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Relationship between limited joint mobility of hand and carotid atherosclerosis in patients with type 2 diabetes

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ABSTRACT

Aim: Limited joint mobility (LJM) of hand, which is one of a complication of diabetic hand, has a close association with diabetic microangiopathy. However, it remains to be elucidated about the relationships between LJM of hand and subclinical atherosclerosis in patients with type 2 diabetes. Therefore, we conducted a cross-sectional study to evaluate the relationships between LJM of hand and carotid intima-media thickness (IMT) and plaque score in patients with type 2 diabetes.

Methods: We evaluated the relationships between LJM of hand, and carotid IMT and plaque score, evaluated by carotid ultrasound examination, in 341 consecutive patients with type 2 diabetes. LJM of hand was diagnosed using a 'prayer sign' or 'table test'.

Results: LJM of hand was present in 72 patients. Carotid IMT and plaque score were higher in patients with LJM of hand than those in patients without (1.45 ± 0.66 vs. 1.14 ± 0.68 mm, $P = 0.013$ and 8.0 ± 5.3 vs. 5.4 ± 4.8 mm, $P < 0.001$). Multivariate linear regression analysis revealed that LJM of hand was positively correlated with plaque score ($\beta = 0.423$, $P = 0.043$) after adjusted for age, sex, durations of diabetes, body mass index, hemoglobin A1c, creatinine, uric acid, smoking, hypertension and dyslipidemia.

Conclusions: Our results demonstrate a relation between LJM of hand and subclinical atherosclerosis, especially plaque score, in patients with type 2 diabetes. Diagnosis of diabetic hand is simple and non-invasive, and thus is a useful method for assessment of subclinical atherosclerosis in patients with type 2 diabetes.

Abbreviations: CVD, Cardiovascular disease; CHD, Chronic heart disease; PAD, Peripheral arterial disease; FRS, Framingham Risk Score; LJM, Limited joint mobility; IMT, Intima-media thickness; BMI, Body mass index; HbA1c, glycated hemoglobin; eGFR, Estimated glomerular filtration rate

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1. Introduction

Cardiovascular disease (CVD) is the most prevalent cause of morbidity and mortality in patients with diabetes [1] and atherosclerosis is a major risk factor for CVD [2]. Type 2 diabetes is known risk for atherosclerosis, leading to non-embolic ischemic stroke [3] and peripheral arterial disease (PAD) [4]. To assess the risk for chronic heart disease (CHD) and CVD, traditional risk scores, such as Framingham Risk Score (FRS) and Framingham based risk score, have been widely used, however a previous report indicated that 175 of 1015 patients who classified low risk of FRS had subclinical atherosclerosis [5]. Therefore, screening for subclinical atherosclerosis has a critical issue for improving the outcome of high risk patients, including patients with diabetes.

'Diabetic hand' is a complication of the upper extremity that manifests as conditions such as limited joint mobility (LJM), Dupuytren's contracture, and trigger finger [6–9]. Diabetic hand tends to be ignored in clinical situation [10], in spite of several reports about positive relation between LJM of hand and microvascular complications [6–8,11,12].

As for macroangiopathy, only few data was reported about the relation to LJM of hand previously [13,14]. It has been reported that the prevalence of history of coronary heart disease and cerebrovascular disease is higher in type 2 diabetic patients with LJM of hand [13] and that there is a relationship between LJM of hand and early atherosclerosis in patients with type 1 diabetes [14].

Moreover, little is known about the relationship between diabetic hand and subclinical atherosclerosis in patients with type 2 diabetes mellitus. Therefore, we investigated the relationship between LJM of hand, and carotid intima-media thickness (IMT) and carotid plaque in this cross-sectional study.

2. Material and methods

2.1. Study design and patients

We included the patients who visited the outpatient clinic of Otsu Municipal Hospital from April 2012 to December 2014 and who were performed carotid ultrasound in this cross-sectional study. Patients were excluded if they had a history of articular rheumatism or surgery for spinal disease. Patients with a history of cardiovascular disease (myocardial infarction, coronary revascularization or stroke) were also excluded. In addition, we excluded the patients who could not be obtained complete results of carotid ultrasound examination. This study was conducted in accordance with the Declaration of Helsinki and informed consent was obtained from all patients. The Ethics Committee of Otsu Municipal Hospital gave approval for this study.

All patients provided details of their demographics, medical history and medication usage. Body mass index (BMI) was calculated as weight (kg) divided by height (m^2) squared. We classified patients as current smokers or not according to self-administered questionnaire. Retinopathy was assessed by ophthalmologists who were unaware of the severity of other diabetic complications [15]. If findings in the left and right fundi were discordant, the worse side was taken as representative of the patient. Neuropathy was defined using the diagnostic criteria for diabetic neuropathy proposed by the Diagnostic Neuropathy Study Group [16]. Nephropathy was graded as normoalbuminuria, urine albumin excretion (UAE) < 30 mg/g creatinine (Cr); microalbuminuria, 30–300 mg/g Cr; or macroalbuminuria, >300 mg/g Cr. Microalbuminuria and macroalbuminuria were considered to indicate nephropathy.

2.2. Measurement of carotid IMT, plaque score

Carotid ultrasound examination was performed by a sonographer who was unaware of the participant's clinical characteristics. Both the left and right common carotid artery, carotid bulb, and internal carotid arteries were scanned using high-resolution B-mode ultrasound scanners (Xario, Toshiba, Inc., Tokyo, Japan), equipped with a 7.5 MHz high-resolution linear array transducer according to recommendations of the American Society of Echocardiography Carotid Intima Media Thickness Task Force [17]. Patients were all examined in the supine position with their necks extended and chins facing the contra lateral side. Intima-media thickness (IMT) was measured in the posterior wall of the carotid artery and was defined as the distance between the leading edge of the lumen-intima echo and the leading edge of the media-adventitia echo in plaque-free area and greater than 75 percentile [17]. Significant variation was not revealed in repeated measurements of IMT which were randomly selected. Intra-operator coefficients of variation was 2.4%.

Mean maximum IMT was defined as the average of three measurements of the maximum IMTs across the 12 carotid arterial segments: the near and far walls of the distal common, the bifurcation and the proximal internal left and right carotid artery [18].

Plaque was defined as IMT of more than 1.2 mm and as a focal thickening of 50% thicker than the neighboring segment [19]. Plaque score was defined as the sum of maximum carotid plaque thickness of all plaques [20].

Plaque echogenicity was assessed with the criteria of the European Carotid Plaque Study Group [21]. Echogenicity is rated on a three-category scale: strong (echo-rich), intermediate, or weak (low echogenicity or echolucency). As previously reported, we defined the weak and intermediate echogenic plaque as the vulnerable plaque and the strong echogenic plaque was considered as stable plaque [22].

2.3. Diagnosis of diabetic hand

LJM of hand was diagnosed using a 'prayer sign' or 'table test' [11]. Patients with LJM were unable to bring the palms together or place them on a table with full contact when they were asked to close their palms in a praying position with the fingers in contact with each other or to place the palms on a table with the wrists flexed maximally [7,8].

2.4. Data collection and measurements

Blood samples were drawn in the morning after an overnight fast for measurement of glycated hemoglobin (HbA1c), total