

Diabetes mellitus and diabetic foot ulcer



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Diabetes Mellitus is a chronic multisystem disease related to abnormal insulin production, impaired insulin utilization, or both. Diabetes mellitus is a serious health problem throughout the world and its prevalence is increasing rapidly. The long term complications of diabetes are what make it such a devastating disease (Lewis, S. 2009). The findings of this study may have implication on management of diabetic foot ulcer that result from damage of blood vessels secondary to hyperglycemia. The focus of the study was to assess the effectiveness of topical insulin in healing of diabetic foot ulcer. Californian podiatric medical association states that foot ulcers in patients with diabetes should be treated for several reasons such as reducing the risk of infection and amputation, improvement of function and quality of life and reducing healthcare costs.

5. 1 General profile of patients with diabetic foot ulcer: The present study revealed that, the age of patients with diabetic foot ulcer ranged between 40 and 85 years. Out of the samples selected, majority of the patients (32) belonged to the age group ranging from 55 to 70 years. This result was supported by a study conducted among patients in Saudi Arabia, by Bacchus (2009) to understand the prevalence of diabetes mellitus associated foot ulcer and found that diabetic foot ulcer affects commonly men aged over 55-70 years. It was also noted that male patients (31) exceed the female patients in terms of gender in this study. Zaid (2009) found that the prevalence of diabetes among patients in Saudi Arabia was 17 % and 22 % among men aged between 41-50 years and 52 -60 years respectively and 11% and 20 % among women aged between 41-50 years and 52 -60 years respectively. Ramachandran et al (2009) found that there was a rising trend

in prevalence of diabetes with a low family income and it is said that lack of education and poor access to health care delivery stay as the main reason for the aforesaid matter. Here in the present study, majority (28) of the patients had a family income ranging between Rs 1000 - Rs 5000.

5. 2 The information related to diabetes mellitus among patients with diabetic foot ulcer:

Time since the person has diagnosed diabetes: In the study, majority of the patients (21) were diagnosed to have diabetes mellitus within 6 months of time after the onset when compared to 15 patients who were diagnosed to have diabetes mellitus by 1 year of time and 10 patients were diagnosed after 1 year of time. This matter is being supported by Cabellero (2004) who says that diabetes can occur at any lifetime of an individual. WHO (2009) also reported that the disease may be diagnosed several years after the onset, once complications have already arisen.

Type of diabetes mellitus: The findings revealed that majority of the patients (31) had insulin dependent diabetes mellitus but Lewis (2009) described that type I diabetes mellitus most often occurs in people who are under 30 years of age but it can occur at any age also.

Reason for admission: In the present study all the 46 patients were admitted for medical reasons such as hyperglycemic emergencies and other comorbid illness inspite of diabetic foot ulcer. Eisenbarth (2008) remarked in his study that diabetes patients were more likely to be admitted to hospital for any reason than patients without diabetes mellitus. 46% of all admissions were due to complications arising from diabetes. However Andrew(2006) reported

that nearly a quarter of all stays for patients with diabetes were principally for the treatment of five circulatory disorders that is Congestive cardiac failure, Acute coronary syndrome , Cerebro vascular disease and Cardiac dysrhythmias. Oybera et al.,(2007) identified that most common reason for admission were hyperglycemic emergencies (40%) and hypertension (21%).

Habit of smoking : Christopher seglav (2010) reported that smoking decreases the rate at which new blood vessels can form in an area surrounding a wound. It decreases the wound healing. It reduces the amount of blood circulation in the feet and legs. In the present study majority of the patients (29) were non smokers . Maranyana(2010) supports the present study by a statement that you don't necessarily have to quit smoking forever. It was shown in a study that if a person had quit smoking for 4 weeks the wound infection rates were the same in those that stopped smoking as those who had never smoked.

Duration of hospitalization: In the present study, majority of the patients (33) had a hospital stay of not less than 15 days and not more than 30 days. This is being supported by a study conducted which revealed that diabetic foot ulcer patients had the most prolonged duration of admission ranging from 15 to 122 days. Increasing prevalence of diabetes mellitus will increase demand for hospital services overall, and particularly for inpatient care related to foot complications (Tomlin, A. 2006).

