RISK STRATIFICATION AND CORONARY OPTICAL COHERENCE TOMOGRAPHY FINDINGS IN ASYMPTOMATIC PATIENTS WITH TYPE 1 DIABETES MELLITUS

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Introduction

Data for primary cardiovascular (CV) prevention of type 1 diabetes mellitus (T1D) patients are lacking or based on T2D patients at lower risk.

CVD arises earlier in life of T1D patients → average of 3 to 4 extra decades of hyperglycemia → reduction of 11 years' life expectancy

After the age of 40 → risk of AMI is 9x ↑ higher in T1D patients vs non-DM

CV risk in T1D may vary from low to very high, therefore risk stratification is important t personalize the preventive measures

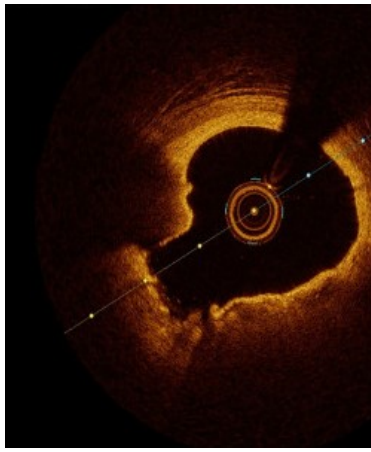
Current guidelines on CVD prevention do not include non-invasive means of risk stratification.

Introduction

Patients with thin-cap fibroatheroma (TCFA) and simultaneous presence of several high-risk optical coherence tomography (OCT) plaque features are associated with higher risk of major adverse CV events (MACE).

Recently, the PREVENT trial has demonstrated that PCI of non-flow limiting TCFA vs OMT reduces MACE

No previous study has described the prevalence of TCFA among patients with T1D and subclinical atherosclerosis presence on non-invasive imaging tests.



Preventive percutaneous coronary intervention versus optimal medical therapy alone for the treatment of vulnerable atherosclerotic coronary plaques (PREVENT): a multicentre, open-label, randomised controlled trial

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Aim

To describe the prevalence of prognostically significant findings on invasive coronary angiography (ICA) and OCT in T1D patients with subclinical atherosclerosis determined by non-invasive examination of the carotid and coronary arteries.

Inclusion and exclusion criteria

Defined according to the 2021 ESC Guidelines on CVD Prevention definition of the high CVD risk categories

Inclusion criteria:

- Age > 18 y.o.
- Duration of T1D ≥ 10 years

Exclusion criteria:

- symptoms of coronary artery disease (CAD)
- history of atherosclerotic CVD
- target organ damage (eGFR < 60 ml/min/1.73 m^2, albumin/creatinine ratio > 30 mg/g, presence of microvascular damage in ≥ 3 locations)

Patients with type 2 diabetes mellitus		
Patients with type 1 DM above 40 years of age may also be classified according to these criteria	Patients with well controlled short-standing DM (e.g. <10 years), no evidence of TOD and no additional ASCVD risk factors	
	Patients with DM without ASCVD and/or severe TOD, and not fulfilling the moderate risk criteria.	
	Patients with DM with established ASCVD and/or severe TOD:[87, 93-95] • eGFR <45 mL/min/1.73 m^2 irrespective of albuminuria • eGFR 45-59 mL/min/1.73 m^2 and microalbuminuria (ACR 30 -300 mg/g) • Proteinuria (ACR >300 mg/g) • Presence of microvascular disease in at least 3 different sites (e.g. microalbuminuria plus retinopathy plus neuropathy)	

Non-invasive examination

- Coronary artery calcium (CAC) score
- Carotid ultrasound

↓

CAC score ≥ 400
and/or
presence of 2 ≥ carotid plaques of ≥ 1.5 mm thickness
= patient considered at **very high CV risk**

↓

Invasive examination indicated

Invasive examination

1. Invasive **c**oronary angiography (ICA) – presence of obstructive CAD (≥ 1 stenosis ≥ 50 %)
2. Vessel fraction flow ratio (vFFR) – evaluation of hemodynamic severity of stenosis
3. Optical coherence tomography (OCT) of 54 mm proximal major coronary vessels

