TYPE 2 DIABETES MELLITUS: HOW WELL CONTROLLED IN OUR PATIENTS?

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Background: Type 2 Diabetes mellitus has reached epidemic proportions worldwide and Pakistan is no exception. This study was done to see the glycaemic control of our diabetic patients by estimating Glycosylated haemoglobin & Fasting blood glucose as poor control leads to significant complications causing enormous human suffering & socioeconomic burden. **Method:** This Cross-sectional study was conducted on Type 2 diabetic patients coming to medical OPD and medical B ward of Ayub Teaching Hospital between March–September 2007 fulfilling the inclusion criteria. **Results:** Among 100 patients with type 2 diabetes forty two had HbA_1c more than 7.5 %, while seventy had fasting blood glucose more than 120 mg/dl. All patients with HbA_1c more than 7.5% had increased fasting blood glucose. While thirty out of seventy patients with fasting blood glucose more than 120 mg/dl had HbA_1c less than 7.5%. None of the patients with fasting blood glucose less than 120 mg/dl had HbA_1c more than 7.5%. **Conclusions:** Significant number of patients (42%) had poor control of diabetes as revealed by HbA_1c, with FBG showing poor control in even more patients, i.e., 70%. However their blood glucose estimation was not frequent enough as required. Blood glucose results can be spuriously high and may lead to frequent change/ increase in the dose of hypoglycaemic medications. This can lead to poor compliance as well as psychological trauma to patients. HbA_1c on the other hand is easy to interpret, reflects long term glycaemic control and cost effective. We recommend its more frequent use along with blood glucose for better glycaemic control and decreased chances of complications.

Keywords: Glycosylated Haemoglobin, Fasting Blood Glucose, Type 2 Diabetes mellitus

INTRODUCTION

The incidence and prevalence of type 2 diabetes mellitus is increasing at an alarming rate especially in the developing countries.[1] It is a bipolar disease with multifactorial inheritance.[2,3] Although an association between elevated blood glucose level and micro/macro vascular complications has been recognized for a long time, it was not until the last decade, that definite proof of benefit of glycaemic control in preventing long term complications was published.[4] It has been established that lowering HbA_1c (which is non enzymatic binding of glucose with free amino group of globin chain) by 1%, e.g., from 8% to7% will reduce the risk of diabetes related end points by 21%.[5] A linear relationship exists between hyperglycaemia and diabetes related complications meaning that risk reduction was seen for all level of HbA_1c.[5,6] Therefore the importance of good glycaemic control cannot be over estimated. Both the duration and degree of hyperglycaemia play a role in the pathogenesis of tissue damage. Thus it is well recognized, that near normal glycaemic control prevents subsequent diabetic complications.[4,7] Self monitoring of blood glucose has been recommended[8] and a common view is that it should form part of an integrated management programme, i.e., to check blood glucose at least twice a day.[9] However in one study, over two third of diabetic patients were not regular in monitoring their blood glucose.[10] HbA_1c on the other hand needs to be done every 8–12 weeks and truly reflects the glycaemic control over this period.[11–13] Therefore it is easy for the doctor as well as the patients to monitor the diabetic status by this method.

This study was conducted to examine the over all glycaemic control in our type 2 diabetic patients by estimating HbA_1c and simultaneously measuring the blood glucose. The aim was also to see the association between the fasting blood glucose and the HbA_1c and to encourage more frequent use of HbA_1c as a tool in monitoring diabetic status along with blood glucose. HbA_1c is easy to determine, reflects glycaemic control over prolonged period and cost effective. That is why it is recognized as a useful parameter in management of diabetic patients.[4,6–10]

METHODS AND MATERIAL

Hundred patients with at least two years history of type 2 diabetes, fulfilling the inclusion criteria, were recruited for the study from diabetic patients who presented to medical B unit and medical OPD of Ayub Teaching Hospital Abbottabad (between Mar to Sep 2007). Fasting blood glucose and HbA_1c were measured. Previous records of blood glucose, if available, were also noted. The data was collected on a questionnaire and categorical variables were described in terms of frequencies and percentages.

RESULTS

Hundred patients were enrolled in the study, incidentally half of them being female. Glycosylated

haemoglobin of these patients was measured (Biosystems method) as recorded in the Table-1. Eighteen 42% of our patients had poor and 58% of the patients had good to normal long term control of blood glucose matched against the criteria.

