MAYO CLINIC LABORATORIES

Test Definition: LMPP

Lipoprotein Metabolism Profile, Serum

Overview

Useful For

Diagnosing dyslipoproteinemia

Quantifying cholesterol and triglycerides in very-low-density lipoprotein, low-density lipoprotein (LDL), high-density lipoproteins (HDL), and chylomicrons

Identifying lipoprotein-X

Classifying hyperlipoproteinemias (lipoprotein phenotyping)

Evaluating patients with abnormal lipid values (cholesterol, triglyceride, HDL, LDL) for specific phenotypes

Profile Information

Test Id	Reporting Name	Available Separately	Always Performed
TCS	Cholesterol, Total, CDC, S	No	Yes
TRIGC	Triglycerides, CDC, S	No	Yes
APLBS	Apolipoprotein B, S	Yes, (order APOLB)	Yes
HDLS	HDL Cholesterol, CDC, S	No	Yes
LMPP1	Lipoprotein Metabolism Profile 1	No	Yes

Method Name

TCS, TRIGD: Enzymatic Colorimetric
APLBS: Automated Turbidimetric Immunoassay
HDLS: Selective Precipitation, Enzymatic Colorimetric
LMPP1: Ultracentrifugation/Electrophoresis/Automated Enzymatic/Colorimetric Analysis

NY State Available

Yes

Specimen

Specimen Type

Serum

Necessary Information

Patient's age and sex are required.

Specimen Required

Patient Preparation:

1**. Fasting: 12 hours, required**

2. Patient **must not** consume any alcohol for 24 hours before the specimen is collected.

Supplies: Sarstedt Aliquot Tube 5 mL (T914)

Collection Container/Tube:

Preferred: Serum gel

Acceptable: Red top

Submission Container/Tube: Plastic vial

Specimen Volume: 5 mL

Collection Instructions: Centrifuge and aliquot serum into a plastic vial.

Forms

If not ordering electronically, complete, print, and send a Cardiovascular Test Request Form (T724) with the specimen.

Specimen Minimum Volume

2 mL

Reject Due To

Gross hemolysis	Reject
Gross lipemia	OK
Gross icterus	Reject

Specimen Stability Information

Specimen Type	Temperature	Time	Special Container
Serum	Refrigerated (preferred)	7 days	
	Frozen	60 days	

Clinical & Interpretive

Clinical Information

Lipoprotein metabolism profile analysis provides information about the causes of elevated serum cholesterol or triglycerides. In some patients, increased serum lipids reflect elevated levels of intermediate-density lipoprotein (IDL), very-low-density lipoprotein (VLDL), lipoprotein a [Lp(a)], or even the abnormal lipoprotein complex, lipoprotein X (LpX). These elevations can signal genetic abnormalities in lipid metabolism or transport, nephrotic syndrome, endocrine dysfunction, or even cholestasis. Identifying the lipoproteins associated with lipid elevation is done using the gold-standard methods, including ultracentrifugation, selective precipitation, and electrophoresis. Proper characterization of a patient's dyslipidemic phenotype aids clinical decisions and treatment.

Classifying the hyperlipoproteinemias into phenotypes places disorders that affect plasma lipid and lipoprotein concentrations into convenient groups for evaluation and treatment. A clear distinction must be made between primary

(inherited) and secondary (liver disease, alcoholism, metabolic diseases) causes of dyslipoproteinemia.

Lipoprotein profiling will identify the presence of Lp(a) and LpX and distinguish between the following dyslipidemias:
-Exogenous hyperlipemia (Type I)
-Familial hypercholesterolemia (Type IIa)
-Familial combined hyperlipidemia (Type IIb)
-Familial dysbetalipoproteinemia (Type III)
-Endogenous hyperlipemia (Type IV)
-Mixed hyperlipemia (Type V)

