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Effectiveness of 3% Citric Acid dressing on diabetic wound status among patients with diabetic foot ulcer

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ABSTRACT

India is a country with second largest number of diabetic patients in the world. Pretest Posttest Control Group Research Design was adopted. Thirty Research participants were recruited using Simple Random Sampling technique. The wound was assessed using Modified Bates Jensen Wound Assessment Tool. 3% citric acid dressing was applied to the interventional group once a day for 15 days. The study findings stated that, the pretest mean and standard deviation of interventional group and routine care group was 41 ± 4.34 and 20.6 ± 4.63 . The calculated "t" value (46.31) was greater than table value (3.66) at the level of $p < 0.001$. 3% Citric acid dressing was effective for patients with diabetic foot ulcer.

Keywords: Effectiveness, 3% Citric Acid, Diabetic Foot Ulcer, Diabetic Wound Status, Diabetes Mellitus

1. INTRODUCTION

India is a country with second largest number of diabetic patients in the world after china. India is home to 69.1 million patients with diabetes mellitus with an overall prevalence of 9.3%. The regional prevalence of Tamil Nadu constitutes of 10.4%. The theme of the World Diabetes Day and Diabetes awareness month 2019 is 'Family and Diabetes'. The theme focuses on the impact of diabetes on the family and provides support to the affected people via proper network. It also promotes the role of the family in the management, care, prevention, treatment and education of diabetes (WHO,2019). Various treatment for diabetic foot ulcer includes the use of bone marrow derived stem cells, negative pressure dressing, bioengineered skin equivalents and growth factor therapy, hyperbaric oxygen treatment, Maggot or larval therapy, Hydrocolloid dressing, enzymatic debridement agents & hydro gel dressings. Though high-tech treatments are available today the cost associated with these treatments are very high (Supaksh 2017). Citric acid shows promise as it causes a boost in fibroblastic growth and neo-vascularization in wounds, aiding the formation of healthy granulation tissue which leads to faster healing and it is economic and affordable to all the population. It is simple, effective, reliable, nontoxic and economic approach to treat the diabetic foot ulcers (Kumari,2016). As the wound healing process is improved by using citric acid dressing, we can reduce the hospital stay, minimize the incidence of amputation, and improve the quality of life among the patient with diabetic foot ulcer.

Statement of the Problem

An Experimental Study to Evaluate the Effectiveness of 3% Citric Acid Dressing on Diabetic Wound Status among Patients with Diabetic Foot Ulcer admitted at Selected Tertiary Care Hospitals, Coimbatore.

Objectives

1. To assess the pretest diabetic wound status among interventional and routine care group of patients with diabetic footulcer.
2. To evaluate the effectiveness of 3% citric acid dressing on diabetic wound status among interventional group of patients with diabetic footulcer.
3. To associate the pretest diabetic wound status with selected demographic variables among interventional and routine care group

of patients with diabetic footulcer.

Operational Definitions

- **Effectiveness**- Effectiveness is the wound healing status due to the effect of 3% citric acid dressing.
- **3% Citric Acid** – The citric acid anhydrous solution made up of 3 grams of citric acid crystals in 100 ml of distilled water for dressing.
- **Patients with Diabetic Foot Ulcer** – The study participants with either type 1 or type 2 diabetes mellitus falls in the category of wound regeneration and wound degeneration according to Modified Bates Jensen wound assessment tool who are admitted in surgery wards.
- **Diabetic Wound Status**- The process of measuring the diabetic wound status by using 13 criteria (i.e.) size, shape, depth, appearance of edges, undermining, necrotic tissue, type and amount, exudates type and amount, skin condition, peripheral tissue edema and indurations, granulation tissue appearance, epithelialization according to Modified Bates Jensen Wound AssessmentTool.

Hypotheses

H1: There will be a significant difference in mean pretest and posttest diabetic wound status among interventional and routine care group.

H2: There will be a significant association between pretest wound status among interventional and routine care group with selected demographic variables.

2. MATERIALS AND METHODS

Quantitative evaluative approach: True experimental research design, pretest - posttest control group design was adopted. The independent variable in the study was 3% citric acid dressing. The dependent variable in the study was diabetic wound status. By using simple random sampling technique, 30 study participants with diabetic foot ulcer were selected for the study in which random assignment of table of numbers was adapted to allocate the study participants of 15 in interventional and 15 in routine care group.

