



# Coronary microvascular dysfunction and Obesity in ED chest pain patients

## A potential area for early prevention of coronary artery disease



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### Background

- 8 million patients present with chest pain to emergency departments (ED) in the U.S each year.
- About 15-20% of these have ischemia from large vessel coronary artery disease (CAD).
- The distribution of chest pain from coronary microvascular dysfunction (CMD) in ED patients and its characteristics is unknown.
- Coronary flow reserve (CFR) is an indirect measure for CMD and CFR <2 has been shown to have a linear relationship with adverse cardiac outcomes.

### Objectives

- To identify CMD in ED patients with chest pain who are ruled out for myocardial infarction.
- To identify clinical factors associated with CMD in ED patients.

### Methods

- Prospective observational cohort of consecutive patients admitted to Yale ED chest pain center (CPC), an observation unit.
- Patients who met clinically indicated 3D cardiac Rb-82 dynamic PET/CT imaging were enrolled.
- Exclusions: age ≤ 30 years, acute coronary syndrome, hemodynamic instability, heart failure or dialysis.
- Gated PET/CT images were evaluated for regional perfusion abnormalities, and coronary calcification.
- Quantitative coronary flow and flow reserve (CFR) were derived by kinetic modeling of dynamic PET/CT images, and corrected for rate pressure product.
- Coronary microvascular dysfunction (CMD) was defined as: no regional perfusion defect, no calcification and CFR < 2.
- CAD defined: new or old regional defect, prior MI, calcification or revascularization.

### Results

- 2600 patients were admitted to the CPC between 02/14-10/15; 8% had PET/CT.
- **Overall:**
  - Approximately half were female and the majority (93%) had at least one cardiac risk factor.
  - The cardiac PET/CT cohort compared to the non-PET/CT cohort were:  
More likely to be female, with greater rates of hypertension, diabetes, dyslipidemia and severe obesity.
- **Among the cardiac PET/CT patients,**
  - Obesity was prevalent with mean BMI 38.
  - 42% had microvascular dysfunction in the absence of CAD.
  - Most (52%) patients with CMD had few (≤ 2) Framingham risk factors compared to 36% patients with normal flows (p > .05) and 29% patients with CAD (p < .05).
  - Mean global CFR in CMD patients (1.59) was significantly less (p < .05) compared to both patients with normal flows (2.61) and those with CAD (1.87).
  - Most (80%) of patients with CMD had at least one prior visit to the ED within 3 years of index presentation.

	CPC Non PET/CT Patients N=2405	CPC Patients Undergoing PET/CT (N=195)			
		Overall N=195	Normal N=43	CMD N=81	CAD N=71
Mean age (SD)	56 (12)	55 (11)	51 (10)	51 (7)	61 (11)
% Female	54	70*	58	81 <sup>†</sup>	63
% White	58	64	65	63	63
% Hispanic	17	19	14	21	20
% Hypertension	53	73*	67	64	87
% Diabetes	19	41*	40	31	54
% Dyslipidemia	41	55*	51	38	76
% Smoking	15	19	21	14	17
% Family HX	28	28	33	30	24
Mean BMI (SD)	30 (7)	38 (9)*	39 (9)	40 (10)	37 (8)
Mean CFR (SD)	N/A		2.6 (0.8)	1.6 (0.3) <sup>†</sup>	1.9 (0.6)

<sup>†</sup>denotes p < .05 using ANOVA among PET/CT patients comparing CMD patients to patients with normal flows and CAD.  
\*non-PET/CT imaging included exercise treadmill test, exercise SPECT, pharmacological SPECT, CT angiogram and stress echocardiogram.

### Conclusions

- Cardiac microvascular dysfunction is common in ED chest pain patients in the absence of CAD.
- ED patients with CMD had severely depressed CFR, even lower than in the CAD group – suggesting an ‘at risk’ population that would benefit from early risk stratification and interventions.
- CMD diagnosed in obese ED patients could serve as an early correlate of CAD.

### Future Implications

- CMD could explain up to a third of the cases of ED chest pain that are otherwise ruled out for acute myocardial infarction.
- These patients often have recurrent symptoms and remain undiagnosed with routine testing.
- Further work on measuring insulin resistance and sensitivity in these patients would help identify targets for early intervention.
- Longitudinal follow-up is needed to correlate the severely depressed CFR seen in obese ED with adverse outcomes.
- Quantitative PET/CT could improve identification and management of CMD in obese ED patients with recurrent chest pain.