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PREVALENCE OF LIPID ABNORMALITIES AND CHOLESTEROL TARGET VALUE ATTAINMENT IN PATIENTS WITH STABLE CORONARY HEART DISEASE AND ACUTE CORONARY SYNDROMES IN JORDAN AND LEBANON

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Azar R, Haddad J, Ambegaonkar B, Brudi Ph, Abu Hijleh MO, Horack M, Kabbani S, Kanaan R, Khoury Ch, Lautsch D, Vyas A, Wajih S & Gitt AK on behalf of DYSIS II investigators. Prevalence of lipid abnormalities and cholesterol target value attainment in patients with stable coronary heart disease and acute coronary syndromes in Jordan & Lebanon. J Med Liban 2020; 68 (3): 134-140.

ABSTRACT • Background : Cardiovascular disease is a growing problem throughout the world. As one of the most significant contributors to the development and progression of this disease, hyperlipidemia is a primary target for improving outcome for these patients. The extent of lipid abnormalities in patients with coronary heart disease (CHD) or those suffering an acute coronary syndrome (ACS), and the strategies used to treat them have not been systematically investigated in Jordan and Lebanon. **Methods :** The second Dyslipidemia International Study (DYSIS II) is an observational study established to quantify hyperlipidemia and its treatment throughout the world. Patients were enrolled if they had stable CHD or were being hospitalized due to an ACS. Data regarding cardiovascular risk factors, comorbidity, lipid levels, and lipid-lowering therapy (LLT) were collected. **Results :** A total of 360 patients were enrolled across Jordan and Lebanon ; 238 with stable CHD & 122 with an ACS. Few LLT-treated patients had a low-density lipoprotein cholesterol (LDL-C) level below the 70 mg/dl guide- line-recommended target for very high-risk patients (28.3% of CHD patients ; 27.1% of ACS patients). The mean atorvastatin- equivalent daily statin dosage was 29 ± 19 mg for the treated subjects with stable CHD and 24 ± 19 mg for those with an ACS. At the 4-month follow-up, statin use had increased significantly, but dosages remained inadequately low. **Conclusions :** CHD and ACS patients in Jordan and Lebanon display extensive hyperlipidemia. Use of LLT is widespread, but the low proportion of subjects achieving the recommended LDL-C target suggests that it is not being optimally employed.

Keywords : dyslipidemia; hypercholesterolemia; statins; coronary heart disease; acute coronary syndrome

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RÉSUMÉ • Contexte : Les maladies cardiovasculaires sont un problème croissant dans le monde entier. L'hyperlipidémie, un des plus importants contributeurs à leur développement et à leur progression, est une cible primaire pour l'amélioration des résultats. L'étendue des anomalies lipidiques chez les patients atteints d'une maladie coronarienne (CHD) ou souffrant d'un syndrome coronarien aigu (SCA) et les stratégies pour les traiter n'ont pas été systématiquement étudiées en Jordanie et au Liban. **Méthodes :** DYSIS II, 2e étude internationale sur la dyslipidémie, est une étude observationnelle établie pour quantifier l'hyperlipidémie et son traitement dans le monde. Les patients étaient recrutés s'ils avaient une coronaropathie stable ou étaient hospitalisés en raison d'un SCA. Les données concernant les facteurs de risque cardiovasculaire, les comorbidités, les taux de lipides et la thérapie hypolipémiante (THL) ont été recueillies. **Résultats :** Au total, 360 patients ont été recrutés en Jordanie et au Liban ; 238 avec une coronaropathie stable et 122 avec un SCA. Peu de patients traités par THL avaient un taux de lipoprotéines de basse densité (LDL-C) inférieur à la cible recommandée de 70 mg/dl chez les patients à très haut risque (28,3% des patients atteints de coronaropathie et 27,1% des patients avec SCA). La dose quotidienne moyenne de statine équivalente à l'atorvastatine était de 29 ± 19 mg chez les sujets traités avec une CHD stable et de 24 ± 19 mg chez ceux avec un SCA. Au suivi de 4 mois, l'utilisation de statines avait augmenté de manière significative, mais les doses restaient insuffisamment faibles. **Conclusion :** Les patients atteints de coronaropathie stable ou de SCA en Jordanie et au Liban présentent une hyperlipidémie importante. L'utilisation d'agents hypolipémiants est répandue, mais la faible proportion de sujets atteignant la cible recommandée de cholestérol LDL-C suggère qu'ils ne sont pas utilisés de façon optimale.

