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General Surgery

A STUDY OF CORRELATION BETWEEN GLYCOSYLATED HAEMOGLOBIN (HbA1c) AND FASTING LIPID PROFILE (FLP) IN DIABETIC FOOT WOUND HEALING

Mohammed Nadeem Nazim — PG student Yenepoya Medical College, Derelakatte, Mangalore, Karnataka, India.

M.S.Moosabba — HOD of General Surgery, Yenepoya Medical College, Derelakatte, Mangalore, Karnataka, India. - CORRESPONDING AUTHOR

ABSTRACT

INTRODUCTION- Foot infections in persons with diabetes are an increasingly common problem and are associated with potentially serious sequelae. Diabetic foot complications continue to be the main reason for diabetes-related hospitalization and lower extremity amputations.While there are no guidelines to use HbA1c as a screening tool, physicians consider its elevated value as an indicator of diabetes mellitus.

METHODOLOGY-105 patients between the age of 30-70 years who were diabetics with foot ulcers of maximum dimension 10cms x 10cms where included in the study. Each ulcer was studied for a period of 30 days. Diabetics with foot ulcers along with peripheral vascular disease/ underlying osteomyelitis and gangrene were excluded from the study. . In this study, we observed the rate of wound healing in relation to HbA1c and FLP levels. Data was analysed using Karl Pearson correlation between the variables and the rate of healing and their levels of significance.

RESULTS- The statistical analysis showed the mean value of the HbA1c (%) for the patients with Diabetic foot ulcer was 9.89%. in addition, 61.9% (n=65) were males with the mean age being 54.22 ± 9.580 (Mean±SD(Standard Deviation)). Patients with higher HbA1c levels took longer for wound healing when compared to patients with lower HbA1c levels. The average number of days taken for wound healing was 17.52 ± 6.048 (Mean±SD). Pearson's correlation test showed that the values of HbA1c have highly positive correlation with the number of days when compared to TC (Total Cholesterol), HDL(High Density Lipoproteins), LDL(Low density Lipoproteins), TG(Triglycerides) and VLDL(Very Low Density Lipoproteins). In the contrary, TC level contain highly negative correlation with the number of days (P Value=0.063).

CONCLUSION: With and increase in HbA1c levels, the wound took longer to heal and also levels of Cholesterol,LDL,TG were elevated in more than 60% of the patients . In this study, HbA1c was found to be a better predictor of diabetic wound healing.

KEYWORDS : Diabetic foot ulcer, HbA1C, Lipid profile

INTRODUCTION

Diabetic foot infections (DFIs) usually arise either in a skin ulceration that occurs as a consequence of peripheral (sensory and motor) neuropathy or in a wound caused by some form of trauma. Foot infections in persons with diabetes are an increasingly common problem and are associated with potentially serious sequelae. If the infection progresses, many patients require hospitalization and all too often, surgical resections or an amputation. Diabetic foot complic ations continue to be the main reason for diabetes-related hospitalization and lower extremity amputations.

While there are no guidelines to use HbA1c as a screening tool, physicians consider its elevated value as an indicator of diabetes mellitus. In most labs, the normal range of Hemoglobin A1c (HbA1c) for non diabetic patients is 4-5.9 % where in poorly controlled diabetes, its 8.0% or above and in well controlled patients it's less than 7.0%. Dyslipidemia has also been found to have an effect on diabetic wound healing. In this context, association of HbA1c and Lipid profile in the patients with diabetic foot ulcer can be significant in the study of diabetic foot ulcer management and treatment.

MATERIALS AND METHODS

An observational Study was conducted in patients who were diabetics with foot ulcers in department of surgery, Yenepoya medical college from October 2016 to October 2017. Clearance from the institutional ethical committee was obtained. 105 patients between the age of 30-70 years who were diabetics with foot ulcers of maximum dimension 10cms x 10cms where included in the study. Each ulcer was studied for a period of 30 days. Diabetics with foot ulcers along with peripheral vascular disease/ underlying osteomyelitis and gangrene were excluded from the study. Dressings with betadine and EUSOL along with debridement of the slough was being done daily. All the patients were on Human Actrapid which was being given according to sliding scale. In every patient , at the time of admission, HbA1c and FLP was assessed. In this study, the ulcers were classified by the University of Texas (UT) ulcer classification , which has a combined matrix of 4 grades (related to the depth of the wound) and 4 stages (related to the presence or absence of infection or ischemia). The classification successfully predicted a correlation of the likelihood of complications in patients with higher stages and grades and a significantly higher amputation rate in wounds deeper than superficial ulcers. The rate of wound healing in relation to HbA1c and FLP levels was observed. Data was analysed using Karl Pearson correlation between the variables and the rate of healing and their levels of significance.

The University of Texas Classification System for Diabetic Foot Wounds

RESULT

The statistical analysis showed the mean value of the HbA1c (%) for the patients with Diabetic foot ulcer was 9.89%.

