

Title

The utilization of Negative Pressure Wound Therapy with Instillation (NPWTi) in the management of complex wound - A Malaysian case series



Harikrishna KR Nair, MD FRCPI FRCPE MSC PHD, Head, Wound Care Unit, Department of Internal Medicine, Hospital Kuala Lumpur. Professor, Faculty of Medicine, Lincoln University College, Malaysia



Ng Ying Ying, MBBS International Medical University, Medical Officer, Department of Internal Medicine, Hospital Kuala Lumpur, Malaysia.

Vani Sri Balakrishnan, Staff Nurse, Wound Care Unit, Hospital Kuala Lumpur, Malaysia.

Abstract:

Negative pressure wound therapy with instillation (NPWTi) stands as a crucial advancement in wound healing, irrespective of wound types. It effectively reduces microbial burden and accelerates wound closure, offering faster healing and improved outcomes. A retrospective observational case series was conducted in Hospital Kuala Lumpur to describe ten cases that was treated with NPWTi. The aim of this study is to assess the healing of acute and chronic wound treated with NPWTi with normal saline using Genadyne Duo.

Introduction:

Advanced wound care has made major strides in addressing both acute and chronic wounds, responding to a dramatic increase in wound incidence worldwide. Chronic wounds impose a considerable human and economic burden, impacting individuals and society alike. [Järbrink et al, 2017] With an aging population and earlier onset of chronic conditions like diabetes, this burden is on an upward trajectory. [Olsson et al, 2019]

Negative Pressure Wound Therapy (NPWT) has been increasingly favoured worldwide as the preferred method of wound care as it is a versatile system designed to optimize wound healing by applying sub-atmospheric pressure and facilitates the modulation of various local and circulating cytokines and growth factors, promoting an anti-inflammatory response. [Ravindhran et al, 2023] It is applicable for managing both acute and chronic wounds, spanning from diabetic foot ulcers, pressure ulcers to open fasciotomy wound.[Zaver et al, 2023] Negative pressure wound therapy with instillation (NPWTi) represents an innovative advancement in wound management, amalgamating the principles of standard negative pressure wound therapy (NPWT) with the controlled administration of topical irrigation solutions.[Kim et al, 2020] This approach entails the timed delivery of irrigation fluids such as saline, distilled water, or antimicrobial agents to the wound bed, concurrent with negative pressure application. Meta-analyses consistently demonstrate that Negative Pressure Wound Therapy with Instillation and Dwell Time (NPWTi) outperforms both NPWT and conventional

dressings in wound care. They reveal higher rates of complete wound closure and fewer complications associated with NPWTi, making it a superior choice for effective wound management. [De Pellegrin et al, 2023]

The authors present a case series involving 10 patients with complex wounds stemming from diverse causes. These wounds were treated intermittently with NPWTi using normal saline. The study aims to underscore the efficacy of NPWTi in addressing a range of difficult wounds.

Materials and methods

The device utilized in this case series was the Genadyne Duo NPWTi, which combines conventional negative pressure with instillation therapy. Patient selection was irrespective of wound type, including wounds unresponsive to standard dressings. Prior to the application of NPWTi, the wound bed was thoroughly cleaned and prepared using aseptic techniques. Ensuring an airtight seal with the adhesive dressing is crucial, as any air leaks can compromise the function and effectiveness of NPWTi. Normal saline was used as the instillation fluid for all wounds, with the volume tailored to the wound area. This volume must be sufficient to cover the wound uniformly without causing leakage or inadequate coverage. The pressure applied and dwell time were adjusted according to the specific wound requirements. In this study, the dressing was changed every 5-7 days.

Total of 10 patients with various types of wounds with no limits to age, gender or types of wounds were selected in this study from Wound Care Department, Hospital Kuala Lumpur.

Patients and/or their caregivers provided consent for the utilization of case details and photographs for publication and educational purposes

Results

Case 1

- 71 years old gentleman with underlying hypertension.
- Presented with alleged motor vehicle accident-causing right femur fracture and developed pressure ulcer during the hospital stay due to prolonged immobilisation.
- Treatment: 1 cycle of NPWTi
- After 1 week of treatment, there is uniform granulation growth and thickness across the wound.

DAY 1



DAY 7



Case 2

- 82 years old gentleman with underlying ischaemic heart disease, chronic obstructive sleep apnoea, severe spinal stenosis caused patient to be bed bound and subsequently patient developed grade 4 pressure ulcer.
- Patient presented to hospital with complains of lower limb pain and redness where he was diagnosed with cellulitis and resolved with antibiotics however the pressure ulcer failed to heal with conventional wound dressing.
- Treatment: 5 cycles of NPWTi
- After 5 cycles of NPWTi, there is increased blood flow to the wound and there is uniform growth of granulation across the wound.

