Clinical Case Report

Medicine®

OPEN

Use of controlled negative pressure in management of phlegmon caused by fulminant complication of pressure wound

A case report

Dariusz Bazaliński, RN, MN, CEN, DHSc[a,b], Paweł Więch, RN, MN, CEN, DHSc[a,*], Dorota Kaczmarska, MD[b], Izabela Sałacińska, RN, MN, CRNA[a], Maria Kózka, RN, MSCN, PhD[c]

Abstract

Rationale: Effective wound healing depends on the adequate choice of the wound cleansing method, to enable rapid removal of necrotic tissue. Negative pressure wound therapy (NPWT) is an effective non-invasive technique for management of wounds of varied aetiology, including deep tissue injuries caused by pressure.

Patient concerns: This article discusses a case of an 82-year-old female receiving hospice care at home owing to progressing untreated thoracic spinal stenosis, bedridden for 4 years, incapable of self-care.

Diagnoses: Three fulminant pressure wounds, 50 cm^2 each, with signs of undermining, Stage II/IV according to National Pressure Ulcer Advisory Panel, were identified in the area of the sacrum and the right and left trochanter. Despite measures used to prevent pressure sores, and nutritional supplementation, two months later a fourth pressure ulcer involving subcutaneous tissue was identified in the area of the right sciatic tuber, accompanied with signs of systemic inflammatory response, as well as massive phlegmon and lesion in the ischial bone.

Interventions: As previously applied treatments (surgical necrectomy, biological therapy - Lucilia Sericata maggots, autolysis, pharmacological therapy) proved ineffective, NPWT was experimentally administered to evacuate exudate and to cleanse the wound.

Outcomes: Application of negative pressure during a 42-day therapy allowed significantly faster cleansing of the wound. The pressure wounds was significantly reduced in size, and necrotic tissue was removed from the sciatic tuber, which ultimately was covered with granulation tissue.

Lessons: Controlled negative pressure can successfully be used in the process of cleansing an infected pressure wound to safely remove exudate and to minimise local inflammation. Administration of controlled negative pressure is an effective and safe method in the process of cleansing an infected pressure wound.

Abbreviations: CRP = C-reactive protein, NPUAP = National Pressure Ulcer Advisory Panel, NPWT = negative pressure wound therapy, TIME = tissue, infection, moisture and wound edge.

Keywords: negative pressure wound therapy, phlegmon, pressure wound, tissue cleansing

1. Introduction

The term fulminant pressure wound is understood as destruction of skin and deep tissues due to defective blood circulation caused by pressure, the skin around the wound showing signs of undermining and the wound visibly increasing in size in a short time, that is, within days. Frequent symptoms negatively affecting the prognosis include coexisting infections accompanied with purulent exudate.[1] Comorbidities, reduced self-care abilities and systemic infections contribute to high morbidity rates in this group of patients.[2] Suffering, pain, bad smell, a co-existing risk of systemic infection, long-lasting therapy, and significant costs of dressings, pressure management mattresses and rehabilitation, all these adversely affect quality of life in health and in sickness.[3]

Negative pressure wound therapy (NPWT) is a widely accepted method supporting management of open wounds of varied etiology, and gaining more and more recognition among medical professionals handling chronic diabetic ulcers and pressure sores. By applying controlled vacuum to the affected area it is possible to increase blood flow in the wound, resulting in faster migration of fibroblasts, and to decrease bacterial count, and reduce exudate, which significantly speeds up the healing processes in the

Editor: N/A.

Funding: The study was performed as part of the project "Centre for Innovative Research in Medical and Natural Sciences" implemented by the University of Rzeszow, co-financed in the framework of 2007–2013 Regional Operational Programme for the Podkarpackie Province, contract number UDA-RPPK.01.03.00–18–004/12-00.

The authors report no conflicts of interest.

[a] Institute of Nursing and Health Sciences, Department of Medicine, University of Rzeszow, Rzeszow, [b] Specialist Hospital Podkarpackie Oncology Center in Brzozów, Brzozow, [c] Department of Clinical Nursing, Faculty of Health Sciences, Collegium Medicum, Jagiellonian University, Krakow, Poland.

[*] Correspondence: Paweł Więch, Institute of Nursin and Health Sciences, Uniwersity of Rzeszów, Poland, Al. mjr.W.Kopisto 2 a, 35 – 310 Rzeszow, Poland (e-mail: p.k.wiech@gmail.com).

