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ORIGINAL RESEARCH

Centralized Pan-Middle East Survey on the Under-Treatment of Hypercholesterolemia: Results from the CEPHEUS II Study in Egypt

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ABSTRACT

Introduction: As part of the CEPHEUS study, CEPHEUS I was conducted in 2010 and 2011 in Cairo and then the CEPHEUS II study was carried out in Alexandria and Delta Regions in Egypt between April 2014 and August 2015 to determine the proportion of dyslipidemic patients on lipid-lowering treatment reaching LDL-C treatment goals.

Methods: We conducted an open-label, observational, multicenter, cross-sectional survey where 90 investigators enrolled 1127 patients receiving lipid-lowering drugs for at least 3 months. After signing informed consent forms, the study questionnaires were completed by patients and investigators. Blood samples were taken for laboratory investigations. Patients with missing LDL-C data were excluded from the analysis and results from 896 patients were analyzed according to European Atherosclerosis Society and EAS/ESC 2011 guidelines.

Results: Out of 896 patients enrolled based on the risk stratification of EAS/ESC 2011 guidelines, 12.4% were classified as low risk, 20.0% as moderate risk, 2.5% as high risk, and 65.2% as very high risk. Achievement goals were 84.7, 44.7, 18.2, and 22.3% for low-risk, moderate-risk, high-risk, and very high risk patients, respectively, with an overall achievement goal of 34.4%. The study population included 50.2% diabetes, 64.4% hypertension, 54.9% metabolic syndrome, 32.2% family history of cardiovascular disease, 23.1% smokers, and 33.8% secondary prevention. Lipid-lowering agents were prescribed as a monotherapy to 90.1% and in combination in 9.9% with goal achievements of 34 and 38%, respectively ($p > 0.05$). Statins were prescribed to 86.9% of patients. The most frequent prescribed statins were rosuvastatin

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(47.1%) and atorvastatin (36.0%), followed by simvastatin (9.2%). Treatment goal was achieved in 34.2, 36.0, and 31.7% for rosuvastatin, atorvastatin, and simvastatin, respectively, with no significant difference in achievement goals ($p > 0.05$).

Conclusions: Hypercholesterolemia is still not being effectively managed in many at-risk patients in Egypt. The majority of patients enrolled in the study were being actively treated with lipid-lowering medications yet the percentage goal achievement was less when compared to CEPHEUS results.

Keywords: Cardiovascular; CVD; Cardiovascular risk; CEPHEUS; Egypt; Hypercholesterolemia; Statins

INTRODUCTION

Cardiovascular diseases (CVD) are the leading cause of death worldwide. Multiple risk factors contribute to CVD. A recent standardized case–control study in 52 countries specifically focusing on acute myocardial infarction identified that six risk factors (dyslipidemia, smoking, hypertension, diabetes mellitus, abdominal obesity, and stressful psychosocial factors) account for 90% of myocardial infarctions in men and 94% in women [1].

Epidemiological surveys have shown that elevated total serum cholesterol (TC) and particular elevated low-density lipoprotein cholesterol (LDL-C) levels are strongly correlated with CHD risk. Many guidelines identify LDL-C as the primary target of cholesterol-lowering therapy and recommend LDL-C goals either numerical or percentage of reduction that are based on the risk category a patient belongs to [2, 3].

Hypercholesterolemia treatment has shown clear benefits in the primary and secondary prevention of CVD. However, cross-sectional surveys conducted in Europe [5, 6], and the USA [6–8] on the management of risk factors in patients with CHD have indicated that hypercholesterolemia continues to be inadequately treated [4–6]. Accordingly, many studies are required to assess the current level of under-treatment of hypercholesterolemia, defined as receiving lipid-lowering drug therapy but having uncontrolled TC and/or LDL-C levels and to understand better why patients on pharmacological treatment do not achieve their treatment goals [4–7].

