

# Management of Diabetic Foot Ulcer with Cost Effective Negative Pressure Wound Therapy

Dr. Gowtham Pandiaraj K<sup>1</sup>, Dr. Nandhana Prashanth .V<sup>2</sup>, Ravi. P M. S<sup>3</sup>

<sup>1</sup>Post Graduate, Department of General Surgery, Meenakshi Medical College Hospital Research Institute, Enathur, Kanchipuram, Tamilnadu, India

<sup>2</sup>Assistant Professor, Department of General Surgery, Meenakshi Medical College Hospital Research Institute, Enathur, Kanchipuram, Tamilnadu, India

<sup>3</sup>Professor, Department of General Surgery, Meenakshi Medical College Hospital Research Institute, Enathur, Kanchipuram, Tamilnadu, India

**Abstract:** Background: In a method to achieve effective wound healing and reduce disability, negative pressure wound therapy had been introduced and to cut down the cost that causes severe burden to the patients which cumulatively cut down of the time spent for wound healing and dressing. Method: In this study compromising 25 diabetic ulcer patients wound scoring system was used After the commencement of NPWT, the percentage of granulation at the end of every three days were analyzed. At the end of 3<sup>rd</sup>, 7<sup>th</sup> and 10<sup>th</sup> day. Result: 12 observed granulation tissue deposition in 90% of wound area within one week and 19 wounds, 76% of cases developed healthy granulation after being treated by NPWT for 3 more days 19 wounds (72%) had attained granulation of 100% and were taken up for grafting. Rest 6 patients had >75% granulation tissue over the wound before closure of the wound. 2 wounds that did not attain satisfactory granulation were taken up for collagen dressing. Conclusion: We are able to overcome the cost limitation with cost effective negative pressure wound therapy that had similar results when compared with conventional negative pressure wound therapy.

**Keywords:** Negative Pressure Wound Therapy (NPWT), Diabetic Foot Ulcer, Granulation, Wound Healing

## 1. Introduction

Being diabetic capital of world, India is expecting 100 million diabetics by the year 2030. It is the disease that produces wide array of disability and diabetic epidemics and complications are continued to be growing. But still the cost spent on diabetic treatment and management of complications are high. It is estimated that approximately 20% GDP of low socioeconomic status people is spent on diabetes and its complication. Around 3000-8000INR is being spent by a healthy diabetic individual and individuals with foot complication spent nearly 20000 INR per month. In a while mean of 4,00,000 INR may be spent for diabetic foot related complication in ones life. On an average a doctor spends 20-40 mins of their time in a ward for a diabetic dressing. And the suffice time spent by the doctors for effective dressing at the ulcer site and fatigue obtained by repeated dressings mental exhaustion could be overcome by negative pressure wound therapy where doctors could have cumulative time to treat the patient and ample time to be spent for other sick patients effectively, without compromising healing progression to the wound. Conventional vacuum therapy cost around 2000INR per dressing needed minimum of three dressings costing average month's medical expenses had been modified in a cost effective way which shows almost equal and efficient result at cost around 150 INR.

## 2. Methodology

**Prospective Study** comprising of 25 patients with diabetes between age group 25-75

**Inclusion criteria:** Patients: diabetic patients with ulcer & willing for the study with HbA1c less than 10 and wound selected after debridement.

**Exclusion criteria:** Hemoglobin : less than 10g%; immune-compromised cases; malignant ulcers; untreated osteomyelitis; necrotic tissue with eschar; exposed bare bone, nerve, vessels.

## 3. Materials

- 1) Suction catheter / ryle's tube 16 F;
- 2) Sponge (autoclaved), SIZE & NUMBER depending on the size of the wound
- 3) Suction apparatus (available in the ward).
- 4) Cling Flim Sheet (Sterilised by Ethylene Oxide)
- 5) Sterile gloves

