



Case Series

A BETTER RECOVERY PATHWAY FOR A WIDE VARIETY OF FASCIOTOMY WOUNDS OF NECROTIZING FASCIITIS WITH NEGATIVE PRESSURE WOUND THERAPY- A CASE SERIES

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ABSTRACT

Management of Necrotizing Fasciitis requires liberal fasciotomy in most cases. These fasciotomy wounds require a long time to heal completely using conventional methods. The authors used early NPWT to cut short this healing time, in a wide variety of challenging cases obtaining excellent results. This case series highlights five such cases.

Keywords: Negative pressure wound therapy, Vacuum dressing, Necrotizing Fasciitis, Fasciotomy.

INTRODUCTION

Necrotizing Fasciitis (NF), once diagnosed, should undergo multimodal management aimed at releasing the pressure built in the tissue compartments, reducing the systemic bacterial load, removal of the devitalized tissue, resuscitation of the fluid compartments, improving the functions of the affected end organs, and pain management. Once the acute phase is over, the focus of the management shifts to promoting good granulation tissue to the wounds and obtaining skin cover.

Repeated debridement is usual in the management of Necrotizing Fasciitis. This is based on the concept of 3 zones in the field of Necrotizing Fasciitis as described by Chin-Ho Wong et al, where zone 1 is the completely devitalized tissue, zone 2 is the borderline tissue and zone 3 is the healthy skin.^[1] Zone 1 is removed in the initial debridement. Zone 2 is removed in subsequent debridement based

on the vitality of the skin. This process produces large wounds with absent fascia on the floor where the muscles would be protruding out. The healing of these wounds usually takes months and leaves the patient with lasting effects of persistent edema, pigmentation, paraesthesia, etc.

Negative pressure wound therapy (NPWT) promotes wound healing through the exertion of suction pressure on the wound surface. This reduces inflammatory exudate, promotes healthy granulation tissue, and reduces the size of the wound. It achieves faster wound healing by the principal mechanisms of, macro deformation, micro deformation, excess fluid removal, and maintaining the equilibration of the wound microenvironment.^[2,3] In the cases described below, the authors attempted a faster way of achieving the healing process in NF, through early induction of NPWT and early skin grafting. These patients had better outcomes, hallmarked by a faster and better skin cover, thereby reducing the

duration of treatment, and decreasing postoperative complications.

Case 1

The first case is an 83-year-old gentleman who presented with Necrotizing Fasciitis of the dorsum of the left foot, referred to us after conservative management with antibiotics for a working diagnosis of cellulitis. On examination, the patient had extensive redness, oedema, and pain with several fluid-filled blebs on the foot, with palpable and tender right inguinal nodes. The blood investigations showed increased Total Leucocyte Count and CRP. Ultrasound showed a cobblestone appearance of subcutaneous fat with no obvious collections and no signs of DVT.

A diagnosis of Necrotizing Fasciitis was made based on the clinical features and the investigations. The patient underwent fasciotomy and derroofing of the skin of the dorsum of the foot. In this case, the NPWT was applied because of increased soakage from the wound. The wound was sealed and connected to the machine and maintained at a negative pressure of 125mm of Hg on continuous suction.

After three cycles of NPWT dressing, each 7 days long, the wound was ready for grafting. Split thickness skin graft was placed over the formed wound bed, which took less than 2 weeks to heal completely.

