



General Surgery

COMPARATIVE STUDY OF NEGATIVE PRESSURE WOUND THERAPY(NPWT) USING VACUUM ASSISTED CLOSURE(VAC) WITH CONVENTIONAL MOIST WOUND THERAPY(CMWT) IN MANAGEMENT OF DIABETIC FOOT ULCER

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ABSTRACT **Background:** On this 21st century diabetes and its associated Diabetic foot ulcer has become a major burden to the universe economically, mentally and physically. **Materials and Methods:** This is a Randomized control trail on patients with Diabetic foot ulcers in the Department of General Surgery, at Andhra medical college and King George hospital, visakhapatnam, Andhra pradesh. Study duration One year. **Conclusion:** Negative pressure wound therapy using Vacuum assisted closure is more efficacious than Conventional moist wound therapy

KEYWORDS :

INTRODUCTION

On this 21st century diabetes has become a major burden to the universe economically, mentally and physically. Diabetic neuropathy(DN) is the leading & most common cause of Diabetes Mellitus(DM) affecting as many as fifty percent of patients¹. It estimated that by 2025 India will have highest number of diabetic patients leading to loss of a limb or foot. Incidence of foot ulcers among diabetic patients is from 1.9% to 2.6% with the optimal life time risk being at 15%. over the past recent years steep economic growth and the dietary modifications have increased the incidence of diabetes mellitus (DM) significantly². From a known epidemiological study, there were 420 million people with diabetes in 2014 and that will rise to 600 million by 2035^{3,4}.

In addition to availability of various methods for Diabetic foot ulcer(DFU) treatment like moist wound dressings (gauzes, films, hydrogels, hydrocolloids, alginates, and foams) and other adjunct techniques like skin substitutes, HBOT(hyperbaric oxygen therapy), stem cell transplant and Negative pressure wound therapy(NPWT) using Vacuum assisted closure(VAC)⁵. This last modality is the focus of my study.

OBJECTIVES: To compare the “effectiveness of Negative Pressure Wound Therapy(NPWT) using Vacuum Assisted Closure(VAC) versus regular Conventional Moist Wound Therapy dressing in the healing of Diabetic foot ulcers(DFUs)”

- i) In terms of healing rate(time to prepare the wound for closure either secondary suturing or by surgery)
- ii) Cost
- iii) Satisfaction(QALY)

REVIEW OF LITERATURE

Hyperglycemia produces oxidative stress on nerve cells and leads to neuropathy. Additional nerve dysfunction follows from glycosylation of nerve cell proteins, leading to further ischemia. These cellular changes manifest in motor, autonomic, and sensory components of neuropathic foot ulcers.

Peripheral arterial disease (PAD) refers to partial or complete obstruction of the peripheral arteries, typically the arteries in the legs. more commonly seen in diabetic patients due to the higher risk for arterial atherosclerosis resulting in a reduction in blood supply that leads to inadequate oxygenation of the tissues of the lower extremity contributing to ulcer formation and poor healing of wound.

Any kind of wound from small abrasion to major incision has to be taken proper care which includes wound dressing. Dressing should be in such that it should be in contact with the whole surface of the wound for proper healing 1600 BC where “linen strips” soaked in oil/grease used for dressing wounds 2500 BCE– “Clay tablets” were used by

mesopotamian origin 460-370 BCE--cleaned wounds with wool material in boiled water⁶. 19th century--major breakthrough in “antiseptic technique” where antibiotics started in use. Later arrival of synthetic dressings includes “Hydrocolloids, Hydrogels, synthetic foam dressing, Alginates, Silicone meshes, silver/collagen containing dressing, tissue adhesives, vapor-permeable adhesive films”⁷.