Mots-clés : dyslipidémie; hypercholestérolémie; statines; maladie coronarienne; syndrome coronarien aigu

INTRODUCTION

Hyperlipidemia is a well-known risk factor for coronary heart disease (CHD). Elevated low-density lipoprotein cholesterol (LDL-C) in particular has been shown to contribute significantly to the development and progression of CHD, greatly increasing cardiovascular risk [1]. In comparison to many countries in the Middle East, Lebanon and Jordan have higher rates of hyperlipidemia [2]. It has been reported that reducing LDL-C by approxi-

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mately 39 mg/dl (1 mmol/l) could decrease the 5-year incidence of major vascular events by around a fifth [3]. Along with lifestyle and dietary improvements, lipid-lowering therapies (LLT) such as statins can be highly effective for controlling cholesterol [4].

In the first Dyslipidemia International Study (DYSIS), statin-treated patients from Lebanon and Jordan were found to have a mean LDL-C level of 96.7 mg/dl [5]. In comparison, the value for the Middle East as a whole was 92.8 mg/dl [6], while that for the global population was 98.2 mg/dl [7].

Lowering LDL-C is the primary focus of current evidence-based guidelines for the management of hyperlipidemia in cardiovascular disease [8-11]. The European Society of Cardiology (ESC) and the European Atherosclerosis Society (EAS) advocate reducing LDL-C levels to below 70 mg/dl (1.81 mmol/l) for patients at very high cardiovascular risk [10]. In the Centralized Pan-Levant Survey on the Under-treatment of Hypercholesterolemia (CEPHEUS-Levant), 24.8% of very high risk patients from Lebanon and Jordan who were being treated with LLT had an LDL-C level < 70 mg/dl [12], while the value was 31.9% for the Arabian Gulf population of CEPHEUS [13], and 26.8% for the European cohort [14]. In DYSIS, target achievement for the very high risk Lebanon and Jordan group was 33.0%, which compared with 26.6% for the Middle East and Africa region as a whole, and 21.7% for the global population [7,15].

Such poor goal attainment calls into question the effectiveness of the way LLT is being applied both in Lebanon and Jordan and across the world. DYSIS II was established in order to quantify hyperlipidemia in patients at the highest cardiovascular risk, and to investigate the LLT being used to treat them.

METHODS

Study design and patients

Patients were recruited from two centers within Jordan and five centers within Lebanon from November 2013 to November 2014. Individuals had either stable CHD or an acute coronary syndrome (ACS), were over 18 years of age, and had a full lipid profile available. ACS was defined as an ST-segment elevation myocardial infarction (STEMI)/left bundle branch block myocardial infarction (LBBB MI), non-ST segment elevation myocardial infarction (NSTEMI), or unstable angina (UA). For patients with CHD, the last blood test prior to the enrollment physician visit was used to provide the lipid profil; for patients with an ACS, a blood test carried out within 24 h of admission to hospital was used. If a patient was receiving LLT, the duration of treatment had to be ≥ 3 months prior to enrollment. For the patients with stable CHD, data were collected at the baseline physician visit, while for those presenting with an ACS, data were collected on admission to hospital and at 4 months (± 15 days) post-admission.

All recruited patients provided written informed consent. The study received ethical approval from the relevant committees at each participating center, and was carried out in accordance with the Declaration of Helsinki and its amendments.