DAY 1



DAY 9



DAY 16



DAY 39



DAY 43



Case 3

- 48 years old lady with underlying type 2 diabetes mellitus.
- Patient underwent Total Abdominal Hysterectomy and Bilateral Salpingo-Oopherctomy (TAHSBO) and was complicated with burst abdomen and surgical site infection.
- Treatment: 2 cycles of NPWTi
- Post 2 cycles of NPWTi, depth of wound decreased where deep layer sutures are completely covered with granulation tissue with increased blood flow to wound.

DAY 1



DAY 8



DAY 14



Case 4

- 27 years old lady with underlying end stage renal disease on regular dialysis
- Patient was admitted for infected urachal cyst and abdominal surgery was done and the wound was left open.
- Treatment: 1 cycle of NPWTi
- At the end of 1st cycle, there is a rapid increased in blood flow with even granulation.

DAY 1



DAY 10



Case 5

- 42 years old patient lady with underlying diabetes and hypertension.
- Patient underwent midline laparotomy for TAHBSO and bladder repair complicated with wound breakdown which failed to heal with conventional dressing.
- Treatment: 2 cycles of NPWTi
- After 2 cycles, there is increased blood flow , healthy granulation tissue and reduced depth of wound seen.

DAY 1



DAY 9



DAY 14



Case 6

- 38 years old gentleman with no co-morbid
- Patient was admitted to ward for stroke and was complicated with hospital acquired infection started on antibiotics.
- Due to prolonged immobilization, patient developed pressure ulcer and was infected. The wound did not improve despite given systemic antibiotics and conventional dressing.
- Education on pressure ulcer prevention reinforced at this point to patient.
- Treatment: 4 cycles of NPWTi
- After 4 cycles of treatment, there is even granulation tissue seen and good blood flow with healthy edges.

DAY 1



DAY 7



DAY 12



DAY 19



DAY 27



DAY 33



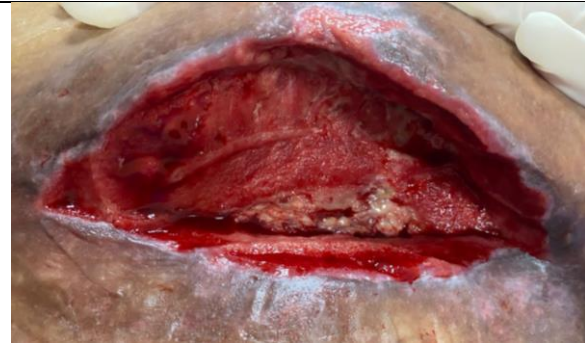
Case 7

- 65 years old lady with no co-morbid
- Patient underwent TAHBSO and was complicated with surgical site infection.
- Treatment: 1 cycle of NPWTi
- Healthy granulation tissue seen with no slough and healthy blood flow at the end of 1st cycle

DAY 1



DAY 6



Case 8

- 50 years old lady with no known medical illness diagnosed to have a pelvic mass.
- Patient was admitted to gynecology ward for TAHBSO which was then complicated with surgical site infection
- Treatment: 2 cycles of NPWTi
- Wound became smaller with granulation tissue after 2 cycles of NPWTi

DAY 1



DAY 7



DAY 14



DAY 17



Case 9

- 36 years old gentleman who is morbidly obese had history of motor vehicle accident and right above knee amputation (AKA) was done in 2018.
- He presented with pain over right lower limb stump and was diagnosed to have infected right AKA stump.
- Wound debridement was done and wound was left open
- Treatment: 3 cycles of NPWTi
- By the end of treatment, there were even granulation tissue seen and the wound is smaller in size.

DAY 1



DAY 7



DAY 13



DAY 29



DAY 36



Case 10

- 58 years old lady with no co-morbid
- Patient was admitted for spine fixation of T11-L2 however it was complicated with surgical site infection post operatively.
- Treatment: 1 cycle of NPWTi
- At the beginning of treatment, the rod and screw of the operative site can be seen clearly, after 1 cycle, granulation has covered most areas of the rod and screw.

DAY 1



DAY 8



Discussion:

A total of 10 patients were included in this study ranging from 27 years old to 82 years old with male to female ratio of 1:1. Out of 10 patients, four patients had no co-morbid while two patients have diabetes mellitus and one patient has end stage renal disease. Treatment cycle and length varies in all patients depending on whether satisfactory wound healing progress has achieved. In this case series, there were no adverse effect reported in all the patients. The dressing change for each patient in this study ranges from 5 to 7 days considering patient's comfort and cost of treatment. According to Kim YH et al, 2015, 7-day interval changes of NPWTi is comparable to 3-day interval change with cost effectiveness.