This study is part of the worldwide conducted CEPHEUS studies; Centralized Pan-Middle East Survey on the under-treatment of hypercholesterolemia and the second wave of the Centralized Pan-Middle East Survey on the under-treatment of hypercholesterolemia: results from the CEPHEUS Study in Egypt [8]. The current study is based on the European Atherosclerosis Society 2011 and the European Society of Cardiology guidelines (EAS/ESC 2011) [8]. The primary objective is to determine the proportion of patients on lipid-lowering pharmacological treatment reaching the LDL-C goals in Egypt according to the EAS/ESC 2011 guidelines. Secondary objectives were to determine the proportions in pre-defined subpopulations including primary and secondary prevention, metabolic syndrome, patients' risk profile category, and identification of determinants (patient and physician characteristics) for patients not reaching their treatment goals and physician characteristics associated with the allocation of different treatment regimens.

METHODS

This is an open-label, observational, non-interventional, multicenter, single-visit cross-sectional survey conducted on patients under lipid-lowering pharmacological treatment. Ninety investigators enrolled 1127 patients on lipid-lowering drugs between April 24, 2014 and August 29, 2015 from Alexandria and Delta Regions in Egypt as part of the CEPHEUS study (NIS-EG-CRE-2012/01). Patients of age 18 years or more receiving lipid-lowering drug for at least 3 months with no dose change for at least 6 weeks signed informed consent to participate and comply with study procedures. Before assessment, after signing informed patient consent, the study questionnaires were completed by patients and investigators. The investigators completed case record forms (CRF) with

the patient's demographics, known cardiovascular risk factors, cardiovascular medical history, current lipid-lowering drug treatment, and the reason for the current therapy. Samples were taken for total cholesterol, LDL cholesterol, HDL cholesterol, triglycerides, HbA1c, and the ratio of total cholesterol/HDL-C was calculated. The investigators received results within 5 days and completed the CRFs. Under-treatment was defined as receiving lipid-lowering pharmacological treatment and not reaching the LDL-C goals according to the EAS/ESC 2011 guidelines. Non-HDL-C goals was defined as patients with HDL-c <40 mg/dl and fasting triglycerides >200 mg/dl.

Among the 1127 enrolled patients, patients with missed LDL-C data ($n = 231$) were excluded from the analysis and results from 896 patients are presented here.

Statistical Analysis

Data of 896 subjects were analyzed in this study. This gives a margin error of ±3.2% at 95% confidence level with expected number of patients achieving treatment goals at 50%.

Number and percentage (n and %) presented the categorical data and Chi-square test (or its subsidiaries) was used to obtain p values to test significance for difference between groups. Descriptive statistics (mean ± SD) presented the numerical data and Student's t test (or its subsidiaries) was used to obtain p values to test significance for difference between groups. The calculation of statistics and proportions did not include the missing data. Missing values were presented in separate tables.

Compliance with Ethics Guidelines

All procedures followed were in accordance with the ethical standards of the responsible committee on human experimentation (institutional and national) and with the Helsinki Declaration of 1964, as revised in 2013. Informed consent was obtained from all patients for being included in the study. This article does not contain any new studies with human or animal subjects performed by any of the authors.

RESULTS

Eight hundred ninety-six subjects were included in the analysis. The mean age was 53.9 ± 10.7 years and 57.6% were male. The main reason of pharmacological therapy was for primary prevention with 59.4% of patients. Statins were the most prescribed agents with 95.2% (853 of 896) of patients; 90% (768) used statins as monotherapy and 10% (85) in combined therapy. Rosuvastatin was the most frequently prescribed statin. It was prescribed to 47.1% (422 of 896) from which 391 were monotherapy and 31 were combined therapy. Other and more detailed demographic data and patients characteristics are shown in Table 1.

LDL Target Goal Achievement

Overall, 34.4% (308 of 896 patients) achieved their LDL-C target goal according to the EAS/ESC 2011 guidelines.

A total of 84.7% of low-risk patients achieved target LDL-C goal (<155 mg/dl), 44.7% of moderate-risk patients achieved target LDL-C goal (<115 mg/dl), 18.2% of high-risk patients achieved target LDL-C goal (<100 mg/dl) and 22.3% of very high risk patients achieved target LDL-C goal (<70 mg/dl or ≥50% reduction).

