KSN 2022
SEOUL, KOREA MAY 26 - 29

Abstract Submission No. : 1182

Atherogenic Indices and The Risk of Development and Progression of Chronic Kidney Disease: Results from Gangnam Severance Medical Cohort (GSMC), 2006-2021

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Objectives: Although atherosclerotic changes contribute to various target organ damages, little is known about the effect of atherogenic indices on kidney function. This study aimed to investigate the association between atherogenic indices and the development and progression of chronic kidney disease (CKD) in adults with metabolic derangement.

Methods: Data were retrieved from the Gangnam Severance Medical Cohort (GSMC, 2006-2021). Total of 5,575 participants with at least one of disease including diabetes, fatty liver, or CKD were analyzed. Atherogenic indices included lipid ratios including atherogenic index of plasma (AIP) and TyG index. Participants were classified into tertile based on atherogenic indices. Study endpoint was a composite of eGFR <60mL/min/1.73m^2 in at least two measurements (in those with baseline eGFR ≥60 mL/min/1.73m^2), ≥30% decrease in eGFR from baseline (in those with baseline eGFR <60 mL/min/1.73m^2), and initiation of dialysis or kidney transplantation.

Results: The mean age of the participants was 55.9 ± 13.6 years, and 58.6% were men. During a median follow-up of 5.7 [2.0-10.0] years, 1,548 (27.8%) events occurred. In multivariable Cox model, the highest tertile of AIP (HR, 1.19; 95%CI, 1.05-1.35; *P*<0.001) and TyG index (HR, 1.36; 95%CI, 1.20-1.54; *P*<0.001) showed increased risks of composite outcome than the lowest tertile. This association was consistent when each index was treated as continuous variables (HR, 1.46; 95% CI, 1.22-1.75, *P*<0.001 per 1.0 increase in AIP and HR, 1.17; 95% CI,1.09-1.26, *P*<0.001 in TyG index). However other indices such as LDL-C/HDL-C, total cholesterol/HDL-C, and non-HDL-C/HDL-C did not show significant association with composite outcome. Adding AIP and TyG index into the traditional risk model to predict composite outcome significantly improved C-indices.

Conclusions: Atherogenic indices including AIP and TyG index may play a role in predicting the development and progression of CKD in adults with metabolic derangement.

Figure 1. Restricted Cubic spline curve for harzard ratio of composite renal outcome according to the indices in multivariable Cox regression model. (A) AIP, (B) LDL-C/HDL-C, (C) TC/HDL-C, (D) non-HDL-C/HDL-C, and (E) TyG index Note: Black line shows HRs and gray area represents 95% CI

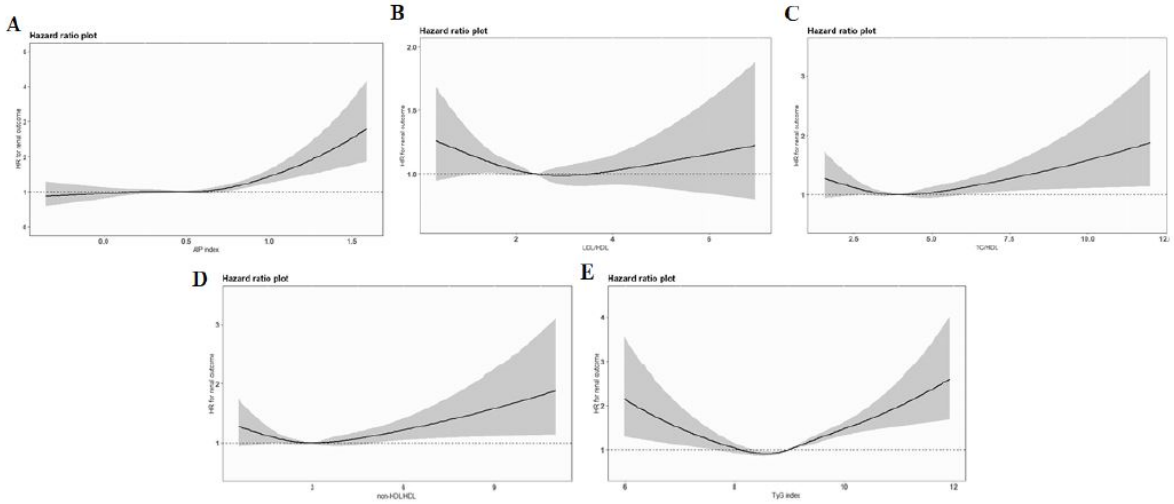

Table 1. Changes in the concorance index(C-index) of atherogenic index including traditional risk factors

Atherogenic index model	Change in C-index	95% Confidence interval	*P* value
Traditional risk factor(RF)*		(Referance)	
vs RF + TyG index	0.0040	0.0013-0.0067	<0.05
vs RF + AIP	0.0030	0.0002-0.0057	<0.05
vs RF + TyG index+ AIP	0.0038	0.0009-0.0067	<0.05
Comparsion of atherogenic index models			
RF +TyG index vs RF +AIP	0.0010	-0.0013-0.0033	0.387
RF +TyG index vs RF +TyG index +AIP	0.0002	-0.0013-0.0017	0.807
RF +AIP vs RF +TyG index +AIP	0.0008	-0.0001-0.0017	0.084

*Traditional risk factor : age, SBP, BMI, past history of HTN, dyslipidemia, DM, and fatty liver, smoking, alcohol, eGFR(CKD-EPI)
Abbreviation: TyG index, triglyceride and glycose index; AIP, atherogenic index of plasma; SBP, systolic blood pressure; BMI, body mass index; HTN, hypertension; DM, diabetes mellitus; eGFR, estimated glomerular filtration rate; CKD-EPI, CKD-Epidemiology Collaboration.