Documentation

A standardized case report form (CRF) was used for data collection. Demographic and clinical variables were collected at baseline. These included age, gender, and body mass index (BMI); a sedentary lifestyle or smoking; presence of hypertension or type 2 diabetes mellitus; a history of CHD, peripheral artery disease (PAD), chronic renal failure (CRF), or chronic kidney disease (CKD); a prior MI or stroke (ischemic or hemorrhagic); and any family history of CHD. Use of cardiovascular medications at admission were also documented. A full lipid profile was recorded, which included serum levels of total cholesterol (TC), LDL-C, high-density lipoprotein cholesterol (HDL-C), non-HDL-C, and triglycerides.

For ACS patients, pre-admission cardiovascular risk status was determined according to the ESC/EAS guidelines, with targets for LDL-C for very high-risk, high-risk, moderate-risk, and low-risk patients were defined as < 70 mg/dL (1.8 mmol/L), < 100 mg/dL (2.6 mmol/L), < 115 mg/dL (3.0 mmol/L) & < 130 mg/dL (3.4 mmol/L), respectively [10].

Patients were divided into subgroups based on whether they were being treated with LLT at the time of the latest lipid test (CHD patients) or at admission to hospital (ACS patients). The following classes of LLT were assessed: statin monotherapy, non-statin monotherapy, statin plus ezetimibe, and statin plus non-statin therapy. The statins assessed were atorvastatin, fluvastatin, lovastatin, pitavastatin, pravastatin, rosuvastatin, and simvastatin. Atorvastatin dose equivalents were based on clinical trial data regarding the LDL-C-lowering efficacy of various statins [16].

For ACS patients, at 4 months (± 15 days) post-admission, any lipid profiles collected since hospital discharge were collected, and the medications that the subjects were receiving at this time were documented.

Statistics

Data are presented as means with standard deviations (SD), medians with interquartile ranges (IQR), or absolute values with percentages. LDL-C target attainment was assessed first by risk classification and then, in the subgroup of patients with LDL-C data at both time points, admission and follow-up.

RESULTS

Patients with stable coronary heart disease

Of the 360 patients enrolled in the study, 238 had stable CHD and 122 had an ACS. The mean age of the stable CHD patients was 64.1 years, and 76.9% were male (Table I). Cardiovascular risk factors were highly prevalent, with 30.3% of patients being classified as obese (BMI > 30 kg/m^2) and 56.5% reporting a family history of CHD. The majority of patients (93.7%) were being treated with LLT prior to enrollment, with these individuals displaying no significant differences in terms of demographics and risk factors to those that were not being treated. Comorbidity was common, in particular, type 2 diabetes mellitus (79.8%) and hypertension (73.1%).

Patients with acute coronary syndromes

The mean age of the ACS patients was 60.5 years, and 70.5% were male (Table II). Obesity was noted for 33.1%, while 47.5% were current smokers, 46.3% had a

TABLE I PATIENT CHARACTERISTICS – STABLE CHD

	Total N = 238	LLT N = 223	No LLT N = 15
Age (years)	64.1 ± 9.5	64.2 ± 9.6	62.9 ± 8.0
Male (%)	76.9 (183/238)	77.1 (172/223)	73.3 (11/15)
BMI (kg/m^2)	27.8 (25.7, 30.8)	27.8 (25.9, 31.2)	26.1 (24.6, 30.0)
BMI > 30 kg/m^2 (%)	30.3 (72/238)	30.9 (69/223)	20.0 (3/15)
SBP (mmHg)	130 (120, 140)	130 (120. 140)	125 (120. 140)
DBP (mmHg)	80 (70, 80)	80 (70, 80)	80 (70. 85)
CV risk factors (%)			
Current smoker	12.6 (30/238)	12.1 (27/223)	20.0 (3/15)
Sedentary lifestyle	55.8	54.8	75.0
Family history of CHD	56.5 (118/209)	59.2 (116/196)	15.4 (2/13)
Comorbidities (%)			
Type 2 diabetes mellitus	79.8 (190/238)	78.5 (175/223)	100.0 (15/15)
Hypertension	73.1 (174/238)	74.0 (165/223)	60.0 (9/15)
CKD	5.0 (12/238)	4.9 (11/223)	6.7 (1/15)
Prior stroke*	2.7 (6/226)	2.8 (6/213)	0.0 (0/13)
History of PAD	10.0 (23/230)	8.8 (19/217)	30.8 (4/13)
Type of CHD			
Coronary angiography (stenosis > 50%)	33.2 (79/238)	35.0 (78/223)	6.7 (1/15)
Cardiac CT (stenosis > 50%)	2.5 (6/238)	2.7 (6/223)	0.0 % (0/15)
Prior PCI	63.4 (151/238)	61.9 (138/223)	86.7 (13/15)
Prior CABG	39.1 (93/238)	41.3 (92/223)	6.7 (1/15)
History of ACS**	23.5 (56/238)	22.9 (51/223)	33.3 (5/15)