Table 1: Age characteristics

	N	Minimum	Maximum	Mean	Std. Deviation
Age	105	33	70	54.22	9.580
Valid N (listwise)	105				

Table 2: Gender characteristics

SEX	Frequency	Percent	
Valid	Female	40	38.1
	Male	65	61.9
	Total	105	100.0

In addition, 61.9% (n=65) were males with the mean age being 54.22 ± 9.580 (Mean±SD).

Table 3: HbA1c, Cholesterol, HDL, LDL, TG and Number of Day values in patients with DFU

	N	Minimum	Maximum	Mean	Std. Deviation
Hba1c	105	7	15	9.89	2.157
TC	105	80	227	152.06	37.685

TG	105	11	302	140.97	62.779
HDL	105	12	54	29.17	10.764
LDL	105	37	167	98.29	29.739
VLDL	105	10	76	29.25	13.943
Days	30	6	30	17.52	6.048
Valid N (listwise)	105				

Patients with higher HbA1c levels took longer duration for wound healing when compared to patients with lower HbA1c levels. The average number of days taken for wound healing was 17.52 ± 6.048 (Mean±SD).

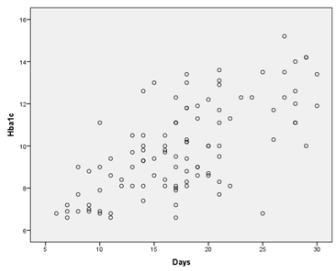
Table 4: Correlation between HbA1c and Days

	Hba1c		Days
Hba1c	Pearson Correlation	1	.665**
	Sig. (2-tailed)		.000
	N	105	105
Days	Pearson Correlation	.665**	1
	Sig. (2-tailed)	.000	
	N	105	105

**. Correlation is significant at the 0.01 level (2-tailed).

The Karl Pearson correlation coefficient between Hba1c and days is 0.665(PValue<0.001).There is a moderate correlation between Hba1c and Days and its statistically significant at 1% level of significance.

Scatter chart 1: HbA1c and Days



Pearson's correlation test showed that the values of HbA1c have highly positive correlation with the number of days when compared to Cholesterol, HDL, LDL, TG and VLDL. In the contrary, TC level contain highly negative correlation with the number of days (P Value=0.063).

Table 5: Correlation between TC and Days

	TC		Days
TC	Pearson Correlation	1	-.182
	Sig. (2-tailed)		.063
	N	105	105
Days	Pearson Correlation	-.182	1
	Sig. (2-tailed)	.063	
	N	105	105

The Karl Pearson correlation coefficient between Tc and days is -0.182(PValue=0.063).There is a negative correlation between TC and Days and its statistically nonsignificant at 1% level of significance.

Scatter chart 2: TC and Days

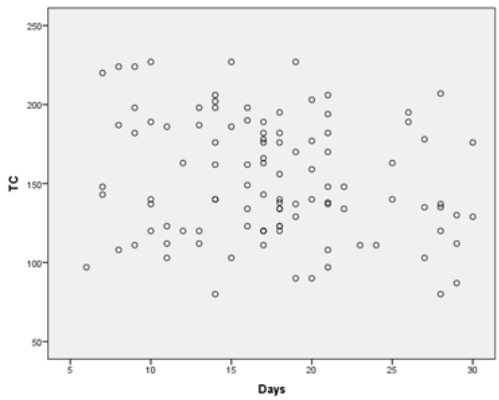


Table 6: Correlation between TG and Days

	TG	Days	
TG	Pearson Correlation	1	-.035
	Sig. (2-tailed)		.723
	N	105	105
Days	Pearson Correlation	-.035	1
	Sig. (2-tailed)	.723	
	N	105	105

Scatter chart 3: TG and Days

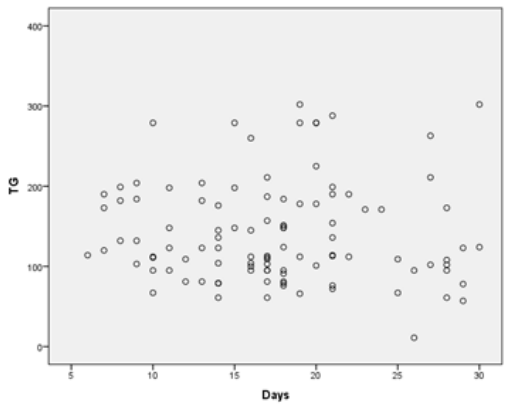


Table 7: Correlation between HDL and Days

	HDL		Days
HDL	Pearson Correlation	1	-.057
	Sig. (2-tailed)		.564
	N	105	105
Days	Pearson Correlation	-.057	1
	Sig. (2-tailed)	.564	
	N	105	105

