

## Original Article



## Relationship between Waist Circumference and Elevation of Carotid Intima-media Thickness in Newly-diagnosed Diabetic Patients\*

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### Abstract

**Objective** Waist circumference, as a brief indicator of visceral obesity, is associated with multi-metabolic disorders and cardiovascular diseases. The present study was aimed to find out the relationship between waist circumference and carotid intima media thickness (C-IMT), as well as the best waist circumference cutoff for identifying C-IMT elevation in Chinese male patients with newly-diagnosed diabetes.

**Methods** Five hundred and seventy-eight patients from Department of Endocrinology and Metabolism in Shanghai Sixth People's Hospital affiliated to Shanghai Jiao Tong University were enrolled. Both physical examination (for measurement of waist circumference) and carotid ultrasonography (for measurement of C-IMT) were performed.

**Results** After grouping according to the quartiles of C-IMT, the waist circumference increased across all its quartiles. The waist circumference in 3rd and 4th quartiles (90.7±9.8 cm and 90.8±9.6 cm) was significant higher than in 1st and 2nd quartiles ( $P<0.05$ ). When subjects were divided into 4 groups according to waist circumference, the C-IMT of subjects with waist circumference 90-95 cm was significant higher than that of subjects with waist circumference 85-90 cm and less than 85 cm respectively ( $P<0.05$ ). Both spearman and partial correlation analysis showed that C-IMT was positively correlated with waist circumference ( $P<0.01$ ). C-IMT was found significantly elevated with the increase of waist circumference. Multiple stepwise regression analysis showed that waist circumference was one of the independent risk factors of C-IMT. After an average of 2.23±0.85 years follow up, there was a significant elevation of C-IMT in the group with baseline waist circumference over 90 cm ( $P<0.05$ ), while no significant difference was detected in the group with baseline waist circumference less than 90 cm ( $P=0.27$ ). Logistic regression showed that baseline waist circumference over 90 cm was associated with a relative risk to C-IMT elevation of 1.132 (95% CI 1.043-1.431,  $P<0.05$ ).

**Conclusion** Among newly-diagnosed diabetic male patients, waist circumference over 90 cm not only reflects sub-clinical atherosclerosis in early stage, but also predicts the progression of atherosclerosis.

**Key words:** Waist circumference; Carotid intima media thickness; Metabolic syndrome

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## INTRODUCTION

Obesity has become a worldwide health problem. As estimated by the World Health Organization (WHO), overweight individuals will reach 2.3 billion by 2015 with 700 million obese ones<sup>[1]</sup>. It is widely convinced that obesity is contributed to a wealth of metabolic disorders, among which the closest are hypertension, hyperglycemia and dyslipidemia<sup>[2]</sup>. Metabolic syndrome (MS) is defined as visceral obesity combined with the above mentioned disorders. A cluster of multi-metabolic disorders may finally lead to future cardiovascular events, threatening the health of the mankind<sup>[3]</sup>. Waist circumference is now widely used as a brief indicator for assessment of visceral obesity. The Working Group on Obesity in China (WGOC) has analyzed more than 240 000 domestic personal data and found that people with exceeding waist circumference were more likely to suffer diabetes and hypertension than those with normal waist circumference. The risk was even 4 times higher. So the WGOC has defined an optimal waist circumference cutoff for men in identifying visceral obesity according to all the epidemiological data, which is more than 85 cm<sup>[4-5]</sup>. In our study group, we found that when applying visceral fat area (VFA) as the precise index, 80 cm<sup>2</sup> was an optimal cutoff for identifying visceral obesity and its corresponding waist circumference was 90 cm<sup>[6]</sup>. The result mentioned was also been included in the 2007 Joint Committee for Developing Chinese Guidelines (JCDCG2007) definition<sup>[7]</sup>. Furthermore, a 7.8-year follow up study was also conducted, which identified that waist circumference of 88 cm was significant in predicting future diabetes<sup>[8]</sup>.

Atherosclerosis is the main pathological process of cardiovascular diseases (CVD). Increment of carotid intima media thickness (C-IMT) is an early phase of atherosclerosis, which is also a strong predictive factor of future CVD events<sup>[9]</sup>. No previous study has ever been published about the relationship between waist circumference and C-IMT in the Chinese male population. Therefore, the present study was aimed to focus on the relationship in question and to find out the optimal cutoff for identifying C-IMT elevation.

## MATERIALS AND METHODS

### Study Subjects

Actually five hundred and seventy-eight newly

diagnosed diabetic individuals were recruited from Department of Endocrinology and Metabolism, Shanghai Sixth People's Hospital affiliated to Shanghai Jiao Tong University. We excluded individuals according to the following criterion: abnormal liver function (alanine aminotransferase (ALT), aspartate transaminase (AST) or direct bilirubin >1.5 times the upper limit of normal); renal dysfunction [serum creatinine (Scr) >115 μmol/L] or patients under hemodialysis; hyperthyroidism and hypothyroidism; presence of cancer; cirrhosis with ascites; psychiatric disturbance; pregnancy; current treatment with systemic corticosteroids; incomplete anthropometric data or laboratory evaluation. Eventually, 578 participants were qualified in this study. Also a questionnaire of medical history and medicine-taking history was accessible for each subject. This study was approved by Ethics Committee of Sixth People's Hospital affiliated to Shanghai JiaoTong University. Informed consents were obtained from all the subjects.

### Physical Examination and Laboratory Information

All subjects received physical examinations, including measurement of weight, height, waist circumference and blood pressure (BP). The body mass index (BMI, kg/m<sup>2</sup>) was defined as weight (kilogram) divided by height (meter) square. Waist circumference was measured via a tape going around the abdomen horizontally at the midpoint of the costal margin and the iliac crest on mid-axillary line. Blood pressure was measured by means of a sphygmomanometer.

Blood samples were all collected from participants in a 10 h fast status in the morning. Fast plasma glucose (FPG) was measured by glucose oxidase method (Hitachi 7600-120; Roche kit). Glycated hemoglobin A1c (HbA1c) was detected via high-pressure liquid chromatography (Variant II, Bio-Rad Inv., Hercules, CA, USA). ALT, AST, Scr, uric acid (UA) were assessed by enzymatic method with an automatic biochemical analyzer (7600-020, Hitachi Inc., Tokyo, Japan). Lipid profiles including serum low-density lipoprotein cholesterol (LDL-C, direct assay method, Sekisui Medical Co. Ltd., Tokyo, Japan), high-density lipoprotein cholesterol (HDL-C, direct assay method, Sekisui Medical Co. Ltd., Tokyo, Japan), serum triglyceride (TG, enzymatic procedures, Roche Diagnostics GmbH, Mannheim, Germany), serum total cholesterol (TC, enzymatic procedures, Roche Diagnostics GmbH, Mannheim, Germany) was detected on a parallel, multichannel analyzer

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