Přehledový článek | Review article

Is the Atherogenic Index of Plasma (AIP) a Cardiovascular Disease Marker?

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SOUHRN

V diagnostice a stanovování prognózy kardiovaskulárních onemocnění (KVO) již byla použita řada ukazatelů. Aterogenní index plazmy (AIP) se vypočítává jako logaritmus molárních koncentrací triglyceridu (TG) a lipoproteinů o vysoké hustotě (high-density lipoprotein, HDL). Vynikající predikční hodnota AIP je výsledkem těsného vztahu mezi AIP a velikostí lipoproteinových částic. AIP lze jednoduše vypočítat pomocí typického lipidového profilu. Jedná se o přesnější prediktor velikosti lipoproteinových částic než velikosti částic jednotlivých lipidů nebo poměru TG a HDL.

Keywords:
Atherogenic index of plasma
Cardiovascular disease
Ratio of triglyceride to high-density lipoprotein

ABSTRACT

Numerous indicators have been used to diagnose and prognosticate cardiovascular disease (CVD). The atherogenic index of plasma (AIP) is a logarithmic conversion of triglyceride (TG) to high-density lipoprotein (HDL) molar concentrations. The close association between AIP and the size of lipoprotein particles may account for its excellent predictive value. AIP may be computed simply using a typical lipid profile. It is a better predictor of lipoprotein particle size than that of individual lipids or the ratio of TG to HDL.

Introduction

Cardiovascular disease (CVD) causes one third of fatalities globally, and the risk factors for CVD are growing.[1] The most fundamental effort in combating the CVD epidemic is preventing risk factors and understanding their interactions. Obesity, inactivity, poor nutrition, and smoking are major CVD risk factors.[2] Among them, the plasma lipid profile is the key CVD predictor.[3]

The LDL/HDL ratio is widely used to assess CV risk since there is a clear link between high LDL-C and low HDL-C.[4,5] Conversely, elevated TG levels have been linked to increased LDL-C particles and CV risk.[6] Thus, atherogenic dyslipidemia (high LDL/HDL ratio and elevated TG) raises CV risk.[7]

Better atherogenic dyslipidemia indicators are replacing old rates.[5] The atherogenic index of plasma (AIP) is

$$\text{Atherogenic index of plasma} = \log \frac{\left[\text{Triglyceride}\right]}{\left[\text{HDL cholesterol}\right]}$$

Fig. 1 – The AIP calculation.

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a powerful predictor of atherosclerosis.[8–10] AIP stands for protective and atherogenic lipoprotein interaction.[11] AIP is calculated as log(TG/HDL-C) (Fig. 1).[12] AIP readings below 0.11 are related to a low risk of CVD, whereas those between 0.11 and 0.21 are associated with an intermediate and increasing risk.[13] We conducted a review to assess the relationship between AIP and CVD.

A novel CV predictive biomarker

Regular exercise has been shown to reduce the risk of heart disease, stroke, hypertension, and diabetes.[14] According to Tariq M. Ali Rajab et al., diabetes dyslipidemia is characterized by a rise in TG and a reduction in HDL-C.[15] Another study indicated that hyperglycemia, aberrant lipid profiles, and HTN all contributed to atherosclerosis progression.[16] Various studies have shown a high association between AIP and lipoprotein particle size, making AIP an indication of atherogenic lipoprotein status.[12]

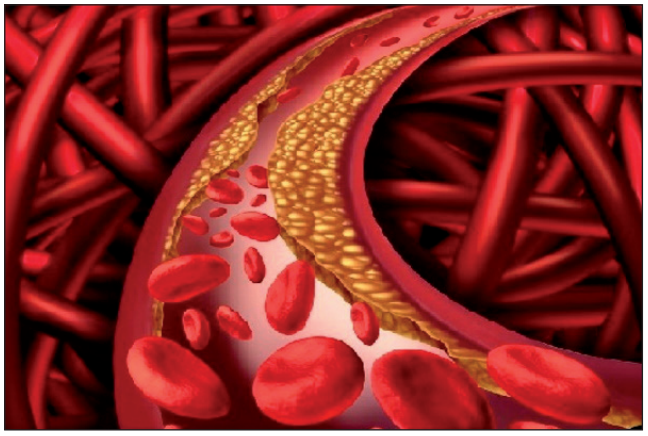

Fig. 2 – AIP may predict acute coronary events.

