



ROLE OF BASELINE GLYCOSYLATED HAEMOGLOBIN IN HEALING OF DIABETIC ULCERS

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ABSTRACT

Background: Diabetic foot ulcers are one among the most commonly encountered complication of Diabetes Mellitus tackled by the surgical department worldwide. Physicians and surgeons have tried various methods of treatment to reduce the bioburden of diabetic ulcer. In this study we tried to find the co-relation between Baseline Glycosylated Haemoglobin (HbA1c) in the healing process of diabetic ulcers

Materials and methods: A prospective study where sixty adult patients admitted in Father Muller Medical College Hospital, Mangalore with diabetic foot ulcers were studied. Baseline HbA1c of all patients were recorded. Treatments of the ulcers were carried out as per the treating physician. Wounds were routinely examined for size of ulcer in area (cm²) and time taken for wound healing.

Results: Among 60 patients studied the mean time taken for wound healing among patients group A (with baseline HbA1c of less than 7.5) was 18.26 days. Those in group B (7.5 – 9) was 23.78 days. Group C (9-10.5) was 19.91 days and those above 10.5 in group D was 26.5 days. This showed a statistical significance of p value 0.018. Percentage of decrease in size of ulcer however did not show a correlation to baseline HbA1c. Overall trend of higher HbA1c however did not show any correlation to baseline HbA1c.

Conclusion: There was a recorded decrease in time taken for wound healing in patients with HbA1c lower than 7.5; However the statistical significance could not be achieved among the other groups nor did it show a significant correlation with higher HbA1c values. Indicating that baseline HbA1c may not be a good indicator for healing of diabetic ulcers

KEYWORDS :

Introduction

Diabetic foot ulcers are one among the most commonly encountered complication of Diabetes Mellitus tackled by the surgical department worldwide. Patients with Diabetes Mellitus have upto 25% lifetime risk of developing foot ulcer. Mainstay of treatment is debridement of all necrotic, callus and fibrous tissue with the primary goal to obtain wound closure.¹ With rate of amputations being high, causing a strain on quality of life and financial burden on health system, it is important for early treatment and early closure of the wound.

There are multiple risk factors for the development of a diabetic ulcer such as gender, age, duration of diabetes, BMI, peripheral vascular disease, poor glycemic control, infections and inappropriate foot care.² The Initial barrier to wound healing is the poor glycemic control which can be reflected in the glycosylated haemoglobin (HbA1c) levels as this level gives an approximate average blood glucose of 3 months.

Increased blood glucose may cause cell wall to become rigid and may impair blood flow through small vessels. Impaired haemoglobin also delivers decreased oxygen to the tissue and thereby hampers wound healing.³

Due to all these reasons, HbA1c is generally considered a good way to measure blood glucose control and is of importance when it comes to healing of diabetic foot ulcers.

Aims and Objectives

- To study a correlation between HbA1c and time taken for wound healing
- To study a correlation between HbA1c and percentage of decrease in size of ulcer

Materials and methods

SOURCE OF DATA:

It is a prospective comparative study using a sample size of 60 patients (30 in each group) using purposive sampling technique based on inclusion and exclusion criteria. The study will include all indicated patients undergoing said treatments modalities in Father Muller Medical College. The study will be done over a period of 2 years from 2015-2017

METHOD OF COLLECTION OF DATA:

Patients who were admitted for diabetic foot ulcers underwent initial assessment. Date of first presentation and size of ulcer at presentation were recorded. Basic investigations were done which included Glycosylated Hemoglobin. HbA1c was measured using the standard

High performance liquid chromatography (HPLC). Treatment modality for the respective patients was chosen by giving the ideal options of treatment and allowing an informed decision from the patient as to which modality of treatment they wanted based on the doctor's recommendation. Patients will be followed up regularly on weekly basis to assess complete wound healing or until deemed fit to undergo closure via skin grafting or secondary closure. In the event of non healing of ulcer by end of 4 months, reduction in area of ulcer in cm² (longest 2 diameters) will be assessed and compared.

Patients were divided into 4 groups depending on their HbA1c values

- Group A – Below 7.5
- Group B – 7.5 – 8.9
- Group C - 9 – 10.4
- Group D - 10.5 and above

Correlation between HbA1c and time taken for wound healing and percentage of decrease in size of ulcers were studied.

