Benefit from the new DiaSys LDL-c direct FS

Overcome the limitations of the Friedewald estimation.

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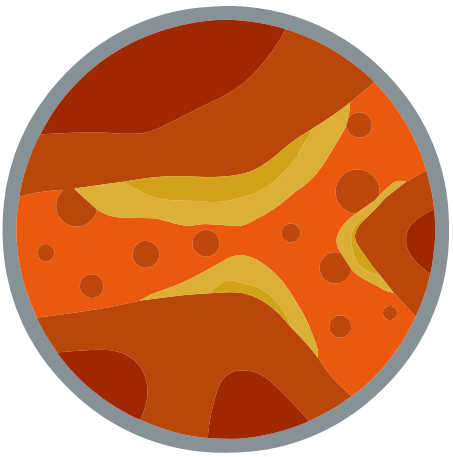
LDL-C direct versus Friedewald calculation

The Friedewald calculation is a common approach to determine low-density lipoprotein (LDL-C) in clinical laboratory. It estimates LDL-C as: Total cholesterol (TC) minus high-density lipoprotein-cholesterol (HDL-C) minus triglycerides (TG)/5. But the calculation only approximates LDL-C and is subject to well-established limitations.



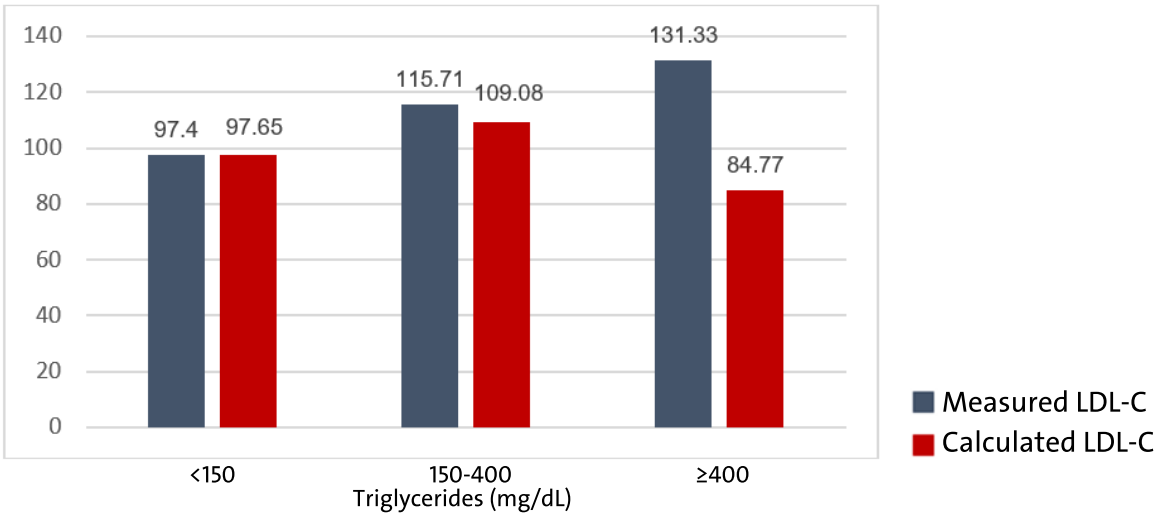
Although calculated LDL-C levels in healthy patients correlate well with directly measured LDL-C, but they do not match in patients with lipid disturbances, diabetes, coronary or other atherosclerotic disease [1]. Furthermore, the Friedewald equation shows limitations under certain conditions since the quotient (TG)/5) is used to estimate the very-low-density lipoprotein cholesterol (VLDL-C) concentration. It assumes that virtually all plasma triglycerides are carried on VLDL-C, and that the TG - cholesterol ratio of VLDL is constant at about 5:1 [2].

