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Original Article

Glycemic and lipids control in patients with diabetes and cardiovascular or renal diseases across all the government health sectors in the Emirate of Dubai, United Arab Emirates

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ABSTRACT

The guidelines suggest setting the glycemic and lipid targets according to the stage of the disease and other co -existing complications in the patients with diabetes.

Aims: We aimed to evaluate the HbA1c and lipids level in patients with high risk diabetes from 2012 −2016, attending different level of care in Dubai health authority.

Materials and methods: This is a retrospective analysis of the electronic medical records of all patients who attended the Dubai Health authority between 2012-2016. All patients with an ICD code of any type of diabetes in addition to cardiovascular or renal diseases were. Patients were categorized based on their HbA1c into control of<7.5, 7.5 − 8, and >8%. While lipids were categorized as f LDL < 70 mg/dl, and the Non-HDL <100 mg/dl.

Results: Out of total number of 26647 patients diagnosed with diabetes, 2015 patients did fit the criteria of this study. The desired mean of HbA1c of <7.5% achieved by 21.76% and 28.94% in T1DM and T2DM, respectively. The LDL of < 70 mg/dl was achieved by 27.8% of the patients.

Conclusion: In patients with diabetes and multiple complications, the glycemic and lipids control is suboptimal. However, the pattern showed numerical improvement over the years.

1. Introduction

The non-communicable diseases have always been a global challenge, this including the chronic metabolic diseases like diabetes (DM), hypertension (HTN), and dyslipidemia [1] Diabetes ranked one of the leading threat globally due to rising prevalence specifically in developing countries [2]. In the United Arab Emirates (UAE) prevalence of diabetes is reported as 18.98% [2]. The microvascular and macrovascular complications associated with diabetes are also frequently encountered in this region [3,4].

A decade ago, the concept of unified HBA1c and LDL target existed for all patients with diabetes, irrespective of the presence of any related complications. However, with the ACCORD trial, the paradigm of diabetes management shifted towards individualized glycemic targets based on each patient's characteristics and co-morbid status. Gradually all guidelines adopted this concept and agreed that patients with more advanced diabetes and related complications should not have a near-normal glycemic control [5].

The same concept applies to lipid control in another way, and it is generally agreed that patients with diabetes and for high risk of cardiovascular disease should have lower lipoproteins level compared to those who are at lower risk [6]. Therefore, most authorities implement these guidelines for glycemic and lipid goals for their patients with diabetes [5]. However, it is essential to look at the percentages of patients able to achieve these goals by doing periodic audits.

It is vital in the country like UAE, where health care facilities are available with all the latest technologies and modern's day medicines, to meet the expected control for diabetes and cardiovascular risk factors in these patients. Although we do not have an international benchmark to compare the percentage of individualized glycemic and lipid control with our subset of the patients. Many countries looked into the achievement of conventional HBA1c and

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Lipid targets by doing national survey and audits [7]. In the UAE, few researchers have looked into it as well. However, there is a paucity of the national and international data about the registry of these individualized goals in the patients with diabetes and coexistent complications like cardiovascular and kidney disease.

Our audit may be a very unique study, since very few studies assessed the glycemic and lipids in general diabetic patients, and even fewer have evaluated the individualized glycemic target in high risk diabetes patient [8]. But in our study, we have assessed both the lipid and glycemic control in patients with diabetes and cardiovascular or renal disease. Guidelines have recommended a tighter lipids control and a vigilant loser control of glycemia [4], However, there is scarcity of data on the control of glycemia and dyslipidemia in this special diabetes subsegment.

2. Aims

We aimed to assess optimal glycemic and lipids control in high-risk diabetic patients, across the Dubai Health Authority (DHA) points of care over five years (2012–2016). Moreover, we aimed for comparing the control between different patients' profile (type 1 and type 2 diabetes).

2.1. Patients and methods

We conducted a retrospective analysis from the electronic medical records of all patients who attended the Dubai Health Authority hospitals and primary health care centers during the period from January 2012 to December 2016. All patients with an International Classification of Diseases (ICD) coding of Type 1 and 2 Diabetes, with or without complications, were selected to be analyzed in this study. Having only one eligibility screening tool, the ICD coding of diabetes with cardiovascular disease or a chronic kidney disease, this may have veiled a very large number of patients with diabetes who were coded under other diseases, or simply coded as diabetes or dyslipidemia, but the occurrence of the co-morbidity was not updated in the coding system (missed cases), however, at the same time, this gives the study the power of having a 100% confirmed diabetes patients, without any inclusion bias.

