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Association of Hba1c level with healing of diabetic foot ulcer

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Abstract
Diabetic foot ulcer are the common complications of diabetes mellitus and it has significant mortality and morbidity in diabetic patients. Hemoglobin A1C (HbA1c) reflects glycemic control over 2–3 months and is the standard measure used to monitor glycemia in diabetic patients, the role of hemoglobin A1C (HbA1c) in assessing the outcome of diabetic ulcer needs to be evaluated.
Aim: This study aims to determine the association of HBA1c level with healing of diabetic foot ulcer
Materials and Methods: This study was conducted in the Department of Surgery, K V G medical college and hospital sullia over a period of 6 months from December 2018 to May 2019. A descriptive study was carried out in 80 diabetic patients with foot ulcers. The data collection included medical diagnoses, ulcer healing duration, and HbA1c results.
Results: About 45 of patients with controlled HbA1c levels had their wounds healed in 2 to 3 months, whereas only 11 of patients with high HbA1c had their wounds healed in 2 to 3months. 24 of patients with high HbA1c had their wounds persisting for more than 6 months.
Conclusion: HbA1c levels were associated with the process as well as the duration of foot ulcer healing in the diabetic patients. Elevated HbA1c was associated with poor prognosis in terms of foot ulcer healing.

Keywords: healing, diabeti, ulcer, mellitus

Introduction

- Diabetic foot ulcers are the most common complications of the diabetes mellitus with a estimated incidence of 15-25 % among diabetes patients. DFU remains a serious challenge for public health because of the high rate of amputation and high mortality.
- Over 30 million have now diabetes in India and considered India as “Diabetic Capital”. The crude prevalence rate in urban areas of India is thought to be 9%. In rural areas, the prevalence is approximately 3% of total population.
- Hyperglycemia and many other related factors, such as micro- and macrovascular complication, were illustrated as possible mechanisms that prevent the ulcers from wound healing, Blood glucose management is therefore considered a basic component of the treatment of wound healing in DFU patients.
- Hemoglobin A1C (HbA1c), an established marker to monitor blood glucose in diabetic patients, is currently being investigated for its association with ulcer healing. As an elevated HbA1c predicts poor prognosis for ulcer healing in patients with diabetes, it has been observed that ulcer healing rate is significantly slower if the HbA1c levels are high. The prime objective of our study was to determine the significance of HbA1c level as predictors of prognosis in patients with diabetic foot ulcers.

Aims and Objectives

This study aims to determine the association of HbA1c in healing of diabetic foot ulcers.

Material and Methods

- Study Design – Prospective study • Sample size -80
- Study duration –December 2018 to august 2019
- Method of collection of data –the data is collected from the 80 patients who have been diagnosed and admitted to have diabetic foot ulcer in K V G Medical college and hospital, sullia, dakshina kannada
- Detail history according to proforma like age, sex, status of smoking, significant complaint, other co-morbidities like Hypertension, Chest disease, IHD, liver disease were obtained.
- And all patients have undergone basal investigation like complete hemogram, LFT, RFT, Chest and Local part X-ray to rule out confounding factors and to reduce bias.
- Then HbA1C value of all patients obtained at initiation and followed to monitor the patient.
- At the time of admission the status of the wound is accessed, the extent of the wound is graded according to Wagner’s classification, and also the approximate dimensions of the ulcers are noted and compared after 12th week of treatment.

Ulcer was characterized as infected when two or more of the followings were met:

1. Local swelling or induration (2) Erythema
2. local tenderness or pain (4) local warmth
3. (5) Purulent discharge.

Inclusion criteria

- Type 1 and 2 wound of wagners classification

Exclusion criteria

- Pregnant ladies
- Age >80 years
- Patients with S. creatinine > 2 mg/dl
- Diabetic foot ulcers grade 3, 4 and 5 (Wagner

classification).
- Data was collected at the time of admission and at 12 weeks of treatment by taking proper history, thorough examination of patient, limb and ulcer, HbA1c assessment.
- History-Duration and family history of diabetes, compliance to treatment, history of numbness, corns/callosities and ulcer/abscess of lower limb.
- Clinical examination -Clinical nutritional assessment, palpation of all peripheral pulses, signs of chronic limb ischemia, ulcer evaluation and neurological examination
- Haematological investigations -Haemogram, fasting and post-prandial blood sugar level, renal function test and HbA1c assessment
- Treatment approach -Under strict glycemic control, patients were followed up at regular intervals and ulcers were debrided surgically. Appropriate antibiotic(s) was advised as per the tissue culture-sensitivity report, and moist dressings were applied.
- At 12th week of treatment, patients were re-assessed by history (for improvement in symptoms), clinical examination (for ulcer healing), biochemically (HbA1c value).

