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Diabetes Mellitus Management by the Egyptian Cardiologists: An Egyptian Survey

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Abstract:

Background : Cardiologists currently see more patients with diabetes mellitus (DM) than endocrinologists. This study aimed to investigate the current management trends of DM among Egyptian cardiologists.**Methods:** A questionnaire was mailed to a random sample of cardiologists from district hospitals across Egypt, and 58 practitioners completed it. The questionnaire included 24 questions about participants' knowledge of treating DM and novel therapies and the choice of oral antidiabetics as first-line or add-on therapy. A separate question investigates using the newer protective agents.
Results: More than 20% of patients encountered by 90% of the practitioners had DM. Nearly half of the practitioners believe cardiologists have sufficient knowledge to address DM with novel treatments, and 60% believe diabetes-related education has gained recent consideration. About one-third of practitioners manage patients with type 1 DM, which was the primary motive (43.1%) for referral to endocrinologists. The primary aim of most practitioners (72%) when they counter the treatment of patients with T2DM was cardiorenal protection. Metformin was the first-line choice of 34 practitioners (58.6%), followed by SGLT2i (37.9%), and for patients with multiple risk factors, SGLT2i was recommended by 44 practitioners (76%). SGLT2 inhibitors were the primary add-on therapy chosen by 43 practitioners (74%). In T2DM-controlled patients, 54 practitioners (93.1%) selected to shift to the newer cardioprotective agents.
Conclusion: The respondent cardiologists encounter a large number of diabetic patients among their cardiac patients, probably more than an endocrinologist can see in his daily practice. They were aware of the new cardioprotective antidiabetic agents and recommended their use.
Keywords: Diabetes Mellitus, Cardiovascular Disease, endocrinal disease, SGLT2 Inhibitors

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Introduction :

More than 500 million people are living with diabetes mellitus (DM) worldwide in 2021, with an age-standardized prevalence of 6.1%. The highest rates were in the Middle East and North Africa (9·3%) [1]. Heart failure and cardiovascular disorders are the leading causes of morbidity and mortality in type 1 and type 2 DM [2].

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Cardiologists currently see more patients with diabetes than endocrinologists [3]. Nevertheless, many cardiovascular (CV) specialists report poor knowledge of managing diabetes with newer therapies [4]. Therefore, cardiologists need to have continuing education programs to reach the required capability to deal with this frequently encountered patient with this co-morbid condition.

The European Society of Cardiology's guidelines aim to prevent and manage cardiovascular disease in diabetes patients. Over the past decade, large cardiovascular outcome trials have expanded therapeutic options for high-risk patients using glucose-lowering agents and non-steroidal mineralocorticoid receptor antagonists [5]. Glucagon-like peptide-1 (GLP-1) receptor agonists and sodium-glucose cotransporter-2 (SGLT-2) inhibitors are novel antihyperglycemic therapies with proven CV safety profiles and CV event reduction properties [6–8]. They improve morbidity in CVD and diabetic patients by promoting weight reduction and cardioprotection [9,10].

This study used a questionnaire to survey a random sample of cardiologists from district hospitals across Egypt to investigate their current management trends of diabetes in cardiac patients. The study aimed to clarify how and when cardiologists treat diabetes and when they refer their patients to endocrinologists.

Methods

A questionnaire was mailed to a random sample of cardiologists from district hospitals across Egypt. Fifty-eight practitioners completed the questionnaire out of 82 invited cardiologists, i.e., a 70.7% response rate. The authors designed the questionnaire to investigate the management trends of diabetes in cardiac patients. A group of questions involved the newer cardioprotective agents and their role in managing cardio-diabetic patients.

