

# Assessment of vascular Endothelial Dysfunction Using Brachial artery Flow Mediated Dilatation and Carotid Intima Media Thickness in children and Adolescents with Type 1 Diabetes

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## INTRODUCTION

• Patients with type 1 diabetes have high risk to develop atherosclerotic disease. The macro and micro vascular complications are the main cause of morbidity and mortality especially in those with more than five years of disease.

• Endothelial dysfunction is now viewed as one of the earliest detectable signs of impaired vascular health, and it has been suggested that its assessment might form part of cardiovascular risk quantification in the future. Early detection of endothelial dysfunction has prognostic value for the development of vascular complications and may be important in strategies for primary prevention of cardiovascular endpoints in type 1 diabetes.

• Various methods of non-invasively assessing the degree of atherosclerosis have been developed. Carotid intima media thickness (cIMT) and Brachial artery flow-mediated dilation (FMD) have been reported to be effective for early detection of atherosclerotic lesions. FMD evaluates the function of vascular endothelial cells, and reduced %FMD is a predictive factor for major vascular complications including cardiovascular diseases.

## OBJECTIVES

• Assessment of vascular endothelial damage in children and adolescents with type 1 diabetes by measuring % of brachial artery FMD and cIMT as indices of presence of subclinical atherosclerosis.

• Correlation of % FMD and cIMT to different risk factors of cardiovascular disease as abnormal lipid profile, glycosylated hemoglobin, body mass index, waist and hip circumference, waist hip ratio, blood pressure, glycated hemoglobin and urinary albumin/ creatinine ratio.

## SUBJECTS AND METHODS

### Design: Cross sectional study

Patients: 100 children and adolescents with T1DM with age range from 5 to 15 (mean 11.22 years) and mean disease duration 6.5 years, regularly following in DEMPU "Diabetes Endocrine and Metabolism Pediatric Unit", Children's Hospital, Cairo University and 50 age and sex matched controls.

### Exclusion Criteria:

- Patients on any medications other than insulin, especially antihypertensive, antiplatelet or lipid lowering medications.
- Patients with anemia, family history of hypercholesterolemia or premature cardiovascular disease.

### Methods:

- Detailed medical history
- Thorough clinical examination and anthropometric measurements: weight SDS, height SDS, waist circumference SDS, hip circumference SDS and W/H ratio
- Systolic and diastolic blood pressure percentiles
- Laboratory tests as fasting blood glucose, mean glycosylated hemoglobin of the last year, urinary albumin/creatinine ratio, fasting lipid profile and thyroid profile were recruited from patients' files as these investigations are routinely done for T1DM patients in DEMPU.
- Measurement of brachial artery FMD and measurement of cIMT of both right and left carotid arteries were done as the radiological interventions to assess endothelial dysfunction in T1DM patients and the healthy controls.
- FMD and cIMT were assessed with high-resolution ultrasound using standardized measurements.

## RESULTS

Table (1): Comparison of cIMT and FMD% between cases and controls

	Cases				Controls				P value
	Mean	SD	Min	Max	SD	Mean	Min	Max	
Rt cIMT	0.48	0.06	0.36	0.65	0.46	0.07	0.38	0.6	0.026*
Lt cIMT	0.48	0.06	0.36	0.65	0.46	0.07	0.38	0.6	0.021*
Brachial a diameter at base line	2.56	0.48	1.70	3.70	2.23	0.52	1.60	3.20	<0.001*
At 60 sec after cuff release	2.65	0.47	1.73	3.70	2.42	0.56	1.71	3.52	0.006*
FMD%	2.90	1.93	0.00	7.00	8.52	1.11	7.00	10.00	<0.001*

FMD: flow mediated dilatation, Rt cIMT: right carotid intima media thickness, Lt cIMT, left carotid intima media thickness. P value <0.05 is significant.

Table (2): Comparison between groups of high serum total cholesterol and normal one as regard cIMT and FMD%

