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The Use of Negative Pressure Wound Therapy (NPWT) as a Dressing for Split Thickness Skin Graft for Bilateral Chronic Venous Leg Ulcer

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ABSTRACT

Background: Chronic ulcer is a type of wound, which persists for at least 3 months. One of the causes of chronic ulcer is deep vein thrombosis (DVT). Chronic ulcers require very high maintenance costs and can negatively impact the patient's quality of life and mental health.

Case Illustration: A 40-year-old man came to the hospital with a history of chronic ulcer on both legs, which first appeared 3 years ago. The Patient had undergone treatment at a public outpatient clinic and hospital, unfortunately the wound did not heal. The patient continued to change the bandage independently and did not go to the doctor for wound control. Upon doppler ultrasound, a sign of deep vein thrombosis (DVT) was observed. Negative Pressure Wound therapy (NPWT) was used for wound bed preparation, Split Thickness Skin Graft (STSG) on the left foot was used as a dressing, while conventional dressing was chosen for the right foot. The graft take on the left foot with NPWT was 95%, while the one on the right foot with conventional dressing was 90%.

Discussion: Negative pressure wound therapy (NPWT) is a closed system that applies negative pressure through continuous or intermittent suction. NPWT can be used in wound bed preparation to reduce biofilm. NNPWT helps in the removal of exudates from the wound, thus preventing the build-up of serous fluids and blood, reducing the growth of bacteria at the base of the wound, which helps tissue growth after split thickness skin graft (STSG).

Conclusion: NPWT stimulates better healing after surgery. The left leg, which used NPWT after STSG had faster healing time and better aesthetic result by promoting graft take. The graft take on the left leg (with NPWT) was higher compared to the right leg.

KEYWORDS: Chronic ulcer, Negative pressure wound therapy, Modern dressing, Deep vein thrombosis, Split thickness skin graft.

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INTRODUCTION

Chronic leg ulcer is a type of wound, which shows no signs of healing after 3 months of adequate treatment or is not fully healed after 12 months.[1] One of the causes for chronic leg ulcers is Deep Vein Thrombosis (DVT) which manifests in the lower extremity. DVT and pulmonary embolism has an incidence of 1-2 per 1000 population annually. The risk of mortality and recurrence after therapy is high.[2] Chronic ulcers increase health care costs and can lead to decreased mobility, constant pain and negative mental health impacts leading to a decrease in quality of life.[1]

A 40-year-old male presented in the hospital with neglected chronic ulcer in both legs. The patient had undergone treatment in primary health centres, unfortunately the ulcer persisted. Upon ultrasound examination multiple thrombus in lower extremity veins were shown. A anticoagulant was chosen as initial therapy. In addition, wound bed preparation with Negative Pressure Wound Therapy (NPWT), debridement and Split Thickness Skin Graft (STSG) was utilized afterwards. This case report aims to evaluate the benefit of NPWT after STSG in chronic ulcer.

Case

A 40-year-old male, working as a private driver, presented in the hospital with chronic ulcer on both legs. The ulcers were the result of a motor-vehicle accident 3 years ago. The patient initially sought treatment from a primary health care centre

where oral antibiotics were prescribed and was ordered to regularly clean the wounds and change gauze. In the last year, the patient cleaned and changed gauze every day by himself. The ulcer was initially described roughly 4-5 cm in width and grew larger with time till it became circumferential. Along with ulcer, the patient also presented with bilateral limb swelling and pitting edema. The patient stated that the swelling was relieved by elevation during the first year. Meanwhile it became more persistent in the last two years. Pain was described as continuous with Visual Analogue Pain Scale (VAS) of 2-4 and increased upon touch (VAS 4-6). The Patient had no history of hypertension or diabetes. Patient had a history of smoking approximately 1 cigarette per day.

On physical examination the patient appeared to be moderately ill, with stable vital signs and body mass index of 27,9 kg/m^2 (Pre obese). Upon examination circumferential ulcers were found on the left and right leg, above the ankle with a largest length of 9 cm and the shortest length of 4 cm, circumference of 40 cm, well defined raised margins and depth of 0.5 cm. The wound has a yellowish-red base with more than 50% unhealthy granulation tissue, a large amount of exudate and gauze fibres. The edges of the wound appear to be swollen with pitting edema around the wound. Marjolin's ulcer was the differential diagnosis due to the chronic nature.

