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RESEARCH ARTICLE

RELATIONSHIP OF GLYCAEMIC CONTROLL TO HEALING OF DIABETIC FOOT ULCERS

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ABSTRACT:

Diabetc foot ulcers are common in clinical practice. But serious complications can arise if the ulcers do not heal and if the blood sugar levels are not under control. An effort is made to quantify critical level of blood sugar for effective healing of diabetic ulcer. The wound healing (decrease in ulcer size) was not statistically significant when blood sugar levels were above 147mg%.. where as the wound size has decreased significantly to a mean of 12.8 cm2 when the blood sugar levels were below146mg%(P=0.023 and more so when the sugar levels fell below 110mg% to a mean of 7.42cm2 .(P=0.021) ; 18 out of 25 patients had residual raw area of <1cm2 at the end of study. Hence blood sugar levels below 140mg% can effectively help healing diabetic ulcers.

KEY WORDS: Diabetic foot ulcer Blood sugar levels Healing of Ulcer Glycemic control

INTRODUCTION

Diabetes is known to world from Egyptian medical literature since second century BC . Pryce was the first to record the association of diabetes with foot ulceration due to vasculopathy and neuropathy. It is all clinical teaching that “for ulcers to heal in diabetic patients glycemic control is essential”. Many studies stress on HbA_1C control which measures average blood sugar concentration over 90 day span of the average red blood cell in peripheral circulation. Higher the HbA1C level, the more glycosylation of haemoglobin in red blood cells will occur. Studies have shown that blood glucose levels >310mg%or HbA1C level > 12 is associate with decreased neutrophil function and chemotaxis. (McMurry JF) . In fact, higher blood glucose levels are associated with higher potential for suppressing inflammatory response and decrease host response to infection.(Alavi A). Here in this study e an attempt is made to quantify the critical blood sugar level to effect healing of diabetic foot ulcer The effect of glycemic control was estimated at various levels of blood sugar in healing of diabetic foot ulcers in 25 patients . It is observed that blood sugar levels below 146 mg% has resulted in faster healing of ulcers.

MATERIAL AND METHODS .

25 patients (18 males,7 females) from rural background and below poverty line between ages of 30- 70 years, randomly selected participated in this study. All of them were diabetic and had diabetic foot ulcers

The ulcer size varied from 15x14cms to 3x2 cms.

All the patients were diagnosed as diabetic for the first time

The blood sugar levels were monitored at 5 day intervals by glucose oxidase—peroxidise method. The wound size is measured by an improvised graph sheet printed on a PVC OHP transparency at 5 day intervals. Initial wound culture was done and appropriate antibiotics administered . Glycemic control was achieved by plain insulin in 20 patients and by mixtard in 5 patients. Blood sugar levels of 110 mgs at the end of 25 days ; wound size of < 1x1 cms is taken as the end point of glycemic control. All patients received same wound care by way of conventional dressings uniformly.

STATISTICAL ANALYSIS

Data was analyzed by Statistical Packages for Social Sciences (SPSS) version 16.0. The correlation between two variables for continuous normal data by using Karl Pearson's Correlation coefficient and for continuous non-normal data by using Spearman's Correlation coefficient. The difference between groups with the same subjects by using paired t-test for continuous normal data and Wilcoxon Signed Rank test for continuous non-normal data.
All p-values less than or equal to 0.05 statistically significant.

RESULTS & OBSERVA TIONS

Age group ranged from 37 to 78 years (mean—53.44). The initial blood sugar levels rangedfrom 370 to 240mg% . one patient had >500mg% without ketoacidosis. The ulcer size varied from 121cm^2 to 6cm^2 .The wound healing (decrease in ulcer size) was not statistically significant when blood sugar levels were above 147mg%.. where as the wound size has decreased significantly to a mean of 12.8 cm^2 when the blood sugar levels were below146mg% and more so when the sugar levels fell below 110mg% to a mean of 7.42cm^2 . Eighteen out of 25 patients(72%) achieved wound size of 1cm^2 by the end of study. The wound healing has not shown any relationship with age or duration of the ulcer.

