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Original Article

Prognostic significance of coronary sinus filling time in patients with angina and normal coronaries at one year follow up



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ABSTRACT

Background: Coronary sinus filling time (CSFT) has been proposed as a simple method for assessment of coronary microvascular function in patients with angina and normal coronaries. But its correlation with inducible ischemia and prognostic significance in predicting future cardiovascular events has not been studied. The present study assessed the prognostic significance of CSFT during one year of follow up.

Methods: We compared coronary sinus filling time of patients with angina and normal coronaries with that of control population. Control group was formed by those patients with supraventricular arrhythmia undergoing radiofrequency ablation and having normal coronaries. Baseline treadmill test (TMT) parameters like workload, duration and Duke Score were assessed. Patients were followed up for one year and a composite of cardiovascular mortality and non-fatal myocardial infarction was analyzed. Number of patients presenting to emergency or outpatient department with recurrent chest pain symptoms during one year follow up was considered for secondary outcome analysis. Coronary sinus filling time was analyzed with respect to cardiovascular events, repeat hospitalization for recurrent angina and TMT parameters.

Results: Total 72 patients and 16 controls were studied. Mean CSFT value in the study group was 5.31 ± 1.03 sec and in the control group was 4.16 ± 0.72 sec and the difference was significant (p value = 0.0001). No correlation was found between baseline and repeat TMT parameters with CSFT. There was no cardiovascular mortality or hospitalization for non-fatal MI during one year follow up. But patients with frequent emergency or outpatient department visits with chest pain had a high CSFT compared with asymptomatic patients (p value = 0.005).

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Conclusion: Coronary sinus filling time may be used as a simple marker of microvascular dysfunction in patients with angina and normal coronaries. Patients with recurrent chest pain symptoms after one year follow up were found to have high CSFT compared to asymptomatic patients.

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1. Introduction

Cardiac syndrome X is characterized by angina, positive exercise stress test, normal coronaries on angiogram and no evidence of coronary artery spasm.^{1,2} Myocardial ischemia is proven to be one of the reasons for persistent angina in this group of patients (using MRI and nuclear perfusion studies).^{3–5} Coronary microvascular dysfunction is identified as the cause of myocardial ischemia.^{6,7} Studies have proved that prognosis of patients with persistent angina and normal epicardial coronaries is not benign.^{8–10} Women Ischemic Symptom Evaluation (WISE) trial showed that persistent angina in patients with normal epicardial coronaries is associated with more than two fold increases in cardiovascular events.^{8,9} This study concluded that such patients should undergo further studies of vascular function and aggressive risk factor modification. There are no simple investigative modalities to assess the coronary microcirculation. Noninvasive as well as invasive modes of investigation have yielded inconsistent results.¹¹ Recent studies have shown that patients with angina and normal coronaries have prolongation of coronary sinus filling time (CSFT) and this can be used as a marker of coronary microvascular function.^{12,13} But the prognostic significance of CSFT has not been studied. In the present study we assessed the prognostic significance of CSFT in predicting cardiovascular events on follow up.

2. Patients and method

In this prospective cohort study, patients undergoing coronary angiogram for evaluation of chest pain in cardiology department of a large tertiary hospital were screened. Study population was selected after applying exclusion criteria. Patients with abnormal coronaries (irregularities, ectasia, stenosis, myocardial bridging), history of acute coronary syndrome with raised cardiac markers and echocardiography showing more than mild valvular heart disease, cardiomyopathies, significant left ventricular dysfunction defined as M-mode ejection fraction less than 50%, regional wall motion abnormality and pulmonary artery hypertension defined as peak pulmonary artery pressure more than 30 mmHg (estimated from tricuspid regurgitant jet velocity) were excluded. Control population comprised of patients above 40 years of age without structural heart disease undergoing electrophysiology (EP) study and radiofrequency (RF) ablation for supraventricular tachycardia (atrioventricular node reentrant, atrioventricular reentrant tachycardia) with ST segment

depression during tachycardia and having normal coronaries on angiogram. Baseline evaluation, ECG, echocardiography and treadmill test (TMT) were done in all cases.

2.1. CSFT estimation

A repeat injection in the left coronary system was taken with 7 ml contrast at approximate rate of 2 ml/s. Injection was taken with 5F Tiger catheter through radial approach or 6F JL catheter through femoral route. Coronary sinus was evaluated in 40° left anterior oblique (LAO) view with 20° cranial angulation. In this view the tract and effluent could be clearly seen draining into the right atrium after six to eight cycles on average. Coronary angiogram was done with Philips Allura Xper FD 20 (Philips electronics, Eindhoven, The Netherlands) at a rate of 15 frames per seconds.

Coronary sinus filling time is defined as the time taken in seconds for the contrast agent in the epicardial coronary artery to traverse the coronary microvasculature and reach the coronary sinus origin. Assessment of CSFT was done offline. Coronary sinus filling time was estimated as the difference between the frame count of maximum left anterior descending artery (LAD) system opacification at first diagonal (D₁) or first septal (S₁) to that of the starting point of opacification of coronary sinus origin (Fig. 1A, B). Frame count at the maximum opacification of LAD at D₁ or S₁ whichever is earlier was taken as the first frame count. The frame count in which dye is first seen at the origin of coronary sinus was counted as the last frame and the frame count was noted. Coronary sinus origin is defined as the point where great cardiac vein joins the posterolateral vein. The CSFT is calculated in seconds as (last frame count – first frame count)/15.

2.2. Follow up

Patients were followed up for a period of one year with data collected at 1 month, 6 month and at 12 month by direct evaluation. At 1 year they were evaluated for cardiovascular mortality, hospitalization for non-fatal myocardial infarction and emergency or outpatient department visits for recurrent chest pain symptoms. Treadmill test (TMT) was repeated at one year to assess the workload, exercise duration and Duke Score.

2.3. Outcome

Primary outcome was composite of cardiovascular mortality and hospitalization for non-fatal myocardial infarction. Secondary outcomes were emergency or outpatients department

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