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Lipid sub-fractionation predicts worsening myocardial perfusion reserve in patients with low-density lipoprotein less than 100mg/dL: a regadenoson dardiac magnetic resonance study

Akhil Narang[1*], Chattanong Yodwut[1,2], Giacomo Tarroni[3], Emily Estep[1], Kristen M Turner[1,4], Benjamin H Freed[1], Nicole M Bhave[1], Cristiana Corsi[3], Michael H Davidson[1], Roberto Lang[1], Victor Mor-Avi[1], Amit R Patel[1]

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Summary

We sought to determine, in patients with LDL <100mg/dL, if abnormalities in lipid sub-fractionation are associated with reduced myocardial perfusion reserve (MPRi; a surrogate for microvascular dysfunction). Despite the absence of a correlation between low-density lipoprotein and MPRi, a significant inverse relationship between sub-fractions of LDL and MPRi exists.

Background

Abnormalities in total cholesterol (TC), high-density lipoprotein (HDL), low-density lipoprotein (LDL), and triglycerides (TG) are associated with microvascular dysfunction and are the primary target for treating atherosclerosis. Newer lipid assays allow for measurements of lipoprotein sub-fractions; however, their impact on microvascular function remain unknown. We sought to determine, in patients with LDL <100mg/dL, if abnormalities in lipid sub-fractionation are associated with reduced myocardial perfusion reserve (MPRi; a surrogate for microvascular dysfunction).

Methods

Ninteen patients with an LDL <100mg/dL underwent regadenoson cardiac magnetic resonance myocardial perfusion imaging (CMR-MPI) and had a nuclear magnetic resonance (NMR) lipid panel (Mayo Clinic; Rochester, MN) drawn. Imaging was performed using a 1.5T MRI scanner. Short-axis images were obtained at three levels of the left ventricle (LV) during first pass of a Gadolinium-DTPA bolus (0.075 mmol/kg at 4 ml/sec) for approximately 50 consecutive heart beats. Images were acquired using a hybrid gradient echo/echo planar imaging sequence 1 minute after injection regadenoson and then repeated 15 minutes after injection of aminophylline 125mg. Time intensity curves were generated to determine the area under-the-curve (from the start of the upslope to the peak of the upslope) for the mid-ventricular slice and the LV cavity. MPRi was defined as the stress-to-rest ratio of mid-ventricular area under-the-curve (normalized to LV cavity area under-the-curve). NMR lipid panels yielded the traditional cholesterol profile plus total-LDL particle concentration (nmol/L), small-LDL particle concentration (nmol/L), total-HDL particle concentration (μmol/L), and large-HDL particle concentration (μmol/L). Linear regression was performed to determine the relationship between traditional lipid profile, lipid fractions and MPRi.

Results

Most patients were male (86%). Their age was 50.4±14.5 years, 53% had coronary disease, 42% had hypertension, and 11% were current smokers. No relationship was found between MPRi and total cholesterol, LDL, total-HDL particle concentration, and large-HDL particle concentration. However, MPRi was significantly correlated to HDL and inversely correlated to triglycerides, small-LDL particle concentration and total-LDL concentration (R-squared= 0.35, 0.25, 0.28, and 0.26 (p-value= 0.004, 0.02, 0.03 and 0.02), respectively). See Figure 1.

[1]Medicine, University of Chicago, Chicago, IL, USA
Full list of author information is available at the end of the article

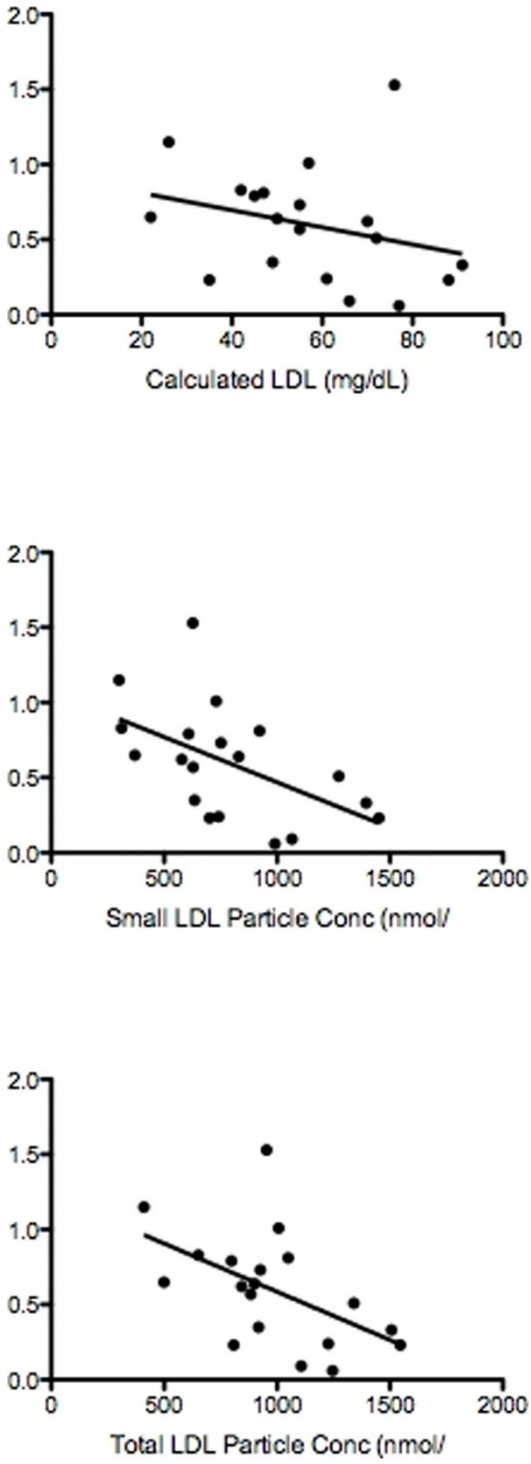

Figure 1 Relationship between myocardial perfusion reserve index and various lipid abnormalities.

Conclusions

Despite the absence of a correlation between LDL with MPRi in patients with an LDL <100mg/dL, an inverse relationship between sub-fractions of LDL (namely small LDL concentration and total LDL concentration) and MPRi existed suggesting that lipid subfractionation could identify patients with LDL <100mg/dL who might have microvascular dysfunction.

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Author details

[1]Medicine, University of Chicago, Chicago, IL, USA. [2]Mahidol University, Bangkok, Thailand. [3]University of Bologna, Bologna, Italy. [4]Loyola Medical Center, Maywood, IL, USA.

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