Case 2

75-year-old patient presented with painful swelling of the lateral part of the right lower limb with soginess of the skin, blackish discoloration, foul-smelling discharge and peeling off of superficial layers of the skin near the lateral malleolus. The patient was in severe pain and presented with tachycardia, tachypnoea, hypotension and was found to be in SIRS. The patient was stabilized with IV crystalloids and IV antibiotics and was immediately taken up for exploration of the area in question. A slit incision was given covering the entire length of the zone 2 and zone 1 and extensive necrosis of the subcutaneous fat was seen. Packing of the adipocytes was loose enough for admitting the finger until around 10cm away from the main incision. The finger was advanced in all the directions until resistance to the separation of subcutaneous fat from the deep tissue was encountered. The deep fascia was opened, and the muscles were found to be normal. The skin overlying the affected subcutaneous tissue was derroofed and the wound was lay open. The patient's general condition and hemodynamic parameters improved after the surgery. The patient needed multiple attempts of debridement until healthy well-perfused margins were obtained. Since the patient wished to go home, NPWT dressing was placed. The patient only needed 2 sets of vacuum dressing of 7 days duration. The wound developed healthy granulation tissue with no bacteria on culture, hence a split thickness skin graft was done on the

granulation tissue which had 90% uptake. The rest of the 10% area epithelized on normal dressing.

Case 3

This 57-year-old female known diabetic and known case of rheumatoid arthritis on treatment with immunomodulators presented with redness, swelling and pain over the medial aspect of the right upper limb with fever and shock. She was being managed elsewhere in lines of lymphangitis with IV antibiotics and analgesics. However, since the patient deteriorated and developed sepsis with MODS the patient was referred to this hospital for further management. Given the patient's condition, she was admitted to the ICU and was started on inotropic supports. The entire medial aspect of the upper limb had developed swelling and oedema with blebs which made the surgeons decide to go forward with fasciotomy in view of the possible Necrotizing Fasciitis. An incision was placed in the most oedematous region and deepened. There was extensive necrosis of the subcutaneous tissue with purulent discharge and the deep fascia was found to be soggy and sloughed. Incising the deep fascia showed pus collection in the intermuscular areas and involvement of the muscles in the form of loss of colour and vascularity. Some areas of the muscles were fragile and had to be debrided. The incision had to be extended until the area of the elbow joint. The wound was lay open, and the dressing was done. However, this patient continued to be in sepsis and the ICU stay had to be extended. The patient also showed rapid progression of necrosis centrifugally and debridement was necessary on alternate days. It took around 2 weeks to see the cessation of the progress of the Necrotizing Fasciitis and healthy margins. The patient was started on NPWT, but the progression of granulation tissue was slow in this case. Each time the NPWT dressing was removed further debridement had to be done. The patient developed granulation tissue slowly and wound contraction was also seen to develop and the NPWT was discontinued after adequate contraction was obtained. Though the patient was planned for skin grafting the relative deferred the grafting to avoid further hospital stay and the wound healed by secondary intention.

Case 4

This 82-year-old retired army personnel had developed ischaemic stroke and paraplegia of the lower limbs. Prolonged lying on the back led to development of pressure ulcers in the bilateral buttocks, which got infected, and the infection spread extensively in the subcutaneous plane. The patient was given local dressings and was brought to our hospital with multiple large islands of necrosis and discharge of foul-smelling pus. The patient was taken up for debridement. This patient had to undergo five serial debridements before control over the Necrotizing Fasciitis could be obtained however the wound was highly secretory and kept extruding purulent fluid. Since this patient's NPWT was not

supported by his insurance provider, we decided to set up our own vacuum dressing arrangement including the provision for flushing the wound with saline in the intact dressing. The packing material was selected after examining various types of sponges available with the vehicle upholstery workers. Using the Y junctions and tubes of the Romovac™ drains, a branched network of tubes was created in such a way that one tube was divided into two limbs using a Y junction and each of the two limbs were again divided in to two limbs each. This was used for irrigation. Another branched network converging in to one tube was created to apply suction. The first tube of the irrigation network was connected to a 500ml 0.9% Normal Saline bottle inside a pressure bag by an IV drip set and the ends of the draining tubes were connected to the wall suction. The entire wound was packed with one layer of sponge on the floor and above this layer of sponge the network of both the sets of tubes were placed. The position of these tubes were fixed by taking sutures from the underlying sponge going around the tubes. The entire tube system was covered by another layer of sponge, whose edges were shaped to fit within the wound margins. The dressing was covered with pieces of IOBAN™ used as incise drape in laparotomies. Initially, the wall suction was switched off and the saline was instilled soaking the sponges inside the dressing. When adequate soakage was seen, the wall suction was switched on at a pressure of 200 mmHg and the vacuum was applied to the wound. The wound was soaked only 3-4 times a day, but the suction was continued at all other times. The patient developed good granulation tissue after 1 week of this treatment after which we could do partial secondary closure and reapplication of the system. The granulation tissue developed steadily. The patient was discharged to continue normal dressing at home and within 2 months the secondary closure could be completed part by part. The entire wound healed eventually with secondary intention.