Medicine (2018) 97:28(e11319)

Received: 30 March 2018 / Accepted: 6 June 2018

http://dx.doi.org/10.1097/MD.0000000000011319

wound.[4–6] To ensure effectiveness of the method, it is necessary to maintain negative pressure within the wound and this may be rather difficult if the injury is located in the area of the trochanter and/or sacral bone, as it is difficult to attach the dressing kit and to ensure its tightness in this area. Effectiveness of the dressing and its durability are also determined by possible contamination of the dressing with urine or excrement and by the patients activity.[7] Various aspects of handling the kit and monitoring its effectiveness as well as the related education are of particular importance if the therapy is provided in home environment where the patient's family is also involved some care related activities.[8]

2. Case report

The article discusses a case of an 82-year-old female receiving hospice care at home owing to progressing untreated thoracic spinal stenosis. The patient, bedridden for 4 years and incapable of self-care (Barthel 0 points), is conscious and oriented, retains respiratory function, with completed tracheostomy, yet periodically is subjected to mechanical ventilation; clinical nutrition (1500 kcal) administered via gastrostomy tube, and supplemented with Protifar and Cubitan. In August 2017, 3 fulminant pressure wounds, 50 cm^2 each, with signs of undermining, Stage II/IV according to the National Pressure Ulcer Advisory Panel (NPUAP) were identified in the area of the sacrum and the right and left trochanter; they were treated using mechanical (surgical necrectomy), and biological method (Lucilia Sericata maggots) and autolysis (specialist dressings) (Fig. 1). Despite measures administered to prevent pressure sores, as well as the nutritional supplementation and management of the pressure wounds with the use of various therapeutic methods, early in November a fourth pressure ulcer was identified in the area of the right sciatic tuber, accompanied with signs of systemic inflammatory response (Fig. 2). Biochemical analyses of blood were conducted (morphology, C-reactive protein [CRP], albumin test) (Table 1); demarcation of tissue necrosis was performed and then necrotic tissue was removed, which revealed damage to the sciatic tuber with signs of phlegmon in the area (Fig. 3). The cleaning of the wound with Lucilia maggots was discontinued due to heavy exudate. Instead, negative pressure wound therapy (NPWT) was administered experimentally.

The study was approved by the institutional Bioethics Committee at the University of Rzeszów 69 (Resolution No. 7/12/2016) and by all appropriate administrative bodies. The study was conducted 70 in accordance with ethical standards laid down in an appropriate version of the Declaration of 71 Helsinki and in Polish national regulations. Written informed consent was obtained from the patient for publication of this case report and any accompanying images.

Figure 2. One of the 3 deep pressure wounds, 10 × 15 cm III/IV NPUAP, treated in the patient, visible (arrow) small yellow and black pressure sore, 2 × 2 cm II/. NPUAP in the area of the sciatic tuber, meeting the criteria of subcutaneous pressure injury.

Before the intervention, the wound bed was exposed and examined, and initial debridement was performed; the latter procedure allowed to confirm the lesion in the right sciatic tuber with signs of phlegmon, and to collect a sample for another bacteriological examination. Controlled vacuum was administered using INFO V.A.C. Aspironix (KCI USA Inc., San Antonio, TX). Although the dressing was applied to the wound with the phlegmon, it was decided that the adjacent wound should also be dressed, using a polyurethane foam bridge (Fig. 4). UrgoClean Ag and UrgoTul Ag/Silver were used under the polyurethane foam as the proper dressing. Initially the device was set to work in a continuous mode, with a pressure of 120 mmHg. The wound was examined after 72 hours; during this time, 400 mL of exudate was removed. The vacuum dressings were changed by the person