Primary analysis of OCT frames of very high risk patients:
1. Presence of TCFA (lipid rich plaque arc ≥ 90° and fibrous cap < 65 µm)
2. Presence of very high risk plaque (TCFA phenotype, > 180° lipid arc, presence of macrophages and minimal lumen area < 3.5 mm^2)

Clinical characteristics of T1D patients – screening phase

- 62 high-risk (HR) TD1 patients enrolled

	n = 62	Total cholesterol, mmol/l	4.69 ±0.79
Age, years	**50.05 ±12.67**	**LDL cholesterol, mmol/l**	2.64 ±0.55
Female gender	33 (**53%**)	No. of patients with LDL cholesterol < 2.6 mmol/l	27 (44%)
BMI, kg/m^2	27.24 ±4.38	HDL cholesterol, mmol/l	1.61 ±0.45
Arterial hypertension	25 (40%)	Non-HDL cholesterol, mmol/l	3.03 ±0.9
Hyperlipidemia	30 (48%)	Triglycerides, mmol/l	0.88 (0.68-1.26)
Current smoking	9 (15%)	NT-proBNP, ng/l	51.45 (28.38-80.9)
Obesity	12 (19%)	Acetylsalicylic acid	4 (6%)
Diabetes duration, years	**27.35** ±10.82	Statin	26 (42%)
HbA1c		High-intensity statin therapy	1 (2%)
mmol/mol	**56.21 ±14.72**	Moderate-intensity statin therapy	4 (6%)
%	7.3 ±1.3	Low-intensity statin therapy	21 (34%)
No. of patients with HbA1c < 53 mmol/mol (7%)	32 (52%)	Ezetimibe	6 (10%)

Results of non-invasive examination

The criteria of **very high risk (VHR)** fulfilled **12/62 (19.4%)** T1D patients based on:

- CAC score in 1/12
- carotid ultrasonography in 5/12
- Both criteria in 6/12

Mean values of **non-invasive examinations of high risk patients**:

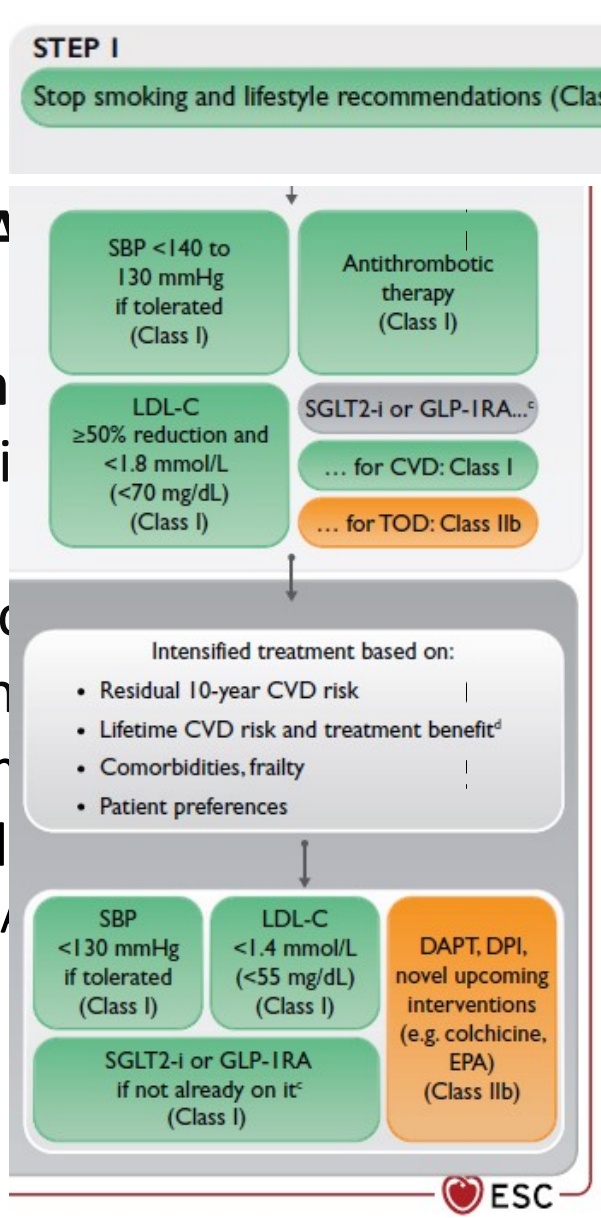
- CAC score - **950 ± 976**
- number of carotid plaques **2.8 ± 1.1**

