Original Article

Glycemic Status of Type 2 Diabetic Subjects On Different Anti-Diabetic Management

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Abstract:

Background: *Diabetes mellitus (DM) is a complex multi-system disorder that may lead to diabetes specific complications and target organ damage which can be prevented or delayed by good or strict glycemic control. Our aims were to evaluate the glycemic status of adult type 2 DM (T2DM) patients on different anti-diabetic management, to evaluate role of education and economic status on glycemic control and to correlate glycemic status with complications.*

Methods: *This cross-sectional study was conducted in BIRDEM General Hospital from November 2013 to April 2015. Data were collected in a pre-formed data collection form, purposively and consecutively from 300 T2DM patients who were diagnosed as diabetic for 3 months or more and were compliant, after face to face interview and undergoing the required physical examinations. Then data were compiled and analyzed accordingly.*

Result: *Neither the educational level nor the monthly income had any influence on glycemic control. Only 17% of the patients had good glycemic control (HbA1c <7) in spite of different anti-DM managements. The overall mean $HbA1_C$ was 8.9±1.9%, among which the group of patients with medical nutrition therapy had the lowest mean HbA1c level (8.5±1.3%). Chronic kidney disease and polyneuropathy are the two commonest (45% and 40% respectively) complications with a significant (r=1, p=0.000) positive correlation between both macro and microvascular complications of DM with uncontrolled glycemic status.*

Conclusion: *From the current study it can be concluded that glycemic control is rarely achieved and no treatment regimen is superior to other in achieving glycemic control. Patients educational or income level did not have any influence in glycemic control and there is a strong positive correlation between uncontrolled T2DM and it's complications.*

Key words: *Anti-diabetic management, complications of diabetes, glycemic status, type 2 diabetes mellitus.*

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Introduction

The prevalence of diabetes mellitus (DM) is increasing. Globally 347 million people are suffering from DM.[1] WHO projects that diabetes will be the 7th leading cause of death in 2030.[2] Ninety percent of total diabetic patients are having type 2 diabetes mellitus (T2DM).[3] Starting with the discovery of insulin in 1921, a long list of therapeutic options are available for treating DM. It is now established that good glycemic control reduces or at least delays diabetes specific complications.[4,5] Targets of glycemic controls are advocated by different authorities.[6,7] Most T2DM patients can be treated at out-patient (OPD) visits but glycemic targets are reached in up to one-third of cases.[8-10] Some of the rest two-third of cases requires hospitalization at some point and

necessitate readjustment of the dose of anti-diabetic drugs or institute a new drug. This study is designed to evaluate the glycemic status of adult T2DM patients at tertiary care settings at the time of hospitalization.

By the WHO, DM is considered as epidemic which is strongly related to lifestyle and economic changes. Diabetes magnifies the risk of vascular diseases several fold and is thus one of the major causes of morbidity and mortality worldwide. The availability of wide range of oral and injectable anti diabetic drugs gave us the hope of preventing complications of diabetes by achieving good glycemic control. This study will help us to understand the effect of different anti-diabetic drugs on glycemic status in study population which can be a guide for us to choose appropriate anti-diabetic drug(s) for good glycemic control of our patients and thereby lessen the burden of morbidity and mortality related to diabetes.

Our objectives were to evaluate the glycemic status of adult T2DM subjects at admission, to compare glycemic status of T2DM patients on different anti-diabetic medications, to evaluate the role of occupation, education and economic status on glycemic control and to correlate glycemic status with complications during admission at hospital.

Methods
Study Design

This cross-sectional observational study with descriptive and analytical component was undertaken in Department of Internal Medicine of BIRDEM General Hospital from November 2013 to April 2014. Data were collected in a preformed data collection form, from consecutive three hundred patients with type 2 diabetes mellitus who got admitted within the study period.

The adult non-pregnant T2DM subjects on regular anti-diabetic medications with duration of T2DM for three months or more were included. But the newly detected T2DM patients (duration of disease less than three months), type 1 DM and gestational diabetes mellitus (GDM) and other specific type of diabetes and non-compliant patients were excluded.

Operational Definitions:
DM: The current WHO diagnostic criteria for diabetes-
- Fasting blood glucose ≥ 7.0 mmol/l
- 2-hours after ingestion of 75 gm glucose ≥ 11.1 mmol/l.[7]

Glycemic control: Targets are-
- Fasting blood glucose: Â 6.0 mmol/L
- HbA1$_c$: Â 7.0%
- 2-hour postprandial blood glucose: Â 8.0 mmol/L[7]

Compliant patients: Diabetic patients strictly adherent to prescribed medication at least for last two follow up.

Sampling Technique:
As study population was limited, purposive sampling technique was adopted.