AIP may be used to evaluate CV risk factors and predict acute coronary events (Fig. 2).[17] AIP may also be used as a screening technique when all atherogenic parameters are normal.[5] The AIP index rises with changes in other CV risk factors. According to Niroumand et al., regular exercise and a balanced diet are suggested. AIP should be used regularly as a CVD indicator, especially in patients with high CV risk factors. It's a simple statistic to calculate, especially when other lipid levels are normal.[18]

For example, a study of 340 healthy women found a significant connection between AIP and the Framingham risk score (FRS), indicating an AIP involvement in early coronary artery disease (CAD) identification.[19] A recent study of young individuals identified an association between AIP and CV risk factors.[20] A higher AIP value enhanced the incidence of CAD in HIV patients and RA/SLE women.[21,22] The AIP value may better reflect metabolic dysfunction than a single metric like LDL-C. This subfraction of LDL-C is known as sdLDL.[23]

Unsurprisingly, a higher AIP score may raise the risk of CAD in adults. It has to be replicated in a larger adult sample to determine the AIP's potential as a CAD risk predictor.[24] Fernández-Macias et al. show that AIP may be used as a CVD biomarker in Mexico, because strong relationships were found between asymmetric dimethylarginine (ADMA) and adipocyte-fatty acid binding protein (FABP4) concentrations and AIP in people.[25]

Cardiovascular diseases

The severity of OSA illness corresponds with AIP but not sleep quality or quantity. Although this was an experimental goal, AIP did not outperform other lipid measures in detecting dyslipidemia in OSA. The AIP value can vary drastically in OSA.[26] In OSA, the apnea-hypopnea index (AHI) is linked to AIP and the apoB/apoAI ratio. According to Cao et al., the AIP and apoB/apoAI ratio rose with OSA severity, perhaps contributing to the significant CVD risk in OSA.[27]

AIP may be a reliable indicator of acute ischemic stroke, particularly the stroke subtype of large-artery atherosclerosis.[28] According to Kim et al., high AIP predicts IHD in non-diabetic Koreans. As an alternative to isolated TG levels or other lipid markers, AIP is increasingly used to stratify distinct cardiometabolic risks.[29] Research by Abacoglu et al. is significant in revealing that AIP is superior to TG/HDL-C and equal to stent length in predicting ST. It also proposes reducing LDL-C as well as serum TG and HDL levels to avoid ST. If AIP is found in regular lipid measurements, treatment choices may need to be changed or expanded.[30] AIP was related to angiographic progression of CAD irrespective of recognized risk factors.[31]

T2DM was linked to AIP transitions. Preventive measures are required to address T2DM at an early dyslipidemic stage.[32] When it comes to AIP and coronary heart disease risk factors, Korean men are no exception. Obesity, diabetes, and lipid metabolic indices are all beneficial. Consumption of milk and dairy products was greater among those with low AIP. The AIP quartiles differed in total fat intake but not in saturated fat consumption. AIP recommends further research on the causal link between coronary heart disease risk factors and dietary intake. It is also vital to include both male and female genders in research for comparative analysis.[33]

Based on a large-scale clinical experiment with 10,251 randomized T2DM patients, AIP is a strong predictor of CV events. Major adverse cardiovascular events (MACEs) were more common in diabetics with high AIP. The outcomes of this research helped design a unique MACE bioindicator for use in high-risk populations.[34] AIP is better than normal lipid profiles in assessing CAD risk, and this finding may offer a theoretical foundation for successful CV prophylaxis in T2DM patients.[35]

Due to its capacity to detect metabolic dysfunction, AIP may be used to predict poor outcomes in non-diabetic individuals following percutaneous coronary intervention (PCI). The HR-AIP index association seems J-shaped. The AIP index cutoff of 0.18 might be utilized to calculate hazard ratios (HRs) for non-diabetic patients following PCI. We need further multi-center research on non-diabetic individuals with metabolic dysfunction to confirm the AIP index's utility in this setting.[36]

Adolescents from Spain had the highest AIP. The ROC AUC findings imply that all atherogenic indicators can predict MetS. More research is required to fully understand this forecasting ability.[37] The best diagnostic cutoff values for CAD and SS >23 were 2.035 and 2.23, respectively. Using AIP as a biomarker may help avoid CAD in Chinese patients. In clinical diagnosis and therapy, clinicians should consider patients' AIP values.[38]

Conclusion

This review is noteworthy since it indicates that AIP is more predictive of CVD than TG or HDL-C. This also means that, in addition to LDL-C, serum TG and HDL levels must be examined while attempting to prevent CVD. If AIP is explored in conjunction with conventional lipid measurements, treatment techniques may need to be altered or increased. This review is important because it sheds light on multicenter, prospective studies with a lot of patients.

Conflict of interest
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