	LAD (n = 12)	LCx (n = 8)	RCA (n = 9)	Overall (n = 29)
Coronary artery calcium score	322 (90-812)	10 (0-64)	15.85 (0-700)	606.3 (175.3-1515)

Results of invasive examination

CA showed **obstructive CA**
patients
vFFR showed **hemodynam**
tenosis in **3/12 (25%)** pati
- PCI (1)
- conservative approac
- invasive reevaluation

OCT pullbacks in all three r
were successfully acquired
(LAD- 100%, LCx - 67%, RC

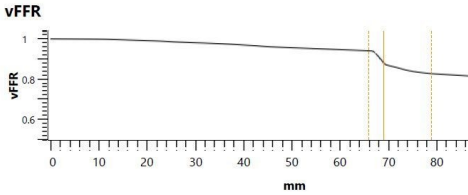


	n = 12
Obstructive coronary artery disease	5 (42%)
vFFR-positive value ≤ 0.80	3 (25%)
Optical coherence tomography	
Thin-cap fibroatheroma	7 (58%)
Very high-risk plaque	4 (33%)
MLA < 3.5mm2	8 (67%)
Lipid-rich plaque	11 (92%)
Maximal lipid plaque arch, °	165 ±100
Calcification	8 (67%)
Maximal calcification arc, °	163 ±146
Spotty Calcium	8 (67%)
Calcific nodule	4 (33%)
Macrophage accumulation	11 (92%)
Cholesterol crystal	3 (25%)
Neovascularization	8 (67%)
Thrombus	3 (25%)
Plaque erosion	6 (50%)

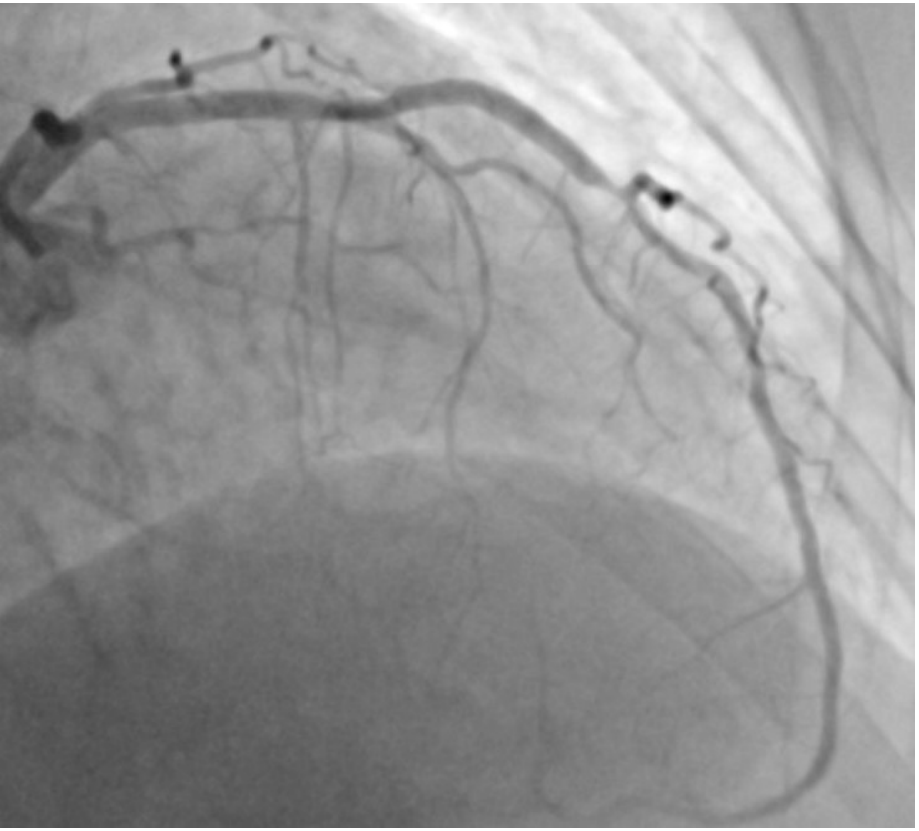
Clinical characteristics of HR and VHR TD1 group