Table-1: Glycaemic status of Patients according to HbA$_1$c

Glycosylated Haemoglobin (HbA1c)A1	Glycaemic Status	Number
< 6.7% *	Normal	46
6.7– ≤ 7.5%	Good	12
> 7.5%	Poor	42

*Referenced to a non-diabetic range of 4.4-6.7 using Bio-Systems based assay

Fasting blood glucose (FBG) was estimated simultaneously with glycosylated haemoglobin. The results are shown in the Table-2. The cut off point was the upper limit of fasting blood glucose taken as 120 mg/dl beyond which further measures for glycaemic control need to be taken.[19,20] In terms of fasting blood glucose 70% of the patients had poor blood glucose control and 30% had good control.

Table-2: Distribution of Patients according to their FBG

Blood glucose	No of patients
>120 mg/dl	70
<120 mg/dl	30

Table-3: Comparison of Patients according to their FBG & HbA$_1$c

FBG	No. of Patients	HbA$_1$c	No. of Patients
>120 mg/dl	70	>7.5 %	40
>120 mg/dl	70	≤7.5 %	30
≤120 mg/dl	30	>7.5%	None
≤120 mg/dl	30	≤7.5 %	30

Comparison of fasting blood glucose and HbA$_1$c revealed that all the patients with poor range HbA$_1$c as shown in (Table-1) had increased fasting blood glucose, while 30 patients with increased fasting blood glucose had acceptable HbA$_1$c (Table-3), i.e., FBG was spuriously high. On the other hand none of the patients with fasting blood glucose less than 120 mg/dl had poor range HbA$_1$c (Table-3).

DISCUSSION

The increase in the incidence and prevalence of type 2 diabetes in the last decade and the recognition that achieving specific glycaemic goals can substantially reduce diabetes related complications; have made the effective treatment of hyperglycaemia a top priority.[1,4,5] There is high prevalence of long-term diabetic complications in our patients responsible for substantial economic burden.[15] It is, therefore, important to achieve good control of diabetes to reduce long-term diabetes related morbidity.[4,7]

Prevention of diabetic complications means not only benefit to the patients, but also to reduce the health care expenditures.

Mostly the blood glucose measurements are relied upon for the control of diabetes. Unfortunately they are not done more often, usually once in 1–2 months interval in a majority of our patients which is consistent with other studies.[10] It may not reflect the overall glycaemic picture in patients. Studies carried out in selected clinic population or under experimental trial conditions have shown that occasional blood glucose test can be inaccurate, unreliable, may not be interpreted by patients correctly and can cause psychological harm.[6,17] Another method to monitor diabetes is through HbA$_1$c, which correlates well with overall blood glucose level for the past 2–3 months. American diabetes Association and the European Association for the study of diabetes recommend HbA$_1$c estimation for monitoring diabetes.[19] Similar views are highlighted in UKPDS. The reference value can vary from lab to lab depending on the method used but a common value system can be devised as shown in Table-4 using Bio-Systems based assay.

Table-4: Bio-systems based values of Glycosylated Haemoglobin[18]

Glycosylated Haemoglobin	Glycaemic Status
4.4–6.7 %	Normal
≤7.5 %	Good
>7.5 %	Poor

Significant number of patients in our study had poor control of diabetes despite their suffering for quite sometime (enrolled patients had disease for more than 2 yrs). Blood glucose levels were abnormal in 70% of patients and forty out of them had HbA$_1$c in poor range. However despite increase in fasting blood glucose of thirty patients, their HbA$_1$c was in acceptable range. This explains the fact that fasting blood glucose can be high despite good overall glycaemic state. This can lead to psychological trauma and frequent increase or change in hypoglycaemic medication. All patients having fasting blood glucose in normal range were found to have acceptable HbA$_1$c levels.

Type 2 diabetes is a complex disease and epidemic nowadays.[19] The achievement and maintenance of normal glycaemic goals should be the priority. As we, now, definitely know that long-term complications can be substantially reduced and enormous human suffering as well as economic costs avoided by measures that achieve glucose levels close to the non-diabetic range.[4,5,7] So it can be safely concluded that:

1. More than 1/3 of patients 42% had poor control of diabetes stressing that further measures need to be taken for better glycaemic control.

2. Estimation of blood glucose in most patients was infrequent. It needs to be done more often.

3. HbA$_1$c is reliable and cost effective diagnostic tool. It should be used along with blood glucose for better glycaemic control. Since its interpretation is easy, it will facilitate the doctors and benefit the patients.

