The Atherosclerosis Risk in Metabolically Healthy Obese Pre-Diabetes

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1. Introduction

Obesity is prevalent in high cardiovascular disease (CVD) risk patients with T2DM. There are individuals without metabolic abnormalities despite the presence of obesity. Effect of obesity without metabolic components on CVD and T2DM risk is inconsistent in studies. Pre-diabetes is closely related to obesity and associated with an increased risk factor for CVD. In past meta-analysis studies, impaired fasting glucose and impaired glucose tolerance are associated with modest increases in the risk for CVD. Therefore, the aim of this study is to investigate the risk of atherosclerosis according to be combined with the presence of obesity and metabolic components in pre-diabetes individuals.

2. Methods

This study included 26,499 prediabetes (fasting blood sugar (FBS) 100~125mg/dL or hemoglobinA1c 5.7~6.4%) that underwent carotid ultrasonography to 16 centers in KAHP in 13 cities Korea, between January 2014 to December 2015. The individuals with history of disease or medicine were excluded. The atherosclerosis was defined as abnormal carotid intima-media thickness (CIMT), the presence of carotid-plaque (CP) and stenosis. Participants were divided into four groups based on the obesity status(using BMI and waist circumference (WC)) and metabolic health status using the modified NCEP ATP-Ⅲ except WC and FBS.

