

Detection of subclinical right and left ventricular dysfunction in young Egyptians with type 1 diabetes mellitus using two-dimensional speckle tracking echocardiography

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Abstract

Objective: This research set out to evaluate. Detection of subclinical right and left ventricular dysfunction using two-dimensional speckle tracking echocardiography in young Egyptians with type 1 diabetes mellitus. The method used was a case-control research with a 40-case and 40-control group. All cases and controls underwent conventional, tissue Doppler, and speckle tracking Echocardiography; cases were drawn from patients at Benha University hospitals with a diagnosis of type 1 diabetes; controls were drawn from children at an outpatient vaccination clinic and from the general population. The research found that there were a total of 80 patients (40 in the case group, 14 men and 26 women, and 40 in the control group, 18 men and 22 women). Speckle tracking Echocardiography reveals systolic failure in the diabetes patients' left and right ventricles, with mean \pm SD global longitudinal strain [-17.32 7.07] and [-18.95 2.02], and corresponding P values of 0.006 and 0.001, respectively. In summary, subclinical cardiomyopathy may be detected with speckle tracing Echocardiography in children with type 1 diabetes.

Key words: Diabetic cardiomyopathy, Diabetic retinopathy of prematurity and Speckle tracking Echocardiography.

1. Introduction

of Since DM is a strong independent predictor of mortality and HF with preserved left ventricular (LV) ejection fraction (HFpEF) [1], it is responsible for an estimated 1.5 million deaths annually, the majority of which are the result of cardiovascular disease.

DCM may now be defined as ventricular dysfunction in the absence of other causes of heart failure, such as high blood pressure, coronary artery disease, congenital heart defects, or valvular heart disease [2].

It's still not clear what caused this. Hyperglycemia, elevated free fatty acids, rennin-angiotensin system activation, microangiopathy, enhanced oxidative stress, and cardiac autonomic neuropathy are often regarded as the most crucial causes [3].

By detecting myocardial strain (the deformation of particular portions of the myocardium throughout the cardiac cycle), a novel method called speckle-tracking echocardiography (STE) may evaluate subclinical heart function. Due to its increased specificity when compared to more conventional echocardiogram metrics like left ventricle ejection fraction [4], it has become an indispensable tool in echocardiography labs throughout the globe in the last decade.

It has been observed that tissue Doppler imaging (TDI) reveals the existence of decreased longitudinal function in diabetes individuals. However, TDI has certain restrictions of its own,

such as the fact that it is only measured in one dimension and depends on the observer's angle of view. Two-dimensional speckle tracking echocardiography (2D-STE) was recently developed to address some these shortcomings; it has been shown to be accurate and clinically beneficial [5].

2. Methods

Participants for this prospective case-control research were drawn from Benha University Hospital's paediatric inpatient department and outpatient paediatric cardiology clinic. Between the months of May 2020 and May 2022, the research was carried out.

All parental permission forms were signed after the research was authorised by the Benha University Faculty of Medicine's institutional ethics committee.

Eighty people were studied, split evenly between a "experimental" group and a "control" group. Forty people with type 1 diabetes participated in the research. Patients in this group were seen in the outpatient paediatric cardiology clinic and paediatric department at Benha University Hospital.

Forty children of similar age and sex to the Patients served as a control group.

Patients had to fulfil the following requirements to participate in the study: Male and female youngsters under the age of 18 who have been diagnosed with type 1 diabetes.

Tissue Doppler, conventional echocardiography, and speckle tracking Various Echocardiograms Were Taken

Statistical analysis:

SPSS v26 (IBM Corp., Chicago, IL, USA) was used for the statistical analysis. The mean and standard deviation (SD) were calculated and compared the two groups using an unpaired Student's t-test. When available, the Chi-square or Fisher's exact test was used to analyse qualitative data provided as frequency and percentage (percent). Statistical significance was assumed when the two-tailed P value was less than 0.05.

3. Results

The current study was conducted on 30 children with type 1 diabetes their mean ± SD age was 10.75±3.23years, they were 12 males (35%) and 18female (65%) and control group included 30 children apparently healthy their mean ± SD age was 9.86±2.35 months, they

were 14males (45%) and 16 females (55%) Age and sex were insignificantly different between the diabetic and the control groups.

There were statistical significant differences regarding anthropomorphic measurements as more body mass index were significantly associated with diabetic group (with P value less than0.001) when compared to control group.