General blood work was conducted, the patient had anemia (Hb 9,2 g/dL microcytic-hypochromic), elevated fibrinogen 466 mg/dL, elevated D-Dimer (0,96 ug/mL), elevated CRP (17,4 mg/L), normal albumin, liver and kidney function test. Doppler ultrasound was performed with a summary of thrombus present in both left and right common femoral vein, great saphenous vein, superficial femoral vein and popliteal vein.

Figure 1: Pre-operative condition of the ulcer on the right and left le

Figure 2: Doppler Ultrasound images

On the first day of hospitalization, wound treatment followed these steps: 1. Polyhexamethylene Biguanide (PHMB) and Iodine was used for cleaning the wound. 2. Pus culture was then taken from the base of the wound. 3. The ulcer was then covered with a multilayer dressing consisting of tulle followed by damp gauze with PHMB, dry gauze, and elastic bandage. The following day, the patient received anticoagulation therapy, enoxaparin sodium 0.6mg twice daily. In addition, NPWT was used for wound bed preparation of ulcers before skin graft treatment. NPWT was used for 3 days with fluid production of 900 ml from the left leg and 700 ml from the right leg.

Figure 3: Pre-operative use of NPWT on both leg

Debridement and split thickness skin graft (STSG) was performed in the operating theatre following 3 days of NPWT wound bed
preparation. NPWT dressing was removed after spinal anaesthesia to minimize the pain. Examination of tissue post NPWT showed healthy granulation tissue approximately 80%. A biopsy was performed to confirm diagnosis and rule out any malignant changes or Marjolin's ulcer. The biopsy result was then revealed to be consistent with granulation tissue accompanied by non-specific acute and chronic inflammation at the base of the ulcer. The ulcer was washed and cleansed before Split Thickness Skin Graft (STSG) was applied. STSG was sutured to the margins of the ulcer. The right leg was wrapped with tulle followed by damp gauze with PHMB liquid, dry gauze, and elastic bandage. The left leg was dressed with tulle, then covered with an NPWT device, with pressure set to 100 mmHg. This method allows us to evaluate the efficacy of using NPWT compared to conventional dressings for STSG. The patient was treated with ceftazidime, in accordance with the culture result of multi resistant Pseudomonas putida microbes for 10 days during inpatient treatment.

Five days following the surgery, the dressing of the right foot was replaced. The dressing on the left foot was changed 6 days after the surgery and was replaced with tulle, dampened gauze soaked in PHMB, followed by dry gauze and elastic bandage. The NPWT cartridge collected approximately 800-900 ml of serohemorrhagic fluid. Fourteen days after the surgery, we evaluated the graft take on both legs. The graft take was 95 on the left leg and 90% on the right leg. In addition, edema after STSG was also significantly reduced.

The patient was hospitalized for 20 days from the start of the wound bed preparation to post STSG wound care. Upon discharge, the patient was prescribed multivitamins, NSAID as painkiller, and rivaroxaban 15 mg orally once a day. Follow-up visit was scheduled 4 days after discharge.

