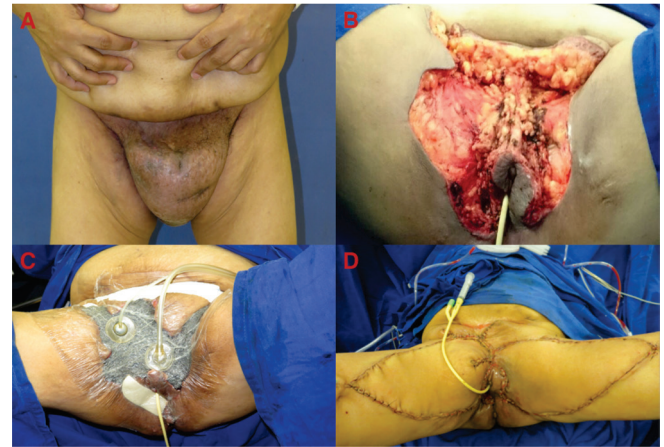


Figure 3. Infected perineal hidradenitis.

as CRP) are generally used to address the need for exchange within the suggested range.

NPWTi's greatest appeal, due to its properties, is in the cases of complex, contaminated or infected wounds. In these cases, NPWTi has the potential to allow a smaller number of surgical interventions and to reach an earlier definitive wound closure. A study of diabetic foot wounds comparing traditional NPT with NPWTi shows results in this regard⁹. They retrospectively evaluated 142 Patients with diabetic wounds divided into two groups, one with traditional NPT and another with NPWTi (this with two instillation time subgroups, of six and 20 minutes). There was no significant difference between the two NPWTi subgroups. They observed a shorter wound closure time (7.6 vs. 9.2 days, $p < 0.05$), a lower number of surgeries (2.5 vs. 3, $p < 0.05$) and a shorter time of hospital stay (11.4 x 14.9 days, $p < 0.05$).



Figure 2. Dehiscence of abdominal surgical wound.

Table 2. Data on the number of NPWTi exchanges, the total number of surgeries, the time to definite wound coverage, and time to discharge.

	Number of NPWTi applications	Total number of surgeries	Time to definite coverage (days)	Time to hospital discharge (days)
Patient 1	1	2	5	12
Patient 2	2	3	10	17
Patient 3	1	2	5	13
Patient 4	2	3	10	14
Patient 5	2	3	9	14
Patient 6	1	2	4	6
Patient 7	1	2	4	9
Patient 8	1	2	4	9
Patient 9	2	3	8	12
Patient 10	1	2	4	8
Average	1.4	2.4	6.3	11.4

A relevant issue is the choice of the solution to be used in the instillation phase. There are reports of several substances such as polyhexanide⁹, Dakin's solution¹⁴, silver nitrate¹⁵ and saline¹⁶. In the experience reported here, we decided to use saline, which was equally effective when compared to polyhexanide in a previous controlled study in diabetic wounds¹⁶. This was a prospective, randomized study with 100 Patients divided into two groups of NPWTi, one with saline solution and one with polyhexanide. There was no statistical difference between the two groups as for the number of surgeries performed and length of hospital stay. There was only favoring of the saline group with respect to shorter time to wound closure (5.6 x 7.5 days, $p < 0.05$). Thus, the authors suggest the use of saline as the standard substance to be instilled, since it has similar results with minimal additional cost. Since the solution is defined by the physician applying the therapy, it is important to choose solutions that are not deleterious to the wound bed such as chlorhexidine gluconate.

For comparison purposes, in our country there is a study of lower limb degloving wounds and

traditional NPT that showed a length of hospital stay of 17.5 days, a mean number of surgeries of 2.9, and a mean NPT changes of 1.6¹⁷. The cases presented here displayed lower means when compared with that study, a hospitalization time of 11.4 days, number of surgeries 2.4 and number of NPT changes of 1.4. Another previous study with traumatic lower limb injuries with the use of traditional dressing (without NPT) showed a longer hospitalization time, of 32 days¹⁸. Some studies indicate a reduction of costs with the use of NPWTi in complex infected or contaminated wounds due to the reduced number of dressing changes, the earlier definitive wound coverage surgery and the shorter hospital stay^{9,19}. The initial impression with the use of the negative pressure therapy with instillation was favorable in the reduction of the time of treatment and hospitalization in patients with contaminated or infected complex wounds when compared with the two previous studies cited (historical control). This study had an initial character, making it necessary to conduct a randomized and controlled work to confirm the efficacy of this therapy and verify its cost-effectiveness.

R E S U M O

Objetivo: relatar a experiência inicial com a terapia por pressão negativa por instilação em feridas complexas infectadas ou contaminadas. **Métodos:** a terapia por pressão negativa por instilação utilizada foi o V.A.C. Ultra com instilação Veraflo (*Kinetic Concepts, Inc*). O modo de operação foi contínuo com pressão sub-atmosférica ajustada em 125 mmHg por duas horas e instilação entre as pausas. O tempo de instilação foi de 20 minutos (tempo de contato do agente tópico com a ferida) e a substância instilada foi solução salina padrão a 0,9%. Após obtenção de preparo adequado da ferida, ela foi coberta com enxerto ou retalho. **Resultados:** foram operados dez pacientes com feridas complexas contaminadas ou infectadas. O número médio de trocas da TPNI foi 1,4, o número médio total de cirurgias foi de 2,4, o intervalo até a cobertura da ferida foi de 6,3 dias e o intervalo até a alta foi de 11,4 dias. **Conclusão:** a comparação da terapia por pressão negativa por instilação com dois estudos prévios (controle histórico) evidenciou um tempo de internação menor, favorecendo a TPNI. Este estudo teve um caráter inicial, fazendo-se necessário conduzir um trabalho randomizado e controlado para confirmar a eficácia desta terapia e verificar a sua custo-efetividade.

Descritores: tratamento de ferimentos com pressão negativa. Técnicas de Fechamento de Ferimentos. Curativos Oclusivos. Cirurgia Plástica.

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