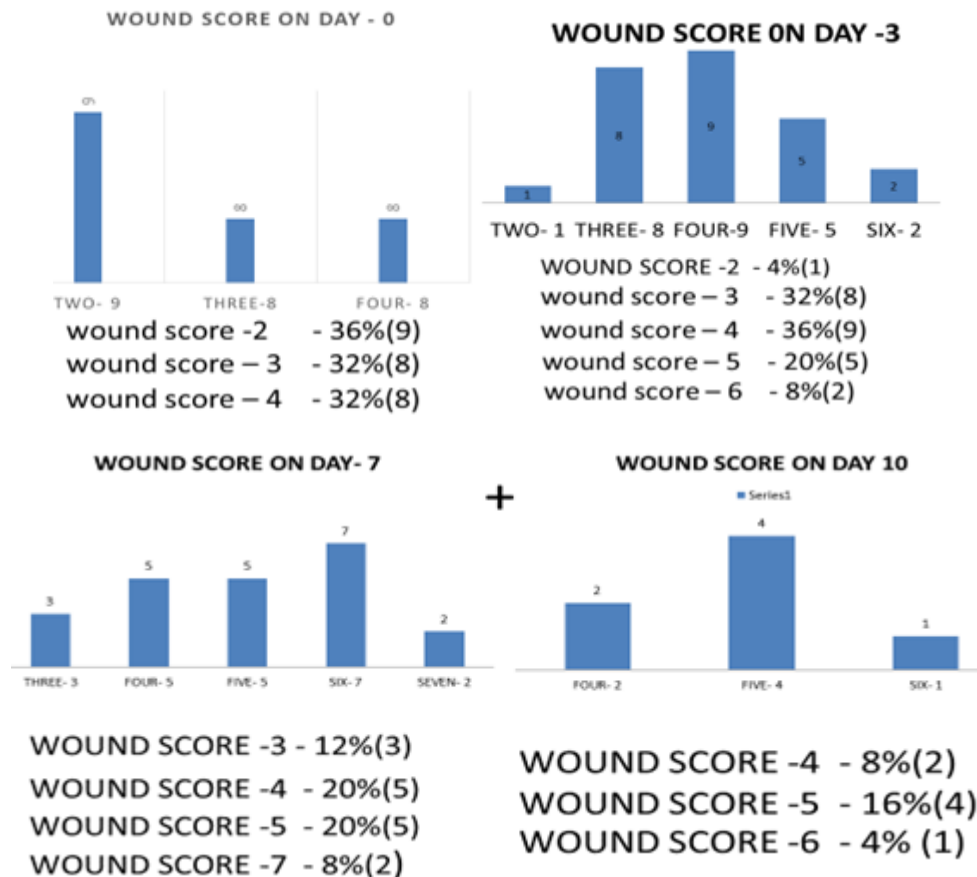
### Method

In a sterile manner The autoclaved sponge is either cut or more sponges added according to the size of the wound. Fenestrations made in suction catheter according to the size of the sponge, such that the diagonal length corresponding to the sponge used is fenestrated.; One end of the suction catheter is inserted into the sponge along the diagonal length of the sponge; The sponge is placed over the wound area, care should be taken to cover the entire wound area and ;manual compression is given over the wound so that sponge is leveled upto ulcer edge or undermined ;This is kept in place by wrapping the entire setup using an AUTOCLAVED CLING FLIM SHEET allowing the other end of the suction catheter to come out through the cover without disturbing the seal. sheet margins are then plastered with micropore tape to ensure its seal.;The suction catheter is connected to a suction apparatus.; INTERMITTENT NPWT IS GIVEN -

15 MINS Negative Pressure And 15 Mins Rest Cycle . During Day Time and 30 Mins Negative Pressure And 30 Mins Rest Cycle During Night Time at 125 mm Hg. NPWT

is opened, assessed and reapplied until the wound is ideal – for skin grafting or healed completely.

## OBSERVATIONS



### Wound scoring of granulation tissue:

Granulation: none -0, ¼ wound area -1, ½ wound area -2, 2/3 wound area -3, Complete -4.

Color : pale-0, pink -1, bright red -2.

Consistency: spongy -0, solid - 1.

Maximum score: 7; satisfactory score : 5

## 4. Results

In our study 14 male and 11 female patients with diabetic foot ulcers included. The diabetic foot ulcer was commonest among the 6 decade of life and **males > females**; More common spontaneously than occurring with trauma. Ulcer common in Plantar region than on dorsal region.

Time taken for wound to granulate is drastically reduced; Duration of hospital stay is reduced and Antibiotics need is reduced.; Acceptance of graft is better; Morbidity is decreased

A satisfactory wound score is achieved by day 3 in 28% of patients ; It increased by a further 20 % on day 7 and most of the patients attained a satisfactory wound score by day 10 (92 %); Studies having shown not only improvement in granulation tissue progression but also appreciable decrease in wound size and decrease in amount of secretions.

With this cost effective dressing we can make a sterile vaccum dressing with cost of less than 150 per dressing and which is as equivalent as any effective vacuum kit dressing.

## 5. Discussion

After the commencement of NPWT, the percentage of granulation at the end of every week was analyzed. At the end of 10<sup>th</sup> day, most of the wounds - 19 wounds (72%) had attained granulation of 100% and were taken up for grafting. Rest 9 patients had >75% granulation tissue over the wound. Lone et al. 12 observed granulation tissue deposition in 90% of wounds within one week and 1 wounds, 76% of cases developed healthy granulation after being treated by NPWT for 3 more days before closure of the wound. 2 wounds that did not attain satisfactory granulation were taken up for local flap cover. Nather, 13 Armstrong et al., 15 also observed early deposition of granulation tissue in patients treated with NPWT.

The end point or the time taken for wound closure was taken as the day the wounds were treated by graft, flap or by complete epithelialization. In our study, at the end of 2 weeks, 6 patients attained complete closure and 9 patients attained complete wound closure at the end of 3rd week. Split skin grafting was the most common treatment modality used for wound closure following NPWT. Of the 25 patients, 8 (32%) underwent skin grafting. 6 patients not

willing for grafting had healed by complete epithelialization of the wound by alternate vacuum and regular dressing. 2 patients were closed with a collagen dressings.

Nain et al.<sup>12</sup> had similar findings where split skin grafting was the most common mode of closure employed (48% of patients). Lone et al.<sup>14</sup> also had similar results where grafting .

The application of NPWT is simple, but requires training to ensure appropriate and competent use. The cost of NPWT will vary and depend on the length of hospital stay and cost of supplies. More rigorous studies with larger sample sizes assessing the use and cost- effectiveness of NPWT on different wound types are required. Awareness and training on application NPWT dressings will allow its utilization more often.

However, these were compensated by the lower number of time-consuming dressing changes and the shorter duration until they were 'ready for surgical therapy', resulting in the therapy being equally as expensive as conventional moist gauze.

## 6. Conclusion

NPWT is a recent modality of treatment of wounds. Its introduction has changed the course of management of wounds. Based on the data from the present study and other studies available, NPWT does appear to result in better healing, with few serious complications, and thus looks to be a promising alternative for the management of various wounds. The system may also be of value in the management of heavily exuding wounds, and those with lymphatic involvement

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