

Predictors of Glycemic Control among Patients with Type 2 Diabetes in Najran Armed Forces Hospital: A Pilot Study

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Abstract

Background: Diabetes mellitus is a serious condition with potentially devastating complications that affects all age groups worldwide. The purposes of this study are to describe the glycemic control levels and to determine the associated factors of poor glycemic control among type 2 diabetes patients followed in Najran Armed Forces Hospital. **Methods:** We conducted a retrospective analysis of administrative data from adult patients with diabetes type 2 followed in NAFH clinics. To be included in the pilot study, patients needed to meet the following criteria: 1) Be identified as having diabetes type 2 using algorithms employed by disease management oasis program; 2) Be at least aged 18; 3) Be male or female; 4) Have Fasting Plasma Glucose (FPG) and HbA1c measured at least twice during the last year. Both univariate and multivariate approaches of logistic regression were applied to determine factors associated with poor glycemic control. **Results:** Data from a total of 100 patients were analyzed. There were 22% of patients that achieved glycemic control. The risk factors associated with poor glycemic control were being female, age < 65 years old and those who had not achieved the target total cholesterol. **Conclusion:** The findings of this study showed that diabetic control is suboptimal. This study provides factors that predict poor glycemic control. With this information, sub-groups with high risk of disease morbidity were identified. Barriers that prevent these patients from meeting their goals must be explored to improve health outcomes.

Keywords

Glycemic Control, Diabetes Type 2, Adults

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1. Introduction

Diabetes mellitus (DM) is now considered one of the most common non-communicable diseases worldwide [1] [2]. It is highly prevalent for all age groups worldwide [3]. It is estimated that the number of people with diabetes worldwide was about 366 million in 2011 and will increase to 552 million in 2030 [4]. According to the International Diabetes Federation's (IDF) statistics released 75% of that figure will be from developing countries [3]. Five of the top ten countries estimated to have the highest prevalence of diabetes are from the Middle East and North Africa region (MENA).

Since the Diabetes Control and Complication Trial and the United Kingdom Prospective Diabetes Study demonstrated that excellent Glycemic control reduces Microvascular complications in types 1 and 2 diabetes mellitus, respectively [5] [6], Glycated hemoglobin has become an increasingly important measure of Glycemic control. Despite the strong consensus that excellent Glycemic control improves Microvascular outcomes in type 2 diabetes mellitus [7], there are limited numbers of patients with diabetes who can obtain good Glycemic control.

International studies showed that more than two thirds of diabetic patients did not achieve target HbA1C level [8].

At the national level, a recent study was conducted in Saudi Arabia in which only 27% of the study patients reached the target HbA1C of <7% [9]. Another study in primary care clinics showed similar results as only 24% of the patients achieved a HbA1C level of <7% [10]. Therefore the current study was conducted to evaluate Glycemic control and its main predictors among diabetic patient's type 2 at the NAFH.

2. Methods

2.1. Study Design

We conducted a retrospective analysis of administrative data from adult patients with diabetes type 2 followed in NAFH clinics.

2.2. Studied Population

A sample of 100 patients was randomly selected among eligible diabetic patients type 2. To be included in the pilot study, patients needed to meet the following criteria:

- Be identified as having diabetes type 2 using algorithms employed by disease management oasis program;
- Be at least aged 18;
- Male or female;
- Have Fasting Plasma Glucose (FPG) and HbA1c measured at least twice during the last year.

2.3. Definition of the Main Variables

- For each patient, we calculated mean of the two last HbA1c levels. We grouped patients into 2 categories according to the recent recommendation of the Canadian Diabetes Association [11]:
 - Controlled, those who achieved and maintained a mean HbA1c $\leq 7\%$.
 - Not controlled, those who had a mean HbA1c higher than 7%.
- Medicines used for glucose control were categorized into three levels:
 - Insulin alone,
 - Oral agents alone, and
 - Insulin with oral agents.
- Clinical characteristics considered were systolic (SBP) and diastolic (DBP) blood pressure, total and HDL cholesterol, weight and height.
- According to their smoking status, patients were grouped into two categories: smokers and non smokers.
- Hypertension was considered SBP or DBP greater than or equal to 130 mm Hg and 80 mm Hg, respectively. Total cholesterol or HDL greater than equal to 200 mg/dl and 45 mg/dl, respectively were defined as non controlled.

2.4. Statistical Analysis

Data were entered and analyzed using Statistical Package for Social Science program: S.P.S.S 17.0.

The Chi square test was used to evaluate the relationships between qualitative variables. A p value less than 5% was considered as significant.