The questionnaire included 24 close-ended questions, except for keeping a place to add other drugs in questions 19 and 20. The first two questions ask about the place of work and qualifications. Questions from 3 to 6 ask about the number of patients managed weekly and how frequently the cardiologist

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encounters patients with DM, hypertension, or dyslipidemia. Next, we ask if the surveyed physician performs risk stratification and his primary objective when treating a diabetic patient. Following is a group of opinion questions about the frequency of seeing diabetic patients, knowledge to treat diabetes and novel therapies, the best way to improve knowledge, and the diabetes-related continuous education programs for cardiologists. They were asked about a referral to an endocrinologist, the primary objective when treating a type 2 diabetic patient, treating type-1 DM and managing insulin therapy. The following questions concerned the choice of oral antidiabetics as first-line or add-on therapy and treating multiple risk factors or heart failure. A separate question investigates using the newer protective agents.

Table 1: The Questionnaire Structure

1.	You work at ……. center.
2.	Qualifications
3.	How many patients do you manage per week?
4.	Percentage of patients with diabetes in your daily practice
5.	Percentage of patients with hypertension in your daily practice
6.	Percentage of patients with dyslipidemia in your daily practice
7.	Do you do risk stratification?
8.	Do you believe that cardiologists see more diabetics than endocrinologists?
9.	Do you think cardiologists have sufficient knowledge to address diabetes with novel treatments?
10.	In your opinion, what is the best way to increase diabetes knowledge among cardiologists?
11.	Do you think that recently, there has been an increase in diabetes-related continuous education programs for cardiologists?
12.	On a scale of 0-10, how frequently do you refer cardiac patients with diabetes to endocrinologists? Zero: I refer no one – Ten: I refer all
13.	What is your primary objective when treating T2D patients?
14.	Do you manage blood glucose levels in patients with type-1 DM?
15.	Do you manage blood glucose levels in patients with DM and insulin therapy?
16.	Do you interfere with the type of insulin used by the patient?
17.	Do you adjust the dose of insulin if needed?
18.	What's your preferred first-line therapy of oral treatments?
19.	For add-on treatment on current medication, do you use:
20.	What's your preferred first-line treatment in diabetic patients with multiple risk factors?
21.	In cardiac T2D-controlled patients with on the current antidiabetic medications, would you change the treatment to include the newer protective agents, GL1RA or SGLT2i
22.	What do you do when you fail to control blood glucose level with two oral medications?
23.	When do you refer your patient to endocrinologists from the start?
24.	For the best achievement of blood glucose control, do you rely on

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The data are presented as percentages of responses chosen from those available for each question. Statistical analysis was done using IBM© SPSS© Statistics version 23 (IBM© Corp., Armonk, NY, USA). Chi-square test (Fisher's exact test) was used to examine the relation between qualitative variables. For quantitative data, comparison between groups was done using Mann-Whitney or Kruskal-Wallis test. Spearman-rho method was used to test the correlation between numerical variables. A p-value < 0.05 was considered significant.

Ethical Consideration

The study was approved by the Ethical Committee of Sohag Faculty of Medicine and written informed consent was obtained from each subject included in the study before enrollment.

Results

The median number of patients the practitioners manage weekly was 60 (5-300). Most respondents (81%) have an MD degree in cardiology. The leading workplace was a hospital (67%). They encounter a relatively large percentage of diabetic patients during daily practice. They believe that cardiologists probably see more diabetic patients than endocrinologists. Their patients commonly have hypertension and/or dyslipidemia.

Thirty-nine practitioners (67.2%) reported performing risk stratification (Table 2). Nearly half of the practitioners believe cardiologists have sufficient knowledge to address diabetes with novel treatments (Figure 1). A standalone cardio-diabetes full course was thought by 57% as the best way to enhance cardiologists' knowledge about DM. About 60% believe that diabetes-related education has gained a recent consideration (Table 2).