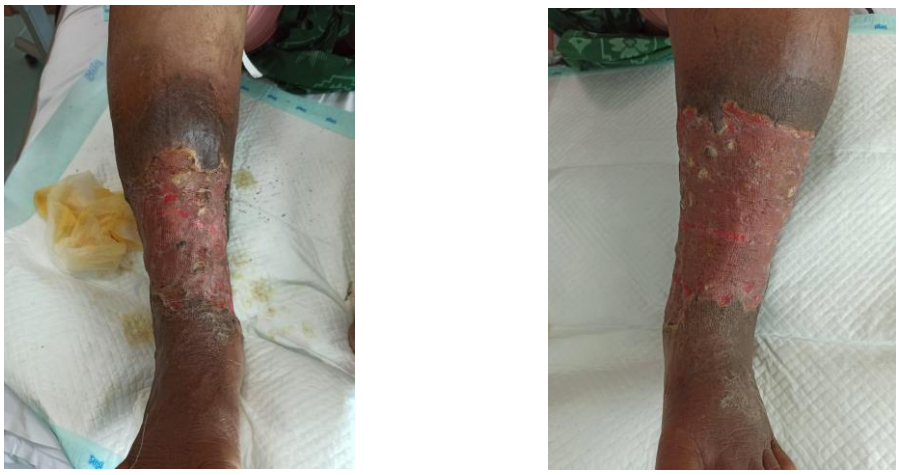

Figure 4:Post operative pictures of both right and left legs day 11

Timeline of hospitalization

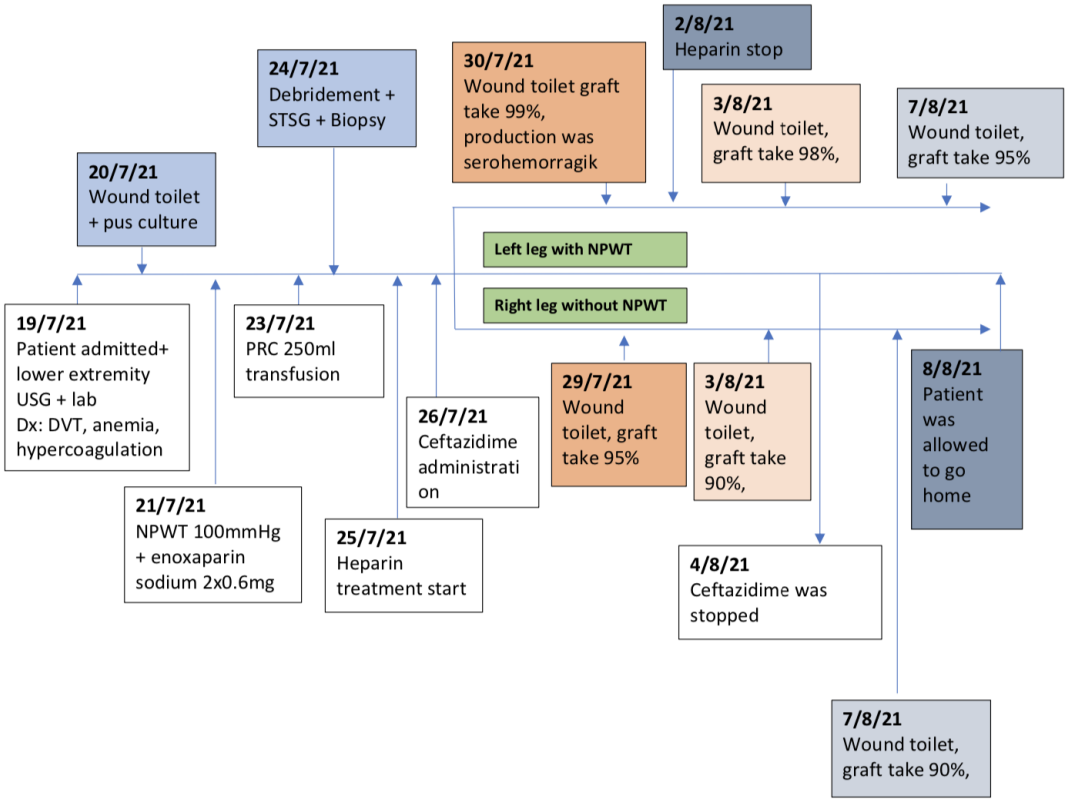

Figure 5. Timeline of hospitalization

USG: ultrasonography; DVT: Deep Vein thrombosis; NPWT: negative pressure wound therapy; STSG: Split thickness skin graft