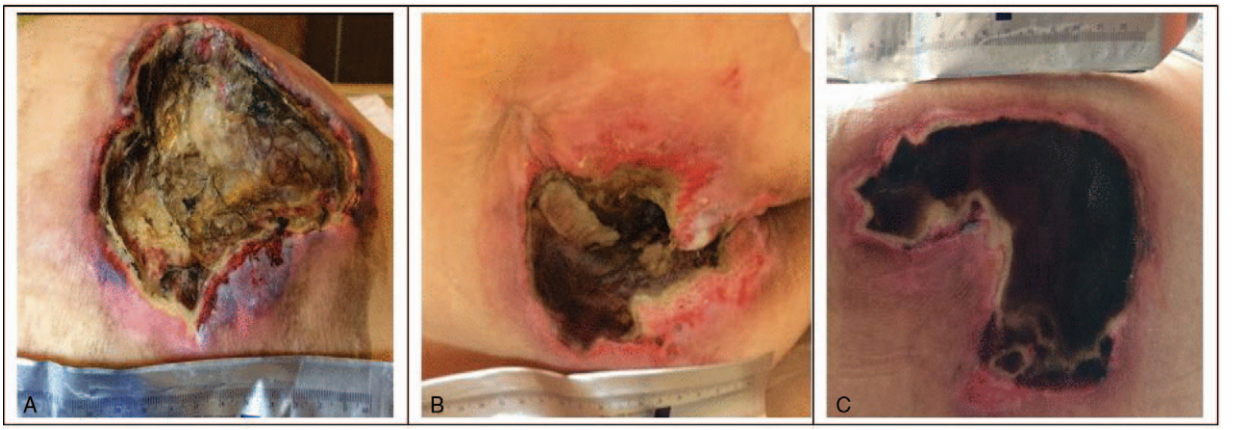

Figure 1. Three pressure ulcers confirmed during the first consultation of the patient. (A) The area of the right trochanter. (B) The sacrum. (C) The area of the left trochanter.

Table 1

Results of selected biochemical tests during NPWT.

Date	Type of test	Result	Normal range
September 21, 2017	Albumin	30.9	35–52 g/L
	Erythrocytes	3.13	4.0–5.2 10^6 cells/mm^6
	Hemoglobin	8.7	12–16 g/L
	Leukocytes	14.5	4.0–10/10^3 mm^3
	Mean corpuscular volume	94	80–97 fl
	CRP	120.2	0.0–5.0 mg/L
November 22, 2017	Albumin	22.8	35–52g/L
	Erythrocytes	2.57	4.0–5.2 10^6 cells/mm^6
	Hemoglobin	7.9	12–16 g/L
	Leukocytes	9.4	4.0–10/10^3 mm^3
	Mean corpuscular volume	87	80–97 fl
	CRP	151	0.0–5.0 mg/L
December 22, 2017	Albumin	28.5	35–52g/L
	Erythrocytes	3.2	4.0–5.2 10^6 /mm^6
	Hemoglobin	92	12–16 g/L
	Leukocytes	10.2	4.0–10/10^3 mm^3
	Mean corpuscular volume	93	80–97 fl
	CRP	42	0.0–5.0 mg/L

CRP = C-reactive protein, NPWT = negative pressure wound therapy.

responsible for the wound management. The remaining wounds were dressed by a nurse, supervised by the person in charge of the therapy. Wound culture identified Proteus Mirabilis (4+) sensitive to majority of the basic pharmaceuticals. Owing to the signs of inflammation (increased body temperature of 38–39°C, particularly in the evening), Gentamicin 2 × 80 mg (i.m.) was administered for 10 days. In early December, the patient's condition deteriorated; examinations showed a further decrease in the count of blood cells, and increase in concentrations of acute phase proteins, because of which the woman was hospitalized. In hospital, the patient's count of blood cells was stabilized following transfusion of 2 units of red cell concentrate; she received pharmaceuticals in accordance with her antibiogram. Until discharge from hospital, no new procedures for wound management were introduced; negative pressure therapy and conservative treatment of the remaining wounds based on dressings were continued.

Figure 3. Pressure wound, 5 × 6 cm IV National Pressure Ulcer Advisory Panel, penetrating into the bone; necrotic tissue was removed and the wound was prepared for the application of a vacuum kit.

Figure 4. Draining in both wounds for effective negative pressure therapy; polyurethane foam bridge with UrgoClean and Urgo Ag/Silver dressing applied to the wound.

Vacuum therapy, applied to the wounds with signs of contamination/infection, was continued for 42 days. Following 14 days of the therapy, the bones were cleaned and exudate decreased to 300 mL in 4 days (Fig. 5). At the start of the treatment (for 3 weeks) nearly 50 to 70 mL of exudate was evacuated per day; the durability of a vacuum dressing ranged between 3 and 4 days; the canister was changed depending on

Figure 5. Cleansed wound covered with granulation tissue on day 14 of therapy; heavy exudate.

Figure 6. The wounds on day 42 of therapy; visible signs of epithelialization along the edges and granulation in the wound bed and walls.

when it was filled. During the entire therapy, the patient was in serious but stable condition. The negative pressure therapy was discontinued on January 17, 2018 (Fig. 6), and replaced with dressings based on 1% silver nitrate and paraffin, because of the visibly reduced destruction of the tissues and the decreased amount of exudate drained, up to 50 mL in 3 to 4 days.