* Includes ischemic & hemorrhagic stroke ** > 3 months prior to enrollment CHD: coronary heart disease LLT: lipid-lowering therapy BMI: body mass index SBP: systolic blood pressure DBP: diastolic blood pressure CV: cardiovascular CKD: chronic kidney disease PAD: peripheral artery disease ACS: acute coronary syndrome PCI: percutaneous coronary intervention CABG: coronary artery bypass graft CT: computed tomography. *Data presented as median (interquartile range), mean ± standard deviation, or percentage (n/N).*

TABLE II PATIENT CHARACTERISTICS – ACS

	Total N = 122	LLT N = 85	No LLT N = 37
Age (years)	60.5 ± 12.6 (n = 112)	62.5 ± 13.0 (n = 78)	55.8 ± 10.4 (n = 34)
Male (%)	70.5 (86/122)	67.1 (57/85)	78.4 (29/37)
BMI (kg/m^2)	28.5 (26.3, 31.2)	28.5 (26.4, 31.6)	28.5 (25.0, 29.7)
BMI > 30 kg/m^2 (%)	33.1 (40/121)	36.9 (31/84)	24.3 (9/37)
SBP (mmHg)	130 (120, 142)	130 (120. 142)	130 (120. 140)
DBP (mmHg)	80 (70, 80)	80 (70, 80)	80 (70. 80)
CV risk factors (%)			
Current cigarette smoker	47.5 (58/122)	44.7 (38/85)	54.1 (20/37)
Sedentary lifestyle	46.3 (56/121)	50.0 (42/84)	37.8 (14/37)
Family history of CHD	26.3 (31/118)	23.5 (19/81)	32.4 (12/37)
Comorbidities (%)			
Type 2 diabetes mellitus	41.8 (51/122)	47.1 (40/85)	29.7 (11/37)
Hypertension	58.2 (71/122)	68.2 (58/85)	35.1 (13/37)
CKD	7.4 (9/122)	8.2 (7/85)	5.4 (2/37)
Prior stroke*	3.3 (4/122)	3.5 (3/85)	2.7 (1/37)
History of PAD	4.1 (5/121)	4.8 (4/84)	2.7 (1/37)
ACS diagnosis (%)			
STEMI/LBBB MI	17.2 (21/122)	12.9 (11/85)	27.0 (10/37)
NSTEMI	15.6 (19/122)	14.1 (12/85)	18.9 (7/37)
Unstable angina	67.2 (82/122)	72.9 (62/85)	54.1 (20/37)

* Includes ischemic & hemorrhagic stroke ACS: acute coronary syndrome. LLT: lipid-lowering therapy BMI: body mass index SBP: systolic blood pressure DBP: diastolic blood pressure CV: cardiovascular CHD: coronary heart disease CKD: chronic kidney disease PAD: peripheral artery disease CT: computed tomography PCI: percutaneous coronary intervention CABG: coronary artery bypass graft STEMI:.ST-segment elevation myocardial infarction LBBB MI: myocardial infarction with left bundle branch block NSTEMI: non-ST-elevation myocardial infarction. *Data presented as median (interquartile range), mean ± standard deviation, or percentage (n/N).*