Case 5

This 75-year-old female presented to the Emergency department with severe pain and blackish discoloration of her right loin for 2 weeks, following a fall at home. The patient initially had only a small hematoma which got infected and developed into a Necrotizing Fasciitis of the entire lateral abdominal wall. The patient was in sepsis on presentation. The patient underwent an incision and drainage of the abscess, and on table, it was discovered that the Necrotizing Adipocytis had spread to a large area in the later abdominal wall. CECT abdomen was done, and the pus was seen extending medially towards the peritoneal cavity with only a 2 cm thick tissue separating the abscess cavity and the peritoneum. The regular dressing of this extensive wound with possibility of traumatic injury to the tissues between the peritoneal and abscess cavity led to the decision of doing NPWT to this patient. The cavity was filled

with appropriate quality sterilized sponge and the tubing's were taken out and attached to the wall suction. The dressing was changed every 4 days. Granulation tissue appeared on the floor and the sides of the large area and when the layer of granulation tissue was completed regular dressing was done. Skin grafting was done from the thighs over this granulation tissue.



Figure 1: The improvement in the wound seen case 1



Figure 2: The low-cost closed irrigation suction system designed by the authors for case 4. The improved wound in the right upper picture is seen partially closed in the right lower picture. The entire wound healed completely, eventually with further secondary suturing and healing by secondary intention.

DISCUSSION

Necrotizing Fasciitis can present in a wide spectrum of clinical conditions of the patient. Some may be localised to a small area and others may cover extensive areas. Systemic involvement may be absent in some of them whereas others may present as sepsis, septic shock, and end-organ dysfunction. In some cases, the progress of infection may be slow, whereas in others the disease may be fast progressing. All of this depends on various factors like age, nutritional status, blood sugar levels, protein reserves, perfusion to the tissues, virulence of the microorganisms, mobility of the patient, presence of obesity, presence of thyroid disorders, presence of immunocompromised states, presence of auto-immune disorders or vasculitis, etc. The patient in the first case was an aged patient with multiple comorbidities and involvement of only one region of the lower limb without any systemic toxicity. The use of vacuum dressing reduced the soakage from the deroofed wound. The vacuum here helped in faster wound healing, thereby hastening the return of the patient back to his normal life.

The patient in case 2 presented with sepsis secondary to systemic toxicity associated with Necrotizing Fasciitis and carried poor prognosis. The systemic involvement in these cases happens due to the presence of inflammatory mediators like cytokines and leukotrienes, which are secreted by the body in response to the infectious insult. Though the initial debridement was done on the first day, for patients requiring continued ICU care, repeat debridements and management of high amount of exudates from the wound becomes a big challenge due to difficulty in mobilising the patient in bed and constant requirement of changing the sheets smeared with foul smelling discharge. Induction of short-term vacuum dressing after good initial debridement solves this problem completely by providing a clean environment for the nursing of the patient and at the same time keeping the wound surface optimally decontaminated and moist. In such a situation the authors recommend initial debridement in an OT setting under proper anaesthesia and placement of vacuum dressing in the theatre itself.