Conventional moist wound therapy dressings were used with sterile gauze soaked in hydrocolloids and hydrogels and sealed the wound Negative pressure wound therapy technology seems to look like a recent invention but going back to the past leads us to the earliest civilizations⁸. Roman epoch--people were assigned to give direct suction by “mouth to the wound”. Later “cupping glasses” came into use⁹ which are dome shaped left over the wound for a day to withdraw the fluid from the open wound, “Dr. Francis Fox, A British physician, invented the GlassLeech” a suction apparatus attached to skin^{10,11}. Moreover in 1985 Dr. Nail B, was the first one who actually started using a unit which was assigned to give vacuum pressure to a foam dressing to treat wounds¹². Only in 1900's the modern VAC systems came into use with the use of “polyurethane foam” which contains small pores and a mechanical vacuum suction unit pioneered by “Drs. Louis Argenta and Michael Morykwa of WakeForest University School of Medicine”¹³. In the current epoch, NPWT continues to dominate other types towards shaping of compound wounds. Much more benefits continue to be explored in my further studies

MATERIAL & METHODS

MATERIALS:- This study conducted was randomized control study(RCT) on Patients with diabetic foot ulcers admitted in Department of General Surgery, at Andhra Medical College, King George hospital, Viskhapatnam, Andhra Pradesh. Study duration on One year.

The patients who has given consent for the study allocated either CMWT or NPWT, before therapy culture swab is taken for organism and the surface area of the wound is calculated. In CMWT daily dressing with hydrocolloids or hydrogel is done, In NPWT wound is sealed with a foam and connected to a vacuum central line with maintaining a 150mmhg pressure for 5 days. When the wound with healthy granulation tissue and ready for skin graft, Again the wound surface area measured to differentiate the surface area pre and post therapy in CMWT and NPWT.

Wound measurement:-

Before study the ulcer size is measured--L1XB1=A1
After the study the ulcer size is measured--L2B2=A2
Reduction in the surface--A1-A2
Percentage decrease in the wound size=A1-A2/A1x100
L1-Length of the wound before the treatment
L2-Length of the wound after the treatment

B1-Breadth of the wound before the treatment
 B2--Breadth of the wound after the treatment
 A1-Area of the wound before the treatment
 A2-Area of the wound after the treatment

INCLUSION CRITERIA:

Patients age between 20 to 80 years old of both sexes with DFU of wegner's grade I & II

EXCLUSION CRITERIA:

Patient not giving consent for the study, Patient having coronary artery disease/Osteomyelitis, Patient with viral markers positive (HIV/HCV/ HEP-B), Patient on steroids, Co-morbidities(Renal failure), Pregnant/ nursing mother, Patient with foot ulceration due to any cause other than diabetes

SAMPLE: My study was of 100 people with Diabetic foot ulcer consented and screened, before randomizing to either of the treatment wound surface area is measured and randomly treated with Moist wound therapy or vacuum dressing after debridement, Post treatment again the surface area measured . Once the wound is with adequate healthy granulation tissue graft is transplanted



FIG:1 NPWT patient from initial presentation to Graft



FIG2 : CMWT patient Non healing ulcer to Graft



Fig 3: NPWT patient grafting done on 15th day



Fig 4: CMWT patient grafting was done on 25th day

OBSERVATION AND RESULTS

Most of the patients are with long standing uncontrolled diabetes with diabetic foot ulcer showing slight male predominance with 57% and females with 43%, Nearly 66% of the study group were between 50-70 years and only 8% are between 20-40 years of age, Most of the patients were anemic, mild, moderate, severe are 51%, 19% and 11% respectively. 85% of my study population are with HbA¹C >7, Duration of Diabetes with more than 5 years are 83% , Location of the ulcer over foot, Majority of the patients had ulcer over distal foot i.e 48%, and 34% of cases are seen involving entire foot. In my study following Organism are isolated

Table 1: Isolated organism from the ulcer

Organism	CMWT	NPWT	Percentage
Staphylococcus aureus/MRSA	13	15	28
Pseudomonas	14	8	22
kleibiella	9	14	13
E coli	3	6	9
Proteus	4	3	7
Acenobacter	3	3	6
Streptococcus	1	2	3
Others	5	2	7
No growth	2	3	5

