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Research Article

Short-Term Scar Outcome of Burned Patients Treated by NPWTi: A Preliminary Report

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Abstract

Background: Negative Pressure wound therapy with instillation combines the advantages of both sub-atmospheric pressure therapy and instillation of wound-decontaminating and infection-controlling solutions. In this paper, we present our experiment in utilizing Negative Pressure wound therapy with instillation for superficial partial, deep partial, and full-thickness burn wound management in the Minia University Hospital Burn Unit. **Methods:** Twenty patients were included in a prospective study of burn wounds. The burn area was divided into two parts; the control part & study part; the control part was managed by occlusive dressing, while the study part was managed by NPWTi. NPWTi was initiated by instilling normal saline with a soaking time of 5 minutes, followed by 8 hours of NPWT at 75 mmHg for children and 100 mmHg for adults. One month after complete healing, all cases were assessed using the Photographs & POSAS Scar Scale. **Results**: The study results revealed faster healing time and significant scar outcomes. **Conclusion**: NPWTi is a valid tool for the management of burns with promising and satisfactory scar outcomes.

Keywords: Burn; NPWTi; Skin Graft; Wound; Scar; Negative pressure.

Introduction

Burn is a significant health issue, and the management of these wounds depends on a multidisciplinary team to achieve therapeutic outcomes[1].

Due to the revolutions in burn management protocols, substantially higher numbers of burn victims survive their injuries and must bear the burden of their scars**.** [2]
Scarring remains a serious adverse consequence of burn trauma despite advances in treatment protocols [3].

NPWTi is one of these technologies in which a closed dressing and intermittent negative pressure are applied to the wounds. When the sub-atmospheric pressure is off, the device can instill the fluid of choice, either an isotonic or an antiseptic solution and when this pressure is on, the fluid is extracted into a special canister beside the wound exudate. This technology was documented as a possible tool for infection control [4].
In burn cases, NPWT is applied to drain the excess fluid and enhance the blood flow of the local wound. In addition, it may result in increased oxygen and nutrients, which may aid the healing process [5].

The Patient and Observer Scar Assessment Scale (POSAS) can predict the long-term results of scars based on their short-term

outcomes, which can be useful when making decisions regarding the management of scars during follow-ups[6].
This study aimed to determine the impact of NPWTi on the scar quality of burned patients using the POSAS to score one month after the burn.

Patients and Methods

This study was approved by the local Ethics Committee, Faculty of Medicine, Minia University REC no (373:5/2022).
From May 2022 to December 2022, a prospective, randomized control, Split case clinical trial was carried out on 20 patients presented with burns (either acute or delayed).

The Patients whom were included in this study fullfilled the following criterae: Partial & full thickness burns, flame, scald, electrical and chemical burns. Major burns with (10 – 30)% TBSA in children, major burns with (15 – 30)% TBSA in adults. Both sexes were eligible and special sites upper limb (UL) & lower limb (LL), while our exclusion criteria was: Extensive burns >30% TBSA, minor burns <10% TBSA in children, minor burns <15% in adults, superficial burns, facial burns with inhalational injury and conditions where usage of NPWT is contraindicated.

Participants were monitored throughout the course of their treatment, up until the time of complete healing, and then re-examined after one month to determine the preliminary outcomes of their treatment. The aim of this trial is to examine the efficacy of NPWTi as a treatment modality for burned patients.

The burn area was divided into two parts; the control part & study part; the control part was managed by occlusive dressing, while the study part was managed by NPWTi.
NPWTi (NP-A Medvac MV-800), MedVac Grand Silver Foam dressings, was initiated by instilling isotonic saline with a soaking time of 5 minutes followed by 8 hours of NPWT at a pressure of 75 mmHg for children & 100 mmHg for adults.

Isotonic saline was primarily instilled unless there were signs of infection. The choice of the instilled antibiotic depended on the result of the wound swab culture taken from the infected burn part.

The soaking time was the same for all cases. The dressings were changed every three days at the bedside or under anesthesia.
The methods of wound closure included secondary intention or Split Thickness Skin Graft (STSG), and the method of wound closure was chosen according to the standard wound therapy protocols.

The research measured the effects of NPWTi on POSAS score [7] items to determine whether its end results were superior to those of the conventional therapy alone.
All of these cases were assessed one month after complete healing using Photographs & POSAS Scar Scale**.**

The POSAS scale consists of two scales, the Patient Scar Assessment Scale (PSAS), six items, and the Observer Scar Assessment Scale (OSAS), five items. The PSAS consists of six items: color, pliability, thickness, relief, itching, and pain, while the OSAS consists of five items: vascularization, pigmentation, pliability, thickness, and relief.
Each item is a ten-step score, with 10 representing the scar's worst possible outcome. The total score of the OSAS consists of a summation of the scores of the five items (range, 5 to 50). In addition, the total score of PSAS score is the summation of the scores of its six items (range, 6 to 60). The total rating on both scales ranges from 1 to 10.