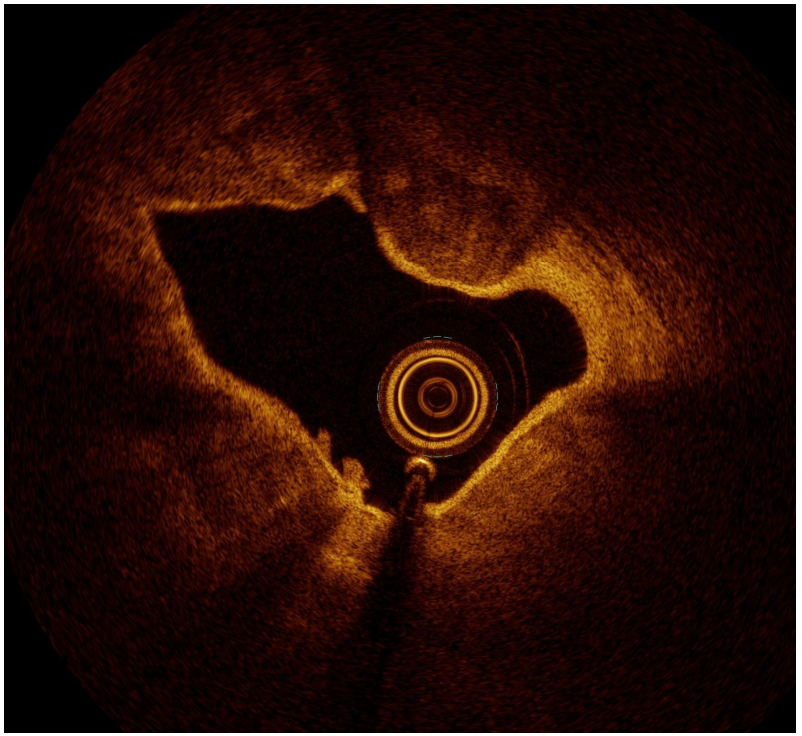
	High-risk (n = 50)	Very high-risk (n = 12)	P value				
Age, years	46.58 ±11.65	64.5 ±1.83	**0.001**	No. of patients with LDL cholesterol < 2.6 mmol/l	21 (42%)	6 (50%)	0.749
Female gender	25 (50%)	8 (67%)	0.350	Triglycerides, mmol/l	0.88 (0.7-1.2)	0.75 (0.53-1.59)	0.527
BMI, kg/m^2	27.04 ±4.46	28.06 ±4.06	0.474	Apo A1, g/l	1.71 ±0.31	1.60 ±0.32	0.273
Arterial hypertension	16 (32%)	9 (75%)	**0.009**	Apo B, g/l	0.79 ±0.20	0.73 ±0.13	0.177
Hyperlipidemia	20 (40%)	10 (83%)	**0.010**	Apo C-III, mg/l	146.15 ±50.67	157.77 ±70.44	0.512
Current smoking	9 (18%)	0 (0%)	0.185	Lp(a), nmol/l	8 (6-19)	15 (6.75-107.3)	0.167
Obesity	9 (18%)	3 (25%)	0.686	NT-proBNP, ng/l	42.8 (29.1-71.5)	125.3 (45.28-270.8)	**0.007**
Diabetes duration, years	25.26 ±9.50	36.08 ±12.02	**0.001**	Homocysteine, µmol/l	8.80 ±3.02	10.12 ±2.44	0.168
HbA1c, mmol/mol	55.66 ±15.79	58.50 ±9.21	0.553	Cystatin C, mg/l	0.96 ±0.10	1.16 ±0.18	**0.001**
No. of patients with HbA1c < 53 mmol/mol (7%)	29 (58%)	3 (25%)	0.055	Acetylsalicylic acid	0 (0%)	3 (25%)	**0.021**
Total cholesterol, mmol/l	4.78 ±0.78	4.28 ±0.74	**0.048**	Statin	16 (32%)	10 (83%)	**0.002**
HDL-cholesterol, mmol/l	1.58 ±0.38	1.76 ±0.66	0.371	High-intensity statin therapy	0 (0%)	1 (8%)	0.194
non-HDL-cholesterol, mmol/l	3.21 ±0.80	2.31 ±0.95	**0.001**	Moderate-intensity statin therapy	2 (4%)	2 (17%)	0.166
LDL-cholesterol, mmol/l	2.67 ±0.57	2.54 ±0.47	0.483	Low-intensity statin therapy	14 (28%)	7 (58%)	**0.086**
				Ezetimibe	5 (10%)	1 (8%)	1.000

