MAYO CLINIC LABORATORIES

Test Definition: LPSC1

Lipid Panel, Serum

Overview

Useful For

Managing atherosclerotic cardiovascular disease risk using serum specimens

Profile Information

Test Id	Reporting Name	Available Separately	Always Performed
CHOL	Cholesterol, Total, S	Yes	Yes
TRIG	Triglycerides, S	Yes, (Order TRIG1)	Yes
HDCH	Cholesterol, HDL, S	Yes	Yes
CLDL1	Cholesterol, LDL, Calculated, S	No	Yes
NHDCH	Cholesterol, Non-HDL, Calculated, S	No	Yes
INTC1	Fasting (8 HR or more)	No	Yes

Method Name

CHOL, TRIG, HDCH: Colorimetric

CLDL1, NHDCH: Calculation

NY State Available

Yes

Specimen

Specimen Type

Serum

Specimen Required

Collection Container/Tube:

Preferred: Serum gel

Acceptable: Red top

Submission Container/Tube: Plastic vial

Specimen Volume: 1 mL

Collection Instructions:

1. Serum gel tube must be centrifuged within 2 hours of collection.
2. Red-top tube must be centrifuged and the serum aliquoted into a plastic vial within 2 hours of collection.

Forms

If not ordering electronically, complete, print, and send 1 of the following forms with the specimen:

-Kidney Transplant Test Request
-Renal Diagnostics Test Request (T830)

Specimen Minimum Volume
0.5 mL

Reject Due To

Gross hemolysis	Reject

Specimen Stability Information

Specimen Type	Temperature	Time	Special Container
Serum	Refrigerated (preferred)	7 days	
	Frozen	30 days	

Clinical & Interpretive

Clinical Information
Lipoprotein cholesterol measurements are essential in managing risk for atherosclerotic cardiovascular disease (ASCVD). Atherosclerosis is defined by a buildup of plaque within arterial walls. ASCVD includes coronary heart disease, strokes, and peripheral artery disease. ASCVD develops over decades and is often asymptomatic until the patient experiences a life-threatening event such as a heart attack, stroke, or aneurysm.

Cholesterol is a lipid that is synthesized in most tissues and actively absorbed from the diet. There is a strong association between serum cholesterol concentrations and cardiovascular disease.

Cholesterol is carried in the blood by lipoproteins. Some lipoproteins carry a stronger risk of cardiovascular disease while others are associated with reduced cardiovascular risk. Total cholesterol concentration includes the sum of all "good" and "bad" cholesterol. Therefore, total cholesterol is recommended to be interpreted in context of a lipid panel that includes high-density lipoprotein cholesterol (HDL-C) and triglyceride measurements.

Low-density lipoprotein cholesterol (LDL-C) is the primary lipoprotein responsible for atherogenic plaque. Very low-density lipoprotein cholesterol (VLDL-C) is also atherogenic and the combination of LDL-C and VLDL-C is called non-HDL cholesterol and often referred to as "bad" cholesterol. Serum total cholesterol, LDL-C, and non-HDL cholesterol are all directly associated with risk for ASCVD.

HDL-C is associated with lower risk of cardiovascular disease. Excess cholesterol is actively pumped into HDL to be carried in the blood circulation and cleared by the liver in a process known as reverse cholesterol transport. For these reasons, HDL-C is often referred to as "good" cholesterol.

Triglycerides are oily lipids carried in the blood by lipoproteins. Triglycerides are primarily carried by VLDL, chylomicrons, and remnant lipoproteins. Recent evidence supports triglycerides as an independent risk factor for ASCVD. Several

conditions are associated with increased plasma triglycerides, including obesity, pregnancy, physical inactivity, excess alcohol intake, kidney disease, and diabetes. Elevated triglycerides are often associated with reduced HDL-C, insulin resistance, hypertension, fatty liver disease, and increased waist circumference. In addition to cardiovascular risk, elevated triglycerides confer a risk for acute pancreatitis.