History of past illness: In this study majority of the patients (27) had comorbid illness like hypertension , ischemic heart disease but no significant past history as such. Funnel (2000) reported that cardiovascular diseases

may accompany diabetes mellitus like coronary artery disease, cerebrovascular disorders. Majority of the patients in the study(38) had no previous injuries. It is said that a history of previous diabetic foot ulceration increases the risk for new ulceration (Iverson, M. 2009).

Sites of wound: In the study, it was found that 16 patients out of 46 patients had foot ulcer at the great toe of the foot . Great toe ulcers were followed by dorsal aspect foot ulcers, heel, medial ankle of the foot , plantar aspect of the foot and lateral ankle of the foot. In a study conducted by Dr. Miridith (2007), it was found that great toe ulcers were the most common 42. 6% followed by the ulcers of the plantar aspect (39%). The lateral ankle , heel, medial aspects of the foot and dorsum of the foot were involved in 7. 2%, 10%, 12. 8% and 13. 6% of the patients respectively among patients with diabetic foot ulcer.

5. 3 Assessment of the wound status of patients with diabetic foot ulcer: In the present study, there were no patients who had healthy wound in both the groups before the treatment with topical insulin as well as Povidone iodine. All the 46 patients were in the stage of wound regeneration and none of the patients were in the stage of wound degeneration based on wound status continuum of Bates jensen's wound assessment tool. All the 13 parameters were assessed for each patients and were recorded in the pre assessment of the wound status. Shabbock (2007) supports the present study by suggesting that the condition of the wounds including the presence or absence of granulation tissue, bleeding, pain, infection, and other wound complications or healing factors were to be assessed and recorded pre-treatment to monitor the effectiveness of therapy. All the patients vary in

their wound status in terms of the different parameters. Oyibo (2001) remarked that systematically recording the wound characteristics and confounding features is critical to plan the treatment strategy, monitoring treatment effect, predicting the clinical outcomes and increasing communication among health care providers. Increasing stage, regardless of grade is associated with increased rate of amputations and prolonged ulcer healing time. Bidar Ramin (2009) in a study reported that a thorough evaluation of any ulcer is critical and should direct management. An adequate description of ulcer characteristics, such as size, depth, appearance, and location, also provides for the mapping of progress during treatment.

5. 4 Assessment of the wound size with wound ruler: The wound size of diabetic foot ulcer among patients in the experimental and control group was measured with the help of an wound ruler. Majority of the patients 13 each in the experimental and control group had wound size ranging between 4 and 16 sq. cms. Carrie sussman (2006) said that appropriate wound assessment provides the framework for establishing goals for wound healing. Goliath (2009) supports the present study by stating that an wound ruler is used to get an accurate measurement of ulcer size. It is done by simply multiplying the greatest length by the greatest width. Barbara (2006) suggested that two dimensional linear wound measurements is a convenient, quick, easy and inexpensive method to measure the wound.

5. 5 Application of topical insulin on diabetic foot ulcers: In the present study, all the 23 patients in the experimental group were applied with topical insulin on diabetic foot ulcers. Jafari (2009) reported that since Bunting's <https://assignbuster.com/diabetes-mellitus-and-diabetic-foot-ulcer/>

discovery of insulin in 1921, many benefits beyond blood glucose regulation have been documented. Preclinical and clinical studies have demonstrated positive effects of insulin on wound healing. Martin green(2007)remarked that Insulin is a hormone known primarily for regulating sugar levels in the blood, yet researchers at the University of California, Riverside, recently found that applying insulin directly to skin wounds significantly enhanced the healing process. Aslani (2009) reported that a review of the physiological properties of insulin suggests it might favorably influence wound healing because it can stimulate growth of individual cells as well and cause increased anabolism of the organism as a whole. The amino acid chain in the insulin like growth factor molecular structure is similar to proinsulin, which is manufactured in the pancreatic Langerhans cells.