From the patients who were on rosuvastatin, 33.2% reached the goal with monotherapy and 48.4% with combined therapy, with an overall achievement of 34.2%. From patients who were prescribed treatment for primary prevention: 36.1% achieved LDL-C goal, for secondary prevention 29.9%, and familial hypercholesterolemia 36.2%. ($p = 0.082$). For special populations, the goal was reached for 67.7% of patients with metabolic syndrome and 63.1% without ($p = 0.087$); the goal was reached for 21.6% of patients with diabetes mellitus and 46.5% without ($p < 0.001$), and finally, goal was reached for 29.6% of patients with arterial hypertension and 42.6% without ($p < 0.001$) (Tables 2, 3).

Table 1 Patients' demography and other variables at the baseline visit

Parameter	Variable	Valid answer (base)	Missing	Mean and SD or *N* and %	
Age		896	0	53.9	10.7
Weight		892	4	92.3	17.1
Height		887	9	168.8	8.8
BMI		887	9	32.5	6.4
Waist circumference		857	39	99.5	21.3
Systolic BP		893	3	133.9	15.9
Diastolic BP		893	3	84.4	9.1
Gender	Male, *n* (%)	896	0	516	57.6%
	Female, *n* (%)			380	42.4%
Nationality	Egyptian, *n* (%)	896	31	859	99.3%
	Other (Syrian), *n* (%)			6	0.7%
Ethnicity	Middle Eastern (including North Africa)	869	27	857	98.6%
	Caucasian (including Europe and North America)			6	0.7%
	Other, *n* (%)			6	0.7%
Reason for pharmacological therapy	Primary prevention	876	20	520	59.4%
	Secondary prevention			296	33.8%
	Familial hypercholesterolemia			60	6.8%
Medical history	History of coronary heart disease, *n* (%)	896	0	309	34.5%
	History of peripheral artery disease, *n* (%)	894	2	118	13.2%
	Cerebrovascular atherosclerotic disease, *n* (%)	896	0	62	6.9%
	Established CVD	886	10	376	42.4%
Comorbid condition	Arterial hypertension, *n* (%)	871	25	561	64.4%
	Diabetes, *n* (%)	877	19	440	50.2%
	Family history of premature cardiovascular disease, *n* (%)	845	51	272	32.2%
	Current smoker, *n* (%)	872	10	207	23.1%

Table 1 continued

Parameter	Variable	Valid answer (base)	Missing	Mean and SD or *N* and %	
Lab test	Total cholesterol, mg/dl (mmol/l)	896	0	189.3	47.6
	HDL-C, mg/dl (mmol/l)	896	0	45.2	13
	LDL-C, mg/dl (mmol/l)	896	0	115	41.7
	Triglycerides, mg/dl (mmol/l)	894	2	150.9	84
	Total cholesterol/HDL-C ratio	2	894	5	1.4
	Glucose, mg/l	716	180	131.9	61.1
	HbA1c, % (mmol/mol)	891	5	7.1	1.9
Current prescribed medication groups	Statin monotherapy	885	11	768	85.7%
	Statin + fibrate			47	5.2%
	Statin + ezetimibe			35	3.9%
	Ezetimibe monotherapy			25	2.8%
	Fibrate monotherapy			7	0.8%
	Statin + fibrate + ezetimibe			3	0.3%
Current prescribed monotherapy drugs	Rosuvastatin	885	11	422	47.7%
	Atorvastatin			323	36.5%
	Simvastatin			82	9.3%
	Ezetimibe			63	7.1%
	Fenofibrate			56	6.3%
	Fluvastatin			10	1.1%
	Lovastatin			3	0.3%
	Pravastatin			3	0.3%
	Bezafibrate			1	0.1%
	Gemfibrozil			1	0.1%
	Undefined statins			32	3.6%

Results of the Investigators' Questionnaire

There were 41.4% of the investigators that mentioned that they use EAS/ESC 2011 guidelines. Most of the investigators use guidelines to set individual cholesterol targets; 94.4% depend on LDL-C as an indicator.

Percent split of prescriptions as reported by investigators was 86.9% for statins, 9.5% for fibrates, and 3.6% for bile acid sequestrants and other drugs. Investigators review their patients mostly every 3 months, and they stated that an average of 55.6% of patients achieved their target cholesterol level. Detailed results of the investigators' questionnaire are presented in Table 4.

