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ORIGINAL ARTICLE

Clinical analysis of the relationship between cystatin C and metabolic syndrome in the elderly

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Abstract
Objective: Studies have shown that both cystatin C and metabolic syndrome (MetS) are associated with inflammation. We set out to investigate the correlation between serum cystatin C levels and MetS in the elderly.
Methods: This prospective study was conducted in 380 elderly individuals, including 135 patients with MetS, 142 patients with metabolic disturbance (MetD), and 103 healthy elderly individuals (control group). Waist–hip ratio, waist circumference, waist–height ratio, body mass index (BMI), fasting plasma glucose (FPG), hemoglobin A1c (HbA1c), low-density lipoprotein cholesterol (LDL-C), triglycerides (TG), high-density lipoprotein (HDL-C), systolic blood pressure (SBP), diastolic blood pressure (DBP), pulse pressure and cystatin C were measured and their mutual relations were analyzed.
Results: The higher the MetS scores, the higher the serum cystatin C concentration in these patients. Serum cystatin C concentration was closely related to waist–hip ratio, waist circumference, waist–height ratio, BMI, TG, FPG, and blood pressure, not related to LDL-C levels, and negatively correlated with HDL-C levels. Logistic regression analysis indicated that cystatin C, waist–height ratio, waist circumference, FPG, TG, SBP and pulse pressure were significantly associated with MetS (OR between cystatin C and MetS 2.164, 95% CI 1.136–8.259).
Conclusion: Cystatin C was significantly associated with MetS in the elderly. As MetS scores rose, serum cystatin C levels increased.

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PALAVRAS-CHAVE
Síndrome metabólica;
Cistatina C;
Idosos;
Inflamação;
Obesidade

Análise clínica para a relação entre a cistatina C e a síndrome metabólica nos idosos

Resumo
Objetivo: Alguns estudos demonstraram que tanto a cistatina C como a síndrome metabólica (SM) estão associadas à inflamação. Procuramos investigar a correlação entre os níveis séricos da cistatina C e a SM nos idosos.
Métodos: Este estudo prospetivo foi realizado em 380 idosos, incluindo 135 doentes com SM, 142 doentes com alterações metabólicas (AM) e 103 idosos saudáveis num grupo de controlo corrente. Foram medidos a relação cintura-quadril, o perímetro abdominal, a razão cintura-estatura, o índice da massa corporal (IMC), glicemia em jejum, a hemoglobina glicada (HbA1c), o colesterol de lipoproteína de baixa densidade (colesterol-DL), os triglicéridos (TG),o colesterol de lipoproteína de alta densidade (colesterol-HDL), a pressão arterial sistólica (PAS), a pressão arterial diastólica (PAD), a pressão do pulso e a cistatina C e foram avaliadas as suas relações mútuas.
Resultados: 1. Como os *scores* dos componentes da SM aumentaram, os níveis da cistatina C subiram nestes doentes. Quanto mais elevados foram os *scores* da SM, mais elevada foi a concentração sérica de cistatina C nestes doentes. 2. A concentração sérica de cistatina C foi estreitamente relacionada com a razão cintura-quadril, com o perímetro abdominal, com a razão cintura-estatura, com o IMC, com os TG, com a glicemia em jejum e com a pressão arterial, mas não associada aos níveis de colesterol-LDL e negativamente correlacionada com os níveis de colesterol-HDL. 3. A análise de regressão logística indicou que a cistatina C, a razão cintura-estatura, o perímetro abdominal, a glicemia em jejum, os TG, a PAS e a pressão do pulso foram significativamente associados à SM, ao valor da OR entre a cistatina C e a SM foi de 2,164 (95% IC=1,136-8,259).
Conclusão: A cistatina C foi significativamente associada com a SM nos idosos. Como os *scores* da SM subiram, os níveis séricos de cistatina C aumentaram.

Introduction

Cystatin C (cysteine protease inhibitor C) is a member of the protease inhibitor superfamily, consisting of 122 amino acids, and is a low molecular weight alkaline protein. Various studies[1–3] have revealed that cystatin C is not only a more sensitive indicator of renal function than creatinine or creatinine clearance but is also an independent and strong predictor of cardiovascular events, diabetes and all-cause mortality. Recent research has shown that cystatin C is closely associated with the inflammatory process and other inflammation factors.[1,4]

Metabolic syndrome (MetS) is a clinical entity characterized by abdominal obesity, hyperglycemia, hypertension, and dyslipidemia. Each of the components has been recognized as a risk factor for cardiovascular events. It is reported that more than 20% of the elderly suffer from MetS in China and the prevalence of MetS in the elderly in the United States has reached 43.5%. A prospective clinical study has demonstrated that serum cystatin C concentration has a strong independent association with cardiovascular events. MetS, as the most important risk factor for cardiovascular disease, carries a high risk of renal dysfunction, and abnormal renal function also has a close correlation with cardiovascular risk. As a marker of renal function, cystatin C may be closely related to MetS.[1,3,5] However, the pathogenesis of MetS has not been fully determined. The elderly have a high incidence of cardiovascular and kidney disease, so this study set out to analyze clinical data on MetS, to investigate whether there is a relationship between cystatin C and MetS in the elderly, and to discuss its possible pathogenesis and clinical importance.

Methods

Study population and diagnostic criteria

A total of 380 consecutive subjects were prospectively recruited between August 2009 and July 2012 from the Second Hospital of Shandong University and Qilu Hospital of Shandong University. According to the International Diabetes Federation (IDF) criteria,[6,7] MetS is defined as central obesity (waist circumference $\geq$90 cm for Chinese men and $\geq$80 cm for Chinese women) plus any two of the following: (1) triglycerides (TG) $\geq$1.7 mmol/l or specific treatment for this lipid abnormality; (2) high-density lipoprotein (HDL-C) levels <1.0 mmol/l in men and <1.3 mmol/l in women or specific treatment for this lipid abnormality; (3) systolic blood pressure (SBP) $\geq$130 mmHg or diastolic blood pressure (DBP) $\geq$85 mmHg or treatment of previously diagnosed hypertension; and (4) fasting plasma glucose (FPG) $\geq$5.6 mmol/l or previously diagnosed type 2 diabetes. The criteria for a diagnosis of metabolic disturbance (MetD) is at least one of the diagnostic criteria for MetS as listed above. The definition of