In pediatrics, the PSAS was carried out with the aid of their parents or guardians. Two members of the research team completed the OSAS independently.
Statistical analysis was conducted using the Statistical Package for the Social Sciences (SPSS) software which is a comprehensive statistical analysis software developed for

data management, advanced analytics & multivariate analysis.

Results

The study was performed on patients presenting with burns (either acute or delayed), who were 20 patients who fulfilled the entry criteria. The mean age of patients was (2-49) 15.4±12.4.

In this study, 15 (75%) were males, and 5 (25%) were females. In 13 (65%) patients, the burn was acute, while in 7 (35%) patients, it was delayed. The depth of the burn was as follows: 1 (5%), superficial partial to deep Partial, 9 (45%), superficial partial to deep partial, 7 (35%), and 3 had full thickness (15%).

The healing time of the study part was *Range Mean ± SD* (11-26) 17.6±4.2, whereas in the control part was (7-22) 12.3±4.2, with a significant **p-value *<0.001****

The healing method was a secondary intention in 11 (55%) cases and skin grafting in 9 (45%) cases.

The results provided by PSAS (Table 1) demonstrated a substantial decrease in the study part managed by NPWTi of the scores of the whole items; (pain, itching, color, stiffness, scar thickness, scar irregularities, total patient, and overall opinion) with significant p-values: (***<0.001*)*** for all items.

Furthermore, all items of OSAS see (Table 2) reported statically significant p-value (***<0.001****) for all the items of OSAS (vascularity, pigmentation, thickness, relief, pliability, total observer, and overall observer opinion) and (***0.002****) for surface area item, in favor of the study group managed by NPWTi.

Table 1: shows the results of PSAS

Patient Scar Assessment Scale		**Study part N=20**	**Control part N=20**	**P value**
Pain	*Range* *Mean ± SD*	(1-3) 1.5±0.6	(1-3) 1.7±0.7	***<0.001****
Itching	*Range* *Mean ± SD*	(1-3) 2±0.6	(2-4) 3.2±0.6	***<0.001****
Color	*Range* *Mean ± SD*	(1-3) 2.7±0.6	(3-4) 3.6±0.5	***<0.001****
Stiffness	*Range* *Mean ± SD*	(1-4) 2.3±0.7	(2-5) 3.5±0.8	***<0.001****
Thickness	*Range* *Mean ± SD*	(2-5) 2.6±0.9	(3-5) 3.7±0.6	***<0.001****
Irregularity	*Range* *Mean ± SD*	(2-5) 2.9±0.9	(3-5) 4.2±0.6	***<0.001****
Total	*Range* *Mean ± SD*	(8-20) 14±2.8	(14-24) 20±2.3	***<0.001****
Overall opinion	*Range* *Mean ± SD*	(6-9) 7.1±0.9	(1-3) 2±0.9	***<0.001****

- ***Paired Samples T test***
- ****: Significant level at P value < 0.05***

Table 2: shows the results of OSAS

Observer Scar Assessment Scale		Study part N=20	Control part N=20	P value
Vascularity	*Range* *Mean ± SD*	(1-3) 2.4±0.7	(3-6) 4±0.9	***<0.001****
Pigmentation	*Range* *Mean ± SD*	(1-4) 2.3±1	(3-6) 4.4±0.9	***<0.001****
Thickness	*Range* *Mean ± SD*	(2-4) 2.8±0.9	(4-7) 4.7±1	***<0.001****
Relief	*Range* *Mean ± SD*	(1-4) 2.9±0.8	(3-7) 5.1±1.1	***<0.001****
Pliability	*Range* *Mean ± SD*	(1-5) 3.7±0.9	(4-7) 5.1±0.9	***<0.001****
Surface area	*Range* *Mean ± SD*	(1-5) 3.6±0.9	(4-7) 4.9±1	***0.002****
Total	*Range* *Mean ± SD*	(7-23) 17.7±3.6	(22-38) 28.1±4.5	***<0.001****
Overall opinion	*Range* *Mean ± SD*	(5-9) 7.1±1.1	(2-5) 2.7±0.9	***<0.001****

- ***Paired Samples T test***
- ****: Significant level at P value < 0.05***

Discussion

Due to the modern advances in burn treatment, the mortality rate associated with burn injuries has decreased significantly. Burn victims may survive their trauma and are forced to deal with the resultant scars [2].

Scars are annoying sequelae of burn injuries. Despite the progress in the modalities of scar management, scar formation remains a troublesome concern for many burn victims [3], influencing their quality of life [8].