Table 2 EAS/ESC 2011 risk-profile category, number and percent in each group, lipid-lowering drug, mean and SD of the used dose and number and percent of patients achieving the LD-C treatment goal

EAS/ESC 2011 risk profile category	Base		Lipid-lowering agents					
			Agent		Dose		Achieved treatment goal	
	Base	%	Name	Base	Mean	SD	*N*	%
All	896		Rosuvastatin	442	14.6	5.1	152	34.4
			Atorvastatin	323	24.8	14.8	118	36.5
			Simvastatin	82	25.7	16.2	26	31.7
			Ezetimibe	63	15.0	7.1	26	41.3
			Fenofibrate	56	260.0	64.8	21	37.5
			Fluvastatin	10	10.0		1	10.0
			Pravastatin	3	20.0		1	33.3
			Lovastatin	3	40.0		1	33.3
			Bezafibrate	1			0	0.0
			Gemfibrozil	1			0	0.0
			Undefined statin	32	21.1	11.7	9	28.1
Very high risk	584	65.2%	Rosuvastatin	272	16.3	5.2	56	20.6
			Atorvastatin	215	25.1	14.2	57	26.5
			Simvastatin	52	31.0	20.2	10	19.2
			Ezetimibe	40	14.2	5.1	12	30.0
			Fenofibrate	33	253.3	70.0	9	27.3
			Fluvastatin	8			0	0.0
			Pravastatin	2	20.0		1	50.0
			Lovastatin	1			0	0.0
			Bezafibrate	1			0	0.0
			Gemfibrozil	1			0	0.0
			Undefined statin	22	26.7	11.5	3	13.6
High risk	22	2.5%	Rosuvastatin	11	15.0	7.1	2	18.2
			Atorvastatin	7	15.0	7.1	2	28.6
			Fenofibrate	3	300.0		1	33.3
			Simvastatin	2			0	0.0
			Ezetimibe	2			0	0.0

Table 2 continued

EAS/ESC 2011 risk profile category	Base		Lipid-lowering agents					
			Agent		Dose		Achieved treatment goal	
	Base	%	Name	Base	Mean	SD	*N*	%
Moderate risk	179	20.0%	Rosuvastatin	88	13.4	4.8	47	53.4
			Atorvastatin	61	23.5	11.9	23	37.7
			Simvastatin	16	23.3	15.3	3	18.8
			Ezetimibe	15	17.5	10.4	8	53.3
			Fenofibrate	13	272.0	62.6	5	38.5
			Fluvastatin	1			0	0.0
			Lovastatin	1			0	0.0
			Pravastatin	1			0	0.0
			Undefined statin	5	10.0		1	20.0
Low risk	111	12.4%	Rosuvastatin	51	13.8	4.9	40	78.4
			Atorvastatin	40	25.8	17.8	36	90.0
			Simvastatin	12	21.0	11.0	10	83.3
			Fenofibrate	7	253.3	72.3	6	85.7
			Ezetimibe	6	13.3	5.2	6	100.0
			Fluvastatin	1	10.0		1	100.0
			Lovastatin	1	40.0		1	100.0
			Undefined statin	5	20.0	12.2	5	100.0

Eighty-five patients were on combined-drug therapy. Each patient was on an average of 1.1 drugs

Results of the Patients' Questionnaire

Eight hundred ninety-two patients returned completed questionnaires. More than 75% of the patients were aware of good and bad cholesterol and mentioned that their doctor told them about their level of cholesterol and target goals and discussed the proper lifestyle, diet, and prescribed medications; 78.5% mentioned that they were satisfied with the information they had about high cholesterol. Results showed that patients were trying to take drugs as they were prescribed but 41% mentioned that they sometimes forgot to take the tablet every day. Most of the patients reported that they did not change the drug they take and few of them (3.3%) reported that they had changed the prescribed drug more than two times. Of the patients, 49% stated that they achieved their target cholesterol level and 75% were satisfied with the treatment they were taking. A strong correlation was found between achieving treatment goal as obtained from CEPHEUS II results and patient compliance as obtained from patients' questionnaire ($p < 0.001$). Table 5 shows detailed results of the patients' questionnaire.

