

A STUDY OF THE RELATIONSHIP BETWEEN MYOCARDIAL PERFORMANCE INDEX AND LEFT VENTRICULAR END-DIASTOLIC PRESSURE IN PATIENTS WITH LEFT VENTRICULAR SYSTOLIC DYSFUNCTION

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Abstract

INTRODUCTION: Doppler echocardiography is used to evaluate global myocardial performance. An index of myocardial performance (Tei Index) can be of great prognostic value in heart failure. This study was performed to assess the correlation between Tei Index (TI) and left ventricular end diastolic pressure (LVEDP).

METHODS: The study group consisted of 38 patients. Each patient underwent ventriculographic evaluation (all had $EF \leq 45$). Eighteen patients had $LVEDP < 15$ (14 males, 4 females, 57 ± 6 years old) and 20 subjects (15 males, 5 females, 56 ± 7 years old) had $LVEDP \geq 15$. Using Doppler echocardiography, TI was determined for all patients and compared.

RESULTS: Mean TI value was significantly different between subjects with $LVEDP < 15$ and those with $LVEDP \geq 15$ (0.55 ± 0.18 vs. 0.76 ± 0.19 , $P < 0.001$, $T = 4.1$).

DISCUSSION: In patients with systolic heart failure ($EF \leq 45$), TI was significantly lower in subjects with $LVEDP < 15$ compared to those with $LVEDP \geq 15$. Thus, TI may be useful for noninvasive assessment of LVEDP in heart failure.

Keywords • Tei index • Ventricular performance • Heart failure

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Introduction

Left ventricle functions as a pump in the systolic phase of heart beat, receiving blood from the atrium and propelling it through the aorta towards body organs. Various methods are used to evaluate the left ventricular pumping function and performance. Measurement of left ventricular emptying fraction (LVEDP) and ejection fraction (EF) are two practical methods. EF measurement provides a good estimate of left ventricular systolic performance.

EF is almost independent of left ventricular end diastolic volume. The filling ability of the left ventricle to supply cardiac output is known as diastolic performance. In 1995, Tei L and Ling LG carried out a study on a number of patients with cardiomyopathy.^{1,2} They developed a combined measure of ventricular systolic and diastolic performance which has since been known as Tei index.

This index provides a simple and repeatable means of assessing cardiac performance. Tei index is calculated by dividing the sum total of Isovolumic Ventricular Relaxation Time (IVRT) and Isovolumic Ventricular Contraction Time (IVCT) by ejection time (ET). Time intervals required for calculation of Tei index are determined by Doppler echocardiography. Tei index normally equals 0.39 ± 0.05 , but increases to 0.59 ± 0.1 in dilated cardiomyopathy.²

Systolic dysfunction increases IVCT and decreases ET; whereas IVRT increases in both systolic and diastolic dysfunction. In a study of pulmonary hypertensive patients conducted by Tei C and colleagues in 1996, Tei index served as an effective means of separating the patients from normal subjects.^{3,4} A study of 43 heart failure patients conducted by Ewehel R and colleagues in 2000 showed that all patients had $LVEDP > 16$ mmHg (0.39 ± 0.18). Tei index in these patients was significantly higher than in healthy subjects. This study revealed no relationship between Tei index and systolic/diastolic pressure and heart rate, however, Tei index significantly correlated with the patients' LVEDP.⁸ The aim of the present study was to assess the relationship between Tei index and LVEDP in patients with left ventricular systolic dysfunction.

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TABLE 1. Results of comparing Tei index and LVEDP between the two groups

	LVEDP	Number	Mean age	Tei index	P value
EF<45	P>15	18	57	0.55±0.18	0.001
	P<15	20	56	0.76±0.19	

Materials and methods

All the patients with EF≤45 referred for angiography were sequentially included in the study. Patients with valvular diseases or chronic arrhythmia and those with poor echo window and low-quality echocardiograms were excluded.

A total of 38 patients (cases: 30, controls: 18) were studied. LVEDP was recorded during angiography from intraventricular pressure curve. The patients then underwent echocardiography and their IVRT, IVCT and ET were measured using Doppler echo curves. Tei index was calculated. All measurements and Doppler echoes were performed in 4-chamber view with pulse Doppler method using a 3.5 MHz probe. After obtaining the required data, the patients were assigned to two groups based on LVEDP (>15). Tei index was subsequently compared between the two groups using t-test.

Results

Mean Tei index was clearly different in the two groups, (i.e. patients with LVEDP>15 and patients with LVEDP<15). Tei index in the group with LVEDP>15 was significantly higher than that of the other group (0.76±0.19 vs. 0.55±0.18). Difference of age and EF was not significant between the two groups (Table 1).

Discussion

A similar study conducted by Bruch C and colleagues in 2000 considered LVEDP=16 as the cut-off point between the two groups under study. In the latter study, Tei index in subjects with LVEDP>16 equaled 0.60±0.18; the index in subjects with LVEDP<16 was 0.39±0.18. Sensitivity and specificity of Tei index for detecting increased LVEDP measured 86% and 82%, respectively. The results of the present study resemble those of the latter in respect of the relationship between Tei index and LVEDP.

In 2001, Sato T and colleagues measured Tei index in children receiving anthracyclines and compared it with exercise test findings. They found Tei index to be a good measure of the severity of disease and clinical outcome in these patients.⁵ Based on research conducted by Tei C and colleagues in 1995-97, Tei

index is not influenced by left ventricular geometry, hence it does not change significantly with enlargement or remodeling of the heart.^{3,4,9} Tei index is also applicable in assessing right ventricular performance.¹⁰ The applicability of Tei index in assessment of ventricular performance in fetuses and children has also been investigated.¹¹⁻¹³ In a study conducted in 2002 by Scott L on 55 patients with CHF and EF<30, Tei index was shown to be an independent and valuable prognostic index for the outcome of cardiovascular disease.⁶ In a study carried out in 2001 by Libonati and colleagues on 51 healthy individuals, Tei index was found to be inversely related to the duration of exercise test.⁷

Tei index is significantly high in patients with left ventricular systolic dysfunction (EF≤45) and LVEDP>15, hence it can be used as a non-invasive tool for evaluating LVEDP in patients with left ventricular failure.

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