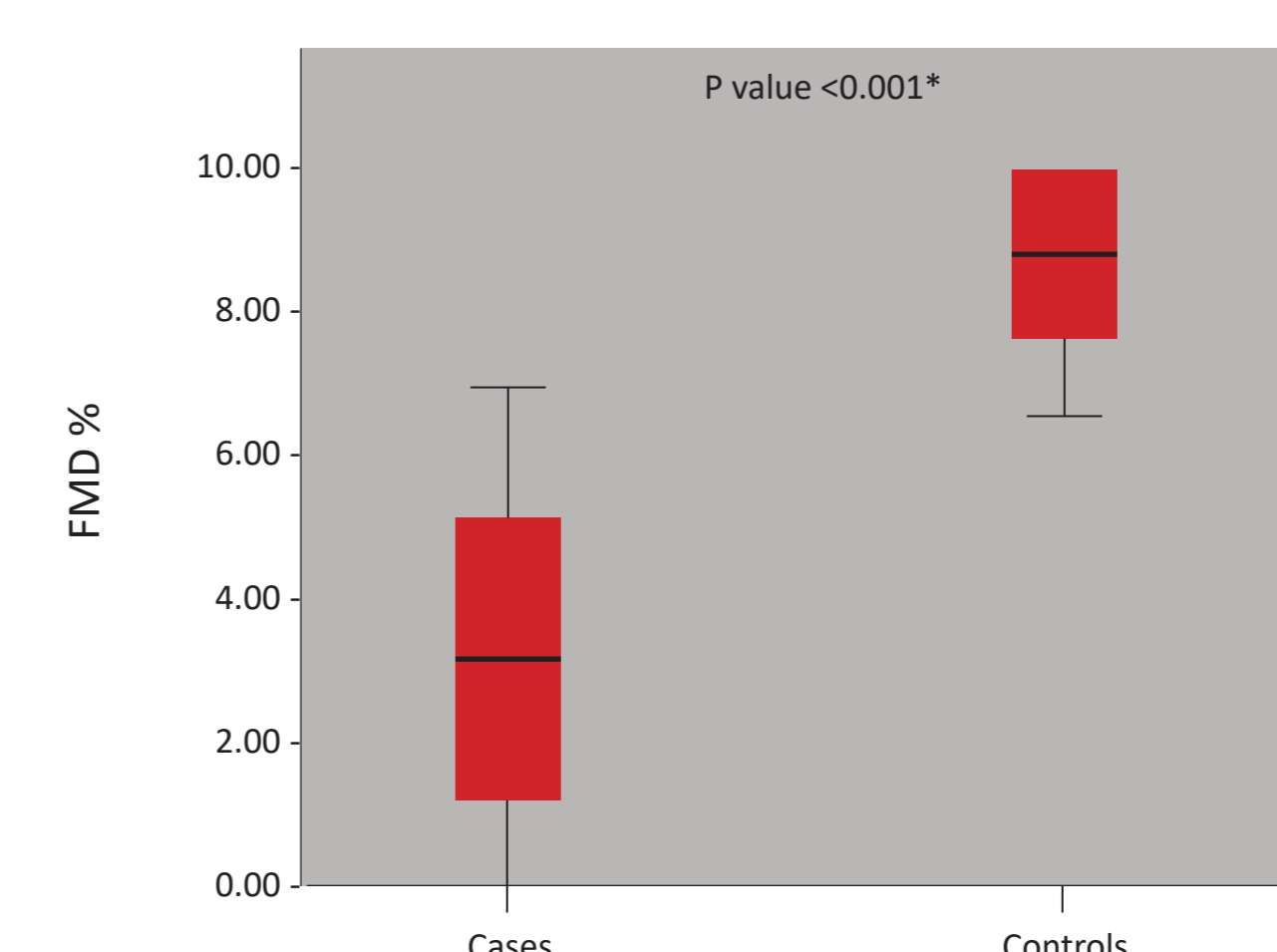
	Total cholesterol level classification				P value
	Normal		High		
	Mean ±SD	SD	Mean ±SD	SD	
Rt cIMT	0.44	0.04	0.54	0.06	<0.001*
Lt cIMT	0.44	0.04	0.54	0.06	<0.001*
FMD%	3.49	1.92	2.00	1.58	<0.001*

FMD: flow mediated dilatation, Rt cIMT: right carotid intima media thickness, Lt cIMT: left carotid intima media thickness, A/C ratio: albumen/creatinine ratio. P value <0.05 is significant.

Table (3): Correlation between cIMT, FMD % and HA1C and lipid profile cases

Variables		FMD%	Rt cIMT	Lt cIMT
HA1C	r	-0.377-	0.640	0.613
	P value	0.0001*	<0.001*	<0.001*
Serum total cholesterol	r	-0.268-	0.640	0.642
	P value	0.009*	<0.001*	<0.001*
Serum TG	r	-0.427-	0.601	0.600
	P value	<0.001*	<0.001*	<0.001*
Serum LDL cholesterol	r	-0.309-	0.659	0.657
	P value	0.002*	<0.001*	<0.001*
Serum HDL cholesterol	r	0.381	-0.683-	0.659
	P value	<0.001*	<0.001*	<0.001*

FMD: flow mediated dilatation, Rt cIMT: right carotid intima media thickness, Lt cIMT: left carotid intima media thickness, A/C ratio: albumen/creatinine ratio. P value <0.05 is significant.



Comparison of FMD % between cases and controls

## CONCLUSION

- Patients with T1D are at increased risk of endothelial dysfunction than general population.
- The diabetic patients had statistically significant higher cIMT and lower FMD than normal healthy controls which reflects the significant presence of higher risk of endothelial dysfunction, premature atherosclerosis and peripheral vascular disease in this type of population.
- The role of T1D in atherosclerosis was still poorly understood and further large-scale studies are still needed.