Limitations of the Friedewald formula

The Friedewald equation shall not be used under the following circumstances:

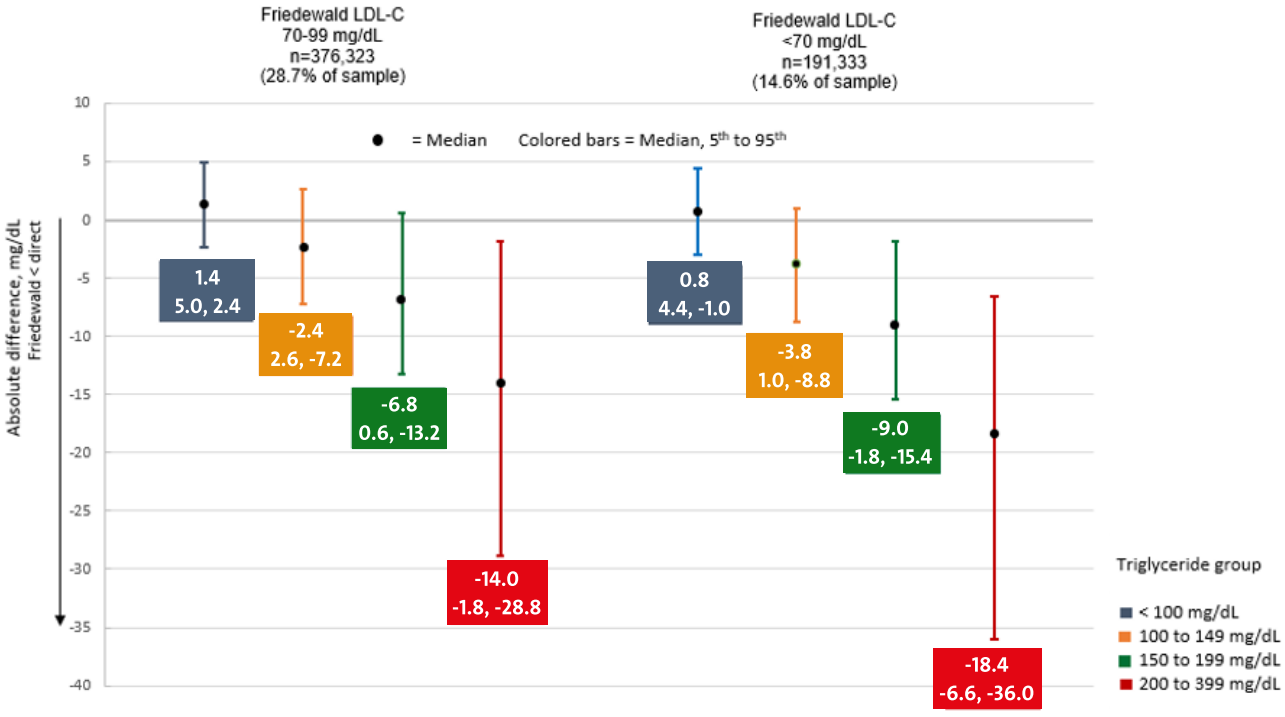
- Elevated triglyceride concentration >400 mg/dL (4,5 mmol/L)
- Presence of chylomicrons (contain proportionately less cholesterol relative to TGs than VLDL) leads to overestimation of VLDL-C and underestimation of LDL-C.
- Elevated VLDL levels
- In diabetic patients
- In severe liver damage
- In postmenopausal women since hormone therapy raises triglycerides (TG) and high-density lipoprotein cholesterol (HDL-C) and alters lipid contents of lipoproteins
- In obesity resp. the metabolic syndrome
- In patients with increased lipoprotein (a) (Lp (a)) (> 50 mg/dL) since calculated LDL-C also contains a contribution from the cholesterol present in Lp(a)

Fig. 1: Comparison of measured and calculated LDL-C in diabetic subjects [3]



Difference between measured and calculated LDL-C increases as triglyceride level is beyond 150 mg/dL.

Fig. 2: Absolute difference in Friedewald-estimated and directly measured LDL-C in the treatment range for high risk patients at different triglyceride levels [4]



Fasting versus nonfasting in the assessment of LDL-C by direct measurement and estimation according to Friedewald [5]

Blood sampling after the last meal	Direct determination of LDL-C	LDL-C estimation by Friedewald
3 hours	8% lower	22 – 37% lower
6 hours	6% lower	15% lower
9 hours	No effect	8% lower

Since the equation is prone to inaccuracy at high VLDL, low LDL-C and/or high TG levels, studies recommend caution when using the Friedewald equation in pathological conditions resulting in lipid disturbances such as diabetes, the metabolic syndrome, kidney disease, and severe liver damage.

Due to the increase in individuals with diabetes, metabolic syndrome and other lipid disturbances on the one hand and the reduction of LDL-C treatment goals in high cardiovascular risk patients on the other hand, precise and accurate clinical tools become even more important.

The direct assay for LDL-C represents a remarkable technological breakthrough with great potential to improve lipoprotein analysis.

Literature

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