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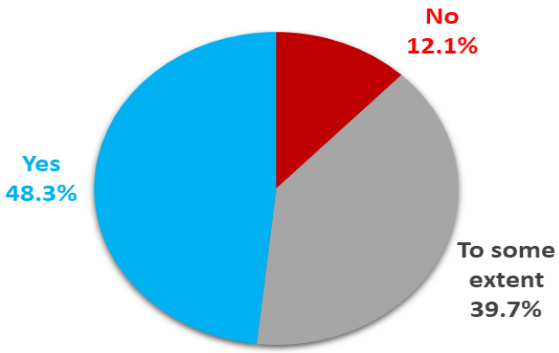

Figure 1: Belief of knowledge sufficiency of cardiologists about the treatment of diabetes mellitus among participants

Table 2: Basic characteristics of the practitioners, their daily practice, and Diabetes-related knowledge

		Number (%)
Qualification	Masters	11 (19%)
	MD	47 (81.0%)
Workplace	Governmental Center	13 (22.4%)
	Private Center	6 (10.3%)
	Hospital	39 (67.2%)
What's the percentage of cardiac patients with diabetes you see in your daily practice?	10-20%	5 (8.6%)
	21-40%	27 (46.6%)
	> 40%	26 (44.8%)
What's the percentage of cardiac patients with hypertension you see in your daily practice?	10-20%	5 (8.6%)
	21-40%	22 (37.9%)
	> 40%	31 (53.4%)
What's the percentage of cardiac patients with dyslipidemia you see in your daily practice?	10-20%	6 (10.3%)
	21-40%	20 (34.5%)
	> 40%	32 (55.2%)
Do you do risk stratification?	No	19 (32.8%)
	Yes	39 (67.2%)
Do you believe that cardiologists see more diabetics than endocrinologists?	No	17 (29.3%)
	To some extent	22 (37.9%)
	Yes	19 (32.8%
Do you think cardiologists have sufficient knowledge to address diabetes with novel treatments?	No	7 (12.1%)
	To some extent	23 (39.7%)
	Yes	28 (48.3%)
In your opinion, what is the best way to increase Diabetes knowledge among cardiologists:	Basic Knowledge course	9 (15.5%)
	Interactive case discussion	16 (27.6%)
	Standalone cardio-diabetes full course	33 (56.9%)
Do you think that recently, there has been an increase in diabetes-related continuous education programs for cardiologists?	No	10 (17.2%)
	To some extent	13 (22.4%)
	Yes	25 (60.3%)

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The participants were asked to estimate the frequency of referring their diabetic patients to endocrinologists on a scale of 0-10. The median score was 4 (range: 0-10). Type 1 DM was the primary motive for referral to endocrinologists, as mentioned by 25 participants (43.1%).

About one-third of practitioners manage patients with type 1 DM, and a smaller percent (19%) manage patients with DM and insulin therapy completely without the aid of another endocrinology specialist. However, 27 of them (46.6%) interfere with the type of insulin when needed, and 40 (69%) adjust its dose if necessary (Table 3).

Table 3: Practice trends of the practitioners in managing patients with Type 1 diabetes mellitus

		Number (%)
Do you manage blood glucose levels in patients with type 1 DM?	No	38 (65.5%)
	Yes	20 (34.5%)
Do you manage blood glucose levels in patients with DM and insulin therapy?	Not at all	11 (19.0%)
	Yes (partially)	36 (62.1%)
	Yes (completely)	11 (19.0%)
Do you interfere with the type of insulin if needed?	No	31 (53.4%)
	Yes	27 (46.6%
Do you adjust the dose of insulin if needed?	No	18 (31.0%)
	Yes	40 (69.0%)

The primary aim of most practitioners (72%) when they counter the treatment of patients with T2DM was cardiorenal protection and not blood glucose control. Regarding oral antidiabetic drugs, metformin was the first-line choice of 34 practitioners (58.6%), followed by SGLT2i (37.9%). Nevertheless, for patients with multiple risk factors, SGLT2i was recommended by 44 practitioners (76%).

SGLT2 inhibitors were the primary add-on therapy chosen by 43 practitioners (74%). GLP1 receptor agonists were proposed as an add-on therapy by ten practitioners (17%). Even in T2DM patients controlled with their current medications, 54 practitioners (93.1%) selected to shift to the newer cardioprotective agents.

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Upon failing to control the blood glucose level of diabetic patients, 50% of the practitioners decided to refer the patient to an endocrinologist. HbA1c and home monitoring of blood glucose levels together were chosen by 70% of practitioners as the most reliable tool to achieve blood glucose control (Table 4, Figure 2).