Separate multivariable logistic regression models were used to identify the main predictors of poor glycemic control. A p value less than 5% was considered as significant for independent variables in the final model.

3. Results

3.1. General Characteristics

Table 1 shows the study population characteristics. About 70% of patients were older than 50 years old with a mean age of 58 ± 14.52 years (55.6 ± 16.31 years among males vs 59.48 ± 12.33 years among females; $p = 0.18$).

3.2. Health Status

The levels of systolic and diastolic blood pressures were respectively less than 130 and 80 mm Hg, in respectively 70% and 72% of the study population. Mean total cholesterol was 174 mg/dl and those with lower total cholesterol (less than 200 mg/dl) had non statistical significant lower mean A1C values (8.53%) than those with higher total cholesterol levels (8.85%) (**Table 2**).

The total cholesterol level was normal in more than 72% of patients while HDL cholesterol was normal in only 44% of patients (**Table 2**).

About 30% of the patient's systolic blood pressure was not controlled and in 28% of patients the diastolic blood pressure was above the target level (**Table 2**).

3.3. Glycemic Control

The overall Glycemic control was evaluated through measurement of Hb A1C as it was mentioned previously, which was acceptable in 22% of the patients. The level of Glycemic control was better among: males, patients aged more than 65 years, normal systolic and/or diastolic blood pressure, normal total cholesterol levels and patients who take oral treatments (**Table 3**).

3.4. Predictors of Non Glycemic Control

A total of 78% of patients were non controlled regarding their diabetes. **Table 4** provides the results of Univariate logistic regression analysis which illustrates the non-adjusted factors associated with non Glycemic control. The risk of non Glycemic control was higher but with no statistical significance among females (OR = 1.26; CI95% = (0.49 - 3.26)). Compared to patients with normal blood pressure (systolic and /or diastolic), patients with high blood pressure were non significantly more likely to have non glycemic control (OR = 1.12; CI95% = (0.40 - 3.09) for SBP; OR = 1.42; CI95% = (0.47 - 4.31) for DBP). Patients taking insulin treatment were more likely to have poor control compared with patients taking oral medications (OR = 2.81; CI95% = (0.76 - 10.42)). Similarly, patients with low level of HDL cholesterol were non significantly more likely to have non glycemic control (OR = 2.21; CI95% = (0.84 - 5.82)). Compared with older patients, those aged less than 65 years were significantly more likely to have poor control (OR = 2.99; CI95% = (1.10 - 8.10)) and patients with high levels of total cholesterol were statistically associated with non Glycemic control (OR = 4.90; CI95% = (1.1 - 22.64)). In the final multivariate logistic regression model, only age less than 65 years and high levels of total cholesterol were statistically associated with non Glycemic control (**Table 5**).

4. Discussion

The adequacy of Glycemic control in diabetes mellitus is a cornerstone in reducing morbidity and mortality of the disease [12] [13]. More than two thirds of the patients in the present study were not adequately controlled and this represents a serious problem because diabetes is a very prevalent disease (23%) in the Saudi community [14]. The poor level of Glycemic control is a common phenomenon among Saudi diabetic patients. A recent study was conducted in Saudi Arabia at a national level including 28 health centers all over the Kingdom of Saudi Arabia in which only 27% of the study patients reached the target of HbA1C of <7% [9]. In our study, this high rate of non controlled patients could be explained in part by the non observance of the prescribed treatment.

Table 1. Distribution of HbA1C according to general and biological data among the studied population.

VARIABLE	NUMBER	PERCENTAGE
GENDER (n = 100)		
Male	50	50
Female	50	50
AGE (n = 100)		
<50	28	28
50 - 65	39	39
>65	33	33
TREATMENT (n = 100)		
Oral	73	73
Insulin	27	27
MARITAL STATUS (n = 94)		
Married	92	97.9
Single	2	2.1
SMOKING STATUS (n = 40)		
Smoker	04	10
Non smoker	36	90
NUMBER OF VISITS DURING THE LAST YEAR (n = 96)		
≤3	70	72.9
>3	26	27.1

Table 2. Distribution of HbA1C according to general and biological data among the studied population.