TABLE III LIPID PROFILE (LATEST BLOOD TEST*)

		CHD			ACS		
		Total N = 238	LLT N = 223	No LLT N = 15	Total N = 122	LLT N = 85	No LLT N = 37
LDL-C (mg/dl)	mean ± SD	87.3 ± 31.2	85.9 ± 30.2	107.9 ± 38.8	108.5 ± 45.7	98.2 ± 41.1	131.9 ± 47.6
	median	80.0	80.0	110.0	108.5	96.0	133.0
	(IQR)	(68.0, 100.0)	(67.0, 98.0)	(85.0, 130.0)	(75.0, 138.0)	(69.0, 121.0)	(88.0, 169.0)
HDL-C (mg/dl)	mean ± SD	41.1 ± 11.3	40.9 ± 10.8	43.9 ± 16.8	37.5 ± 11.1	36.2 ± 10.3	40.4 ± 12.4
	median	40.0	40.0	42.0	36.0	34.0	40.0
	(IQR)	(33.0, 47.0)	(33.0, 47.0)	(35.0, 48.0)	(29.0, 45.0)	(29.0, 43.0)	(31.0, 49.0)
Non-HDL-C (mg/dl)	mean ± SD	120.7 ± 40.4	118.6 ± 36.4	152.7 ± 73.7	147.8 ± 55.1	135.7 ± 53.8	175.2 ± 48.2
	median	115.0	112.0	138.0	144.0	122.0	177.0
	(IQR)	(95.0, 139.0)	(95.0, 136.0)	(116.0, 186.0)	(102.0, 183.0)	(94.0, 173.0)	(153.0, 214.0)
TC (mg/dl)	mean ± SD	161.8 ± 42.0	159.4 ± 37.7	196.6 ± 77.1	189.1 ± 69.4	177.5 ± 72.2	215.7 ± 54.5
	median	153.5	152.0	188.0	181.5	164.0	215.0
	(IQR)	(135.0, 185.0)	(133.0, 180.0)	(160.0, 232.0)	(138.0, 222.0)	(130.0, 211.0)	(197.0, 254.0)
Triglycerides (mg/dl)	mean ± SD	166.7 ± 98.2	168.5 ± 99.8	140.0 ± 66.5	255.0 ± 489.6	256.5 ± 570.5	251.8 ± 214.7
	median	147.0	147.0	128.0	172.5	167.0	200.0
	(IQR)	(107.0, 188.0)	(108.0, 189.0)	(85.0, 181.0)	(121.0, 262.0)	(123.0, 261.0)	(111.0, 276.0)
LDL-C < 70 mg/dl**		27.7 (66/238)	28.3 (63/223)	20.0 (3/15)	21.3 (26/122)	27.1 (23/85)	8.1 (3/37)
Distance to LDL-C target (< 70 mg/dl)		20.0 (8.0, 40.0)	20.0 (8.0, 37.5)	46.5 (31.0, 71.5)	47.5 (20.0, 77.5)	43.0 (16.0, 57.0)	68.0 (41.0, 99.0)

*CHD patients: last recorded lipid profile prior to physician visit; ACS patients: within 24 h of admission for ACS event.
**ECS/EAS guidelines [10]. LDL-C: low-density lipoprotein cholesterol HDL-C: high-density lipoprotein cholesterol TC: total cholesterol.
Data presented as median (interquartile range) or percentage (n/N).

sedentary lifestyle, and 26.3% had a family history of CHD. A total of 69.7% of patients were being treated with LLT prior to their ACS event, with these subjects being older than those that were not being treated (62.5 *vs*. 55.8 years).

Cardiovascular risk factors were equally prevalent for the patients with and without prior LLT. Comorbidities were reported for high proportions of patients, with hypertension being found more frequently for the patients receiving LLT in comparison to those that were not (68.2% *vs*. 35.1%). A slightly smaller proportion of the patients being treated with LLT were diagnosed with a STEMI or MI/LBBB in comparison to those that were not being treated (12.9% *vs*. 27.0%). A diagnosis of NSTEMI was found for similar percentages of patients in each group.