Table 4: Practice trends of the practitioners in managing patients with Type 2 diabetes mellitus

		Number (%)
What is your primary objective when treating T2DM patients?	Cardio-Renal Protection	42 (72.4%)
	Blood Glucose Control	16 (27.6%)
What's your preferred first-line therapy of oral treatment?	DPP4 receptor antagonists	1 (1.7%)
	Metformin	34 (58.6%)
	SGLT2 inhibitors	22 (37.9%)
	Sulphonylureas	1 (1.7%)
What's your preferred first-line treatment in diabetic patients with multiple risk factors?	GLP1 receptor antagonists	2 (3.4%)
	Metformin	12 (20.7%)
	SGLT2 inhibitors	44 (75.9%)
For add-on treatment on current medication, do you use:	DPP4 receptor antagonists	2 (3.4%)
	GLP1 receptor agonists	10 (17.2%)
	Metformin	3 (5.2%)
	SGLT2 inhibitors	43 (74.1%)
In a cardiac T2DM-controlled patient on the current antidiabetic medications, would you change the treatment to include the newer protective agents, GL1RA or SGLT2i	No	4 (6.9%)
	Yes	54 (93.1%)
When do you refer your patient to endocrinologists from the start?	T1DM	25 (43.1%)
	T2DM on insulin	2 (3.4%)
	T2DM not controlled by oral medications	6 (10.3%)
	Both 1 & 2	12 (20.7%)
	All of the above	13 (22.4%)
What do you do when you fail to control blood glucose levels with 2 oral medications?	Add another oral drug	23 (39.7%)
	Add insulin	6 (10.3%)
	Refer to endocrinologists	29 (50.0%)
For the best achievement of blood glucose control, do you rely on	HbA1c	15 (25.9%)
	Home monitoring of blood glucose	2 (3.4%)
	Both	41 (70.7%)

DPP-4: Dipeptidyl peptidase, SGLT2: Sodium-Glucose Transport Protein 2, GLP-1: Glucagon-like peptide-1

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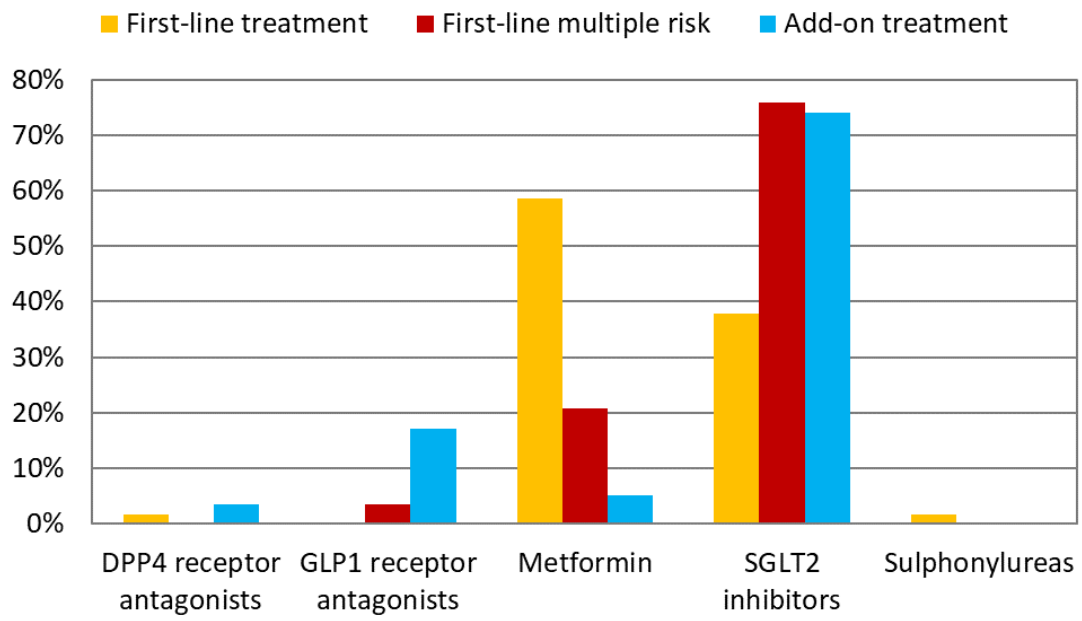