3. Discussion

Incidence of pressure wounds increases with the aging population and the growing numbers of elderly people with disabilities. Research into preventive measures and treatment of pressure injuries is more and more important for all professionals involved in wound management and medical care of older and disabled people. In the last two decades the approach to chronic wound management has evolved considerably, mainly as a result of better understanding of the scientific underpinnings. Each wound is unique; therefore, it should be examined and treated individually, and the process should involve corrections of the underlying cause(s) and a systematic consideration for each of the components of TIME framework (Tissue, Infection, Moisture and Edge advancement) in cleaning and treating of wounds.[8]

NPWT is a recognized method of cleaning and treating wounds of varied etiology, including deep pressure ulcerations. It can safely be administered in patient's home environment by trained medical personnel[9]; this fact is also confirmed by the present study. The method is based on the use of controlled vacuum, and drainage system which effectively removes exudate and exfoliated necrotic tissues, additionally reducing inflammation and bacterial count, leading to wound contraction through stimulation of microcirculation, and by promoting proliferation and migration of fibroblasts.[7,10,11] At present in Poland in outpatient healthcare, it is not refundable or easily accessible, which adversely affects its popularity among clinicians.

Most pressure wounds are located in the sacral and gluteal region, which increases the risk bone infection and phlegmon in soft tissues.[12] One of the challenges observed during the therapy is connected with the efforts to retain healthy skin around the wound, and this is determined by tightness of the dressing kit and maintenance of the required negative pressure within the wound. Ligresti and Bo[13] point out that the patient's general condition is of critical importance in designing a treatment scheme related to difficult wounds. The present study focused on a female geriatric patient, incapable of self-care, and diagnosed with comorbid conditions. Furthermore, effectiveness of vacuum dressings also depends on regulation of bowel movement cycle and urine drainage. Loose stool and urine may be damaging and irritating to the skin, or lead to skin inflammation, and may damage the dressing. During the treatment process it is necessary to educate the family and the patient him/herself, and to train the nursing personnel to respond quickly and effectively in case of disrupted adhesive dressing or ineffective operation of the kit, or if exudate is retained within the wound (insufficient pressure).

Application of negative pressure during the therapy of the fulminant pressure wound resulted in significantly faster cleansing of the wound. The size of the pressure wounds was significantly reduced, and necrotic tissue was removed from the sciatic tuber, which ultimately, in course of a few weeks, was covered with granulation tissue. There was notable progress in healing and regeneration despite the unsatisfying count of blood cells and excessive level of CRP. The therapy was accompanied with simultaneously administered secondary preventive measures recommended by the Polish and European Wound Management Association.[14] All the time the patient was using an alternating pressure mattress of tubular structure; dietary protein intake was increased to 2 g/kg; formula for skin protection and other amenities were applied. Browning et al used NPWT in 4 patients with extensive wounds, in palliative care. They observed decrease in exudate, and a healing process which led to improvement in the subjects' quality of life as a result of pain reduction and odour control. Furthermore, the procedures applied improved psychosocial functioning of the patients and their families. The authors also pointed out that the therapy was cost-effective, as it reduced time required for wound management and maximised the resources needed for the care of the patient.[15] Some authors question the effectiveness of NPWT in management of deep pressure wounds, emphasizing the lack of well-established therapeutic effects as compared to other autolytic methods.[16,17] Our study unquestionably showed a positive effect of therapy based on controlled vacuum. Despite the patient's overall condition, the co-existing hemiplegia, poor blood test results, and raised inflammation markers, the infected bone was healed within a short time, preventing serious life-threatening systemic complications. Similar findings were reported by Moues et al who applied NPWT in a group of 54 patients and found more effective wound healing linked with elimination of exudate and increased granulation, which ultimately decreased the time needed for wound therapy. The researchers also observed the healing process was not disturbed by bacteria colonizing the wound. The authors found 2 cases of complications: septicaemia and tissue necrosis, because of which the vacuum therapy was discontinued in these patients.[18]

From economic viewpoint, NPWT is more beneficial than conventional therapies. Overall, costs of therapy are largely reduced by the decreased use of dressing, underwear, and bedding materials, as well as shorter duration of treatment.[19] A retrospective analysis performed by Driver and Blume[20] in patients with diabetic foot ulcers showed that the cost of complete wound closure per 1 cm^2 was 1227 USD in the case of NPWT and 1695 USD in the case of therapy based on specialist dressings, which shows greater cost-effectiveness of NPWT. Given the fact that in Poland no refund is available for the procedure, the estimated cost of the therapy amounts to 15 to 20 USD per day. However, the benefits of the therapy definitely were greater than potential losses.

Administration of controlled negative pressure is an effective and safe method for evacuation of exudate and for minimising local inflammation in the process of cleansing an infected pressure wound.