INCLUSION CRITERIA:

- All patients above 18 years of age diagnosed to have an ulcer as a complication of Diabetes Mellitus

EXCLUSION CRITERIA:

- Patients with proven malignancy
- Patients with proven venous ulcers
- Traumatic ulcers

STATISTICAL ANALYSIS

The collected data was analyzed using Pearson Correlation, mean with standard deviation and kruskal wallis test with a p value of less than 0.05 being statistically significant

Results

Demographic data

Age

Age	Count	Total
40 - 50	Count	14 23.3%
51 - 60	Count	23 38.3%
61 - 70	Count	17 28.3%
Above 70	Count	6 10.0%
Total	Count	60 100.0%

Gender

			Total
Gender	Female	Count	16
			26.7%
Male	Count	44	
			73.3%
Total	Count	60	
			100.0%

HbA1c

Frequency	Percent	
< 7.5	19	31.7
7.5 - 8.9	18	30.0
9 - 10.4	11	18.3
>10.4	12	20.0
Total	60	100.0

Correlation

HbA1c	N	Mean	Std. Deviation	Kruskal Wallis test p value	Percentiles		
					25th	50th (Median)	75th
percentage of decrease							
< 7.5	19	25.41	24.457	.072	.00	20.00	40.00
7.5 - 8.9	18	42.10	17.730	NS	25.00	42.46	55.31
9 - 10.4	11	30.59	18.902		16.66	28.00	52.00
>10.4	12	31.94	25.083		12.71	25.00	55.41
time taken							
< 7.5	19	18.26	8.008	.018	14.00	18.00	21.00
7.5 - 8.9	18	23.78	9.422	sig	16.50	24.50	30.00
9 - 10.4	11	19.91	10.329		13.00	16.00	26.00
>10.4	12	26.50	8.017		21.25	24.00	31.75

When divided into groups there was no statistically significant correlation between HbA1c and percentage of decrease in size of ulcer. However the time taken for wound healing did produce a statistical difference in that patients with lower HbA1c showed a decrease in time taken when compared to those with higher HbA1c.

Correlations

HbA1c		Percentage of decrease	Time Taken
	Pearson Correlation	-.014	.210
	P	.913	.108
	N	60	60

Generalized correlation was measured using Pearson Correlation wherein upward trend of HbA1c was studied with both percentage of decrease in ulcer size as well as time taken for wound healing. Using this statistical analytic tool there was no statistically significant correlation between the parameters.

DISCUSSION

Diabetic foot ulcers being one of the common complications of diabetes mellitus which in itself is an extremely common disease, it is an imperative to treat it as a multispecialty disease. Mainstay of treatment is debridement followed by proper dressings of the ulcer followed by closure. However many other factors need to be taken into consideration. Namely Glycemic control, superadded infection, arterial insufficiency, proper hygiene and foot care etc. They cause significant distress to the patients who are often unable to carry out their daily activities. Furthermore if left untreated, the patient may succumb to secondary infection leading to sepsis and in some cases even death.

Glycated Haemoglobin (HbA1c) is hemoglobin formed due to non enzymatic glycation pathway by its exposure to plasma glucose. Since RBC have a life span of 120 days, HbA1c gives an estimated average of plasma glucose levels of 3 months.

When blood glucose is elevated persistently, chemotaxis and phagocytosis are affected. Delayed Macrophage introduction and diminished leukocyte migration can cause prolonged inflammatory phase in wound healing. According to the American Diabetes Association, HbA1c in known diabetics must be maintained below 7% as optimal conditions for patients with diabetic foot as a complication.⁴

According to a study by Vella L, Gatt A and Formosa C it was concluded that baseline HbA1c reading was not a significant predictor of foot ulcer outcome. (p value = 0.603, resolved versus amputated).⁵ This study corroborates the current study wherein statistical significance could not be achieved. However in the same study the authors did find a significance in the time taken for wound healing (p =

0.009). In our current study statistical significance was found only among the group A or those with baseline HbA1c less than 7.5.

According to another study by Markuson M et al, healing time was found to be significantly lower in patients with lower HbA1c.⁶ While these were replicated in our study among those with HbA1c of less than 7.5, statistical significance could not be achieved in the patients in the groups with higher HbA1c.

It is in our opinion that while glycemic control is of utmost importance in the healing of a diabetic ulcer, baseline HbA1c may not be an adequate enough predictor for wound healing. This is mainly as patients once presented to the hospital have access to better quality of diabetes control. HbA1c reflect on the patient's glycemic control in the past 3 months. However it is more important for the current plasma glucose to be controlled adequately. Hence daily blood glucose levels are a better prognostic factor of a patient ulcer healing properties. In our study there was a significant p value in the time taken amongst those with low HbA1c (less than 7.5%). This signifies that baseline HbA1c may still affect the ulcer healing at this level. However as the HbA1c levels go higher there may not be much significance and will depend more on daily plasma glucose levels. Furthermore it is important to note that there are more important prognostic factors when it comes to diabetic foot ulcers such as microbiological index, adequate antibiotic coverage, proper foot hygiene, arterial insufficiency, adequate debridement and dressing.

Many surgeons may defer surgical closure by grafting or flap covers based on the poor glycemic control of the patient. This study can clarify that baseline glycated hemoglobin should not be taken as an absolute prognostic indicator for wound healing.

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