2.1 Sample SelectionCriteria

Inclusion Criteria

- Patients who were willing to participate in the study
- Patients who belonged to the category of wound regeneration and wound degeneration according to Modified Bates Jensen Wound Assessment tool.
- Patient who was present at the time of data collection period

Exclusion Criteria

- Patients who were critically ill
- Patients who had vascular and neurological problem
- Patients who had been planned for wound debridement

2.2 Instruments and Tools for DataCollection

Tool consists of two sections. Demographic variables and Modified Bates Jensen Wound Assessment Tool, 13 characteristics of wound status were scored. The scores were categorized into Tissue healthy (1-22), Wound Regeneration (23-45), Wound Degeneration (46-65).

Table 1: Scoring Interpretation of the tool

S no.	Score	Interpretation
1.	1-22	Tissue Healthy
2.	23-45	Wound Regeneration
3.	46-65	Wound Degeneration

2.3 Validity and Reliability of Tool

The content validity of the tool was obtained from experts. Reliability of the tool was determined using split half reliability method & it was 0.91. Thus, the tool was found to be highly reliable and feasible to conduct the study.

2.4 Data Collection Procedure

Data collection was carried for the period of 6 weeks. Permission was obtained from the Principal, PSG College of Nursing and Head of Surgery Department, PSG Hospitals. The ethical approval was obtained from Institutional Human Ethics Committee (IHEC), PSG Institute of Medical Science and Research. Study participants who met the inclusion criteria were selected and they were assigned to interventional group and routine care group by simple random sampling technique. Informed consent was obtained from the patients. Demographic data was collected through interview method and the necessary information were retrieved from medical records. Pretest wound status was assessed using Modified Bates Jensen Wound Assessment Tool through interview and observation method in both the groups. Citric acid dressing using 3% citric acid in interventional group and routine dressing using normal saline or povidone-iodine was applied once a day for 15 consecutive days. The duration of intervention was 20 to 30 minutes and it may vary according to size of wound. Posttest wound status was assessed using Modified Bates Jensen Wound Assessment Tool in both groups on the 15th day after dressing.

3. RESULTS

The results of the study were categorized into 3 tables given below,

Table 2: Frequency and Percentage Distribution of Wound Status among Interventional and Routine Care Group of Patients with Diabetic Foot Ulcer N=30

Wound Status	Interventional Group				Routine Care Group			
	Pretest		Post Test		Pretest		Post Test	
	F	%	f	%	f	%	f	%
Tissue Healthy (1-22)	-	-	11	73.33	-	-	-	-
Wound Regeneration (23-45)	13	86.67	4	26.67	14	93.33	1	6.67
Wound Degeneration (46-65)	2	13.33	-	-	15	100	-	-

Table 3: Comparison of Pretest and Post test Scores on Wound Status among Interventional and Routine Care Group of Patients with Diabetic Foot Ulcer using Paired “t” test

H1: There will be a significant difference in mean pre test and mean post test diabetic wound status in interventional and routine care group
N=30

Parameters	Pre test	Post test	Calculated Paired ‘t’ Value	df	Table Value
	Mean ± SD	Mean ± SD			
Interventional group (n=15)	41 ± 4.34	20.6 ± 4.63	17.95***	14	4.14
Routine care group (n=15)	40.6 ± 3.93	34.5 ± 5.23	5.27***		

*** Highly Significant at p<0.001

Table 4: Comparison of Post test Scores on Wound Status among Interventional and Routine Care Group of Patients with Diabetic Foot Ulcer using Independent “t” test.

H1: There will be a significant difference in mean pre test and mean post test diabetic wound status in interventional and routine care group
N=30

Parameters	Interventional Group (n=15)	Routine Care Group (n=15)	Calculated ‘t’ Value	Table Value
	Mean ± SD	Mean ± SD		
Pre Test	41 ± 4.34	40.6 ± 3.93	46.31***	3.66
Post Test	20.6 ± 4.63	34.5 ± 5.23		

*** Highly Significant at p<0.001

Associations between Pre-Test Scores on Wound Status and Selected Demographic Variables among Interventional Group of Patients with Diabetic Foot Ulcer

There was an association between pre test scores on wound status and selected demographic variables. Thus, the H2 stating that “There will be a significant association between pre test wound status in interventional and routine care group with selected demographic variables” was retained among interventional group of patients at p<0.05 level.