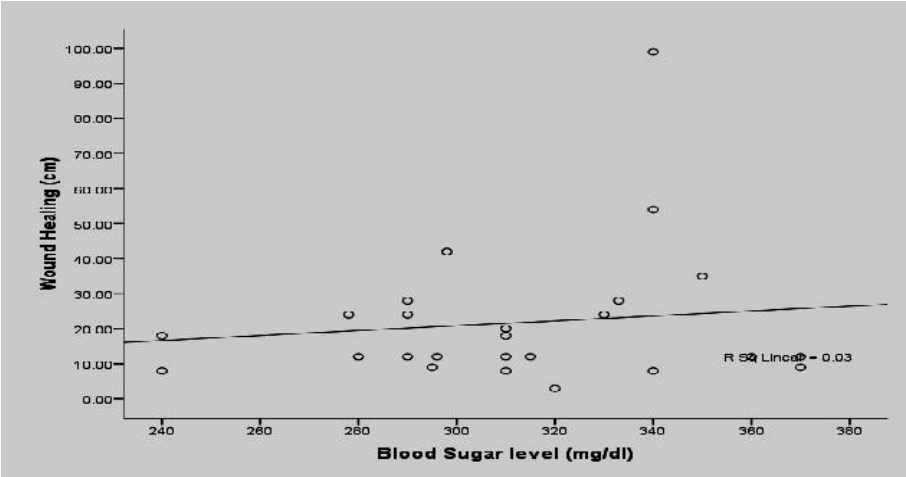

Figure-1:- Scatter plot between blood sugar level (>300mg/dl) and wound healing (cm) for the first time

Table-1:- Correlation between blood sugar level(>300 mg/dl) and wound healing (cm) for the first time

Parameter	*N*	*Mean*	*SD*	*r-value*	*P-value*	*Inference*
Blood Sugar level (mg/dl)	25	312.2	34.41	0.054	0.798	Not Significant
Wound Healing (cm)	25	21.72	20.03			

Figure-2:- Scatter plot between blood sugar level (189mg/dl) and wound healing (cm) for the second time

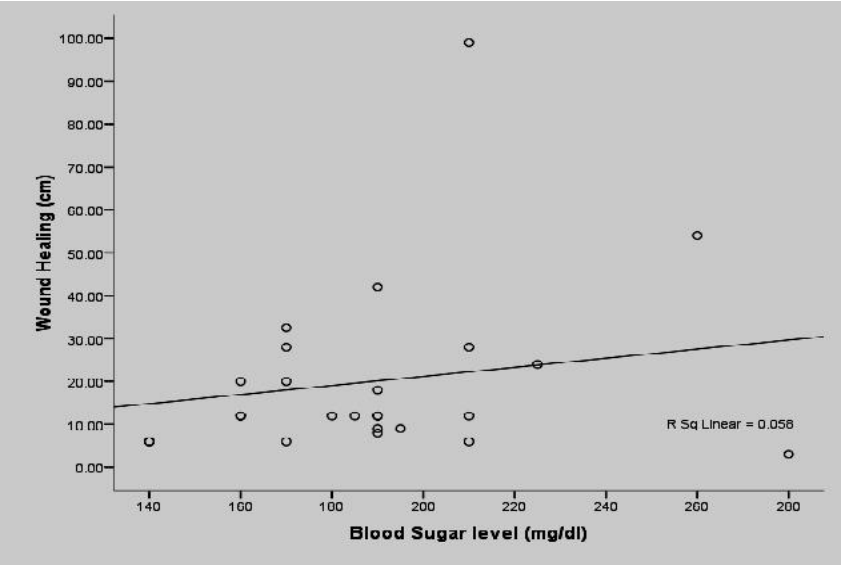

Table-2:- Correlation between blood sugar level (189mg/dl) and wound healing (cm) for the second time

Parameter	*N*	*Mean*	*SD*	*r-value*	*P-value*	*Inference*
Blood Sugar level (mg/dl)	25	189.8	32.45	0.168	0.423	Not Significant
Wound Healing (cm)	25	20.1	20.51			

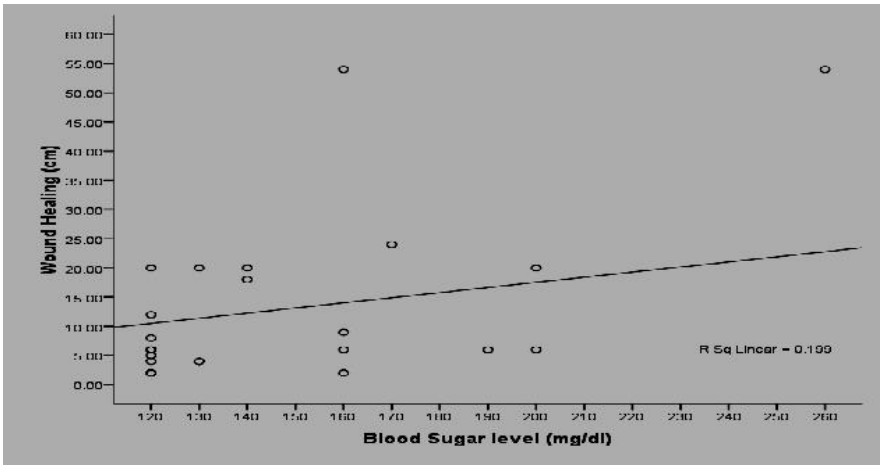

Figure-3:- Scatter plot between blood sugar level (146mg/dl) and wound healing (cm) for the third time data