4. Patients need to have more awareness and education about the disease so as to improve the quality of life and to minimize the risk of complications.

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REFERENCES

1. World health organization, Definition, diagnosis and classification of diabetes mellitus and its complications. Report of a WHO consultation. Part 1; Diagnosis and classification of diabetes mellitus .Geneva; World Health Organization, 1999.
2. Expert Committee on the Diagnosis and Classification of Diabetes Mellitus. Report of the Expert Committee on the Diagnosis and Classification of Diabetes Mellitus. Diabetes Care. 1997;20:1183–97.
3. Scheen AJ, Lefebvre PJ. In; Di Mario U, Leonetti F, Pugliese G, Sbraccia P, Signore A, eds. Diabetes in the New Millennium New York: Wiley and sons; 2000.p 101–13.
4. UK Prospective Diabetes study (UKPDS) group. Intensive blood glucose control with sulphonylureas or insulin compared with conventional treatment and the risk of complications in patients with type II DM (UKPDS 33) Lancet 1998;352:837–53.
5. Stratton IM, Adler AI, Neil HA, Matthews DR, Manley SE, Cull CA *et al.* Association of glycemia with macrovascular and microvascular complications of type 2 diabetes (UKPDS 35): prospective observational study. BMJ 2000;321:405–12.
6. Evans JMM, Newton RW, Ruta DA, MacDonald TM, Stevenson RJ, Morris AD. Frequency of blood glucose monitoring in relations to glycaemic control: observational study with diabetes database. *BMJ* 1999;319:83–6.
7. DCCT Research Group. The effect of intensive treatment of diabetes on development and progression of long-term complications in insulin dependant diabetes mellitus. N Eng J Med 1989;329;977–86
8. Davis M, Day J. Screening for NIDDM; how often should it be performed. J Med Screening. 1994;1:78–81.
9. American Diabetes Association. Consensus statement on self–monitoring of blood glucose. Diabetes Care 1994;17:81–6.
10. Harris MI, Cowie CC, Howie LJ. Self monitoring of blood glucose by adults with diabetes in the United States population. Diabetes care. 1993;16:1116–23.
11. Peters AL, Davidson MB, Schriger DL, Hasssel Blad V. A clinical approach for the diagnosis of diabetes mellitus ; an analysis using glycosylated haemoglobin levels. JAMA 276;1996:1246–52.
12. Clutter WE: Meta-analysis: glycosylated hemoglobin levels are useful for diagnosing diabetes. ACP Jrn Club 126;1997:46.
13. American Diabetes Association : Screening for diabetes (position statement).Diabetes Care 2002;25(Suppl-1);S21–S24.
14. Alberti K, Zimmer P. Definition, diagnosis and classification of Diabetes mellitus and its complications, part1: diagnosis and classification of diabetes mellitus, provisional report of a World Health Organization consultation. Diabet Med.1998;15:539–53.
15. Basit A, Hakeem R. Hydrie Z I, Ahmedani Y, Masood Q. Frequency of chronic complications of type 2 diabetes in subjects attending a tertiary care unit in Karachi, Pakistan.18th International Diabetes Federation Congress, PARIS 2003;1–40.
16. Silverman. The Relationship of plasma Glucose and HbA1c Levels among Emergency Department patents with no prior history of Diabetes Mellitus. Acad Emerg Med 2006;13:722–6.
17. Patrick AW, Gill GV, MacFarlane IA, Cullen A, Power E, Wallymahmed M. Home glucose monitoring in type 2 DM: is it waste of time? Diabetic Med 1994;11:62–5.
18. Kilpatrick. Glycated haemoglobin in the year 2000. J Clin Pathol 2000;53:335–9.
19. David MN, John BB, Mayer BD, Robert JH, Rury RH, Robert S, Bernard Z. Management of Hyperglycemia in Type 2 Diabetes: A consensus algorithm for initiation and adjustment of therapy; A consensus statement from the American Diabetes Association and the European Association for the Study of Diabetes. Diabetes Care 2006;29:1963–72.
20. Sacks DB, Burns DE, Goldstein DE, Maclaren NK, McDonald JM, Parrott M. Guidelines and recommendations for laboratory analysis in the diagnosis and management of diabetes mellitus. Clin Chem 2002;48:436–72.

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