DISCUSSION

CEPHEUS surveys in different countries worldwide have aimed to investigate the proportion of patients receiving lipid-lowering drugs and

Table 3 LDL-C target goal achievement according to EAS/ESC 2011 guidelines by different sample determinants

Determinant	Variable	Base	Achieved		Not achieved		*p* value
			Yes	%	No	%	
Reason for treatment	Primary prevention	520	189	36.3	331	63.7	0.082
	Secondary prevention	296	86	29.1	210	70.9	
	Familial hypercholesterolemia	60	23	38.3	37	61.7	
Metabolic syndrome	Metabolic syndrome	492	159	32.3	333	67.7	0.087
	Non-metabolic syndrome	404	149	36.9	255	63.1	
Gender	Male	516	167	32.4	349	67.6	0.140
	Female	380	141	37.1	239	62.9	
Age distribution	<20 years	1	0	0.0	1	100.0	0.081
	20–34 years	40	21	52.5	19	47.5	
	35–39 years	39	19	48.7	20	51.3	
	40–44 years	89	34	38.2	55	61.8	
	45–49 years	132	45	34.1	87	65.9	
	50–54 years	170	60	35.3	110	64.7	
	55–59 years	163	50	30.7	113	69.3	
	60–64 years	122	32	26.2	90	73.8	
	65–69 years	85	26	30.6	59	69.4	
	70–74 years	33	15	45.5	18	54.5	
	75–79 years	10	3	30.0	7	70.0	
	>79 years	12	3	25.0	9	75.0	
Ethnic origin	Middle Eastern (including North Africa)	857	297	34.7	560	65.3	0.135
	Caucasian (including Europe and North America)	6	1	16.7	5	83.3	
	Others	6	0	0.0	6	100.0	
Current smoking	Smokers	207	71	34.3	136	65.7	0.971
	Non-smokers	665	229	34.4	436	65.6	
Diabetes mellitus	Diabetics	440	95	21.6	345	78.4	0.000
	Non-diabetics	437	203	46.5	234	53.5	
Arterial hypertension	Arterial hypertension	561	166	29.6	395	70.4	0.000
	Non-arterial hypertension	310	132	42.6	178	57.4	
Family history of CVD	History of CVD	272	91	33.5	181	66.5	0.643
	No history of CVD	573	201	35.1	372	64.9	

Table 4 Answers of investigators' questionnaire

Question	Answers	Valid Answer (base)	Missing	Mean & SD or N & %	
Q1 For what proportion of patients do you set individual target cholesterol levels expressed as an actual number.		82	8	76.9	27.2
Q2 Which lab measures do you generally use to set individual target cholesterol levels. (Yes)					
	Q2 Total Cholesterol	90	0	70	77.8%
	Q2 HDL-C	90	0	64	71.1%
	Q2 LDL-C	90	0	85	94.4%
	Q2 Triglycerides	90	0	67	74.4%
Q3 Do you utilize any guidelines to help establish individual cholesterol targets for your patients? (yes)		88	2	84	95.50%
Q4a) Which guidelines do you use? You can give more than one answer					
	* Joint European guidelines (SCORE)	29	61	12	41.4%
	* NCEP ATP III guidelines (FRAMINGHAM)	29	61	13	44.8%
	* National guidelines (if present)	29	61	7	24.1%
	* Local healthcare authority guidelines/recommendations	29	61	3	10.3%
	* Individual practice guidelines/recommendations	29	61	9	31.0%
	* Other (write in)	29	61	0	0.0%
	* Unable to name the precise guidelines used	29	61	0	0.0%
Q4b) Which one do you mainly use? Give only one answer					
	* Joint European guidelines (SCORE)	82	8	44	53.7%
	* NCEP ATP III guidelines (FRAMINGHAM)	82	8	25	30.5%
	* National guidelines (if present)	82	8	3	3.7%
	* Local healthcare authority guidelines/recommendations	82	8	0	0.0%
	* Individual practice guidelines/recommendations	82	8	6	7.3%
	* Other (write in)	82	8	4	4.9%
	* Unable to name the precise guidelines used	82	8	0	0.0%
Q5 When patients are first diagnosed with hypercholesterolemia do you generally inform them of their cholesterol level?					
Yes		Yes		83	98.8%
No		No		1	1.2%
Q6 In what proportion of patients do you					
	Q6a) not mention extent of reduction at all	86	4	8.8	12.2
	Q6b) provide a target cholesterol level expressed as an actual number	86	4	63.1	28.8
	Q6c) provide a percentage or proportion reduction	86	4	14.8	15.3
	Q6d) provide a more general description such as a need to reduce by 'a little' or 'a lot'	86	4	13.3	15.4
Q7 When informing your patients which of the following types of lipid parameters measurement do you generally use? You can give more than one answer (Yes)					
	Q7 Total cholesterol	88	2	70	79.5%
	Q7 HDL-C	88	2	56	63.6%