Observation and Results

- Total 80 patients, complying with inclusion criteria, were enrolled in the study and received optimal treatment from department of surgery at K V G medical college and hospital, sullia, dakshina kannada.
- All had unilateral limb involvement. They were assessed at the time of first presentation and at 12th week of treatment.
- The mean age of presentation was 54.5 years with a male preponderance (65 out of 80).
- Out of 80 patients, 61 patients had a history of diabetes from less than 5 years with most of the patients are on oral hypoglycemic.
- Among 65 male patients in this study most of the patients (70%) had a history of tobacco smoking and 21 patients out of 80 are hypertensive who are on regular medications
- 20% patients had history of trauma while two patients presented with a history of thorn injury. However, maximum number of patients (66%) presented with history of unknown injury.
- On the time of accessing and evaluating the wounds at the beginning of the study most of the wounds (84 %) were in Wagner‟s grade 1 diabetic ulcer and 16% had grade 2 ulcers.
- At the admission the mean glycosylated haemoglobin level of study population was 6.6 and 35 patients had value higher than 6.5 (mean 7.23).
- 56% of diabetic patients with controlled HbA1c (7 mmol/L) had foot ulcer healing within 3 months,
- 13% with high hba1c (7 to 10 mmol/L) had healed in 3–6 months,
- 30 % with hba1c value more than 10mmol/L took more than 6 months for complete healing of the foot ulcers.

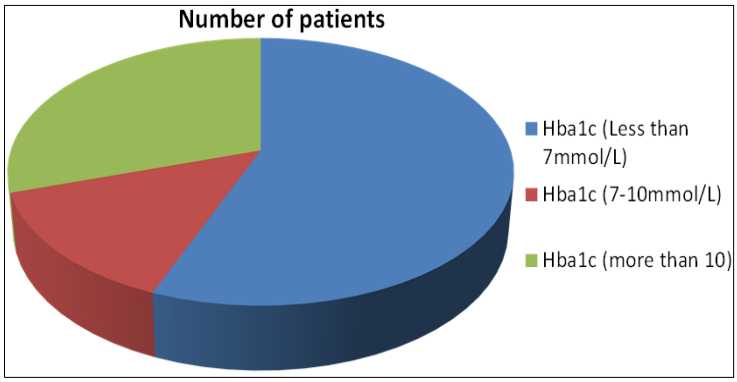

Fig 1

- While studying the healing process in relation to HbA1c levels, we observed that 56% of patients with normal HbA1c had completely healed foot ulcers within 3 months of duration, whereas 13 % with elevated hba1c showed healing in the same duration of follow up, and 30 % of patients had uncured foot ulcers.
- Among the remaining patients with high HbA1c, 45% showed complete healing after 6 months duration, whereas 35% had partial healing, 5% progressed to grafting process, and 15% had unhealed foot ulcers.

Table 1: Number of patients with association of HbA1c and healing time duration

	<3 months	3–6 months	6 months–1 year
HbA1c (less than 7 mmoL/L)	45	0	0
HbA1c (Between 7 to 10 mmol/L)	10	1	0
HbA1c (more than 10 mmol/L)	0	2	22

Discussion

- Diabetic foot syndromes is characterized by foot infection, ulceration, or destruction of deep tissues in association with neurological abnormalities and peripheral vascular insufficiency.
- Despite in-depth studies of the risk factors associated with diabetic foot ulcer development and the seriousness of the pathological consequences that may culminate into limb amputation and fatality, there is no standard criterion yet established to predict the prognosis of diabetic foot ulcer healing.
- In this study we reported that increased prevalence of problems associated with diabetic foot syndrome and search for a predictor that would be helpful in predicting the prognosis at the end of the treatment.
- The main findings of the study are that HbA1c as an indicator of glycemic control in the body shows significant association with foot ulcer healing and therefore can be used as reliable predictors of diabetic

foot ulcer prognosis.

- In a prospective study involving 314 diabetic patients conducted by Apelqvist J *et al*, with foot ulcers showed a significant association between various clinical risk factors and the healing process but with little evidence of association with short-term metabolic control assessed by HbA1c analysis.
- On the contrary, more recent studies conducted by Christman A L and Zubair M *et al*, contradict this observation and report not only that there is a significant association of HbA1c with foot ulcer development but also that HbA1c is a reliable predictor of foot ulcer healing.
- In a study conducted by Markuson M *et al*, It was observed that for every 1% increase in HbA1c levels, the rate of ulcer-area healing decreased by 0.028 cm2/day which implies HbA1c as a significant determinant of foot ulcer healing in diabetic patients.

Conclusion

- In this study results shows that HbA1c has a good association with the process of healing as well as time required for healing process to complete.
- Elevated HbA1c is also associated with slower and incomplete healing of foot ulcers in diabetic patients.

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