

# Hospital Care Efficiency – Measuring Lipid Profile During Hospitalization

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**Background:** Lipid profile measurement in order to identify patients with elevated low-density lipoprotein cholesterol (LDL-C) is clearly recommended for all age groups. However, the value of screening patients for elevated LDL-C during hospitalization has not been determined. The aim of this study was to investigate the value of lipid screening tests in patients admitted to internal medicine wards, and as part of our efforts to promote a more intelligent and efficient use of laboratory and imaging tests during hospital care.

**Methods:** We conducted this retrospective, observational study, in which medical charts of patients for whom at least one lipid profile measurement was performed during hospitalization were reviewed. The patients were categorized into 5 groups according to admission diagnosis, and for each patient, we looked if the lipid profile was mentioned or referred to, based on guidelines, in the discharge summary.

**Results:** Lipid profile taken during hospitalization was referred to in the discharge letter in only 38.7% of patients, and even in the case of a need to consider according to guidelines, only a 45.7% consideration rate was found.

**Conclusion:** This study highlights the need for a more efficient and focused approach to the use of lipid profile measurement during hospitalization.

**Keywords:** lipid profile measurement, hospitalization, efficiency, discharge recommendations

## Introduction

Guidelines clearly recommend the determination of elevated low-density lipoprotein-cholesterol (LDL-C) for the primary prevention of atherosclerotic cardiovascular disease (ASCVD) for all age groups.<sup>1</sup> The measurement of blood lipid profile during hospitalization in patients with documented ASCVD probably has clinical benefit,<sup>2,3</sup> but the value of lipid profile screening for patients admitted for other reasons has yet to be determined. On the one hand, the National Cholesterol Education Program (NCEP) recommends that lipid profile should be measured in all patients with chest pain or acute coronary syndrome (ACS), preferably on the first 24 hours of hospital admission.<sup>4</sup> On the other hand, lipid profile measurement during hospitalization can result in values that are not representative and might be lower than the patient's actual level.<sup>5</sup> The utility of measuring lipid profile for patients admitted not due to ASCVD has not been determined.

Rambam Health Care Campus (RHCC) is a tertiary hospital in northern Israel. The internal medicine division of RHCC has six internal medicine departments, containing 238 beds. The measurement of total cholesterol, high-density lipoprotein-cholesterol (HDL-C), triglycerides (TG), and calculated LDL-C is commonly performed in these wards, and the decision to measure them is up to the treating physician. A previous initiative performed in the internal medicine division of our medical center focused on improving the efficiency of medical investigations, resulted in significant reduction of unnecessary blood tests and other diagnostic tests.<sup>6,7</sup> In this study, we aimed to investigate the value of lipid

screening tests in patients admitted to internal medicine wards as part of our efforts to promote a more intelligent and efficient use of laboratory and imaging tests during hospital care, inspired by the Choosing Wisely campaign<sup>® 8</sup>.

## Methods

A retrospective observational study of patients admitted to the internal medicine division at RHCC, was performed between 01/01/2019 and 31/12/2019. Data were collected from computerized medical records. Patients for whom at least one lipid profile measurement was performed during hospitalization were included. Data collection included demographic variables (age and gender), HDL-C, total cholesterol, and TG measurements and calculated LDL-C. Relevant past medical history was obtained. Patients were divided into 5 groups according to admission diagnosis: (1) chest pain, including unstable angina (UA) and myocardial infarction (MI), (2) congestive heart failure (CHF), (3) neurological problem, (4) fever/infectious disease, and (5) other. For each subject, we documented whether the discharge summary referred to the lipid profile, and whether therapeutic recommendations relating to the lipid profile were provided. Normality was assessed using skewness and kurtosis. The demographic and laboratory results were presented in terms of median and interquartile range (IQR). Two-tailed Mann–Whitney test was used to assess significance. Categorical variables were described in percentage. Chi-square test was used to compare percentages. Fisher's exact test was used to compare between small sample-sized groups. A p-value of less than 0.05 was considered statistically significant. SPSS, version 25 (IBM Corp, Armonk, NY) was used for the statistical analysis.

## Results

A total of 199 patients were included in this study. The median LDL-C was 89.5 mg/dL. The demographic and clinical characteristics of the patients are presented in Table 1. Lipid profile was mentioned in the discharge summary in 77 patients (38.7%). In 94 patients, the lipid profile measurement should have been referred to based on guidelines, and this was indeed the case for 43 (45.7%), 35 (37.2%) of whom had an appropriate adjustment in medical treatment. In 105 patients, the lipid profile did