The most common diagnosis was unstable angina, being found for 72.9% and 54.1% of the LLT and no LLT patients, respectively.

TABLE IV

MULTIPLE LOGISTIC REGRESSION MODEL FOR TARGET ATTAINMENT (LDL < 70 mg/dl) FOR PATIENTS RECEIVING LLT AT BASELINE

Variable	ACS patients OR (95% CI)	ACS patients OR (95% CI)
Age ≥ 70 years	1.61 (0.80-3.24)	0.55 (0.12-2.45)
Female gender	0.59 (0.26-1.34)	1.46 (0.40-5.31)
BMI > 30 kg/m²	0.71 (0.34-1.46)	0.65 (0.16-2.60)
Current smoking	1.19 (0.48-2.97)	2.47 (0.72-8.45)
Sedentary lifestyle	1.24 (0.65-2.38)	0.70 (0.18-2.77)
Stable angina	1.34 (0.70-2.56)	0.43 (0.07-2.61)
Type-2 diabetes	1.78 (0.76-4.15)	0.39 (0.10-1.52)
Hypertension	1.36 (0.65-2.86)	1.50 (0.36-6.18)
Statin dose (calculated as atorvastatin equivalent, mg/day)	**1.03 (1.01-1.04)**	0.998 (0.96-1.04)
Chronic kidney disease	0.82 (0.16-4.27)	1.75 (0.19-16.07)
History of congestive heart failure	0.29 (0.08-1.07)	3.89 (0.53-28.76)

BMI: body mass index. The model includes all displayed variables, which were selected based on clinical relevance.

Lipid profile at time of latest lipid test

For the LLT-treated patients with stable CHD, the lipid profile that was constructed from the last blood test prior to enrollment revealed a mean LDL-C level of 85.9 ± 30.2 mg/dl (Table III). The median HDL-C level was 40.0 [33.0, 47.0] mg/dl, the median non-HDL-C level was 112.0 [95.0, 136.0] mg/dl, the median TC was 152.0 [133.0, 180.0] mg/dl, and the median triglyceride level was 147.0 [108.0, 189.0] mg/dl. A total of 28.3% of LLT-treated CHD patients had attained the < 70 mg/dl ESC/EAS LDL-C target, with the median distance to goal being 20.0 [8.0, 37.5] mg/dl. (Table IV).

The LLT-treated ACS patients displayed a mean LDL-C level of 98.2 ± 41.1 mg/dl (Table III). The median HDL-C level was 34.0 [29.0, 43.0] mg/dl, the me-

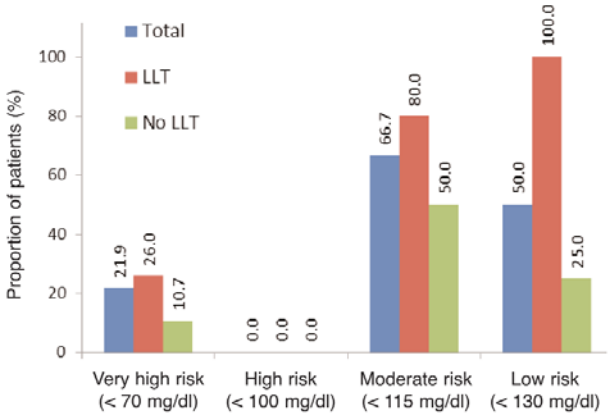

Figure 1
Target LDL-C attainment in ACS patients (% at goal) by risk level* prior to hospital admission

TOTAL POPULATION: very high risk: N = 105 (LLT 77, no LLT 28); high risk: N = 2 (LLT 1, no LLT 1); moderate risk: N = 9 (LLT 5, no LLT 4); low risk: N = 6 (LLT 2, no LLT 4).
**Risk level determined according to ESC/EAS guidelines [10].*