Author contributions

Conceptualization: Dariusz Bazaliński.
Data curation: Paweł Więch.
Formal analysis: Dariusz Bazaliński, Paweł Więch.
Methodology: Dariusz Bazaliński.
Project administration: Dariusz Bazaliński, Dorota Kaczmarska.
Resources: Paweł Więch.
Writing – original draft: Dariusz Bazaliński, Paweł Więch, Izabela Sałacińska.
Writing – review & editing: Dariusz Bazaliński, Paweł Więch, Dorota Kaczmarska, Izabela Sałacińska, Maria Kózka.

References

[1] Bazaliński D, Wołkowicz M, Więch P, et al. Treatment of fulminant pressure sore using recommendations for pressure sore prophylaxis—case study [Leczenie piorunującej rany odleżynowej z wykorzystaniem rekomendacji dotyczących profilaktyki przeciwodleżynowej - opis przypadku]. Leczenie Ran 2017;2:1–5.
[2] Brown G. Long-term outcomes of full-thickness pressure ulcers: healing and mortality. Ostomy Wound Manage 2003;49:42–50.
[3] White-Chu EF, Flock P, Struck B, et al. Pressure ulcers in long-term care. Clin Geriatr Med 2011;27:241–58.
[4] Apleqvist J, Willy C, Fagerdahl AM, et al. EWMA Document: Negative Pressure Wound Therapy. J Wound Care 2017;26:1–54.
[5] Kairinos N, Solomons M, Hudson DA. Negative-pressure wound therapy I: the paradox of negative-pressure wound therapy. Plast Reconstr Surg 2009;123:589–98.
[6] Huang C, Leavitt T, Bayer LR, et al. Effect of negative pressure wound therapy on wound healing. Curr Probl Surg 2014;51:301–31.
[7] Sun X, Wu S, Xie T, et al. Combing a novel device and negative pressure wound therapy for managing the wound around a colostomy in the open abdomen. A case report. Medicine 2017;96:e9370.
[8] Halim AS, Khoo TL, Mat Saad AZ. Wound bed preparation from a clinical perspective. Indian J Plast Surg 2012;45:193–202.
[9] Monsen C, Acosta S, Kumlien C. Patients experiences of negative pressure wound therapy at home for the treatment of deep perivascular groin infection after vascular surgery. J Clin Nurs 2017;26:1405–13.
[10] Lo Torto F, Ruggiero M, Parisi P, et al. The effectiveness of negative pressure therapy on infected wounds: preliminary results. Int Wound J 2017;14:909–17.
[11] Cai SS, Gowda AU, Alexander RH, et al. Use of negative pressure wound therapy on malignant wounds - a case report and review of literature. Int Wound J 2017;14:661–5.
[12] Schiffman J, Golinko MS, Yan A, et al. Operative debridement of pressure ulcers. World J Surg 2009;33:1396–402.
[13] Ligresti C, Bo F. Wound bed preparation of difficult wounds: an evolution of the principles of TIME. Int Wound J 2007;4:21–9.
[14] Szewczyk MT, Sopata M, Jawien A, et al. Guidelines for pressure wound prevention and management [Zalecenia profilaktyki i leczenia odleżyn] Leczenie Ran. 2010;7:79–106. [In Polish].
[15] Browning K, Zeda G, Cardin J, et al. A new focus for negative pressure wound therapy: palliative care, a case series. J WOCN 2014;41:25–35.
[16] Soares MO, Dumville JC, Ashby RL, et al. Methods to assess cost-effectiveness and value of further research when data are sparse: negative-pressure wound therapy for severe pressure ulcers. Med Decis Making 2013;33:415–36.
[17] Ashby R, Dumville J, Soares M, et al. A pilot study of negative pressure wound therapy for the treatment of grade III/IV pressure ulcers. Trials 2012;13:119.
[18] Moues CM, van den Bemd GJ, Heule F, et al. Comparing conventional gauze therapy to vacuum-assisted closure wound therapy: a prospective randomised trial. J Plast Reconstr Aesthet Surg 2007;60:672–81.
[19] Birke-Sorensen H, Malmsjo M, Rome P, et al. Evidence-based recommendations for negative pressure wound therapy: treatment variables (pressure levels, wound filler and contact layer)—steps toward an international consensus. J Plast Reconstr Aesthet Surg 2011;64:1–6.
[20] Driver VR, Blume PA. Evaluation of wound care and health-care use costs in patients with diabetic foot ulcers treated with negative pressure wound therapy versus advanced moist wound therapy. J Am Podiatr Med Assoc 2014;104:147–53.