Effect of metabolically health obesity on carotid intima-media thickness in general population: a community-based cohort study

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Topic(s):
Obesity

Citation:

Introduction: Obesity is a common and independent risk factor for all-cause mortality. More specifically, obesity is a major component of atherosclerosis in association with metabolic disorders including metabolic syndrome (MetS), resulting in various cardiovascular diseases (CVD). Alternatively, obese subjects without MetS are prevalent, also referred to as metabolically healthy obesity (MHO). However, most preceding studies regarding MHO have been limited by small cohorts. Therefore, the effect of MHO on atherosclerosis in the general population remains unclear.

Purpose: In this study, we sought to clarify the effect of MHO on carotid intima-media thickness (IMT) as a marker of early stage atherosclerosis using a community-based cohort in general population.

Methods: We examined subjects who underwent medical check-up at our University Hospital. We defined obesity as body mass index = 25.0 kg/m². Abdominal obesity, defined as waist circumstance at umbilical level = 85 cm in men and = 90 cm in women, was obligatory for the diagnosis of MetS. In addition to abdominal obesity, any two of the following three abnormalities should be observed for the diagnosis of MetS, [1] Dyslipidemia: triglyceride = 150 mg/dL, HDL-C < 40 mg/dL, or use of lipid lowering medication, [2] Hypertension: systolic blood pressure = 130 mmHg, diastolic blood pressure = 85 mmHg, or use of antihypertensive medication, and [3] Hyperglycemia: fasting plasma glucose = 110 mg/dL or use of hypoglycemic medication. MHO was defined as obese subjects without MetS, whereas we defined metabolically unhealthy obesity (MUO) as obese subjects with MetS. We defined carotid plaque as IMT = 1.1 mm.

Results: Among 1,241 subjects, 857 subjects (69%) were categorized in the normal body weight group, whereas 275 subjects (22%) were categorized as MHO, and 109 subjects (9%) were categorized as MUO. Compared to non-obese subjects, prevalence of classical cardiovascular risk factors including hypertension, diabetes mellitus, and dyslipidemia increased in subjects with MHO, and further increased in those with MUO. IMT was higher in obese subjects compared to those without obesity. Similarly, the prevalence of carotid plaque formation was also higher in obese subjects. Multivariable logistic regression analysis demonstrated that age = 60 years, male sex, hypertension, diabetes mellitus, MHO subjects (Odds ratio [OR]; 1.6, p = 0.005), and MUO subjects (OR 1.7, p = 0.04) were independently associated with carotid plaque formation. There was no statistical difference in the risk of carotid plaque formation between subjects with MHO and MUO.

Conclusions: IMT and the prevalence of carotid plaque are higher in both subjects with MHO and MUO compared to non-obese subjects in the general population. We need to take obesity regardless of the presence of MetS into consideration as high-risk subjects for subsequent CVD.
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(A) Intima-media thickness
(B) Prevalence of carotid plaque

- Non-obese
- Metabolically healthy obesity
- Metabolically unhealthy obesity

p = 0.019
p < 0.0001
p = 0.002