Reference Values

The National Lipid Association and the National Cholesterol Education Program have set the following guidelines for lipids in a context of cardiovascular risk for adults 18 years and older:

TOTAL CHOLESTEROL
Desirable: <200 mg/dL
Borderline High: 200-239 mg/dL
High: > or =240 mg/dL

TRIGLYCERIDES
Normal: <150 mg/dL
Borderline High: 150-199 mg/dL
High: 200-499 mg/dL
Very High: > or =500 mg/dL

HIGH DENSITY LIPOPROTEIN (HDL) CHOLESTEROL
Males
> or =40 mg/dL
Females
> or =50 mg/dL

LOW DENSITY LIPOPROTEIN (LDL) CHOLESTEROL
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

NON-HDL CHOLESTEROL
Desirable: <130 mg/dL
Above Desirable: 130-159 mg/dL
Borderline High: 160-189 mg/dL
High: 190-219 mg/dL
Very High: > or =220 mg/dL

The Expert Panel on Integrated Guidelines for Cardiovascular Health and Risk Reduction in Children and Adolescents has set the following guidelines for lipids in a context of cardiovascular risk for children ages 2-17:
Reference values have not been established for patients who are younger than 24 months.

TOTAL CHOLESTEROL

Acceptable: <170 mg/dL
Borderline High: 170-199 mg/dL
High: > or =200 mg/dL

TRIGLYCERIDES
2-9 years:
Acceptable: <75 mg/dL
Borderline High: 75-99 mg/dL
High: > or =100mg/dL

10-17 years:
Acceptable: <90 mg/dL
Borderline High: 90-129 mg/dL
High: > or =130 mg/dL

HDL CHOLESTEROL
Low HDL: <40 mg/dL
Borderline Low: 40-45 mg/dL
Acceptable: >45 mg/dL

LDL CHOLESTEROL
Acceptable: <110 mg/dL
Borderline High: 110-129 mg/dL
High: > or =130 mg/dL

NON-HDL CHOLESTEROL
Acceptable: <120 mg/dL
Borderline High: 120-144 mg/dL
High: > or =145 mg/dL

Interpretation

Maintaining desirable concentrations of lipids lowers atherosclerotic cardiovascular disease (ASCVD) risk. Establishing appropriate treatment strategies and lipid goals require blood lipid values be considered in context with other risk factors including, age, sex, smoking status, and medical history of hypertension, diabetes, and cardiovascular disease.

Triglycerides results of 500 mg/dL or above are severely elevated increasing the risk of pancreatitis. Triglycerides can be lowered by increasing physical activity, low-fat diet, weight loss, and/or triglyceride lowering pharmaceuticals.

Low high-density lipoprotein cholesterol is a risk factor for cardiovascular disease.

High density lipoprotein (HDL) cholesterol can be increased by the same lifestyle changes that reduce risk for cardiovascular disease; physical activity, smoking cessation, and eating healthier. However, medications that specifically increase HDL levels have failed to reduce cardiovascular disease. Extremely low HDL values (<20 mg/dL) may indicate liver disease or inherited dyslipidemia.

Low-density lipoprotein cholesterol results of 190 mg/dL or above in adults (> or =160 mg/dL in children) are severely elevated and may indicate familial hypercholesterolemia.

For non-HDL cholesterol results of 220 mg/dL or above, a possible inherited hyperlipidemia diagnosis should be considered.

Cautions

Consuming alcohol or fatty foods 24 hours prior to specimen collection can increase serum triglycerides.

Eating a meal 12 hours prior to specimen collection can increase serum triglycerides.

Calculated low-density lipoprotein cholesterol is not applicable when triglyceride levels are greater than 800 mg/dL.

Consider repeat measurement of lipids prior to initiating or changing lipid therapy.