DISCUSSION

Chronic Venous Insufficiency (CVI) is a chronic, progressive disease that can manifest in a wide clinical spectrum, it is caused by ambulatory venous hypertension as a result of either obstruction or reflux or both.[3] With the increase of sedentary lifestyle and obesity, CVI should be given more clinical attention as it poses a threat to a patient's quality of life and mortality. 50% of Chronic Venous Insufficiency (CVI) occurs in the legs and can manifest as telangiectasias (Spider veins), reticular veins, varicose veins with hints of skin discoloration, pain, oedema and ulcers.[4,5] In this patient the risk factors that trigger chronic venous insufficiency (CVI) include obesity, smoking, lifestyle (work as a driver and sedentary lifestyle), history of lower extremity trauma and previous venous thrombosis. Successful healing for leg ulcers directly depends on how long the inflammation has occurred and the area of the wound itself. According to Melikian (2019), if the ulcer has been around for less than a year and the wound area is less than 10 cm^2, 29% will fail to close in the first 6 months, and this will increase to 78% if it has been more than a year and the wound area is more than 10 cm^2. With a high recurrence rate, management of foot ulcers is very complicated because of many variables and multidisciplinary approach that is required. For the diagnosis of wounds in patients with chronic venous disease, the CEAP classification is used, which consists of clinical, etiological, anatomical and pathophysiological.[6] To describe the severity of wounds the venous clinical severity score was used with the criteria consisting of pain, varicose veins, venous edema, skin pigmentation, inflammation, active ulcers, and use of compression therapy; with a score of 21.[5,7]

Table 1: CEAP classification for this patient:[6]

C	Clinical Classification	C6r	Recurrent active venous ulcer
E	Etiologic	Ep	Primary: a degenerative process of venous valve and/or venous wall which leads to valve/or vein wall weakness and dilatation that results in pathologic reflux.
		ESi:	Intravenous Secondary Causes: any condition that causes damage to wall and/or valve, such as DVT, traumatic arteriovenous fistulas.
A	Anatomic: Thrombus was identified in 4 locations of the left and right leg.	As-2- GSV	Great saphenous vein
		Ad-11-CVF	Common femoral vein
		Ad-13- FV	Femoral vein
		Ad-14 POPV	Popliteal vein
P	Pathophysiologic	Po	Obstruction

Table 2: Venous clinical severity score for this case:[5]

Clinical descriptor	Absent (0)	Mild (1)	Moderate (2)	Severe (3)
Pain	None	Occasional	**Daily not limiting**	Daily limiting
Varicose veins	**None**	Few	Calf or thigh	Calf and thigh
Venous edema	None	Foot and ankle	**Below knee**	Knee and above
Skin pigmentation	None	Limited perimalleolar	Diffuse lower 1/3 calf	**Wider above lower 1/3 calf**
Inflammation	None	Limited perimalleolar	Diffuse lower 1/3 calf	**Wider above lower 1/3 calf**
Induration	None	Limited perimalleolar	Diffuse lower 1/3 calf	**Wider above lower 1/3 calf**
No. active ulcers	None	1	**2**	3 or more
Ulcer duration	None	<3 mo	3-12 mo	**>1 y**
Active ulcer size	None	<2 cm	2-6 cm	**>6 cm**
Compression therapy	**None**	Intermittent	Most days	Fully comply

Deep Venous Thrombosis (DVT) is an obstructive venous disease that results in a compromised venous reflux mechanism. DVT Usually occurs on the legs, although cases involving the upper extremities, mesenteries and the head have been reported. The Virchow's Triad involving venous stasis, dysfunctional endothelial venous wall and hypercoagulability causes blood clot formation.[8] Pulmonary embolism is a cause of cerebrovascular and cardiovascular diseases. DVT is a part of venous thromboembolic (VTE) disorder that has high mortality and morbidity rate. Another sequelae to DVT is recurrent thrombosis and post thrombotic syndrome.[4]