The latest hemoglobin A1c (HbA1c) and lipid panel tests within the fourth quarter in each year were selected to represent the glycemic and lipids control in each year. Patients were categorized based on their HbA1c into control of<7.5, 7.5–8, and >8%, since the recommended HbA1c for them is between 7 and 8%. Based on this categorization, we labled the groups into desired control (HbA1c of <7.5%), Acceptable control (HbA1c 7.5–8%), and uncontrolled DM (HbA1c >9%).

Regarding the lipids, we chose only the low-density lipoprotein (LDL) and the non-high-density lipoproteins (Non-HDL) levels. All targets of control of each lipid parameter was assessed according to the ADA standards [4], which dictates a level of LDL < 70 mg/dl, and the Non-HDL <100 mg/dl data was analyzed to obtain the mean of each parameter's control annually, as well as percentage of patients in target.

Data were statistically described in terms of mean ± standard deviation (±SD), median and range, or frequencies (number of cases) and percentages when appropriate. Comparison of numerical variables between the study groups was made using Student t-test for independent samples in comparing two groups and one-way analysis of variance (ANOVA) test with post-hoc multiple 2-group comparisons in comparing more than two groups. Within-group comparison between the different years was made using repeated measures analysis of variance (ANOVA) test. For comparing categorical data, Chi-square [2] test was performed. The exact test was used instead when the expected frequency was less than 5. A p value of less than 0.05 was considered statistically significant. All statistical calculations were done using computer program IBM SPSS (Statistical Package for the Social Science; IBM Corp, Armonk, NY, USA) release 22 for Microsoft Windows.

3. Results

This analysis is part of a big study, where we collected total of 26447 patients with diabetes. That study is considered the largest cohort of patients being evaluated for diabetes control in the UAE and the Middle East region.

Out of the total cohort, 7.7% (n = 2015) of the total patients were coded as diabetes with complications (nephropathy and Cardiovascular diseases), which projects a rough estimate of volume of the diabetes with advanced complication in the UAE, bearing in mind missed coded cases as mentioned earlier. T2DM with complications counted in 1763 (87.5%), compared to 252 (12.5%) of T1DM of the total cohort. The desired mean of HbA1c of <7.5% achieved by 21.76% and 28.94% in T1DM and T2DM, respectively, p = 0.004. Similarly, the T2DM group had a better HbA1c control of 7.5–8% and >8% compared to type1 DM group (Fig. 1). Regarding the HbA1c targets, the year 2012 till 2016, optimal HBA1c of 7–7.5% was maintained between 18.5% and 20.7% of type 2 diabetic population, while an acceptable range of 7.5–8% was obtained between 18.5% and 23.2% during the year 2012 till 2016 (Fig. 1). Interestingly, the annual total number of diabetes patients with complications remained almost the same over each year, the fact that may reassure that the complication rate is not on the rise, at least during this period.

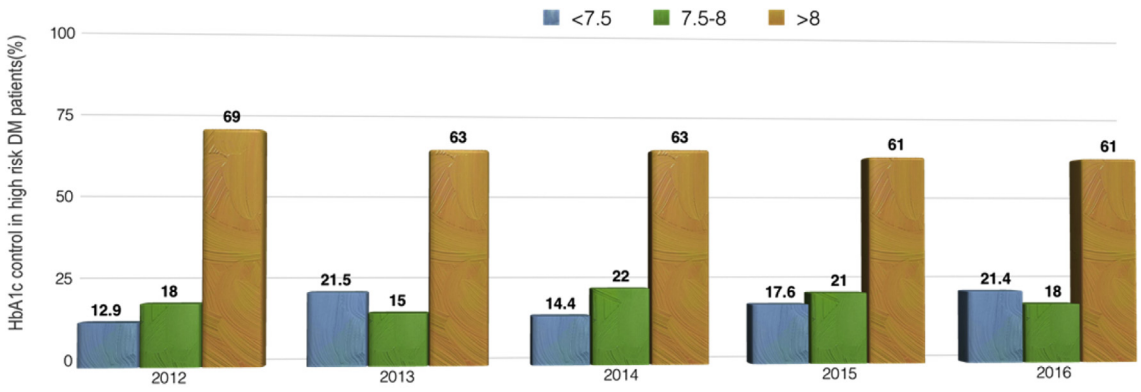
In patients with diabetes and complications, the LDL <70 mg/dl was achieved in almost a third of the patients. There was no significant statistical difference between type 1 and type 2 diabetes (Fig. 2). Concerning non-HDL cholesterol, our cohort showed pronounced numerical improvement over the years from 2012 till 2016, though it failed to reflect a statistical significance. Patients with the T2DM average non-HDL cholesterol level of <100 mg/dl was seen in 36.1% of the population in 2012, which was increased to 42.1% in 2016. (Fig. 3). Non-HDL cholesterol of <100 mg/dl was seen in 24.0% of T1DM in 2012, and that value increased to 41.8% in 2016 (Fig. 3). 76% of T1DM patients had non-HDL cholesterol >100 mg/dl in 2012 that percentage decreased to 58.2% in 2016.