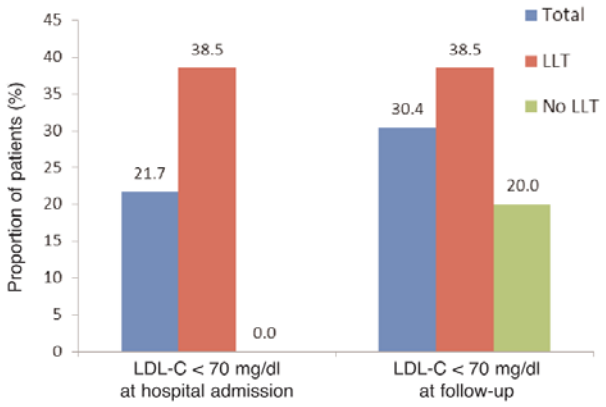

Figure 2
LDL-C target achievement at ACS hospital admission and 4-month follow-up

Target attainment in sub-groups of patients for whom LDL-C values were available at both baseline (admission) and follow-up: N = 23 for total; N = 13 for LLT patients; N = 10 for no LLT patients.

dian non-HDL-C level was 122.0 [94.0, 173.0] mg/dl, the median TC level was 164.0 [130.0, 211.0] mg/dl, and the median triglyceride level was 167.0 [123.0, 261.0] mg/dl. A total of 27.1% of these patients had an LDL-C level below < 70 mg/dl, with the median distance to goal being 43.0 mg/dl. When the LLT-treated ACS patients were divided according to pre-admission risk status, 26.0% (20/77) of the very high-risk individuals treated with LLT had an LDL-C level at their target of < 70 mg/dl, while only 10.7% (3/28) of those not treated were at target (Figure 1 & Table IV).

During the 4-month follow-up period, 23 patients had a newly constructed lipid profile available, 13 in the group that had been receiving LLT prior to their initial hospitalization, and 10 in the group that had not. A total of 38.5% of the LLT group had an LDL-C level < 70 mg/dl at hospital admission, with this percentage not changing during the follow-up period (Figure 2).

TABLE V LIPID-MODIFYING THERAPY AT PHYSICIAN VISIT/ADMISSION TO HOSPITAL

	Stable CHD*	ACS	
		Hospital admission	4-month follow-up
	N = 238	N = 122	N = 108
Treated with LLT (%)	93.7 (223/238)	69.7 (85/122)	98.1 (106/108)
Statin therapy (%)	92.0 (219/238)	67.2 (82/122)	98.1 (106/108)
Atorvastatin	44.7 (98/219)	54.9 (45/82)	77.4 (82/106)
Fluvastatin	1.4 (3/219)	1.2 (1/82)	0.0 (0/106)
Lovastatin	0.0 (0/219)	0.0 (0/82)	0.9 (1/106)
Pitavastatin	3.7 (8/219)	1.2 (1/82)	0.9 (1/106)
Pravastatin	0.5 (1/219)	1.2 (1/82)	0.0 (0/106)
Rosuvastatin	36.1 (79/219)	15.9 (13/82)	15.1 (16/106)
Simvastatin	13.7 (30/219)	25.6 (21/82)	5.7 (6/106)
Statin daily dose – Atorvastatin eq. (mg/day)**	29 ± 19 (n = 219)	24 ± 19 (n = 82)	38 ± 16 (n = 106)
Statin daily dose – Simvastatin eq. (mg/day)**	59 ± 38 (n = 219)	49 ± 38 (n = 82)	76 ± 37 (n = 106)
Statin monotherapy (%)	64.7 (154/238)	63.1 (77/122)	89.8 (97/108)
Non-statin monotherapy (%)	1.7 (4/238)	2.5 (3/122)	0.0 (0/108)
Statin + ezetimibe (%)	14.7 (35/238)	1.6 (2/122)	0.9 (1/108)
Statin + non-statin (%)	27.3 (65/238)	4.1 (5/122)	8.3 (9/108)

*LLT at time of latest lipid profile **Dose equivalents calculated according to ref [16].
Data presented as mean ± standard deviation, or percentage (n/N).