Statistical Analysis
After collection all the data were checked and edited. Then data were entered into computer with the help of software SPSS for windows programmed version 20. After frequency run, data were cleaned and frequencies were checked. Each respondent has been given as his own code and was entered separately. An analysis plan was developed keeping in view with the objectives of the study. Data have been analyzed with this software where there are frequency table of the variables with mean, median standard deviation.

Ethical Considerations
Informed written consent was taken from all patients/guardians regarding storage of medical data and possible use for scientific research without disclosing their identity. In this study no intervention was planned and identity of the recipients was not disclosed.

Results
Study population consisted of three hundred patients who were at regular follow up prior to hospitalization in internal medicine of BIRDEM General Hospital of whom 64% were female. Mean age of the patients were 54.79 ± 10.28 years [maximum patients are from 50 to 59 years of age (111, 37%)] with mean BMI 24.34 ± 4.61 (table 1).

Table I. Base-line characteristics	
Character	Value
Age (mean±SD)	54.79 ± 10.28
Male:Female	108:192
Weight (kg) [mean±SD]	59.59 ± 12.43
Height (cm) [mean±SD]	155.44 ± 8.49
BMI (kg/m^2) [mean±SD]	24.34 ± 4.61

The mean HbA1$_c$ of these patients was $8.9 \pm 1.9\%$, reflecting poor glycemic control and explains presence of both macro- and micro-vascular complication during hospitalization (table 2, 3, 4). Commonest co-morbidity

was hypertension (HTN) and commonest complication of DM was chronic kidney disease (CKD) (table 4). In general, the glycemic control was poor in every age group, still patients aging 30 to 39 years showed relatively good control (HbA1$_C$ was < 7% in 44% of patients of this age group) (table II).

Table II. HbA1c of different age group

Age group (years)	No, of patients [n (%)]	HbA1c <7% [n (%)]	HbA1c ≥7% [n (%)]
<30	6 (2%)	2 (33%)	4 (67%)
30-39	9 (3%)	4 (44%)	5 (56%)
40-49	63 (21%)	12 (19%)	51 (81%)
50-59	111 (37%)	9 (8%)	102 (92%)
60-69	87 (29%)	21 (24%)	66 (76%)
≥70	24 (8%)	3 (12%)	21 (88%)

Fasting blood glucose (FBG), post prandial blood glucose (PPBG) of after breakfast (ABF), after launch (AL), after dinner (AD) all were way beyond the target value in these patients (table III)

Only 18(6%) patients were on diabetic diet only and most of the patients (195, 65%) were on insulin. Glycemic control was found to be inadequate in all the patients whichever the treatment is (table V).

Among our three hundred patients, most of them had educational background of secondary or higher secondary level with monthly income of 10,000 to 30,000 taka. Satisfactory glycemic control was found more in uneducated study population and persons with least income group (table VI - VII).

All the macro- and micro-vascular complications in our study population was common after 15 years of DM except cerebro-vascular disease, which was evident in patients with DM of less than 10 years. Incidence of

these the complications were less in patients with good glycemic control. (table VIII)

Table III. Glycaemic status

		Frequency	Percent
HbA1c %	Mean	8.9 ± 1.9	
	<7	51	17
	7-8.5	137	46
	>8.5	112	37
FBG (m.mol/L)	Mean	10.37 ± 4.2	
	<6.0	27	9
	≥6.0	273	91
PPBG (m.mol/L) ABF	Mean	13.43 ± 4.4	
	<8.0	30	10
	≥8.0	270	90
PPBG (m.mol/L) AL	Mean	13.77 ± 5.2	
	<8.0	33	11
	≥8.0	227	89
PPBG (m.mol/L) AD	Mean	12.24 ± 5.1	
	<8.0	51	17
	≥8.0	249	83

Table IV. Co-morbidities and complications of DM during hospitalization

Co-morbidities	Frequency	Percent
Hypertension	255	85
Ischaemic heart disease	81	27
Chronic kidney disease	135	45
Non-alcoholic fatty liver disease	0	0
Dyslipidaemia	102	34
Stroke	21	7
Hypothyroidism	36	12

Table V. Glycaemic status of patients on different anti-diabetic management

Anti-diabetic management	Frequency, percent	Mean BMI	Mean HbA1c (%)	Mean FBG (m.mol/L)	Mean PPBG (m.mol/L)
Diet	18 (6%)	23.8 ± 3.1	8.5 ± 1.3	9.9 ± 3.3	12.3 ± 3.8
Oral drugs	30 (10%)	24.1 ± 4.6	8.8 ± 2.3	9.3 ± 2.7	12.9 ± 3.4
Insulin	195 (65%)	24.0 ± 4.2	8.8 ± 2.0	10.6 ± 4.5	13.4 ± 4.8
Combinations	57 (19%)	26.0 ± 5.9	9.2 ± 1.5	10.2 ± 3.6	14.2 ± 3.6