In the current study there were statistical significant differences regarding AP2,AP3,AP4 and GLS of LV all were significantly lower in cases than control group with P value 0.009, 0.005 ,0.008 ,0.006respectively.

Also in the current study there was no statistical significant difference between young patients with T1DM & healthy controls as regards TAPSE, However when the same patients were examined by 2D-STE; RV systolic dysfunction in diabetic patients was identified as highly significant decrease in the average RV-GLS (-17.38+ 6.49 in diabetic vs.-23.81 +- 1.56 in control, P < 0.001).

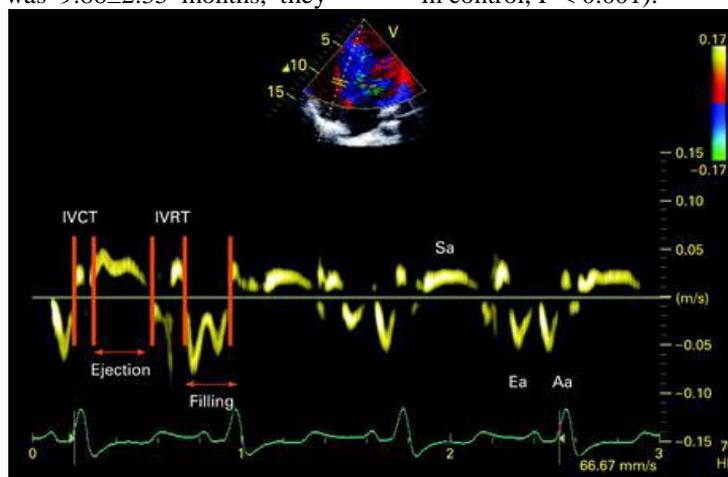


Fig. (1) The PW TDI waveform at the mitral valve septum seems normal. Isovolumic contraction time (IVCT), ejection, isovolumic relaxation time (IVRT), and filling are all parts of the cardiac cycle [4].

Table (1) comparison between study groups regarding demographic data

	Cases (n=30)		Control (n=30)		Test of sig.	p-value	
Age in years (mean ± SD)	10.75	3.23	9.86	2.35	1.4	0.2	
Sex (No. & %)	Female	18	65.0%	16	55.0%	0.8	0.4
	Male	12	35.0%	14	45.0%		
BMI (mean ± SD)	19.82	5.29	16.46	1.06	3.9	<0.001*	
Weight	38.49	14.45	26.18	4.96	5.1	<0.001*	
height	138.13	15.57	125.73	9.62	4.3	<0.001*	

4. Discussion

HF in diabetic individuals without other cardiac comorbidities was originally reported by Rubler et al. in 1972 in their publication titled "New type of cardiomyopathy associated with diabetic glomerulosclerosis" [6].

Recent research, however, suggests that STE-measured subclinical systolic dysfunction may precede or coexist with diastolic dysfunction [7].

Therefore, reducing morbidity and mortality in individuals with DM may depend on recognising ventricular dysfunction at its earliest, subclinical phases [1].

This research set out to determine how useful two-dimensional speckle tracking echocardiography is for detecting early signs of right and left ventricular failure in children and young adults in Egypt who have type 1 diabetes mellitus.

There were statistical significant differences regarding anthropomorphic measurements as more body mass index were significantly associated with diabetic group (with P value less than 0.001) when compared to control group

These results were in agreement with Taghreed A. Ahmed et al., 2018 who studied thirty-nine patients with T1DM (Group 1, mean age 18.2±1.7y, BMI = 26.23.9kg/m²), without cardiac problems and 15 apparently healthy matched subjects as a control group (Group 2 mean age 18.8±2.3 y, BMI = 22.8±3.3kg/m²) In this study, there were statistically significant differences between the two groups as regard BMI (26.23.9kg/m² vs 22.83.3 kg/m² , P=<0.05)

In the present study there were statistical significant differences between studied groups regarding conventional Echo parameters of LV IVSd, IVSs, LVPWd were significantly higher in cases with P values 0.001, 0.03, 0.01 respectively when compared to control groups.

These results were in agreement with Ilona Je, drzejewskal et al., 2015 as Interventricular septum, posterior wall and relative wall thickness (RWT) of LV were higher in diabetic patients compared with controls.

5. Conclusion

The Art of Speckle-Traking Children with type 1 diabetes may have subclinical cardiomyopathy detected by echocardiography.

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