VARIABLE	NUMBER (%)	MEAN (A1C ± SD)	p
GENDER			
Male	50 (50)	8.59 ± 1.99	0.74
Female	50 (50)	8.71 ± 1.81	
AGE			
<50	28 (28)	8.97 ± 2.23	0.17
50 - 65	39 (39)	8.83 ± 1.53	
>65	33 (33)	8.14 ± 1.91	
TREATMENT			
Oral	73 (73)	8.42 ± 1.79	0.05
Insulin	27 (27)	9.25 ± 2.04	
NUMBER OF VISITS DURING THE LAST YEAR			
≤3	70 (72.9)	8.36 ± 1.89	0.01
>3	26 (27.1)	9.48 ± 1.75	
SBP (mmHg)			
<130	70 (70)	8.69 ± 1.93	0.74
≥130	30 (30)	8.55 ± 1.79	
DBP (mmHg)			
<80	72 (72)	8.58 ± 2.00	0.58
≥80	28 (28)	8.81 ± 1.58	
TOTAL CHOLESTEROL (mg/dL)			
<200	74 (72.4)	8.53 ± 2.08	0.46
≥200	27 (27.6)	8.85 ± 1.27	
HDL (mg/dL)			
≤45	55 (56.1)	8.82 ± 1.81	0.23
>45	43 (43.9)	8.36 ± 1.98	

Table 3. Distribution of the studied population according to their glycemic control status (controlled Hba1c \leq 7%, uncontrolled Hba1c $>$ 7%).

HBA1C	$\leq 7\%$		$> 7\%$		p
	n	%	n	%	
GENDER (n = 90)					
Male	12	24.0	38	76.0	0.62
Female	10	20.0	40	80.0	
AGE (n = 90)					
<65	10	37.0	17	63	0.02
≥ 65	12	16.4	62	83.6	
TREATMENT (n = 100)					
Oral	19	26.0	54	74	0.11
Insulin	03	11.1	24	88.9	
SBP (mmHg) (n = 100)					
<130	15	21.4	55	78.6	0.83
≥ 130	07	23.3	23	76.7	
DBP (mmHg) (n = 100)					
<80	17	23.6	55	76.4	0.53
≥ 80	05	17.9	23	82.1	
TOTAL CHOLESTEROL (mg/dL) (n = 98)					
<200	20	28.2	51	71.8	0.02
≥ 200	02	7.4	25	92.6	
HDL (mg/dL) (n = 98)					
≤ 45	09	16.4	46	83.6	0.10
> 45	13	30.2	30	69.8	

Table 4. Factors associated with poor Glycemic control: univariate analysis.

VARIABLE	OR	CI95%
GENDER		
Male	1	
Female	1.26	(0.49 - 3.26)
AGE		
≥ 65	1	
<65	2.99	(1.10 - 8.10)
TREATMENT		
Oral	1	
Insulin	2.81	(0.76 - 10.42)
SBP (mmHg)		
<130	1	
≥ 130	1.12	(0.40 - 3.09)
DBP (mmHg)		
<80	1	
≥ 80	1.42	(0.47 - 4.31)
TOTAL CHOLESTEROL (mg/dL)		
<200	1	
≥ 200	4.90	(1.1 - 22.64)
HDL (mg/dL)		
≤ 45	1	
> 45	2.21	(0.84 - 5.82)

Table 5. Factors associated with poor Glycemic control: Multivariate analysis.

VARIABLE	OR	CI95%
GENDER		
Male	1	
Female	1.48	(0.53 - 4.11)
AGE		
≥65	1	
<65	3.71	(1.26 - 10.87)
TOTAL CHOLESTEROL (g/dL)		
<200	1	
≥200	6.08	(1.26 - 29.47)

This issue should be explored by further studies to estimate the real rate of observance and its main determinants. Glycemic control in males was found to be significantly better than females, and this can be due to the fact that ; females are usually the caregivers for the entire family not only the husband and children but also mothers and mothers in law which may increase their heavy domestic responsibilities. This feature could be a local and regional phenomenon as other studies found that gender was not associated with Glycemic control [15].

In our pilot study, age was found significantly related to Glycemic control and the older age group (>65 years) was better controlled compared to younger patients. The same finding was found in recent studies [16] [17].

This pilot study has some limitations such as poor recording in the charts which were missing some important variables such as level of education, smoking status, body mass index. Another limitation is that Glycemic control can be affected by other factors that were not studied here, such as the duration of diabetes and especially the patient's compliance.

Although the Najran Armed Forces Hospital offers a high standard of medical care, the findings of the present pilot study showed that diabetic control is suboptimal.

5. Conclusions

The main results indicate that age and high levels of total cholesterol are predictors for non glyceemic control. Patients with these characteristics may need targeted interventions to improve glyceemic control. Patients younger than age 65 years should be warned of the health risks of non glyceemic control.

There is really a need for further studies to find out the level of patient's compliance and the possible other causes of the poor glyceemic control in order to take the necessary and adapted intervention measures.

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