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. Jacobson TA, Ito MK, Maki KC, et al. National Lipid Association recommendations for patient-centered management of dyslipidemia: Part 1-executive summary. J Clin Lipidol. 2014;8(5):473-488. doi:10.1016/j.jacl.2014.07.007
3. 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(Suppl 5):S213-S256. doi:10.1542/peds.2009-2107C
4. Sampson M, Ling C, Sun Q, et al. A new equation for calculation of low-density lipoprotein cholesterol in patients with normolipidemia and/or hypertriglyceridemia. JAMA Cardiol. 2020;5(5):540-548

Performance

Method Description

Total 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; 09/2023)

Triglycerides:
This test uses a lipoprotein lipase from microorganisms for the rapid and complete hydrolysis of triglycerides to glycerol followed by oxidation to dihydroxyacetone phosphate and hydrogen peroxide. The hydrogen peroxide produced then reacts with 4-aminophenazone and 4-chlorophenol under the catalytic action of peroxidase to form a red dyestuff (Trinder endpoint reaction). The color intensity of the red dyestuff formed is directly proportional to the triglyceride

concentration and can be measured photometrically.(Package insert: Triglycerides. Roche Diagnostics; 05/2024)

HDL Cholesterol:
Non-high-density lipoprotein (HDL) lipoproteins such as low-density lipoprotein, very low-density lipoprotein, and chylomicrons are combined with polyanions and a detergent forming a water-soluble complex. In this complex, the enzymatic reaction of cholesterol esterase (CHER) and cholesterol oxidase (CHOD) towards non-HDL lipoproteins is blocked. Finally, only HDL-particles can react with CHER and CHOD. The concentration of HDL-cholesterol is determined enzymatically by CHER and CHOD. Cholesterol esters are broken down quantitatively into free cholesterol and fatty acids by CHER. In the presence of oxygen, cholesterol is oxidized to 4-cholesten-3-one and hydrogen peroxide. In the presence of peroxidase, the hydrogen peroxide generated reacts with 4-amino-antipyrine and N-ethyl-N-(3-methylphenyl)-N'-succinylethylenediamine to form a dye. The color intensity of this dye is directly proportional to the cholesterol concentration and is measured photometrically.(Package insert: HDL-Cholesterol Gen4. Roche Diagnostics; 02/2020)

The calculations below are performed in the laboratory information system.

Calculated Non-HDL Cholesterol:
This test calculates the non-high-density lipoprotein cholesterol concentration by subtracting the high-density cholesterol concentration from the total cholesterol concentration.

Calculated Low-Density Lipoprotein Cholesterol:
The low-density lipoprotein (LDL) cholesterol concentration is calculated from total cholesterol (TC), triglyceride (TG), and HDL cholesterol (HDLc) concentrations, according to the following formula by National Institutes of Health.

$$LDL = \frac{TC}{0.948} - \frac{HDLc}{0.971} - \left(\frac{TG}{8.56} + \frac{TG*nonHDLc}{2140} - \frac{TG(2)}{16,100} \right) - 9.44$$

nonHDLc = Non-HDL cholesterol

PDF Report
No

Day(s) Performed
Monday through Sunday

Report Available
1 day

Specimen Retention Time
7 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 cleared, approved, or is exempt by the US Food and Drug Administration and is used per manufacturer's instructions. Performance characteristics were verified by Mayo Clinic in a manner consistent with CLIA requirements.

CPT Code Information

80061-Lipid panel (if all 3 performed)
82465-Cholesterol, total (if all 3 are not performed)
84478-Triglycerides (if all 3 are not performed)
83718-Cholesterol, HDL (if all 3 are not performed)

LOINC® Information

Test ID	Test Order Name	Order LOINC® Value
LPSC1	Lipid Panel, S	24331-1

Result ID	Test Result Name	Result LOINC® Value
CHOL	Cholesterol, Total, S	2093-3
HDCH	Cholesterol, HDL, S	2085-9
NHDCH	Cholesterol, Non-HDL, Calculated, S	43396-1
TRIG	Triglycerides, S	2571-8
CLDL1	Cholesterol, LDL, Calculated, S	13457-7
INTC1	Fasting (8 HR or more)	87527-8