Reference Values

	2-9 years	10-17 years	> or =18 years
Total cholesterol	* Acceptable: <170 mg/dL Borderline high: 170-199 mg/dL High: > or =200 mg/dL		** Desirable: <200 mg/dL Borderline high: 200-239 mg/dL High: > or = 240 mg/dL
Triglycerides	* Acceptable: <75 mg/dL Borderline high: 75-99 mg/dL High: > or =100 mg/dL	* Acceptable: <90 mg/dL Borderline high: 90-129 mg/dL High: > or =130 mg/dL	** Normal: <150 mg/dL Borderline high: 150-199 mg/dL High: 200-499 mg/dL Very high: > or =500 mg/dL
Low-density lipoprotein (LDL) cholesterol	* Acceptable: <110 mg/dL Borderline high: 110-129 mg/dL High: > or =130 mg/dL		*** Desirable: <100 mg/dL Above Desirable: 100-129 mg/dL Borderline high: 130-159 mg/dL High: 160-189 mg/dL Very high: > or =190 mg/dL
LDL triglycerides	< or =50 mg/dL		< or =50 mg/dL
Apolipoprotein B	* Acceptable: <90 mg/dL Borderline high: 90-109 mg/dL High: > or =110 mg/dL		*** Desirable: <90 mg/dL Above Desirable: 90-99mg/dL Borderline high: 100-119 mg/dL High: 120-139 mg/dL Very high: > or =140 mg/dL
High-density lipoprotein (HDL) cholesterol	* Low: <40 mg/dL Borderline low: 40-45 mg/dL Acceptable: >45 mg/dL		*** Males: > or =40mg/dL Females: > or =50mg/dL
Very low-density	<30 mg/dL		<30 mg/dL

lipoprotein (VLDL) cholesterol		
VLDL triglycerides	<90 mg/dL	<120 mg/dL
Beta VLDL cholesterol	<15 mg/dL	<15 mg/dL
Beta VLDL triglycerides	<15 mg/dL	<15 mg/dL
Chylomicron cholesterol	Undetectable	Undetectable
Chylomicron triglycerides	Undetectable	Undetectable
Lp(a) cholesterol	<5 mg/dL	<5 mg/dL
LpX	Undetectable	Undetectable

Reference values have not been established for patients less than 2 years.
*Expert Panel on Integrated Guidelines for Cardiovascular Health and Risk Reduction in Children and Adolescents
**National Cholesterol Education Program (NCEP)
***National Lipid Association

Interpretation

Patients with increased lipoprotein a [Lp(a)] cholesterol values have been associated with increased risk for the development of atherothrombotic disease. If not previously tested, it is recommended to order the immunoassay for Lp(a) (Test ID LIPA1 / Lipoprotein [a], Serum) to fully assess cardiovascular risk associated with Lp(a). Aggressive low-density lipoprotein reduction is the recommended treatment approach in most patients with increased Lp(a).

Lipoprotein-X (LpX) is an abnormal lipoprotein that appears in the sera of patients with obstructive jaundice and is an indicator of cholestasis. The presence of LpX will be reported if noted during Lp(a) cholesterol analysis.

Cautions

Cholesterol and triglyceride results can be falsely decreased in patients with elevated levels of N-acetyl-p-benzoquinone imine (a metabolite of acetaminophen), N-acetylcysteine, and metamizole.

Clinical Reference

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: A report of the American College of Cardiology/American Heart Association Task Force on Clinical Practice Guidelines. Circulation. 2019;139(25):e1082-e1143
2. Expert panel on integrated guidelines for cardiovascular health and risk reduction in children and adolescents; National Heart, Lung, and Blood Institute: Expert panel on integrated guidelines for cardiovascular health and risk reduction in children and adolescents: summary report. Pediatrics. 2011;128 Suppl 5:S213-S256
3. Rosenson RS, Najera SD, Hegele RA. Heterozygous familial hypercholesterolemia presenting as chylomicronemia syndrome. J Clin Lipidol. 2017;11(1):294-296. doi:10.1016/j.jacl.2016.12.005
4. Hopkins PN, Brinton EA, Nanjee MN. Hyperlipoproteinemia type 3: the forgotten phenotype. Curr Atheroscler Rep. 2014;16(9):440. doi:10.1007/s11883-014-0440-2
5. Gotoda T, Shirai K, Ohta T, et al. Diagnosis and management of type I and type V hyperlipoproteinemia. J Atheroscler Thromb. 2012;19(1):1-12
6. Gonzales KM, Donato LJ, Shah P, Simha V. Measurement of apolipoprotein B levels helps in the identification of

patients at risk for hypertriglyceridemic pancreatitis. J Clin Lipidol. 2021;15(1):97-103. doi:10.1016/j.jacl.2020.11.010
7. Fatica EM, Meeusen JW, Vasile VC, Jaffe AS, Donato LJ. Measuring the contribution of Lp(a) cholesterol towards LDL-C interpretation. Clin Biochem. 2020;86:45-51. doi:10.1016/j.clinbiochem.2020.09.007
8. Arnett DK, Blumenthal RS, Albert MA, et al. 2019 ACC/AHA guideline on the primary prevention of cardiovascular disease: A report of the American College of Cardiology/American Heart Association Task Force on Clinical Practice Guidelines. Circulation. 2019;140(11):e596-e646