4. Discussion

The value of intensive glycemic control in newly diagnosed type 2 diabetes is evident by results of the UKPDS trial by the 16% reduction in cardiovascular events and all-cause mortality [9]. Similarly intensive glycemic control in type 1 diabetes resulted in 57% reduction of MI, stroke, and cardiovascular deaths [10]. But, on the other hand, intensive glycemic control (HbA1c < 6.5%) in the patients with high risk DM (longer duration of diabetes, coexistent cardiovascular or renal diseases) was found to be associated with increased total mortality rate along with an increased in cardiovascular deaths [11]. Moreover, ADVANCE and VADT trials also suggested that intensive glycemic control in high-risk patients with diabetes carries more risk than benefits [12,13]. Thus, avoidance of stringent DM control and hypoglycemia was set to be a goal of treatment in this group.

On the other hand, It was also recommended that these patients get more benefits by aggressive reduction of other cardiovascular risk factors like lipid and blood pressure [12].

Since the concept of the individualized glycemic target has emerged in the guidelines(5). The physicians are expected to keep HBA1c level that is safe and can be achieved without risk of hypoglycemia in patients with existing cardiovascular disease.



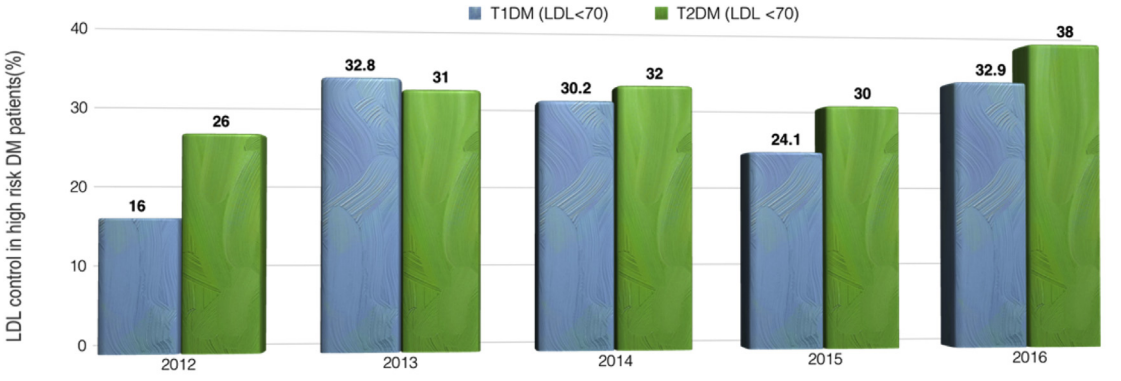
HbA1c	Mean of 2012-2016			2012		2013		2014		2015		2016	
	Type 1	Type 2	P	Type 1	Type 2	Type 1	Type 2	Type 1	Type 2	Type 1	Type 2	Type 1	Type 2
7-7.5	28.9%	21.8%		7.3%	18.5%	22.8%	20.2%	9.3%	19.5%	17.6%	17.6%	22.2%	20.7%
7.5-8	32.0%	27.6%	0.04	18.2%	18.5%	10.5%	20.4%	22.2%	22.6%	18.9%	23.2%	12.5%	22.6%
> 8	39.1%	50.6%		74.5%	63.0%	66.7%	59.4%	68.5%	57.9%	63.5%	59.2%	65.3%	56.7%

Fig. 1. Comparison between high risk patients with T1DM and T2DM in terms of HbA1c targets achievement between the year 2012 and 2016.