5. 5 Reassessment of the wound status after topical application of insulin in patients with diabetic foot ulcer: The findings of the study revealed that the therapy with topical application of insulin was effective in terms of changes in wound characteristics. It was found from the present study that the epithelialisation of the wound was the most affected factor by insulin therapy followed by granulation tissue of the wound and peripheral tissue induration of the wound as 15 patients in the experimental group showed remarkable changes related to epithelialisation because the patients with the most worst grades of epithelialisation of the wound were progressed to better epithelial wound status after the insulin therapy. The total Bates jensen's wound assessment tool score of patients in both the experimental and control group were plotted on the wound status continuum which was monitored over time and it was found that patients in the experimental group had greater

reduction in total wound scores when compared to patients in the control group. Sarabchi (2009) in vivo studies have shown that insulin can stimulate the epithelialisation, proliferation and differentiation of endothelial cells and fibroblasts and promote granulation tissue regeneration to contribute to wound healing. O'Mearas (2000) found out in a study that growth factors like epidermal growth factor, platelet derived growth factor and insulin like growth factor accelerate tissue repair in an experimental wound model. Growth factors attach to cell receptors regulating gene expression of several cytokines and chemokines via different signaling pathways. They promote cell division, migration, angiogenesis and thus tissue regeneration and remodeling process.

5. 6 Effectiveness of Povidone iodine in healing of diabetic foot ulcer through paired ' t' test: The findings of the study reveal that there is a difference in healing of diabetic foot ulcer before and after application of Povidone iodine in the control group ($t = 9.95, p < 0.05$). Piaggasi (2004) in his study reported that the diabetic foot ulcers treated with antiseptic solution of Povidone iodine 50% mixed with saline 50% twice a day was effective in wound healing and shortens the time for wound closure. Caputo et al (2005) reported that a controlled clinical study showed that foot ulcers treated with Povidone iodine had 75% re epithelilisation in a significantly shorter period. Lineaweaver (2005) reported that Povidone iodine moiety does not interfere with overall wound healing or harm delicate tissues. It was concluded that Povidone iodine does not delay wound healing in humans.

5. 7 Effectiveness of topical Insulin in healing of diabetic foot ulcers through independent ' t' test: The findings of the study show that there is a

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significant difference in healing of diabetic foot ulcer among the patients who were treated with topical insulin and the patients who were treated with Povidone iodine. This study results show that topical insulin therapy is better over treatment with Povidone iodine on diabetic foot ulcers ($z = 17.24$, $p < 0.05$). This was supported by a study conducted by Hunt (2006) who compared daily wound dressing on acute and chronic diabetic wounds with a saline soaked gauze impregnated with 5 - 10 units of insulin with daily wound dressing using 0.05% Povidone iodine. The reported time to complete healing in both the groups found a significant benefit with topical insulin (12 people in each group, healing time: 14.6 days with insulin and 53.5 days with Povidone iodine; $p < 0.001$).

CHAPTER VI

SUMMARY AND CONCLUSION

This study was conducted to analyse the effectiveness of topical insulin in healing of diabetic foot ulcers. The literature was reviewed regarding diabetes mellitus, diabetic foot ulcer and topical application of insulin in healing of diabetic foot ulcers. Diabetes and its complications have a significant economic impact on individuals, families, health systems and countries. For example WHO estimates that in the period 2006-2015, China will lose 558 billion dollars in foregone national income due to heart disease, stroke and diabetes alone. After being diagnosed it is only a matter of time in learning how to control the disease (WHO, 2009).

The research design adopted for the study was true experimental study- pretest posttest control group design. The study was conducted in male and

female surgical wards of PSG hospitals. Forty six samples were selected by using degree of precision formula.

The tool used for the study was Bates jensens wound assessment tool.

Validity and reliability of the tool was tested through the pilot study. Keeping the objectives in mind, the demographic profile, the information related to diabetes mellitus and data related to the wound characteristics were collected.

