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Original Article

Coronary sinus filling time: A novel method to assess microcirculatory function in patients with angina and normal coronaries

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ABSTRACT

Objective: Dysfunction of the coronary microcirculation is considered as one of the factors responsible for symptoms and abnormal stress tests in patients with angina and normal coronaries (syndrome X). We sought to evaluate the usefulness of coronary sinus filling time (CSFT) to assess coronary microcirculation in this group of patients.

Methods: We compared the CSFT of patients having definite angina or atypical angina with positive treadmill electrocardiography test (angina group), with that of patients undergoing coronary angiogram (CAG) prior to balloon mitral valvuloplasty (control group). During CAG, coronary sinus was visualized in appropriate views and CSFT in seconds was derived from frame count. Thrombolysis In Myocardial Infarction (TIMI) flow grade, corrected TIMI (cTIMI) frame count, TIMI Myocardial Perfusion grade (TMP) were assessed.

Results: There were 41 patients in angina group and 16 in control group. Among the angina group 68.8% were females as against 81.8% in the control group. 87.8% ($n = 36$) had typical angina. Mean CSFT was 4.25 ± 0.72 s and 3.46 ± 0.99 s in the angina group and control group respectively ($p = 0.001$). No significant differences were found between the groups with respect to TMP ($p = 0.68$) & cTIMI frame count ($p = 0.22$).

Conclusion: CSFT is a simple method to assess the transit time through coronary microcirculation. CSFT was significantly delayed in patients with angina and normal coronaries. TMP and cTIMI frame count were not significantly different between groups.

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1. Introduction

Twenty percent of all diagnostic angiograms in patients referred for evaluation of chest pain have normal epicardial coronary arteries.¹ First described by Kemp in 1973, syndrome X comprises of a heterogeneous group presenting with typical

angina, a positive exercise stress test, normal epicardial coronaries and no clinical or angiographic evidence of epicardial coronary artery spasm.² Dysfunction of the coronary microcirculation may be one of the factors responsible for persistent anginal symptoms and abnormal stress test.^{3,4} Prognosis of these patients is not as benign as reported by preliminary

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cohort studies. There are studies showing increased risk of myocardial infarction and cardiac death, especially in patients with positive stress test.^{5,6} Women Ischemic Symptom Evaluation (WISE) trial showed that persistence of symptoms is associated with more than two-fold increase in cardiovascular events and concluded that such patients should undergo formal studies of vascular function and aggressive risk factor modification.⁷ Noninvasive as well as invasive modes for assessing microcirculation have yielded inconsistent results and there is yet no simple method available at present to assess coronary microcirculation.^{8–10} In this study, we have attempted to evaluate the usefulness of coronary sinus filling time (CSFT) for assessment of microcirculatory transit time in the coronary circulation.

2. Patients and methods

Adult patients presenting to the cardiology department of a major teaching hospital with angina-like chest pain from June 2011 to January 2012 were screened for this study.

The assessment of chest pain was done by two cardiologists of the department separately and doubtful cases were reviewed by a third cardiologist. Patients with chest pain were grouped into: 1) definite angina with/without positive TMT 2) probable angina with positive TMT and 3) non-cardiac chest pain. Definite (typical) angina was defined as substernal chest discomfort 1) of characteristic quality and duration 2) provoked by exertion or emotional stress 3) relieved by rest or

sublingual nitrites. Probable angina was defined as those that met any two of the above characteristics; non-cardiac chest pain as those meeting one or none of the characteristics.¹¹

Baseline evaluation, electrocardiogram (ECG) and echocardiography were done in all subjects. Definite and probable angina group underwent TMT. Patients were grouped as having either positive, negative or inconclusive test result based on standard criteria.¹² Patients with definite angina regardless of the result of TMT and patients with probable angina and a positive stress test were subjected to CAG. Among patients undergoing CAG, those with normal coronaries formed the angina group. The control group consisted of patients with mitral stenosis in sinus rhythm, normal coronary angiogram and normal left ventricular structure and function undergoing percutaneous balloon mitral valvuloplasty (BMV). The right atrial pressures and left ventricular end diastolic pressures were measured in all cases. Exclusion criteria were: 1) abnormal coronaries on angiography (any vascular irregularity/ectasia/stenoses), 2) patients with current or prior cardiovascular events by history, ECG or echocardiography, 3) presence of cardiac diseases other than isolated mitral stenosis. Fig. 1 outlines the selection of patients for the study.

Coronary angiogram was done with Philips Allura Xper FD20 (Philips Electronics, Eindhoven, The Netherlands) at a rate of 15 frames/s. Left coronary artery injection was taken with 7 mL contrast at 2 mL/s rate. A normal coronary artery was defined as epicardial coronary artery at angiography without any wall irregularities, ectasia or stenosis. TIMI

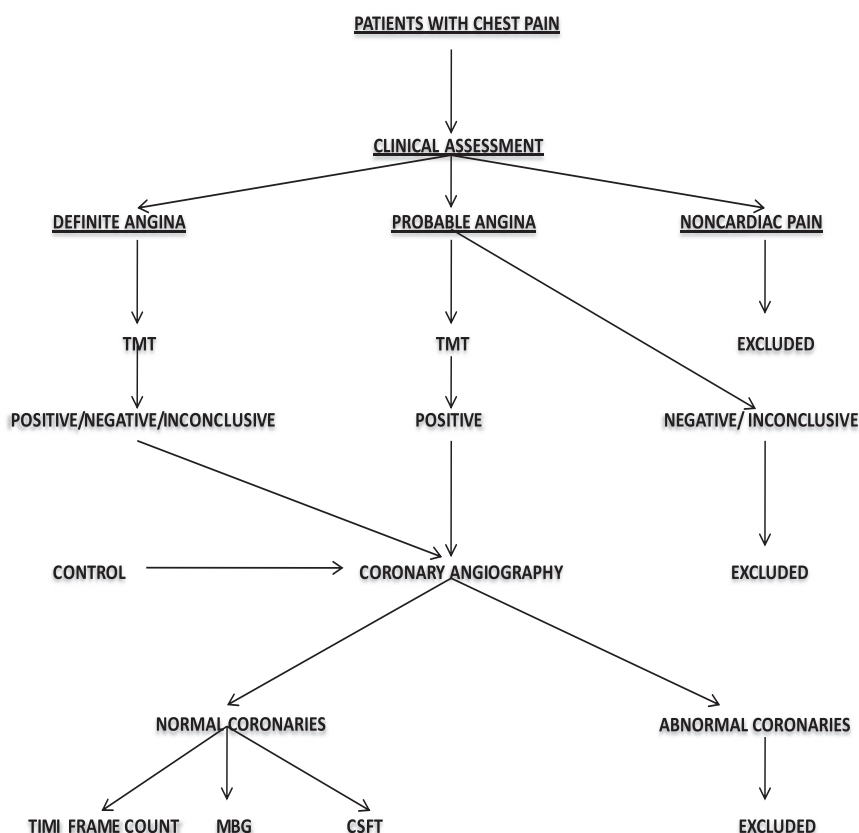


Fig. 1 – Flow diagram showing the enrollment of patients for the study.

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