Table-3:- Correlation between blood sugar level (146mg/dl) and wound healing (cm) for the third time

Parameter	*N*	*Mean*	*SD*	*r-value*	*P-value*	*Inference*
Blood Sugar level (mg/dl)	25	146.0	35.59	0.452	0.023	Significant
Wound Healing (cm)	25	12.8	14.19			

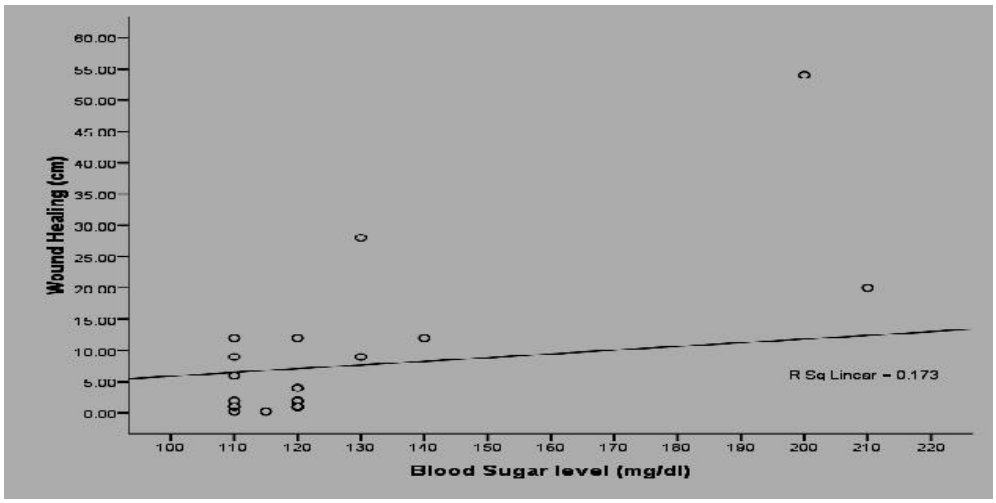

Figure-4:- Scatter plot between blood sugar level (125mg/dl) and wound healing (cm) for the fourth time

Table-4:- Correlation between blood sugar level (125mg/dl) and wound healing (cm) for the fourth time

Parameter	*N*	*Mean*	*SD*	*r-value*	*P-value*	*Inference*
Blood Sugar level (mg/dl)	25	125.4	25.08	0.458	0.021	Significant
Wound Healing (cm)	25	7.42	11.91			

DISCUSSION

The importance of essential control of blood sugar in diabetes for healing of diabetic foot ulcer is well known. Higher blood sugar levels hamper chemotaxis of leucocytes and also suppress inflammatory response. Pomposelli et al has indicated blood glucose levels greater than 220mg% on first post operative day was a sensitive predictor post op. infection and infection rates were 2.7 times higher than the patients with lower blood sugar levels. He concluded " no RCT has been performed to determine whether improved glucose control has benefits after a foot ulcer has developed".

The present study has clearly shown that blood sugar levels below 146mg% resulted in wound healing by 12.8 cms which is statistically significant (P=0.023). Further, at blood sugar levels of 110mg% or less, the ulcer healing is almost complete. Eighteen of 25 patients had good healing with residual raw area less than one cm.(P=0.021).

In contrast , the ulcers did not heal at all when the blood sugar levels are above 300mg% and even when controlled 189mg%.

This proves that for the systemic response to inflammation and chemotaxis and other healing mechanisms to start the blood sugar levels need to be less than 146 mg%.

HbA1C though is a good indicator of glycemic control in a span of 90 days, it does not help planning hypoglycaemic therapy on day to day basis. In this study glycemic control was achieved with human insulins

CONCLUSION

Diabetic foot ulcers heal better when Blood sugar levels of 145mg% or less are maintained. If the blood sugar levels are 110mg% the ulcer healing is almost complete.

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