Coronary artery calcium and diabetic kidney disease: Markers of preclinical atherosclerosis and aggressive therapy need

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POSTER No. OP-0025

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CAC scores - Preclinical Atherosclerosis - Diabetes Background

Coronary artery disease (CAD) is the foremost cause of death in many countries and hence, its early diagnosis is usually concerned as a major healthcare priority.

CAC scores - Preclinical Atherosclerosis - Diabetes Background

- **Coronary artery calcium scoring (CACS)** using either electron beam computed tomography (EBCT) or multislice computed tomography (MSCT) has been applied for more than 20 years to provide an early CAD diagnosis in clinical routine practice.
- Moreover, its association with other body organs has been a matter of vast research.

CAC scores - Preclinical Atherosclerosis - Diabetes Background

- **CAC score:**
 - Independent predictor of coronary heart disease.
- **Combined information from CAC score + conventional cardiac risk factors:**
 - Whether the CAC score may add clinically useful information?

CAC scores - Preclinical Atherosclerosis - Diabetes Background

- **CAC scores and Death:**
 - CAC score can be used to predict death in asymptomatic individuals for as long as next 15 years.

Ref: Long-Term Prognosis After Coronary Artery Calcification Testing in Asymptomatic Patients: A Cohort Study. Ann Intern Med. 2015;163(1):14-21.

CAC scores - Preclinical Atherosclerosis - Diabetes Aim

- To determine the spectrum of **Coronary Artery Calcium CAC Scores** in type 2 diabetes and its correlations to renal dysfunction, to serve as surrogate indices of **preclinical atherosclerosis**, marking the need for **aggressive therapy for cardiovascular prophylaxis**.

Risk of 5 years Coronary Events in Relation to Coronary Artery Calcium in the MESA study

Coronary Artery Calcium Imaging predicts All Cause Mortality: Observational study

CAC scores - Preclinical Atherosclerosis - Diabetes Methods

- **Subjects:** 2248; type 2 diabetes [Mean]
 - Age= 62 y; Body weight= 72 kgs;
 - Diabetes duration= 16 y;
 - Hypertension= 71%; BP= 131/74 [1+ meds];
 - Hypertension duration= 15 y;
 - Atherosclerotic cardiovascular disease=
 - No known symptoms / clinical history
 - Cardiovascular prophylaxis with statins and antiplatelet drugs= 100% Unless contraindicated

CAC scores - Preclinical Atherosclerosis - Diabetes Methods

- **Subjects:** 2248; type 2 diabetes [Means]
 - HbA1c= 8.5; FBG= 189; PPBG= 207;
 - Serum cholesterol= 168;
 - HDLc= 45;
 - Triglycerides= 179;
 - LDLc= 91
- ECHO LVEF= 57%.

CAC scores - Preclinical Atherosclerosis - Diabetes Methods

- **CAC scores:** Multidetector CT scan (MDCT)
- **Calcification grade = risk of imminent coronary event:** 0= None; 0-10= Minimum; 1-100= Mild; 101-400= Moderate; 401-1000= Severe; >1000= Very severe.

Calcium Scoring Presence of CAD	
0	No evidence of CAD
1-10	Minimal evidence of CAD
11-100	Mild evidence of CAD
101-400	Moderate evidence of CAD
Over 400	Extensive evidence of CAD

Patient with calcium score zero. Patient with calcium score 1-10

Patient with calcium score 101-400. Patient with calcium score above 400

CAC scores - Preclinical Atherosclerosis - Diabetes Results: Prevalence of CAC Score Grades

CAC Group	CAC Score Grades [Risk of imminent coronary event]	%	CAC Score Mean
A: 0-10	None / Minimum	37	1
B: 11-100	Mild	20	48
C: 101-400	Moderate	27	220
D: > 400	Severe / Very severe	16	930
P value			< 0.00001

CAC scores - Preclinical Atherosclerosis - Diabetes Results: Diabetes

CAC Group	%	DM duration	DM age onset	Age at study
A: 0-10	37	12	44	56
B: 11-100	20	14	51	65
C: 101-400	27	13	47	60
D: > 400	16	22	47	69
P value		< 0.001		< 0.001

CAC scores - Preclinical Atherosclerosis - Diabetes Results: Hypertension

CAC Group	%	Sys BP	Dia BP	HTN age onset	HTN Duration
A: 0-10	37	128	75	42	11
B: 11-100	20	131	69	50	13
C: 101-400	27	131	79	48	12
D: > 400	16	134	70	57	14
P value		0.08		< 0.001	< 0.001

CAC scores - Preclinical Atherosclerosis - Diabetes Results: Diabetes

CAC Group	%	HbA1c	FBG	PPBG
A: 0-10	37	8.3	160	243
B: 11-100	20	9.7	170	210
C: 101-400	27	8.2	269	164
D: > 400	16	7.9	124	165
P value				

CAC scores - Preclinical Atherosclerosis - Diabetes Results: Cholesterol

CAC Group	%	TChol	LDLc	HDLc	TG
A: 0-10	37	180	98	49	194
B: 11-100	20	158	76	42	178
C: 101-400	27	167	91	42	182
D: > 400	16	149	91	41	130
P value				< 0.0001	

CAC scores - Preclinical Atherosclerosis - Diabetes Results: Diabetes – Renal Function - Nephropathy

CAC Group	%	Serum Creatinine	eGFR	UAC
A: 0-10	37	0.6	109	22
B: 11-100	20	0.8	94	50
C: 101-400	27	0.8	92	45
D: > 400	16	0.9	77	59
P value		<0.001	< 0.01	< 0.0001

CAC scores - Preclinical Atherosclerosis - Diabetes Results

- **Higher CAC scores significantly associated with:**
 - Elevated systolic blood pressure,
 - Increased diabetes duration
 - Increased hypertension duration
 - Lower HDL cholesterol
 - Increased serum creatinine
 - Lower eGFR and
 - Increased urine albumin creatinine ratio "besides age"

CAC scores - Preclinical Atherosclerosis - Diabetes Conclusions

- CAC testing is very useful for **guiding interventions to prevent coronary heart disease (CHD)**.
 - CAC scores predict risk for CHD events, and higher risk individuals are more likely to benefit from prevention interventions such as **aspirin** and **statins**.

CAC scores - Preclinical Atherosclerosis - Diabetes Discussion

- **Preclinical atherosclerosis** – reflected by CAC score starts very early in DKD, and may be responsible for the increased cardiovascular morbidity in early stage DKD.

CAC scores - Preclinical Atherosclerosis - Diabetes Conclusions

- Combining information from the CAC score with information from conventional risk factors can change assessment of CHD risk to an extent that may be clinically important.
- Use of **CAC Score plus traditional risk factors** substantially enhances the ability to classify asymptomatic persons without known CVD into clinically accepted categories of risk of future CHD events.