4. DISCUSSION

The data presented in the table 2 elicits that the pretest scores of wound status in interventional group most of the study participants 13 (86.67%) were under the category of wound regeneration status, and remaining 2(13.33%) were under the category of wound degeneration status whereas after dressing most of them about 11 (73.33%) were under the category of tissue healthy and remaining 4 (26.67) were under wound regeneration and none of them under wound degeneration status. In routine care group, before dressing 14(93.33%) belonged to category of wound regeneration status and one (6.67%) under the category of wound degeneration status whereas after the routine care, majority 15(100%) were also under the category of wound regeneration status. The data presented in the table 3 reveals that in the interventional group, the mean and standard deviation of pre test was 41 ± 4.34, and post test score was 20.6 ± 4.63. There is a significant difference between the interventional and routine care group of patients in pre test and post tests (p<0.001). Even though there is a significant difference in pre test and post test wound scores between the interventional and routine care group, mean difference (13.9) is higher in post tests. The calculated “t” value 17.95 was greater than the given table value (4.14) at the level of p<0.001. It can be attributed to the effectiveness of 3% citric acid dressing among interventional and routine care group of patients. Hence the research hypothesis H1 is retained.

The data presented in the table 4 reveals that the post tests mean and standard deviation in the interventional group was 20.6 ± 4.63, and in routine care group was 34.5 ± 5.23. The calculated “t” value was 46.31 which is greater than the given table value (3.66) at the level of p<0.001. It can be attributed to the effectiveness of 3% citric acid dressing among interventional and routine care group of patients. This shows that there was significant improvement in diabetic wound status. Hence the research hypothesis H1 was retained.

Thus, the above findings were consistent with a study which compared the patient treated with conventional dressing and 3% citric acid dressing where the mean and standard deviation of pre test was 30.44 ± 25.75, and post test score was 72.06 ± 14.05, and

regarding the unpaired “t” test, the calculated “t” value was 2.245 whereas the given table value is 0.029, showed the effectiveness of the therapy at the level of $p \leq 0.05$. The remarkable progress in the calculated “t” value indicated that 3% citric acid dressing was more effective among diabetic foot ulcer patients. The increase in granulation area was more by the use of citric acid (65.36%) than routine care group (60.60%). (Supaksh,2017)



Fig. 1: Progress of Wound healing

5. CONCLUSION

Diabetic foot infections are the major cause of morbidity among diabetic patients. Inappropriate treatment and infections are the common sequel of diabetic foot ulcer and it leads to delayed wound healing. 3% Citric acid is a solution which contains the healing and anti- microbial properties like Vitamin C and it is effective in the successful management of foot ulcers in an affordable and simple way.

5.1 Nursing Implications

The present study has implications for nursing practice, nursing education, nursing administration and nursing research.

Nursing practice

The nurse working in the surgical unit should be trained in implementing 3% citric acid dressing as adjuvant therapy on their routine clinical practice.

Nurses can also support the patient and their relatives in educating them regarding home care management of diabetic foot ulcer using 3% citric acid dressing

Nursing Education

Organizing continuing nursing education for staff nurses will help to promote and update their knowledge on various innovative therapies like dressing with various topical agents like 3% citric acid, Acetic acid and medicated collagen.

Nursing Administration

The protocol of 3% citric acid dressing can be developed and implemented for the patients with diabetic foot ulcer.

Nursing Research

The nursing research intended to offer up to date suggestions in implementing the alternative treatments like application of 3% citric acid dressing.

Nursing researchers can conduct further comparative studies to find the effect of citric acid dressing to improve the patient outcomes.

5.2 Limitations of the study

- Patients who had undergone amputation for further treatment.
- Patients who were discharged within few days.

5.3 Recommendations

1. An extensive experimental study can be conducted for larger number of samples in the health care settings.
2. Further research can be conducted with the help of other wound assessment scale.
3. A study can be conducted to find out effectiveness of 3% citric acid dressing in the healing of burns wound, cellulitis, bed sore and surgical wounds.
4. A comparative study can be conducted with other products used for wound dressing.

6. REFERENCES

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