**Table 1** Demographic and Clinical Characteristics of the Patients

		<b>Recommendation Required N=94</b>	<b>Recommendation Not Required N=105</b>	<b>P value</b>
Median age (IQR)	65.7 (18.0)	69.5 (18.8)	67.0 (22.0)	0.114
Male sex – no. (%)	102 (51.3)	46 (48.9)	56 (53.3)	0.535
<b>Coexisting illness – N (%)</b>				
Ischemic heart disease	65 (32.7)	35 (37.2)	30 (28.6)	0.193
Diabetes mellitus	84 (42.2)	47 (50.0)	37 (35.2)	0.035
Hypertension	138 (69.4)	72 (76.6)	66 (62.8)	0.036
Smoking	84 (42.2)	47 (50.0)	37 (35.2)	0.035
<b>Relevant treatment – N (%)</b>				
Statin treatment on admission	99 (49.7)	42 (44.7)	57 (54.3)	0.225
Ezetimibe treatment on admission	13 (6.5)	6 (6.4)	7 (6.7)	0.936
<b>Admission cause – N (%)</b>				
Chest pain/UA/MI	69 (34.7)	36 (38.3)	33 (31.4)	0.309
CHF	24 (12.1)	12 (12.8)	12 (11.4)	0.772

(Continued)

**Table 1** (Continued).

		<b>Recommendation Required N=94</b>	<b>Recommendation Not Required N=105</b>	<b>P value</b>
Neurological problem	14 (7.0)	10 (10.6)	4 (3.8)	0.060
Fever/Infectious disease	26 (13.1)	9 (9.6)	17 (16.2)	0.167
Other	66 (33.2)	27 (28.7)	39 (37.1)	0.208
<b>Lipid profile - median (IQR)</b>				
TC	157.0 (60.5)	175.0 (54.0)	134.0 (46.0)	<0.001
LDL-C	89.5 (51.0)	108.0 (43.0)	65.0 (38.0)	<0.001
HDL-C	39.0 (17.4)	38.8 (16.4)	39.0 (18.2)	0.795
TG	122.0 (78.0)	129.0 (70.5)	110.0 (81.0)	0.014

**Abbreviations:** IQR, interquartile range; N, number. UA, unstable angina; MI, myocardial infarction; CHF, congestive heart failure; TC - total cholesterol; LDL-C - low-density lipoprotein cholesterol; HDL-C - high-density lipoprotein cholesterol; TG - triglycerides.

**Table 2** Consideration of Lipid Profile Measurement in the Discharge Summary

	<b>Reference Required N=94</b>		<b>Reference Not Required N=105</b>		<b>Total N=199</b>		
<b>Admission Cause</b>	<b>Lipid Profile Considered N (%)</b>	<b>Lipid Profile Not Considered N (%)</b>	<b>Lipid Profile Considered N (%)</b>	<b>Lipid Profile Not Considered N (%)</b>	<b>Lipid Profile Considered N (%)</b>	<b>Lipid Profile Not Considered N (%)</b>	<b>P value</b>
<b>Chest pain/ UA/MI</b>	24 (66.7)	12 (33.3)	18 (54.5)	15 (45.5)	42 (60.9)	27 (39.1)	0.333
<b>CHF</b>	1 (8.3)	11 (91.4)	4 (33.3)	8 (66.7)	5 (20.8)	19 (79.2)	0.317
<b>Neurological problem</b>	6 (60.0)	4 (40.0)	0 (0.0)	4 (100.0)	6 (42.8)	8 (57.2)	0.085
<b>Fever/infectious disease</b>	1 (11.1)	8 (88.9)	3 (17.6)	14 (82.4)	4 (15.4)	22 (84.6)	1.000
<b>Other</b>	11 (40.7)	16 (59.3)	9 (23.1)	30 (76.9)	20 (30.3)	46 (69.7)	0.174
<b>Total</b>	43 (45.7)	51 (54.3)	34 (32.4)	71 (67.6)	77 (38.7)	122 (61.3)	0.059

**Notes:** The P-value for the difference between the admission reasons was highly significant ( $P<0.001$ ) in the total cohort and in the "reference required" group. In the "reference not required group", the significance was less strong ( $P=0.03$ ).

**Abbreviations:** N, Number; UA, unstable angina; MI, myocardial infarction; CHF, congestive heart failure.

not require a change in treatment based on guidelines. Within this group, 34 (32.4%) had a reference to the measured lipid profile in the discharge summary. In general, there were no statistically significant differences between groups regarding the mention of the lipid profile in the discharge summary or advice regarding treatment (Table 2). Within the group of patients admitted for chest pain, the consideration given to the lipid profile was significantly higher (21.1%,  $P<0.001$ ) than in the other admission groups.