However, the published data about the attainment of the adequate individualized glycemic goal is sparse, probably being a relatively new concept. Schmieder and colleague studied the achievement of the individualized blood pressure and glycemic target set according to the patients 'characteristics and co morbid in DIALOGUE registry from multiple centers in Germany, as recommended by current ADA guideline [14]. Their result showed that only 59.4% of the achieved their target, who were set for loser glycemic control (HbA1c 7–7.5%.) [8].

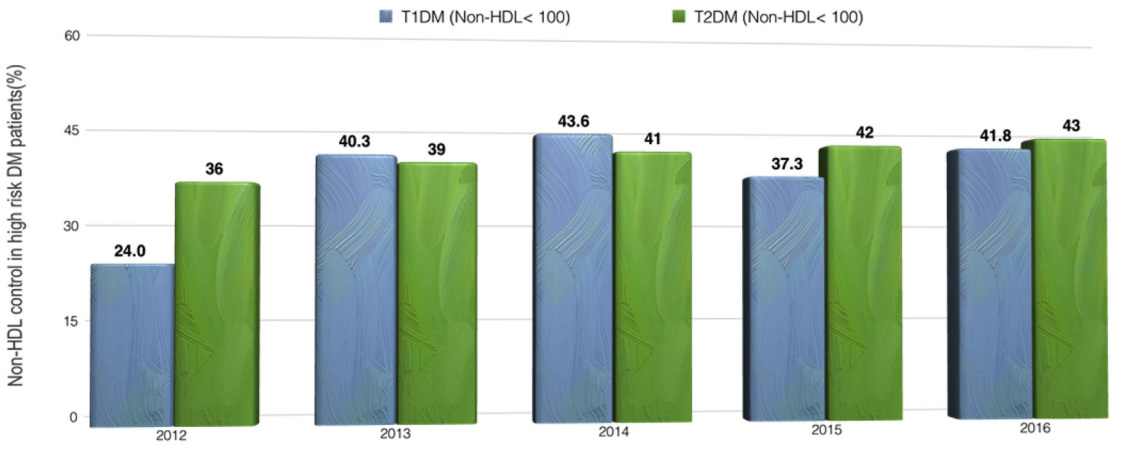
Many internationally and regionally studies/surveys were conducted to monitor the achievement of conventional glycemic and lipid targets in real life for all patients with diabetes Most of them showed that achieving the optimal glycemic goal is not satisfactory [15–17] This suboptimal control could partly be explained by recording the HbA1c and lipids, irrespective of underlying comorbid conditions and individualization. This critical aspect is raised by an analysis from the National Health and Nutrition Examination Survey (NHANES), Where 52.2% of the diabetes population in the US were considered to have an uncontrolled diabetes if the conventional target of A1C <7% was set as a benchmark. However, setting HBA1c to individualized target (Excluding the loser control group of HbA1c >7%) would reduce this percentage of the uncontrolled patients to 30%. (i.e. diabetes control would reach 70% of total diabetes population) [18].

This fact was further highlighted by an interesting cross-sectional study from Spain, done in 5382 primary care patients



LDL	2012		2013		2014		2015		2016	
	T1DM	T2DM	T1DM	T2DM	T1DM	T2DM	T1DM	T2DM	T1DM	T2DM
<70mg/dl	16.00%	26.00%	32.80%	31.40%	30.20%	32.10%	24.10%	29.80%	32.90%	37.70%
>70mg/dl	84.00%	74.00%	67.20%	68.60%	69.80%	67.90%	75.90%	70.20%	67.10%	62.30%

Fig. 2. Comparison between high risk patients with T1DM and T2DM in terms of LDL targets achievement between the year 2012 and 2016.



Non-HDL	2012		2013		2014		2015		2016	
	T1DM	T2DM	T1DM	T2DM	T1DM	T2DM	T1DM	T2DM	T1DM	T2DM
<100mg/dl	24.00%	36.10%	40.30%	39.20%	43.60%	41.00%	37.30%	42.10%	41.80%	43.40%
>100mg/dl	76.00%	63.90%	59.70%	60.80%	56.40%	59.00%	62.70%	57.90%	58.20%	56.60%

Fig. 3. Comparison between high risk patients with T1DM and T2DM in terms of Non-HDL targets achievement between the year 2012 and 2016.

with T2DM in 2011–2012 [19]. They aimed to assess the achievement of the individualized glycemic target according to strategies of individualization from different authorities {i.e. ADA/EASD, The Spanish diabetes Society Consensus (SED)}. Their findings showed that 67.4% of their T2DM population with complications achieved a less stringent HBA1c target of <8%. With the addition of HYPO score, 68.5% of patients had an adequate glycemic target. Their result showed better target achievement than our study where we noticed mean HbA1c <8% (from 2012 to 2016) was achieved in 49.4% of T2 DM and 60.9% of T1 DM. This could be partly be explained due to variation in the management of different level of care. Most of our patients in this high-risk group were managed in tertiary health care that translated them of having probably more advanced complications.