Scatter chart 4: HDL and Days

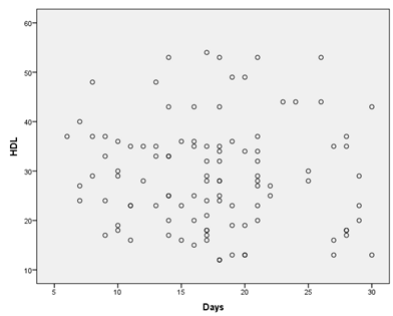


Table 8: Correlation between LDL and Days

	LDL		Days
LDL	Pearson Correlation	1	-.102
	Sig. (2-tailed)		.298
	N	105	105
Days	Pearson Correlation	-.102	1
	Sig. (2-tailed)	.298	
	N	105	105

Scatter chart 5: LDL and Days

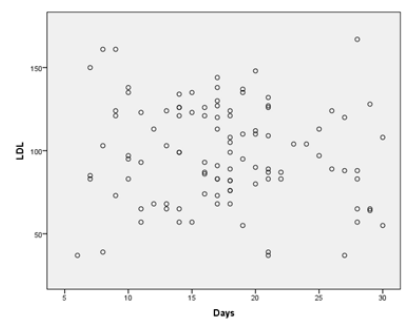
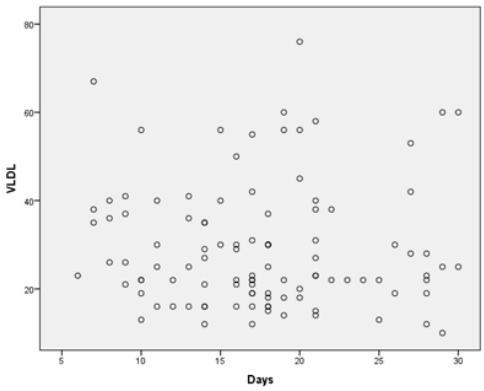


Table 9: Correlation between VLDL and Days			
	VLDL	Days	
VLDL	Pearson Correlation	1	-.020
	Sig. (2-tailed)		.843
	N	105	105
Days	Pearson Correlation	-.020	1
	Sig. (2-tailed)	.843	
	N	105	105

Scatter chart 6: VLDL and Days



DISCUSSION

Lower extremity amputation is a long-term major concern in patients suffering from diabetes mellitus and is often preceded by neglected and untreated foot ulcers. 1-4% of people develop foot ulcer each year and can result in gangrene/ amputation associated with socioeconomic impact, and globally 70% of all leg amputations occur in people with diabetes. Increased HbA1c level is considered to be a positive indicator of uncontrolled glucose in blood. This study evaluated the level of HbA1c in diabetic patients and its effect on wound healing rate. The delayed rate of wound healing with increased HbA1c level may a significant observation in the management of diabetic foot ulcer and this finding correlated with our study.

A study conducted by C.M.M. Hasan et al 1 showed that the values of HbA1c have highly positive correlation with the values of Cholesterol, LDL and TG.

In a study by Andrea L. Christman et al 2 showed that their results suggest that glycemia, as assessed by HbA1c, may be an important biomarker in predicting wound healing.

In another study by Mohammad Zubair et al3 showed HbA1c is a good tool for monitoring diabetes and its complications such as foot ulcers. In a study by R Shashanka et al4 suggests that slower wound healing is associated with increased HbA1c levels and can be considered as an independent biomarker in assessing wound healing in patients with diabetic foot ulcer.

Regarding lipid profile, the level of serum cholesterol, triglycerides and LDL are higher in this group of patients. This finding can be correlated to the fact that being a metabolic disorder, diabetes mellitus causes altered protein and lipid metabolism and thereby favours the disease progression.

C.M.M. Hasan et al 1 showed that with the increase of HbA1c level, Cholesterol, LDL and TG level increases in DFU patients. Also, HDL level contain highly negative correlation with other parameters ($p<0.01$). In a study by Dr. Shibu T S et al 5 the level of serum cholesterol, triglycerides and LDL are higher in this group of patients. This finding can be correlated to the fact that being a metabolic disorder diabetes mellitus causes altered protein and lipid metabolism and thereby favors the disease progression.

CONCLUSION:

The data indicates that majority of the patients have the HbA1c levels between 8% and 11% with an average value of 9.89% where normal range is less than 5.7% and 5.7%-6.4% in pre-diabetics. It was found that with increase in HbA1c levels, the wound took longer to heal and also levels of Cholesterol, LDL, TG were elevated in more than 60% of the patients, with the least correlation being in TC and highest in LDL (amongst FLP).

The data analysis also indicates that male persons are at the greater risk of foot ulcer than those of female person. It was also found that foot ulcer more frequently occurs in patients aged more than 45 years. In this study, HbA1c was found to be a better predictor of diabetic wound healing.

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