Figure 2: Choice of oral antidiabetic drugs as a first-line basic or for multiple-risk patients or as an add-on treatment

Table 5: Factors that might affect the frequency of referring diabetic patients to an endocrinologist

		n	Referral frequency	p-value
Workplace	Governmental Center	13	3 (0-9)	
	Private Center	6	2 (0-6)	0.071
	Hospital	39	5 (0-10)	
Qualifications	Master	11	3 (0-9)	0.216
	MD	47	5 (0-10)	
Percentage of patients with diabetes in daily practice	10-20%	5	0 (0-9)	
	21-40%	27	5 (0-10)	0.051
	> 40%	26	3 (0-10)	
The primary objective when treating T2DM	Cardio-Renal Protection	42	5 (0-10)	0.622
	Glucose Control	16	3 (0-9)	
Do cardiologists have sufficient knowledge to address diabetes	No	7	8 (0-10)	
	To some extent	23	5 (0-10)	0.009
	Yes	28	3 (0-8)	

Data are presented as median (range)

There was no correlation between the number of patients managed weekly and the frequency of referring diabetic patients to endocrinologists (r = -0.016, p 0.903). Also, the qualification and the place of work did not affect

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the frequency of referral (p=0.216 and p=0.071, respectively). The percentage of patients encountered with DM did not affect the frequency of referral to endocrinologists (p=0.051); likewise, the primary objective when treating diabetic patients (p=0.622). The main factor increasing the frequency of referral to an endocrinologist is the doubt in the knowledge of the cardiologist concerning the treatment of diabetes with novel agents (p=0.009). A higher frequency of referral was seen among those believing that cardiologist knowledge is insufficient to treat (Table 5).

Table 6: Factors that might affect the decision to treat patients with Type 1 diabetes mellitus

		Treating T1DM		p-value
		Yes	No	
Workplace	Governmental Center	7 (63.6%)	4 (36.4%)	0.126
	Private Center	13 (27.7%)	34 (72.3%)	
	Hospital	7 (53.8%)	6 (46.2%)	
Qualifications	Master	3 (50.0%)	3 (50.0%)	0.036
	MD	10 (25.6%)	29 (74.4%)	
Percentage of patients with diabetes in daily practice	10-20%	2 (40.0%)	3 (60.0%)	0.767
	21-40%	8 (29.6%)	19 (70.4%)	
	> 40%	10 (38.5%)	16 (61.5%)	
Do cardiologists have sufficient knowledge to address diabetes	No	0 (0.0%)	7 (100.0%)	0.123
	To some extent	9 (39.1%)	14 (60.9%)	
	Yes	11 (39.3%)	17 (60.7%)	

Data are presented as number (%)

Cardiologists with a higher qualification, i.e., MD, preferred not to treat patients with T1DM compared to those with a Master's degree (p=0.036). Otherwise, the place of work, frequency of encountering diabetic patients, and belief in cardiologist's knowledge about diabetes treatment did not affect the decision of the participants to treat T1DM (Table 6).

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Discussion:

The results of this study are based exclusively on the responses to a questionnaire. However, they illustrate the beliefs of Egyptian cardiologists about DM, its cardiovascular consequences, and treatment strategies. Although the number of respondents is relatively small, their distribution is more or less representative of CV specialists in different districts of Egypt. To the best of our knowledge, this is the first study to investigate the role of cardiologists in managing diabetic patients in a cardiovascular setting.