Table 4 continued

Q7 LDL-C	88	2	78	88.6%
Q7 Triglycerides	88	2	59	67.00%
Q8 Focusing now on pharmacological treatment for hypercholesterolemia, for what percentage of your patients do you recommend treatment with:				
Q8a) Statins	88	2	86.85	12.6
Q8b) Fibrates	88	2	9.45	10.4
Q8c) Bile acid sequestrants	88	2	1.42	3.0
Q8d) Other	88	2	2.27	4.8
Q9 How frequent do you see the patient to review their cholesterol level?				
Less frequent than once per year	88	2	1	1.1%
Once per year	88	2	3	3.4%
Once every 6 months	88	2	12	13.6%
Once every 3 months	88	2	58	65.9%
More frequent than once per 3 months	88	2	14	15.9%
Q21 In summary, thinking of all your hypercholesterolemia patients what percentages of those that have been set a target cholesterol level fall into the following categories?				
Q21a) Reached their target cholesterol level and continue to stay at this level	85	5	55.6%	21.1%
Q21b) Generally stay at their target cholesterol level but their cholesterol is sometimes too high	85	5	18.8%	11.5%
Q21c) Reached their target cholesterol level in the past but have now lapsed	85	5	14.7%	10.0%
Q21d) Have never reached their target cholesterol level	84	6	10.8%	12.1%
Q22 In general, once a patient has reached their target cholesterol level after what length of time do you ask that patient to come back to review their hypercholesterolemia? (months)				
One month	85	5	3	3.50%
2 months	85	5	7	8.20%
3 months	85	5	52	61.20%
6 months	85	5	22	25.90%
12 months	85	5	1	1.20%
Q23 What percentage of patients actually attends this review?				
	85	5	69.7%	19.9%

Q10-20 Please circle the most applicable number that meets how much you agree/disagree with each one (1 is disagree strongly and 5 is agree strongly).
The same scale will be used for all statements.

Statements	Base	Strongly Disagree (1)	Disagree (2)	Neither / Nor (3)	Agree (4)	Strongly Agree (5)	Mean Score
Q10 I feel frustrated that I am not always able to effectively treat my patients with cardiovascular disorders	**86**	40.7%	16.3%	14.0%	11.6%	17.4%	2.49
Q11 I find it stressful trying to get my patients to their cholesterol targets	**84**	27.4%	14.3%	21.4%	16.7%	20.2%	2.88
Q12 I feel pressured to get patients to their target cholesterol levels	**85**	22.4%	14.1%	14.1%	20.0%	29.4%	3.20