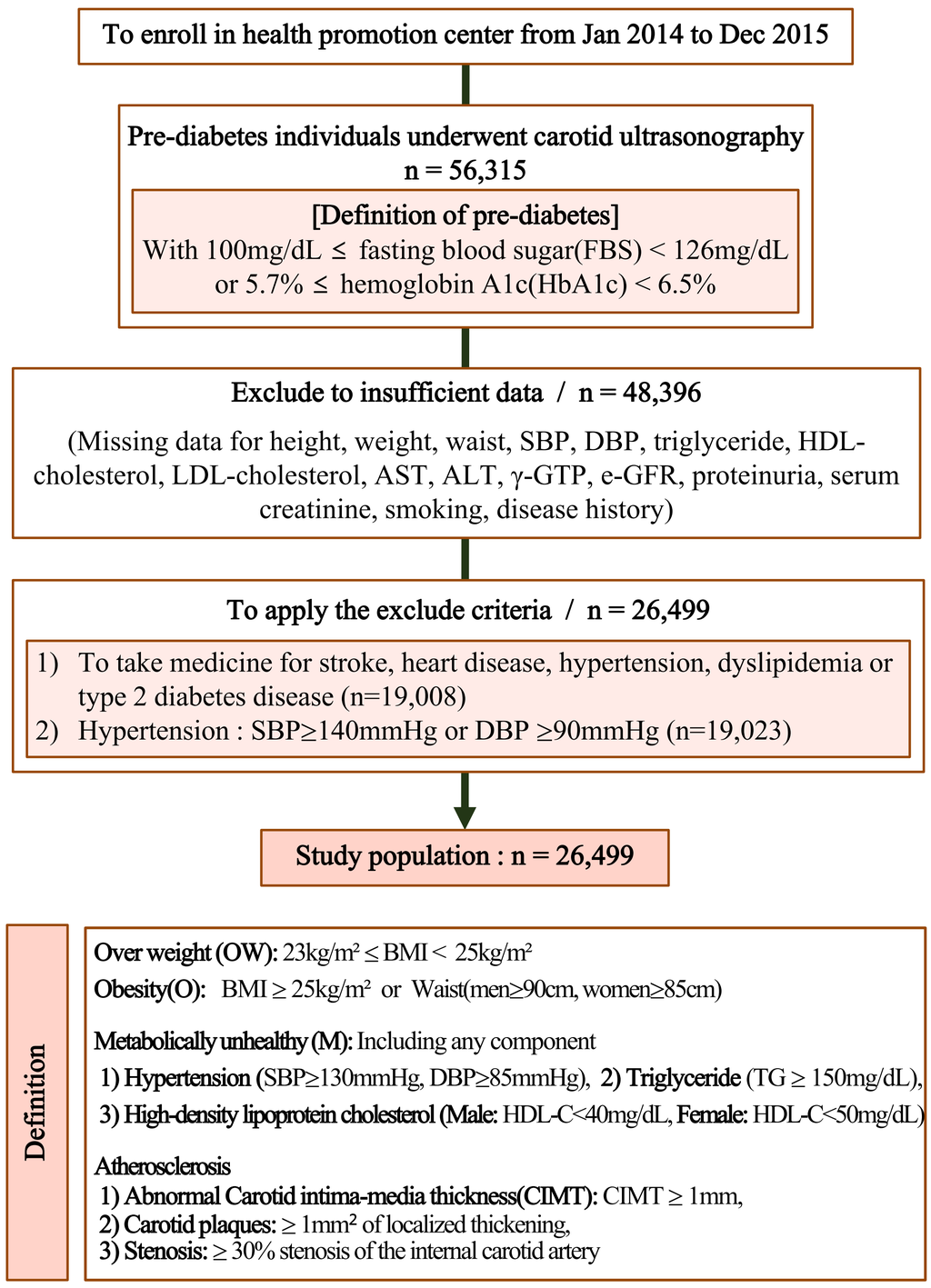

Figure 1. Study flow diagram and definition

3. Results

The metabolically unhealthy (M) normal weight (NW) and M Obesity (O) groups had the higher risk for CP and abnormal CIMT, compared to metabolically healthy (MH) NW group (all *P* for odds-ratios (OR) < 0.05). Specifically, ORs of CIMT were increased according to obese level (normal 1.48 < over-weight 1.52 < obesity 1.78) within metabolically unhealthy subjects (all *P*<0.05). When defining obesity as the combination of BMI and WC, ORs of CP and stenosis were significantly high at metabolically unhealthy individuals either with or without obesity. In comparison, the risk of CIMT was increased in sequential order from MH-O<M-NW<M-O groups.

Table 1. Odds ratios for abnormal carotid intima-media thickness, the presence of carotid plaque and stenosis according to metabolic phenotype

	Abnormal CIMT	Carotid Plaque(+)	Stenosis(+)
	OR (95% CI)	OR (95% CI)	OR (95% CI)
WC and BMI			
MH-NW	ref	ref	ref
MH-O	1.43 (1.06, 1.92)	0.99 (0.90, 1.08)	0.95 (0.78, 1.16)
M-NW	1.52 (1.18, 1.95)	1.21 (1.12, 1.30)	1.22 (1.04, 1.42)
M-O	1.87 (1.47, 2.38)	1.24 (1.15, 1.33)	1.20 (1.02, 1.40)
WC			
MH-NW	ref	ref	ref
MH-O	1.32 (0.94, 1.84)	1.05 (0.94, 1.16)	0.95 (0.75, 1.20)
M-NW	1.52 (1.23, 1.88)	1.24 (1.16, 1.32)	1.28 (1.12, 1.47)
M-O	1.68 (1.32, 2.15)	1.24 (1.14, 1.34)	1.08 (0.91, 1.29)
BMI			
MH-NW	ref	ref	ref
MH-OW	0.94 (0.64, 1.37)	1.06 (0.96, 1.18)	0.97 (0.78, 1.21)
MH-O	1.39 (0.99, 1.96)	1.01 (0.91, 1.11)	0.93 (0.75, 1.17)
M-NW	1.48 (1.06, 2.07)	1.24 (1.12, 1.38)	1.19 (0.98, 1.44)
M-OW	1.52 (1.11, 2.10)	1.24 (1.13, 1.37)	1.13 (0.93, 1.36)
M-O	1.78 (1.33, 2.38)	1.26 (1.16, 1.38)	1.23 (1.04, 1.47)

* Adjusted by age, sex, smoking, disease history, FBS, LDL-cholesterol, AST, ALT, γ-GTP, e-GFR, proteinuria, Serum creatinine.

† Abbreviations: CIMT, carotid intima media thickness; WC, waist circumference; BMI, body mass index; MH, metabolically healthy; M, metabolically unhealthy; NW, normal weight; O, normal weight; OW, overweight.

4. Conclusion

Metabolically unhealthy status (MNW, MO phenotypes) is related to CP and CIMT as atherosclerosis index. Additionally, obesity (MHO phenotype) only defined as the combination of BMI and WC is associated with CIMT. It's meaningful to manage only obesity (MHO) as well as only metabolically unhealthy status (MNW) in the prevention of CVD among pre-diabetes. Therefore, lifestyle modification to maintain a healthy body weight is necessary to pre-diabetic individuals for preventing CVD.