Regarding individualized lipid targets, the non-HDL cholesterol level of less than 100 mg/dl and LDL <70 mg/dl is required to reduce the residual cardiovascular risk in those patients who are at a high-risk of such incidences [20]. There is an absolute lack of published categorical data for these targets in type 1 DM patients. We cannot compare our finding in this group with other centers. However, compared to T2DM, these patients in our cohort had numerically higher LDL and non-HDL level. Especially in 2012, only 16.0% of T1DM have LDL <70 mg/dl though this percentage got better gradually and in 2016 where 32.9% of patients had achieved the target value. A similar trend of improvement is also seen in T2DM and while in 2012 only 26.0% of the population showed LDL of <70 mg/dl, this figure reached to 37.7% in 2016. Target for non-HDL cholesterol of less than 100 mg/dl also showed numerical improvement in both T1 & 2 DM subgroups. Where 36.1% of patients with T2DM achieved this target in 2012, this percentage rose to 43.4% in 2016. The 24.0% in subgroup of patients of T1DM attained this target in 2012 and the percentage reached to 41% by 2016.

Our results showed better LDL-C control profile compared to the results obtained from the metanalysis of CEPHEUS observational studies from 29 countries, where LDL-C control in very high risk patients was only 23% [21]. Our result showed better outcome in the lipid control on regional level as well. The fraction from the middle East showed that only 30%(n = 1929) of high risk patients achieved the LDL-C target level as per guidelines.

Our result also showed relative better LDL-C control form the data of the CEPHEUS study (2014) was conducted in six middle Eastern countries including UAE and done in 5457 patients. Investigators determined the lipid targets of LDL, non-HDL-C and apolipoprotein B according to all current guidelines in high and very high -risk patients. The major part of their cohort consisted of patients with diabetes. Their result showed that only 25% of highest risk patients achieved target LDL-C and 36% got non-HDL-C on target [22]. The sub-analysis done in 3338 patients with diabetes and results showed that only 48% achieved the LDL goal and out of those one third were very high risk for cardiovascular disease [23].

To the best of our knowledge and search, this is the largest cohort of patients being evaluated for diabetes control in the UAE and the middle east region.

5. Conclusions

This study has shown suboptimal glycemic and lipids control targets in patients with diabetes and cardiovascular or renal diseases in the Emirate of Dubai. However, there is a positive trend evident in both glycemic and lipid goals over the five years in both type 1 and type 2 diabetes subgroups. Reassuringly, the annual number of diabetes patients with complications remained almost the same over the study period.

Our finding raises an essential demand to find and solve the gap between the knowledge in managing diabetes management and to look into the potential causes for not achieving these goals. Further collaboration among different health strategic and providers bodies is highly needed to attain better glycemic and lipids control.

6. The significance of the study

This analysis is part of the biggest cohort of patients been assessed for diabetes and lipids control in the region. All patients included in this study are based on the ICD coding, which confirms

the diagnosis strictly. It indirectly shows the prevalence of T1DM which is (9.8%) of the total studied diabetes population, as well as the percentage of patients with advance diabetes complications. The study could be relatively reassuring, having the static percentage patients with diabetes and complications over the 5 years of the study (No increase between 2012 and 2016).

7. Limitations of the study

Our results missed the detailed patient record including the age, duration of diabetes, and stage of underlying cardiovascular and renal disease, as being a captured data from the electronic record. We also do not have the compliance report of each patient that plays a vital role in reaching to target.

List of abbreviation

DHA	Dubai Health Authority
UAE	United Arab Emirates
T1DM	Type-1 diabetes mellitus
T2DM	Type-2 diabetes mellitus
HbA1c	Glycated hemoglobin
LDL-C	Low density lipoprotein
Non-HDL-C	Non-High density lipoprotein
ADA	American Diabetes Association

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