Table 4 continued

Q13 A sufficient number of patients reach their target cholesterol levels	**86**	5.8%	4.7%	20.9%	31.4%	37.2%	3.90
Q14 I'm frustrated that the guidelines instruct me to advise lifestyle changes alone as first line therapy in all patients	**86**	38.4%	10.5%	23.3%	12.8%	15.0%	2.56
Q15 I'm frustrated that the guidelines instruct me to prescribe a low dose of lipid-lowering drug to all patients and titrate upwards	**86**	37.2%	10.5%	20.9%	16.3%	15.1%	2.62
Q16 I tend to prescribe a lipid lowering drug only to patients who have proved they can adhere to diet and exercise change	**85**	49.4%	22.4%	10.6%	5.8%	11.8%	2.08
Q17 Patient compliance decreases if lipid lowering drugs take too long to have an effect	**86**	12.8%	10.5%	17.4%	34.9%	24.4%	3.48
Q18 I feel constrained to use less effective lipid lowering drugs first line	**86**	41.9%	20.9%	12.8%	10.4%	14.0%	2.34
Q19 Patients become concerned that their condition is more severe if their lipid lowering drug is titrated up	**86**	12.8%	17.5%	26.7%	22.1%	20.9%	3.21
Q20 Patients become concerned that their condition is more severe if their lipid lowering drug is frequently changed	**86**	7.0%	15.1%	20.9%	33.7%	23.3%	3.51

reaching their LDL-C treatment goals according to international guidelines. Compared to the CEPHEUS I survey that had been conducted in Egypt between October 2010 and June 2011, achievement of treatment goal was 32.5% (339 patients out of 1043) according to the NCEP ATP III Updated 2004 guidelines [8]. CEPHEUS II in Egypt showed a slight improvement in terms of achieving treatment goals compared to CEPHEUS I according to NCEP ATP III Updated 2004 guidelines, as 39.6% (355 out of 896) in CEPHEUS II achieved their LDL-C treatment goal.

CEPHEUS surveys in other countries were reported and the achievement was 57% in combined Western European countries [9], 49% for combined Asian countries [10], and 49.1% in combined eight Asian countries (Korea, Taiwan, Thailand, Indonesia, Philippines, Malaysia, Vietnam, Hong Kong SAR, and China) [10]. The individual results were 52% for South Africa [11], 49% for Greece [7], 83% for Hong Kong [12], 50% for Taiwan [13], 31.3% for Indonesia [14], and 53% for Thailand [15].

Our study (CEPHEUS II) showed that the lowest target LDL-C goal achievements were obtained with diabetes mellitus (21.6%), followed by secondary prevention (29.1%), arterial hypertension (29.6%), and metabolic syndrome (32.3%). On the contrary to previous findings from the CEPHEUS Pan-Asian survey, most of our patients with diabetes mellitus and hypertension did not achieve LDL goals. It is worth mentioning that ezetimibe achieved LDL-C goal with the highest percentage of 41.3% (63 out of 89 patients), in contrast to current knowledge in the literature about statins.

Table 5 Answers of patients' questionnaire

Question	Answers	Valid Answer (base)	Missing	Mean & SD or N & %	
S1 Have you ever heard or been told about bad cholesterol, otherwise known as LDL-C?					
	Yes	**891**	1	707	79.3%
	No			134	15.0%
	Don't Know			50	5.6%
S2 Have you ever heard or been told about good cholesterol, otherwise known as HDL-C?					
	Yes	**891**	1	675	75.7%
	No			161	18.0%
	Don't Know			56	6.3%
S3 When you were first told by your doctor that you had high cholesterol did your doctor tell you what your cholesterol level was?					
	Yes	**892**	0	740	83.00%
	No			152	17.00%
S4 Did your doctor give you a target cholesterol level to aim for?					
	Yes	**890**		692	77.80%
	No			198	22.20%
S4b Did your doctor give you a target cholesterol level to aim for?					
	* Only prescribe a tablet	**890**	2	106	11.9%
	* Both advise lifestyle changes and prescribe a tablet?			733	82.3%
	* Only advice you to change your lifestyle e.g. change your diet, stop smoking and/or do more exercise?			50	5.6%
	* Neither advice lifestyle changes nor prescribes a tablet			2	0.2%
S5 As a first step when you were diagnosed with high cholesterol, did the doctor:					
	* Only prescribe a tablet	**890**	2	106	11.9%
	* Both advise lifestyle changes and prescribe a tablet?			733	82.3%
	* Only advice you to change your lifestyle e.g. change your diet, stop smoking and/or do more exercise?			50	5.6%
	* Neither advice lifestyle changes nor prescribes a tablet			2	0.2%
S6 Which one of the following best describes the number of times your cholesterol lowering tablets has been changed since it was first prescribed?					
	* Still on the same tablet - go to Q8	**890**	2	106	11.9%
	* Still on the same tablet but the dose has increased - continue			733	82.3%
	* Have changed tablets once or twice (may include adding another tablet) - continue			50	5.6%
	* Have changed tablets several times (may also include adding other tablets) - continue			2	0.2%