The patient in case 3 had very aggressive Necrotizing Fasciitis of the upper limb, probably due to her immunocompromised state. There was extensive tissue loss including muscles and there was continuous pus discharge from the inter-muscular area. Multiple compartments of the patient had to be laid open to drain the continuously forming purulent discharge. Repeated dressing of this wound in the hand poses danger to the nerves and the major blood vessels. Vacuum dressing gave the authors a definite advantage in this regard. Since the wound is sealed, there is no displacement of any internal structures after the dressing is applied. But

the vacuum will clear the purulent discharge continuously from the inter-muscular space better than intermittent dressing with no risk for the damage of the nerves and the vessels. In this patient the tissue approximation was easier for a secondary closure when the infection settled down because of vacuum dressing.

The patient in case 4 though was 84 years old, had preserved general health, probably due to military background. However, his Necrotizing Fasciitis involved both buttocks which was a difficult area to treat as the patient had to be nursed in a prone position. Also, this patient had financial difficulty to afford the conventional NPWT provided by the designated company which otherwise has major advantages like continuous negative pressure maintenance, ability to detect the leaks in the sealing of the wound, provision of sequential vacuum application, provision of adjusting the end pressure based on patients requirements, additional provision of soaking the wound with saline and then automatically applying vacuum which will give a cleansing effect and can also be used to instill antibiotics to the wound and above all battery backup that will help the patient to be mobile by carrying the machine. In this case the authors were able to create a suction irrigation vacuum dressing replicating many advantages of the conventional vacuum dressing except mobility. The team was able to successfully soak the wound and apply vacuum after soaking manually so that the cleansing effect could be obtained. This patient had a dramatic recovery due to the wound contraction obtained, enabling sequential secondary closing of the wound; and was achieved using materials that are cheap and readily available in any surgical wards.

The patient in case 5 had Necrotizing Fasciitis with extensive erosion towards the peritoneal cavity with a high possibility of breach into the peritoneal cavity resulting in peritonitis. The NPWT used in the scenario was kept in a very low suction pressure with its inbuilt capacity to maintain that low pressure helped in easing the pull on the delicate tissues in the deep planes and at the same time promoting quick growth of granulation tissue. In fact, NPWT can be applied to anatomically difficult areas to do conventional dressing like naked testis after debridement in Fournier's Gangrene, large perianal abscesses, buttocks, axilla etc. and can hasten healing without the patient having to suffer the pain of daily dressing.

This team considers financial feasibility with at most importance before advising NPWT. Though the initial charges of application of NPWT for 7 days seems to be high in most of the cases we have noted that the total cost of conventional dressing including the cost of hospital stay/ cost of travel to and from the hospital, cost of materials used for 1 dressing and professional charges for dressing when summed up is usually equal to or greater than vacuum dressing when considering 7 days. But an

important factor here is that application of vacuum dressing hastens the wound dressing thus significantly reducing the total number of days a patient needs to have a dressing. This equates to significant saving when vacuum dressing is used. Additionally, the patient can go back to his income generating profession earlier.

CONCLUSION

As many experts in the wound healing agree that NPWT has revolutionized the management of different types of wounds. More innovations for reducing the cost of conventional NPWT dressings

must come to make this methodology more universally used.

REFERENCES

1. Wong CH, Yam AK, Tan AB, Song C. Approach to debridement in necrotizing Fasciitis. *Am J Surg.* 2008 Sep;196(3): e19-24. doi: 10.1016/j.amjsurg.2007.08.076. Epub 2008 Jul 9. PMID: 18614147.
2. Huang C, Leavitt T, Bayer LR, Orgill DP. Effect of negative pressure wound therapy on wound healing. *Curr Probl Surg.* 2014 Jul;51(7):301-31. doi: 10.1067/j.cpsurg.2014.04.001. Epub 2014 Apr 26. PMID: 24935079.
3. Zaver V, Kankanalu P. Negative Pressure Wound Therapy. [Updated 2023 Sep 4]. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2024 Jan-. Available from: <https://www.ncbi.nlm.nih.gov/books/NBK576388/>.