The study highlights the efficacy of NPWTi with normal saline in managing both acute and chronic wounds. All patients experienced notable benefits, including the formation of new granulation tissue, absence of infection, and reduced wound size in some cases. The selection of normal saline as the instillation fluid is supported by previous research, such as the work by Kim et al, 2015. Additionally, international consensus recommends normal saline as the preferred instilled solution for NPWTi further reinforcing its effectiveness and widespread acceptance in clinical practice. [Kim et al, 2013 & 2015]. Prior to undergoing NPWTi, all patients had previously tried conventional wound dressings without success. A retrospective study conducted by Gabriel et al, 2008. demonstrated that NPWTi significantly reduced the microbial burden of wounds, expedited wound healing, and shortened hospitalization time when compared to traditional wound treatments for various complex infected wounds. Moreover, NPWTi has been found to be beneficial in the management of sacral and ischial pressure ulcers. It facilitates wound irrigation, removes fibrinous debris, and promotes granulation tissue formation, thereby reducing the need for operative debridement. [Arowojolu and Writh, 2021] This highlights the efficacy of NPWTi in addressing challenging wounds and improving patient outcomes.

Limitations:

This study has several limitations worth noting. Firstly, its small sample size and the diverse nature of the wounds limit the generalizability of the findings. With a larger sample size, it would be possible to categorize wounds more accurately and consider patients' comorbidities, which could provide deeper insights into wound healing dynamics.

Secondly, the study did not account for factors such as patients' nutritional status, control of comorbidities, history of smoking, or previous experiences with poor wound healing. These factors can significantly influence wound healing outcomes and could have provided valuable context to the study results. Future research should consider incorporating these variables to better understand their impact on wound healing and treatment efficacy.

Conclusion:

The results have shown that the use of NPWTi is efficacious in various types of complex wounds with even just 1 cycle. Despite the limited sample size, the study highlights the utility of NPWTi-d as a valuable addition to a healthcare provider's toolkit for managing challenging wounds. It underscores the device's effectiveness in promoting wound closure, offering clinicians a beneficial option for addressing complex cases.

Declaration of interest:

The author has no conflicts of interest to declare and receives no funding for this study. This was a wound care investigator-initiated study.

References

- Arowojolu OA, Wirth GA. Sacral and ischial pressure ulcer management with negative-pressure wound therapy with instillation and dwell. *Plast Reconstr Surg*. 2021;147(1s-1):61S-67S.
- De Pellegrin L, Feltri P, Filardo G, Candrian C, Harder Y, Galetti K, et al. Effects of negative pressure wound therapy with instillation and dwell time (NPWTi-d) versus NPWT or standard of care in orthoplastic surgery: A systematic review and meta-analysis. *J Name*. 2023;20(6)August. doi:10.1111/iwj.14072.
- Gabriel A, Shores J, Heinrich C, et al. Negative pressure wound therapy with instillation: A pilot study describing a new method for treating infected wounds. *Int Wound J*. 2008;5(3):399-413.
- Järbrink K, Ni G, Sönnnergren H, Schmidtchen A, Pang C, Bajpai R, et al. The humanistic and economic burden of chronic wounds: A protocol for a systematic review. *Syst Rev*. 2017;6(1):15. doi:10.1186/s13643-016-0400-8.
- Kim YH, Hwang KT, Kim JT, Kim SW. What is the ideal interval between dressing changes during negative pressure wound therapy for open traumatic fractures? *J Wound Care*. 2015;24(11):536-41. doi: 10.12968/jowc.2015.24.11.53
- Kim PJ, Attinger CE, Constantine T, Crist BD, Faust E, Hirche CR, et al. Negative pressure wound therapy with instillation: International consensus guidelines update. *Int Wound J*. 2020;17(1):174-86. doi:10.1111/iwj.13254.
- Kim PJ, Attinger CE, Constantine T, et al. Negative pressure wound therapy with instillation: International consensus guidelines update. *Int Wound J*. 2020;17(1):174-86.
- Kim PJ, Attinger CE, Oliver N, et al. Comparison of outcomes for normal saline and an antiseptic solution for negative-pressure wound therapy with instillation. *Plast Reconstr Surg*. 2015;136(5):657e-664e.
- Kim PJ, Attinger CE, Steinberg JS, et al. Negative pressure wound therapy with instillation: International consensus guidelines. *Plast Reconstr Surg*. 2013;132(6):1569-79.
- Olsson M, Järbrink K, Divakar U, Bajpai R, Upton Z, Schmidtchen A, et al. The humanistic and economic burden of chronic wounds: A systematic review. *Wound Repair Regen*. 2019;27(1):114-25. doi:10.1111/wrr.12683.
- Ravindhran B, Schafer N, Lathan R, Carradice D, Smith G, Chetter I. Mechanisms of action of negative pressure wound therapy at a molecular level: Systematic review. *J Vasc Surg*. 2023;77(6) E233-E234
- Zaver V, Kankanalu P. Negative pressure wound therapy. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2023. PMID: 35015413.