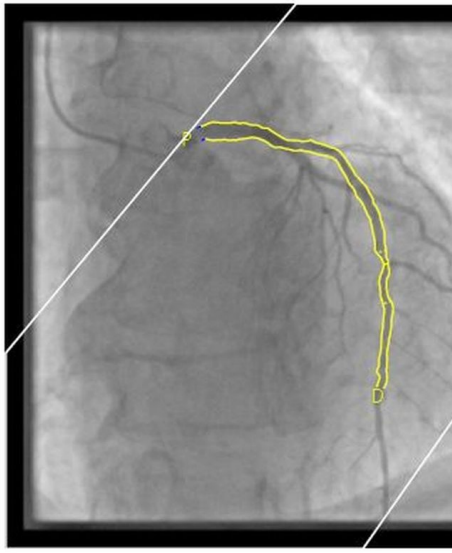
65 y.o. asymptomatic T1D female patient



5% stenosis of middle LAD; vFFR value of 0.79; TCFA +







Conclusions

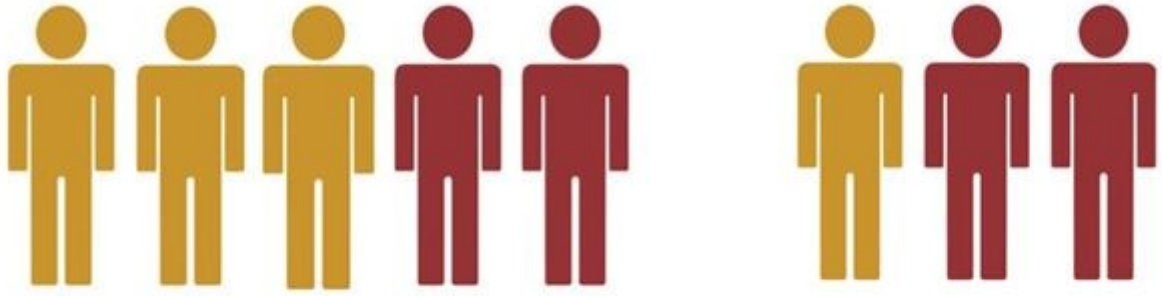
(1) Majority of T1D patients did not achieve HbA1c and LDL-C primary prevention targets

(2) A large proportion of T1D patients were actually at very high, rather than high, CV risk

(3) The combination of calcium score and carotid ultrasound identified a group of patients with a high prevalence of obstructive CAD and clinically significant vulnerable plaques in the coronary arteries as defined by the OCT imaging.

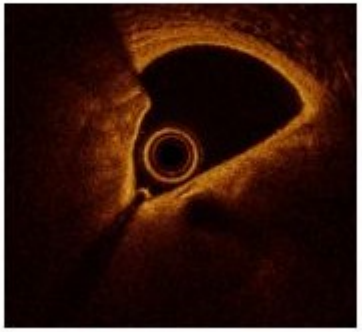
Conclusions

Asymptomatic patients with type 1 diabetes mellitus and a CAC score > 400 and/or ≥ 2 carotid plaques:



Three out of five patients have thin-cap fibroatheroma.

One out of three patients has very high-risk plaque.



Thank you for your attention!

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