Data was collected from all diabetic patients with foot ulcers who met with the inclusion criteria. In the first day, baseline data of patients in both the groups regarding demographic profile , history of diabetes were collected through medical records and interview. The mode of intervention included dressing of diabetic foot ulcer with topical insulin Human Actrapid of 5-10 units diluted with 1 cc of 0. 9% Normal saline for every 10 cm of wound done twice a day for the patients in the experimental group where as the patients in the control group were given dressing with routine solution of Povidone iodine. Before the treatment the researcher used to assess the wound parameters of patients and assess the wound size using a wound ruler and record the total wound score and assess for changes in the wound status after intervention. The researcher assessed the wound status using Bates jensens wound assessment tool in both the experimental and control group. After the intervention with topical insulin, the wound was reassessed for any changes and were recorded and was compared with the initial wound status. The effectiveness of topical insulin was assessed among patients in the experimental group by assessing the wound status every 3rd day of topical application. The same was done with the patients in the control group also.

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Two assessment scores were taken and the final assessment score was taken as the wound status after the treatment. Later the wound status of patients in both the groups were compared to find out which works better.

Collected data was tabulated and analysed by using descriptive and inferential statistics. Paired ' t ' test was used to compare the pre-assessment and post-assessment wound status among patients in the experimental and control group, independent ' t ' test was used to compare the wound status among patients in the experimental and control group.

6. 1 Major findings of the study:

The majority of the patients (32) belonged to the age group of 55-70 years of age. There were 11male patients and 4 female patients in the experimental group, and 13 male patients and 4 female patients in the control group who belonged to this age group.

The majority of the patients (31) in the study were male patients.

The majority of the patients (31)in the study had Insulin dependent diabetes mellitus.

The majority of the patients (33) in the study had duration of hospitalization between 15 - 30 days of duration.

The majority of the patients (27) in the study had associated comorbidities.

The majority of the patients (16) in the study had wound at the site of Great toe which is being followed by Dorsal aspect of the foot (8).

The majority of the patients (26) had wound size ranging between 4 and 16 sq. cms which was assessed with the help of an wound ruler. There were only 3 patients in the study who had an wound size between 36 and 80 sq. cms in the pre-assessment.

6. 2 Limitations of the study:

6. 2. 1 The time period undertaken for the study was not sufficient to monitor the progress of the wound status in response to the therapy as wound healing is a slow process.

6. 2. 2 The patients with grade 3 or above of Wagner's diabetic wound classification were excluded.

6. 2. 3 The use of insulin was not cost effective.

6. 3 Suggestions:

6. 3. 1 Long term study can be conducted to assess the wound healing among patients with diabetic foot ulcer.

6. 3. 2 The same study can be conducted with large number of sample.

6. 3. 3 More researches need to be undertaken to compare the effectiveness of insulin therapy with other treatments used for diabetic wound dressing.

6. 3. 4 A comparative study can be conducted to assess the wound healing among patients with diabetes and patients without diabetes mellitus.

6. 3. 5A similar study can be conducted to assess the wound healing effect of insulin on other types of wounds.

6. 3. 6 Advanced techniques of wound assessment can be used to evaluate the wound healing process.

6. 4 Recommendations:

6. 4. 1 The staff nurses can implement this mode of dressing for diabetic foot ulcers after proper education on topical application of insulin for wound healing.

6. 4. 2The staff nurses can be trained to use the wound ruler to assess the wound size.

6. 4. 3 The staff nurses can use the Bates Jensen's wound assessment tool in the clinical settings to assess the wound status.

6. 4. 4 The staff nurses can be trained to assess the wound characteristics to monitor for wound healing.

6. 5 Conclusion:

Diabetes mellitus is increasing globally at an alarming rate. The disabling complications of the disease are draining the health care resources of both developed and developing nations. 15% of the annual health care budget is used in treating the diabetic foot. It is unacceptable that too much disability and death are caused by leg amputations, when the solutions are clear and affordable. Small investments in prevention and education can mean fewer leg complications, increased quality of life for individuals and dramatic reduction in health care costs. Let us say together with WHO " put feet first: prevent amputations.