Patients presenting with DVT usually have elevated D-Dimer levels, but elevated d-dimer levels can be found in older patients, sepsis, malignancy, burns, recurrent surgery and chronic kidney failure.[2,8] Testing D-Dimer levels is highly sensitive (94-96%) but not specific. Hence, a diagnostic imaging is needed to confirm the presence of DVT. The imaging used is venous compression ultrasound (CUS) which is both sensitive (93.8%) and specific (97.8%) in diagnosing DVT.[2] However, the diagnostic imaging used in this patient is doppler ultrasound because this patient has ulcers on both legs so the use of stockings is not suggested as it can cause discomfort. The doppler ultrasound shows a thrombus present in both left and right common femoral vein, great saphenous vein, superficial femoral vein and popliteal vein which shows that the diagnosis of this case is deep vein thrombosis (DVT). Anticoagulation therapy is still the main treatment of choice for DVT. [2] Therapy can last for 3 to 6 months depending on recurrence and bleeding. Therapy involves the initial stage (first 2 weeks after initial diagnosis), long term therapy (3 months or more) and follow-up therapy. The initial therapy involves direct oral anticoagulants (DOAC), but if not feasible unfractionated heparin and warfarin can be used as initial therapy.[2] This patient was given enoxaparin sodium during inpatient treatment, then after OP he was given heparin and rivaroxaban 15 mg for outpatient treatment.

Split thickness Skin Graft (STSG)

There are several modalities that can be used to close wounds depending on the size of the wound defect. Reconstructive ladders can be used to cover wound defects in the order of per second, primary suture, skin graft and using local or distant

flap modalities, depending on the location, base and size of the defect. In this case, a split thickness skin graft (STSG) was used because the wound defect was quite large (4-9 cm in length) and the wound base was damp. In accordance with this case of venous ulcers, according to a systematic review conducted in 2017, STSG is still the gold standard for treating venous ulcers.[9] Skin Graft is a form of autologous transplantation used for reconstruction. There are several different skin graft techniques, starting from full thickness skin graft (FTSG), intermediate skin graft, and epidermal skin graft. Split thickness skin graft (STSG) consists of a portion of the skin graft, and if it consists of the entire dermis, it is called full thickness skin graft (FTSG). Full thickness skin graft (full thickness skin graft) requires a better vascular layer in the wound to survive compared to split thickness skin graft (STSG) which can survive in conditions with less vascularization.[10] Split thickness skin graft (STSG) can be harvested with an electric dermatome and should be transplanted into a healthy, non-contaminated wound bed for optimal healing. Some factors that influence graft take include the quality of the recipient's skin, the production of seroma and hematoma, and the nutritional condition of the patient.[11] After skin graft placement, fixation is essential, usually with sutures or staples and bandaging. Various methods are described, conventionally using non-adherent bandages with gauze and elastic bandages to more modern methods such as Negative pressure wound therapy (NPWT). Special attention should be paid to avoid too much pressure causing necrosis and enough pressure to promote graft take.[11] Negative pressure wound therapy (NPWT) is a closed system that applies negative pressure through continuous or intermittent suction. Apart from cleaning wounds with PHMB and debridement, NPWT is a modality for reducing biofilm which is often found in chronic wounds.[12] The wound is wrapped with foam and sealed with an occlusive dressing (plastic), a suction tube is connected to a vacuum pump to collect exudate fluid. NPWT has been known for its function of optimizing graft take by creating continuous and controlled pressure distribution on the wound bed, especially in patients with irregular wound bed shapes. Continuous removal of exudate from the wound prevents the accumulation of serous fluid and blood, also reduces the proliferation of bacteria in the wound bed. Negative pressure promotes increased perfusion which is essential for wound healing to provide nutrients for tissue growth.[13] According to a systematic review conducted by Jiang et al. 2021, the optimal pressure for NPWT post skin graft is 80 mmHg.[14]

The most frequently encountered complications of skin grafts are hematoma, seroma, infection and contracture. The management of post-operative STSG wound recovery is very important to promote graft take. Postoperative recovery includes immobilization of the wound site using a “bolster dressing” to prevent fluid accumulation which can affect revascularization of skin graft. The wound area must be kept moist and covered to promote healing.[14]

CONCLUSION

Chronic wounds are medical problems commonly found in daily practice. It is important to know the cause of chronic wounds in order to give appropriate therapy for patients. Chronic wounds due to venous insufficiency often occur with a high recurrence rate in the legs. In this case, the neglected care of the wound could be caused by the patient's psychosocial and economic factors. NPWT was effective in wound bed preparation observed from the reduction in slough presentation and increased epithelialization. STSG was chosen for the treatment as it has a better chance of survival in a less vascularized environment. NPWT is one of the various modalities to stimulate wound healing. It was shown in this case, that the use of NPWT stimulates better healing following surgery. The use of NPWT after STSG promotes faster healing time and better aesthetic results by increasing the graft take.