Table 5 continued

S7 How did you feel about your cholesterol lowering tablets having to be changed i.e. having the dose of your tablets increased or taking a different tablets?				
a. Satisfied	892	0	249	27.9%
b. Concerned that your condition was now a 'serious illness'	892	0	130	14.6%
c. No strong feelings	892	0	81	9.1%
d. Less motivated to keep taking your tablets	892	0	32	3.6%
e. Irritated at having to keep making changes	892	0	79	8.9%
f. Disappointed that treatment was not successful	892	0	41	4.6%
S8 I am satisfied with the level of information available to me about high cholesterol:				
Agree	**892**	0	700	78.50%
Disagree			104	12%
Don't know/not applicable			88	9.90%
S9 I am frustrated that I still do not know whether my tablets have been effective enough in lowering my cholesterol.				
Agree	**889**	3	185	20.8%
Disagree			602	68.0%
Don't know/not applicable			102	11.5%
S10 I always take my tablets to lower my cholesterol every day.				
Agree	**889**	3	790	88.90%
Disagree			88	10%
Don't know/not applicable			11	1.20%
S11 I stopped taking my tablets when my cholesterol level returned to normal.				
Agree	**889**		155	17.4%
Disagree			690	78.0%
Don't know/not applicable			44	4.9%
S12 Sometimes I forgot to take my cholesterol lowering tablets.				
Agree	**889**	3	368	41.4%
Disagree			505	57.0%
Don't know/not applicable			16	1.8%
S13 Approximately how often do you forget to take your cholesterol lowering tablets?				
* Once a week	**474**	418	135	28.5%
* Once every two weeks			97	20.5%
* More than once a week			102	21.5%
* Once a month or less			140	29.5%
S14 How often do you think you can miss a tablet without affecting your cholesterol levels?				
* Once a week	**871**	21	215	24.7%
* Once every two weeks			120	13.8%
* More than once a week			156	17.9%
* Once a month or less			380	43.6%

Table 5 continued

S15 Which of the following best describes your current situation?				
* I have not reached my target cholesterol level	**887**	5	151	17.0%
* I'm not sure whether I have reached my target cholesterol level			351	39.6%
* I have not been given a target cholesterol level			32	3.6%
* I have reached my target cholesterol level			353	39.8%
S16 In general how do you feel about the way your high cholesterol has been treated?				
a. Satisfied	**742**	150	560	75.5%
b. Motivated	**652**	240	340	52.1%
c. Concerned	**631**	261	181	28.7%
d. Frustrated	**589**	303	40	6.8%
e. Disappointed	**587**	305	31	5.3%
f. Confused	**591**	301	68	11.5%
g. No strong feelings	**609**	283	176	28.9%
S17 In general, how often do you see your doctor for a checkup of your cholesterol level?				
Every 3 months	**883**	9	377	42.7%
Every 6 months			246	27.9%
More frequent than once every 3 months			149	16.9%
Every year			64	7.2%
Less often than once a year			20	2.3%
Do not have check-ups			7	0.8%
Don't know/ Can't remember			20	2.3%

Finally, this study was an observational rather than interventional study, and as such, it suffers from many limitations. Most of the variables that may affect treatment goals were considered; however, many variables were not counted, such as differences in clinical practice between study investigators, lifestyle, diet factors, adverse events, and socioeconomic status.

CONCLUSIONS

Statins are the most frequently used lipid-lowering drugs and have a significant impact on achieving target LDL-C goals. As per the current CEPHEUS II results, hypercholesterolemia is still not being effectively managed in many at-risk patients in Egypt. The majority of patients enrolled in the study, all of whom were being actively treated with lipid-lowering medication, were considered at high risk of a cardiovascular event; hypercholesterolemia was particularly poorly managed in this group. Initiatives are needed to improve physicians' management of these patients with more focus on their risk profiles. Patient compliance to treatment is still urgently needed.

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