Performance

Method Description

Electrophoretic separation of lipoproteins followed by lipid staining and densitometry measurement.(Package insert: SPIFE Vis Cholesterol Reagent. Helena Laboratories; 09/2015)

Cholesterol:
Cholesterol esters are cleaved by the action of cholesterol esterase to yield free cholesterol and fatty acids. Cholesterol oxidase then catalyzes the oxidation of cholesterol to cholest-4-en-3-one and hydrogen peroxide. In the presence of peroxidase, the hydrogen peroxide formed effects the oxidative coupling of phenol and 4-aminophenazone to form a red quinone-imine dye. The color intensity of the dye formed is directly proportional to the cholesterol concentration. It is determined by measuring the increase in absorbance (Package insert: Cholesterol Gen2 Reagent. Roche Diagnostics; V 16.0, 10/2023)

Triglyceride:
Samples analyzed for triglycerides are measured by an automated enzymatic method. The chemistry includes hydrolysis of the triglycerides and phosphorylation of the resulting glycerol.(Package insert: Triglycerides Reagent, Roche Diagnostics; V 13.0, 03/2022)

Apolipoprotein B:
Anti-apolipoprotein B antibodies react with the antigen in the sample to form antigen:antibody complexes, which, following agglutination, can be measured turbidimetrically.(Package insert: Tina-quant Apolipoprotein B. Roche Diagnostics; V 13.0 03/2022)

High-Density Lipoprotein:
Sample is combined with dextran sulfate and magnesium, ions precipitate the low-density lipoprotein and very-low-density lipoprotein fractions, leaving the high-density lipoprotein (HDL) fraction in solution. The HDL cholesterol is then determined using an enzymatic cholesterol assay.(Package insert: HDL Cholesterol Precipitating Reagent Set (Dextran Sulfate). Pointe Scientific, INC; 12/2009)

PDF Report

No

Day(s) Performed

Monday through Thursday, Sunday

Report Available

2 to 4 days

Specimen Retention Time

14 days

Performing Laboratory Location

Mayo Clinic Laboratories - Rochester Main Campus

Fees & Codes

Fees

- Authorized users can sign in to Test Prices for detailed fee information.
- Clients without access to Test Prices can contact Customer Service 24 hours a day, seven days a week.
- Prospective clients should contact their account representative. For assistance, contact Customer Service.

Test Classification

This test has been modified from the manufacturer's instructions. Its performance characteristics were determined by Mayo Clinic in a manner consistent with CLIA requirements. This test has not been cleared or approved by the US Food and Drug Administration.

CPT Code Information

80061-Lipid panel (includes: HDL [CPT Code 83718], total cholesterol [CPT Code 82465], and triglycerides [CPT Code 84478] if all performed)
82172-Apolipoprotein B
83700-Lp(a) cholesterol electrophoresis

LOINC® Information

Test ID	Test Order Name	Order LOINC® Value
LMPP	Lipoprotein Metabolism Profile	In Process

Result ID	Test Result Name	Result LOINC® Value
TCS	Cholesterol, Total, CDC, S	2093-3
HDLS	HDL Cholesterol, CDC, S	2085-9
TRIGC	Triglycerides, CDC, S	2571-8
APLBS	Apolipoprotein B, S	1884-6
2839	LDL Cholesterol	18261-8
2840	LDL Triglycerides	3046-0
2844	VLDL cholesterol	2091-7
2847	VLDL triglycerides	3047-8
2842	Beta VLDL Cholesterol	66499-5
2843	Beta VLDL triglycerides	3045-2
2855	Chylomicron cholesterol	34467-1
2856	Chylomicron triglycerides	35363-1

2849	Lp(a) Cholesterol	35388-8
23924	LpX	42178-4
23937	Interpretation	59462-2