POSAS [9] scales are commonly utilized in the subjective assessment of scar quality [10]. The older scar scales were developed for clinicians [11]. In contrast, newer scales have been developed to incorporate the patient's perspective [12], which could be different from the clinician perspective point of view [13]. POSAS is very simple to use, incorporates both the observers' and the patient's insights, and is more beneficial than other scales. It was utilized to assess either burn or linear scars, which reported advantageous, and valid outcomes for scar evaluation [9, 14-16].

One of the most critical steps to guide the process of scar management is the patients' opinion and how they report the quality of their scars relatively short time after complete healing[6,17]. The short-term outcome of the scar detected by POSAS can predict the later, long-term scar quality, which can be useful in the decision-making for outpatient follow-ups [6]. It is common sense when the patient considers his scars more unsatisfactory than the observer's, as stated by Bianchi et al.,[18], but this was incompatible with the overall opinion of the patients and/or their guardians regarding the short outcome of their scars.

Hypertrophied burn scars are annoying situation that affects the victim's quality of life due to aesthetic and functional incapability. In addition to psychological sequences such as stress disorders, depression, anxiety, and loss of self-esteem [19], the thickness factor in both the PSAS and OSAS had statistically significant p-values in favor of the study part in this series. Furthermore, pain and pruritus add burdens on the burn victims and may be

severe enough to wake the patient from sleep. Its etiology remains poorly understood, and physicians face challenges in its management[20]. Moreover, Willebrand et al.,[20] added that it exists in the rehabilitation period as high as 87% in adults and 100% in pediatrics.

Consistent with the PSAS, item, itching, and pain scores that showed a significant decrease in patients treated with NPWTi (p-value <0.001) which showed significant value of NPWTi application over the conventional dressings in agreement with the results of Opasanon et al., who treated acute superficial burn adult patients with alginate silver dressing & 1% silver sulfadiazine, their TBSA was only less than 15% and the results showed more pain score (p-value <0.02) and healing time was 7 ± 3·51. The primary objective of burn management is to expedite the burn victim's return to everyday life[21]**.** It is common sense that the earlier the healing, the better the scar outcome, which is consistent with the results of this study where the healing time in the study part managed by NPWTi healed faster than the control part, with the better scar outcome in favor of the study part, as depicted. In the field of burn management, it is a common occurrence for partial-thickness burn wounds to deteriorate into full-thickness wounds over the course of the next few days. The borderline zone of stasis and its microvascular patency are the cause [22].

Changes in the microvasculature status with convertible degrees of inflammation and hypoperfusion happen in this borderline zone, the stasis zone. These changes may lead to cellular necrosis if the burn wounds are not properly treated [23, 24]**.** More than 21 days of the healing time is documented to predict pathological scar formation in burn traumas [25]. Many factors affect these scars, such as specific sites of burn, darker skin, the number of operated operations of the same wound, and age [26, 27]. Over the past decades, NPWT has invaded the wound-healing arena [28]. Surprisingly, few studies have investigated the effect of NPWT in the treatment of acute burns, despite promising evidence of its role in reducing the ischemic changes, formation of edema, and wound progress to a better outcome[22,29, 30]**.** To our knowledge, this is the first prospective clinical trial that investigated the role and the outcome of NPWTi in both acute and delayed burn management. Applied pressure above 125 mmHg causes pain [31]**.** Therefore, it is recommended to adjust blood pressure to 75 mmHg for children & 100 mmHg for adults. No pain was detected during this thesis as we applied the advised laws of NPWTi application besides application of Vaseline gauze as a first layer in contact with burn wound followed by application of foam dressing while [1] applied Niltac™ (ConvaTec, Greenlane, New Zealand) to ease extraction of the adhesive film in order to decrease pain felt during dressing.

NPWT decreases the infection and edema , thereby shortening the inflammatory phase of wound healing. Many authors have addressed many valuable benefits of its use in wound healing protocols, including the reduction of dressing changes and hospital stays. Additionally, it accelerates angiogenesis, cellular divisions, and granulation tissue formation. Furthermore, it causes both micro- and macro-deformations of the wounds and may decrease the number of surgical debridement sessions [32-34]**.** These data are in agreement with this report, which translates in the form of faster healing time in the study parts handled by NPWTi, which adds more benefits in moisturizing the burned areas three times for 5 minutes a day by isotonic saline and or by a mixture of the saline with an antibiotic. The off-cycle wash cooled the wound, stopped the burning process, washed the debris and exudate, decreased the pain, and subsequently decreased the inflammatory period.

Conclusion

NPWTi plays a significant role in decreasing the wound healing time required for partial and full-thickness burn wounds. Subsequently, the short-term outcomes of utilizing NPWTi in the management of partial and full-thickness burns are

promising for the resulting scar quality. In order to confirm these results, long-term results will be followed.

Conflict of interest:

The authors declare no conflict of interest.

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