## Discussion

There is no doubt that lipid profile measurement should be performed, and lipid-lowering medications prescribed, particularly for the secondary prevention of ASCVD. However, generally the benefits of lipid profile measurement during hospitalization have not been determined and information from previous studies remains inconclusive. A large-scale study performed in the United States revealed that lipid-lowering medications were part of the discharge regimen

only in 31.7%.<sup>9</sup> Yet, studies aiming to investigate the impact of acute illness on lipid profile found a large variation in LDL-C measurement between consecutive tests, and thus may have an impact on the treatment.<sup>10,11</sup>

In our study, we found that the results of the lipid profile performed during hospitalization were mentioned in the discharge summary in only 38.7% of cases, and that treatment recommendations when indicated occurred in less than half of the cases. Where medical resources are limited and cost-effectiveness considered on a daily basis, great attention should be given to unnecessary blood tests taken on admission. A previous study performed at our hospital using clear recommendations and unbundling routine panels of chemistry tests resulted in a 20% reduction in the use of unnecessary laboratory tests.<sup>6</sup> However, that study did not relate to the lipid profile.

This study has several limitations. First of all, it is a small sample of hospitalized patients, randomly assigned from our hospital computerized data-base. Second, it is a single-center study, so the observed outcomes may not be generalizable to other centers. Above all, it is a retrospective observational study, not an interventional one.

## Conclusions

We believe that the current study helps to highlight the need for a more focused approach to the use of lipid profile measurements in acute admissions to internal medicine wards and to further assimilate a more efficient use of it.

## Data Sharing Statement

All data are available upon request to the corresponding author.

## Ethics Approval

The study was approved by the RHCC Institutional Review Board (Approval #RMB-20-0087). Informed consent was waived due to the retrospective design of this study. The data was anonymized and maintained with confidentiality, and only the first and corresponding author had access to the collected data. This study was performed in compliance with the declaration of Helsinki.

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## Disclosure

The authors report no conflicts of interest in this work.

## References

1. Grundy SM, Stone NJ, Bailey AL, et al. 2018 AHA/ACC/AACVPR/AAPA/ABC/ACPM/ADA/AGS/ APhA/ASPC/NLA/PCNA guideline on the management of blood cholesterol: executive summary. *Circulation*. 2019;139(25):e1082–e1143. doi:10.1161/CIR.0000000000000624
2. Muhlestein JB, Horne BD, Bair TL. Usefulness of in-hospital prescription of statin agents after angiographic diagnosis of coronary artery disease in improving continued compliance and reduced mortality. *Am J Cardiol*. 2001;87(3):257–261. doi:10.1016/S0002-9149(00)01354-0
3. Khanderia U, Townsend KA, Eagle K, et al. Statin initiation following coronary artery bypass grafting: outcome of a hospital discharge protocol. *Chest*. 2005;127(2):455–463. doi:10.1378/chest.127.2.455
4. National Cholesterol Education Program (NCEP) Expert Panel on Detection, Evaluation, and Treatment of High Blood Cholesterol in Adults (Adult Treatment Panel III). Third Report of the National Cholesterol Education Program (NCEP) Expert Panel on Detection, Evaluation, and Treatment of High Blood Cholesterol in Adults (Adult Treatment Panel III) final report. *Circulation*. 2002;106(25):3143–3421. doi:10.1161/circ.106.25.3143
5. Gaziano JM, Hennekens CH, Satterfield S, et al. Clinical utility of lipid and lipoprotein levels during hospitalization for acute myocardial infarction. *Vasc med*. 1999;4(4):227–231. doi:10.1177/1358836X9900400404
6. Zalts R, Ben-Hur D, Yahia A, et al. Hospital Care Efficiency and the SMART (Specific, Measurable, Agreed, Required, and Timely) Medicine Initiative. *JAMA Intern Med*. 2016;176(3):398–399. doi:10.1001/jamainternmed.2015.7705
7. Zalts R, Buchrits S, Khateeb J, et al. Diagnostic process-how to do it right? The SMART medicine initiative. *Eur J Intern Med*. 2017;46:e11–e12. doi:10.1016/j.ejim.2017.09.011
8. Cassel CK, Guest JA. Choosing Wisely: helping physicians and patients make smart decisions about their care. *JAMA*. 2012;307(17):1801–1802. doi:10.1001/jama.2012.476

9. Fonarow GC, French WJ, Parsons LS, et al. Use of lipid-lowering medications at discharge in patients with acute myocardial infarction: data from the National Registry of Myocardial Infarction 3. *Circulation*. 2001;103(1):38–44. doi:10.1161/01.CIR.103.1.38
10. Nawaz H, Comerford BP, Njike VY, et al. Repeated serum lipid measurements during the peri-hospitalization period. *Am j Cardiol*. 2006;98(10):1379–1382. doi:10.1016/j.amjcard.2006.06.030
11. Faulkner MA, Hilleman DE, Destache CJ, et al. Potential influence of timing of low-density lipoprotein cholesterol evaluation in patients with acute coronary syndrome. *Pharmacotherapy*. 2001;21(9):1055–1060. doi:10.1592/phco.21.13.1055.34614

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