Table VI. Status of glycemic control in patients from different educational background

Education	Total patient(pt) n (%)	No of pt with HbA1c <7n (%)	No of pt with HbA1c ≥7n (%)
None	36 (12%)	15 (42%)	21 (58%)
Primary	45 (15%)	3 (7%)	42 (93%)
Secondary	84 (28%)	15 (18%)	69 (82%)
Higher Secondary	84 (28%)	12 (14%)	72 (86%)
Graduate	45 (15%)	6 (13%)	39 (87%)
Post graduate	6 (2%)	0 (0%)	6 (100%)

Table VIII. Status of glycemic control in patients from different income group

Income range	Total patient n (%)	No of pt with HbA1c <7n (%)	No of pt with HbA1c ≥7n (%)
< 10,000/month	84 (28%)	30 (36%)	54 (64%)
10,000 to < 30,000/month	138 (46%)	21 (15%)	117 (85%)
30,000 to < 50,000/month	45 (15%)	0 (0%)	45 (100%)
> 50,000/month	33 (11%)	0 (0%)	33 (100%)

Table IX. Relationship of complication during admission at hospital with mean duration of DM and glycemic control.

Complications	Number of patients	Mean duration of DM (years)	No. of patients with HbA1c <7 %	No. of patients with HbA1c ≥7 %
Ishcaemic heart desease	81	15.49 ± 10.09	6	75
Chronic kidney disease	135	15.18 ± 8.24	24	111
Cerebrovascular disease	21	7.73 ±3.87	3	18
Diabetic retinopathy	120	15.35 ± 8.21	12	108
Diabetic polyneuropathy	81	16.11 ± 9.66	12	69
Peripheral vascular disease	9	17.26 ± 6.27	3	6

* significant (r=1, p=0.000) positive correlation between both macro and microvascular complications of DM with uncontrolled glycemic status.

Discussion

Diabetes mellitus is a leading cause of death and disability worldwide. Its global prevalence was about 8% in 2011 and is predicted to rise to 10% by 2030. Nearly 80% of people with diabetes live in low- and middle-income countries. Asia and the eastern Pacific region are particularly affected: in 2011, China was home to the largest number of adults with diabetes (i.e. 90.0 million, or 9% of the population), followed by India (61.3 million, or 8% of the population) and Bangladesh (8.4 million, or 10% of the population).[11] Globally 60% of the people with DM are of Asian descendant. 40% of all people with diabetes in least developed countries live in Bangladesh.[12] Only 7.8% of people with diabetes in Bangladesh can achieve the target.[13]

In this study these relatively well glycemic control was found in illiterate and low income society' patients. On

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the other hand in a few highly educated and representative of high society population group reflects relatively poor control of DM, which can be explained by their uncontrolled dietary habit and sedentary lifestyle.

Associations with glycemic control with educational level and socioeconomic status vary internationally. The associations found in this study, between these two factors and diabetes have also been observed previously in Bangladesh, China and India. In contrast, another study in China found that the prevalence of diabetes was generally unaffected by educational level but was higher in the high-income group. Moreover, studies from both developing and developed countries have found inverse associations between diabetes and educational level and household socioeconomic status.[14]

It's a fact that having high blood glucose levels over a long period of time will cause damage to the large blood vessels in heart, brain and feet and smaller blood vessels supplying eyes, kidneys and nerves. Prolong uncontrolled DM had led to various macro- and micro-vascular complications in my study population. However, it is important to maintain a healthy blood pressure and cholesterol level to reduce existing risk of complications.

In a study on more than 8000 Bangladeshi population, Akhter S et al had pointed out the following barriers of good outcome in DM control [11] -

- The unavailability of health insurance, except in small areas of the country where it is provided by programs run by nongovernmental organizations

- Inadequately trained staff and limited health-care facilities in rural areas

- Rapid lifestyle changes caused by urbanization

- The absence of health awareness programs in the education curriculum.

This study was done only in 300 hospitalized populations. This can give an insight of the current status and response to management of antidiabetic management with burden of complications in patients from various age group, socio-economic and educational background in our country.

In conclusion, good glycemic control is the sole way to keep a diabetic person healthy and avoid the disabling and life threatening complications. To achieve this, our target should be to overcome the following barriers of good glycemic control –

- Lack of education and awareness about diabetes, its complications and its cost

- Lack of high-quality health care professionals and clinics, long distance to facilities and long waiting time for treatment

- It is difficult for many people with diabetes to remember medication and follow scheduling, many have a fear of injections, and many are stigmatized and have psychological issues

- Many cannot afford medicine and treatment services, the majority do not have health insurance or access to other finance solutions, and the healthcare system is lacking the necessary resources to treat diabetes

- Some medicines/package solutions are not available in the country or in the region

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