In the current study, 40% of the patients seen in the daily practice of 45% of cardiologists had diabetes. Ninety percent of participants reported that more than 20% of their patients present with DM. Many previous investigations indicated cardiologists see more patients with diabetes than endocrinologists. This was the opinion of 33% of our cardiologists. A large American research of 109747 T2DM patients found that outpatient visits to cardiologists were almost threefold higher than visits to endocrinologists. For patients with diabetes and CVD, cardiologist visits were five times more than endocrinologist visits [3]

These findings emphasize the importance of a good knowledge of cardiologists of treatment strategies for DM. Given that CVD is the primary cause of morbidity and death among type 2 diabetics [11], adequate knowledge of diabetic management becomes crucial to the cardiologist's equipment. Despite this, many cardiologists report being poorly prepared to deal with diabetes, especially with novel agents [4]. In the current study, 48.3% of respondents believe cardiologists have sufficient knowledge in this field. However, 40% reported "to some extent" to this question, i.e., they were unsure of knowledge adequacy. In general, the prevailing view was that the knowledge of cardiologists concerning the management of diabetic patients needs to be increased.

Due to this perspective, diabetes-related continuing education programs for cardiologists are increasing. About 60% of the respondents in the present study believe there has been an increase in such programs. However, 17% of

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the respondents did not have this impression. An example of these programs is the Diabetes and CVD Educational Program held by the European Society of Cardiology. They aim to raise awareness and education on DM and CVD risk, focusing on novel therapeutic approaches [12]. Another example of an educational tool for training in DM is the platform (Tradicar.es) developed by the European Society of Cardiology [13]. As a response to the best way to increase diabetes knowledge among cardiologists, 57% of respondents preferred a standalone cardio-diabetes full course to accomplish this objective.

It is clarified in the educational programs to train cardiologists on DM management that novel therapeutic strategies are vital to any program. The anti-hyperglycaemic agent sodium-glucose cotransporter-2 inhibitors (SGLT-2i) and glucagon-like peptide-1 receptor (GLP-1-R) agonists have demonstrated an apparent CV benefit in patients with T2DM [14]. These agents have shown significant CVD risk reduction in diabetic patients in large clinical trials [15–18]. The novel antihyperglycemic medication has changed the care paradigm for high-risk groups due to its therapeutic advantages [19].

Among the respondents in the current study, 38% prefer SGLT2i as a first-line oral therapy, while 58.6% recommend metformin. However, 76% have chosen SGLT2i as a first-line treatment for patients with multiple risk factors, and 74.1% recommend it as an add-on treatment. Notably, few respondents adopted GLP-1-R agonists for first-line or add-on therapy. The reason for this difference between the two agents needs to be investigated. Of the 58 respondents, 93% can change the treatment of a cardiac T2DM-controlled patient to include the newer protective agents, GL1RA or SGLT2i. This reply is consistent with the primary aim of most practitioners (72%) when they counter the treatment of patients with T2DM, which is cardiorenal protection and not blood glucose control.

Now promising, SGLT2i are predicted to become clinical first-line T2DM agents [20]. SGLT2i have shown many cardio-protective positive

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effects in primary and secondary prevention [21]. SGLT-2 inhibitors are proven to prevent cardiovascular events, improve HF symptoms, reduce HF death rates and hospitalizations, protect heart function during myocardial ischemia, and halt AF development [20]. SGLT2i increase urinary glucose excretion by blocking SGLT2 in the early proximal renal tubule [22]. Their unique mechanism of action is independent of insulin or β-cells islets. They can improve the function of β-cells and reduce insulin levels [23].

Regarding managing T1DM, 65.5% of the respondents prefer not to treat the patient. Type 1 DM was the primary motive for referral to endocrinologists, as mentioned by 25 participants (43.1%). Surprisingly, cardiologists with a higher qualification, i.e., MD, preferred not to treat patients with T1DM compared to those with a Master's degree (p=0.036). We think these findings emphasize the need for continuous education programs for cardiologists to manage both types of DM.

Conclusion:

The respondent cardiologists encounter a large number of diabetic patients among their cardiac patients, probably more than an endocrinologist can see in his daily practice. They were not entirely confident of sufficient knowledge of cardiologists concerning diabetic management. They were aware of the new cardioprotective antidiabetic agents and recommended their use, especially in patients with multiple risk factors. Continuous education programs for the management of both types of DM and novel treatment agents are recommended for Egyptian cardiologists.

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