REFERENCES

I. Agale SV. Chronic Leg Ulcers: Epidemiology, Aetiopathogenesis, and Management. Frade MAC, editor. Ulcers. 2013 Apr 22;2013:413604.

II. Kruger PC, Eikelboom JW, Douketis JD, Hankey GJ. Deep vein thrombosis: update on diagnosis and management. Medical Journal of Australia. 2019 Jun;210(11):516–24.

III. Bonkemeyer Millan S, Gan R, Townsend PE. Venous Ulcers: Diagnosis and Treatment. Am Fam Physician. 2019 Sep 1;100(5):298–305.

IV. Youn YJ, Lee J. Chronic venous insufficiency and varicose veins of the lower extremities. Korean J Intern Med. 2019 Mar;34(2):269–83.

V. Azar J, Rao A, Oropallo A. Chronic venous insufficiency: a comprehensive review of management. JOURNAL OF WOUND CARE. 2022;31(6).

VI. Melikian R, O’Donnell TF, Suarez L, Iafrati MD. Risk factors associated with the venous leg ulcer that fails to heal after 1 year of treatment. Journal of Vascular Surgery: Venous and Lymphatic Disorders. 2019 Jan;7(1):98–105.

VII. Lurie F, Passman M, Meisner M, Dalsing M, Masuda E, Welch H, et al. The 2020 update of the CEAP classification system and reporting standards. J Vasc Surg Venous Lymphat Disord. 2020 May;8(3):342–52.

VIII. Vasquez MA, Rabe E, McLafferty RB, Shortell CK, Marston WA, Gillespie D, et al. Revision of the venous clinical severity score: Venous outcomes consensus statement: Special communication of the American Venous Forum Ad Hoc Outcomes

Working Group. JOURNAL OF VASCULAR SURGERY. 2010;52(5).

IX. Waheed SM, Kudaravalli P, Hotwagner DT. Deep Vein Thrombosis. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2023 [cited 2023 Nov 20]. Available from: http://www.ncbi.nlm.nih.gov/books/NBK507708/

X. Serra R, Rizzuto A, Rossi A, Perri P, Barbetta A, Abdalla K, et al. Skin grafting for the treatment of chronic leg ulcers - a systematic review in evidence-based medicine. Int Wound J. 2017 Feb;14(1):149–57.

XI. Shimizu R, Kishi K. Skin Graft. Plastic Surgery International. 2012 Feb 6;2012:1–5.

XII. Mandili A, Aljubairy A, Alsharif B, Patwa W, Alotibey K, Basha S, et al. Application of Negative Pressure Therapy on Skin Grafts after Soft-Tissue Reconstruction: A Prospective Observational Study. Clinics and Practice. 2022 Jun 7;12(3):396–405.

XIII. Wei D, Zhu XM, Chen YY, Li XY, Chen YP, Liu HY, et al. Chronic wound biofilms: diagnosis and therapeutic strategies. Chin Med J (Engl). 2019 Nov 20;132(22):2737–44.

XIV. Webster J, Scuffham P, Stankiewicz M, Chaboyer WP. Negative pressure wound therapy for skin grafts and surgical wounds healing by primary intention. Cochrane Wounds Group, editor. Cochrane Database of Systematic Reviews [Internet]. 2014 Oct 7 [cited 2023 Sep 21]; Available from: https://doi.wiley.com/10.1002/14651858.CD009261.pub3

XV. Jiang ZY, Yu XT, Liao XC, Liu MZ, Fu ZH, Min DH, et al. Negative-pressure wound therapy in skin grafts: A systematic review and meta-analysis of randomized controlled trials. Burns. 2021 Jun 1;47(4):747–55.