Lipid-lowering therapy
LLT was being used by 93.7% of the CHD patients at the time of their latest lipid test, with 92.0% of the population being treated with a statin (Table V).

Atorvastatin was the most commonly used (44.7%). When normalized to atorvastatin potency, the mean daily statin dosage was 29 ± 19 mg. A non-statin was being taken in addition to a statin by 27.3%, while non-statin monotherapy was the LLT for 1.7%. A statin plus ezetimibe was used by 14.7% of patients. For the ACS patients, 69.7% were being treated with LLT at hospital admission, with 67.2% taking a statin (Table V). Again, atorvastatin was the most frequently prescribed (54.9%). The mean daily atorvastatin equivalent statin dosage was 24 ± 19 mg. Non-statin LLT was not commonly used, with only 4.1% being treated with a statin plus a non-statin and 2.5% receiving non-statin monotherapy. Ezetimibe plus a statin was used by 1.6% of patients.

At the 4-month follow-up point, LLT use had increased significantly to 98.1% of the ACS population (Table V).

Events during follow-up for ACS patients
Two patients died during the follow-up period, one from each group. A cardiovascular cause was noted in both cases. Rehospitalization was required for 17.1% of the LLT group and 11.8% of the no LLT group.

DISCUSSION

For patients in Lebanon and Jordan, the use of LLT was widespread, and its initiation after an ACS was wide-ranging. The prescribed dosages, however, were often insufficient for producing the benefits that have been previously demonstrated with intensive therapy.

Patients
For the patients with CHD, smoking was not particularly common at 12.6%, which is much lower than the proportions of patients in the general populations of Lebanon and Jordan that have been identified as smokers (approx. 30-40%) [2]. This suggests that these patients have made some effort to improve their lifestyles after receiving a diagnosis of CHD, although smoking cessation in CHD patients in Jordan has been reported to be poor [17].

Type 2 diabetes mellitus was alarmingly prevalent at almost 80%, which is a much higher rate than that found in the general population [2,18].

Lipid profile and LDL-C target attainment
Whilst the mean LDL-C value was only 15 mg/dl above the < 70 mg/dl target value for the LLT-treated patients with stable CHD, only 28.3% had attained this goal. For the treated ACS patients, it was achieved by an even smaller percentage (27.1%), with 26.0% of those with a very high-risk pre-admission status meeting the target. Similar goal achievement has been reported for dyslipidemic Lebanese and Jordanian patients being treated with LLT.

Lipid-lowering therapy
At the time of the latest lipid test, the majority of the stable CHD patients were being treated with a statin; however, the atorvastatin-equivalent dosage was low at 29 mg/day. For the ACS patients, the dosage was even lower at 24 mg/day, with only 69.7% being treated with LLT prior to admission.

At the 4-month follow-up point, although the majority of patients were receiving a statin, the daily dosage remained fairly low at 38 mg/day. This is in spite of guidelines recommending initiation of intensive statin therapy for all patients hospitalized for an ACS [10]. Benefits of intensive statin therapy for patients with CHD have been demonstrated by Nicholls *et al*., who reported significant coronary plaque regression with atorvastatin (80 mg/day) or rosuvastatin (40 mg/day) use [19].

Limitations
A significant limitation of the present analysis is the lack of information available regarding lipid levels at follow-up. A further drawback is the relatively small size of the populations, diminishing the statistical value of any comparisons.

CONCLUSIONS

Hyperlipidemia is highly prevalent in patients with CHD in Lebanon and Jordan. The use of LLT is widespread, but the low number of patients reaching the recommended LDL-C target indicates that such treatment is not being optimally employed. Furthermore, maximization of therapy for patients with an ACS is often insufficient. The data demonstrate that there is a great scope for improvement in the way people with CHD are treated. By achieving this, the rate of adverse cardiovascular events that these high-risk patients suffer could be greatly diminished.

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