Graph 1: Wound surface reduction between the graph lines in NPWT and CMWT

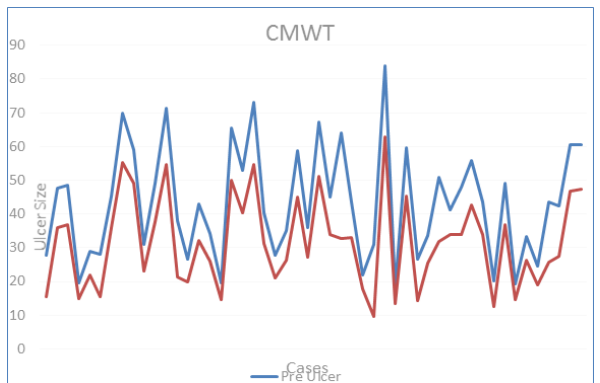
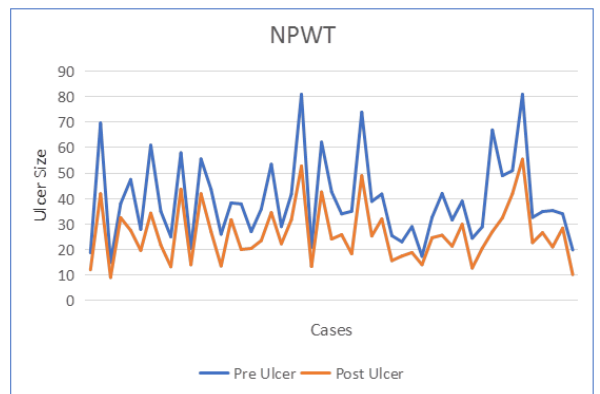


Table 2: percentage of wound surface area reduced

% Reduction	CMWT	NPWT
<25% Reduction	31	16
25-50% Reduction	17	32
51-75% Reduction	2	2
>75% Reduction	0	0

Table 3: Duration of the treatment

	CMWT	NPWT	Marginal row total
<3 Weeks	4	48	52
>3 Weeks	46	2	48
Marginal column total	50	50	100(grand total)

Our study revealed that the time taken for the wound to heal with NPWT is significantly less when compared to CMWT

In our study the pt recieved CMWT had more than 4 weeks hospital stay while only 2 weeks for the cases who were on NPWT

RESULTS**COMPARISON OF CLINICAL OUTCOME OF THE TWO GROUPS****1) DECREASE IN WOUND SIZE POST INTERVENTION**

Out of 100 cases of diabetic foot ulcer 50 was assigned to CMWT and 50 cases to NPWT, 55 cases had a decrease in surface area of 0-25%, While 42 cases had a decrease in surface area between 26-50% , out of 42 cases 32 cases are from NPWT and only 10 cases from CMWT. So in NPWT there was a greater decrease in size when compared to CMWT

2) DURATION OF THE TREATMENT

Time period from debridement of the wound to complete closure of the ulcer is taken as duration of the treatment.

Closure of the ulcer has been done after 90 % of the granulation tissue is formed.

Out of 100 cases, All the diabetic foot ulcers have been closed by split-skin grafting, Mean duration for complete closure of ulcer in CMWT is 27.44 days, while in NPWT mean duration was 15.34 days. Therefore data suggesting that NPWT is more efficacious than CMWT in closing of ulcer with more than 90% granulation tissue

**CONCLUSION**

Our study is concluded saying Negative Pressure Wound Therapy USING Vacuum Assisted Closure is more efficacious than Conventional Moist Wound Therapy in terms of wound surface area reduction and lesser hospital stay and decreasing the morbidity of the patient reducing the Quality Adjusted Life Yeras(QALY).

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