QUANTITATIVE CORONARY ANGIOGRAPHY: Manual Versus Automated Edge Detection.

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The known inaccuracies in visual angiographic interpretation have led to the development of many quantitative methods for determining absolute coronary arterial dimensions. These quantitative angiographic measurements may have direct clinical application (*e.g.* in determining the physiologic significance of coronary stenoses and predicting rethrombosis after thrombolysis). However, the comparability of measurements obtained with different edge-detection techniques and algorithms is not known. To determine if the two most widely used QCA methods produce different results, we analyzed 42 angiograms (12 normal, 30 with a stenosis) using the Brown/Dodge method (B/D, manual edge detection, biplane matching) and the Reiber-CAAS method (R-C, automated edge detection, no biplane matching). The same frames and identical arterial segments from two orthogonal projections (RAO and LAO) were analyzed using each method. In stenotic arteries, the minimum diameter (mD) and percent diameter stenosis (%DS) in each projection were calculated. In normal vessels, the *average* segment diameter was assessed. The arterial cross-sectional area (CSA) using the B/D method was automatically obtained from biplane-matched diameters. CSA from the R-C method was geometrically calculated from the two single-plane diameters using the formula $(mD_{LAO} \cdot mD_{RAO} \cdot \pi)/4$.

***Results*: Reiber-CAAS - B/D measurements** (mean difference±SD)

segment	D_{RAO}(mm)*	$\%DS_{RAO}$	D_{LAO}(mm)*	$\%DS_{LAO}$	$CSA(mm^2)$*
normal (n=12)	0.16±.25[a]	--	0.14±.25	--	0.33±.74
stenosis (n=30)	0.06±.18	-1.2±8.2	0.04±.12	-1.2±3.7	0.04±.17

*average D(or CSA) in normal segments, mD (or mCSA) in stenotic segments, [a]$p=.05$

For all segments, D ranged from 0.46mm to 4.76mm and CSA from 0.25 to 15.61mm^2. D and CSA were highly correlated (r) between methods (D_{RAO} 0.98; D_{LAO} 0.99; CSA 0.99) These data demonstrate that these two methodologically different techniques of QCA produce similar measurements and suggest that manual tracing is similar to automated-edge detection and that biplane matching is not usually required to obtain geometrically-calculated CSA.

A SIMPLIFIED METHOD TO MEASURE CORONARY VELOCITY IN PATIENTS: VALIDATION OF A JUDKINS-STYLE DOPPLER TIPPED ANGIOGRAPHIC CATHETER.

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Although intracoronary Doppler-tipped catheters provide useful measurements of coronary flow velocity reserve (CFVR) in Pts, their widespread use has been limited by the need for selective deep coronary catheterization. To facilitate more rapid and safe measurement of CFVR in Pts without coronary artery disease, we developed a Judkins-style angiographic catheter (JUD) tipped with a 20 MHz Doppler crystal. A feasibility study in 6 anesthetized dogs, confirmed temporal and configurational similarity between waveforms recorded by JUD and surgically implanted cuff-type Doppler transducers. In 19 patients without coronary artery disease, resting and hyperemic [10 mg intracoronary papaverine] mean and phasic coronary flow velocities (cm/sec) were measured with JUD and 2.5 F intracoronary Doppler catheters (IC-DOP) at identical coronary loci. Both measurements were achieved in 80% of Pts without complications. JUD also permitted diagnostic angiography. CFVR was calculated as the ratio of mean velocity at rest to mean velocity following papaverine.

	Mean Velocity		Peak Phasic Velocity		CFVR
	Rest	Papaverine	Rest	Papaverine	
JUD	14±8	41±18	22±11	58±21	3.3±1.4
IC-DOP	10±7	32±14*	15±9	48±17*	3.7±1.2
(r; p-value)	(0.783; <.001)		(0.784; <.001)		(0.801; <.001)

*p<.05 compared with JUD; mean±SD

Although mean and peak velocity during hyperemia were higher using JUD, there was no significant difference in CFVR as calculated by the two methods. Thus, the JUD Doppler catheter technique permits flow velocity and CFVR measurements that correlate strongly with the intracoronary catheter technique, facilitating safe, quick, and accurate assessment of coronary physiology in populations of patients without coronary artery disease (e.g., transplant, non-ischemic cardiomyopathy, valvular heart disease, syndrome X).

LIMITATIONS OF CORONARY ANGIOGRAPHY FOR THE DETERMINATION OF MYOCARDIUM AT RISK

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Previous studies from this laboratory have shown that tomographic perfusion imaging with Tc-99m-sestamibi (RP-30A) can accurately measure the myocardium at risk (%LVRISK) during acute myocardial infarction (MI). The ability of early coronary angiography to predict the wide variability in %LVRISK was studied in 21 patients with their first acute MI. The most predictive angiographic parameters were the location of the infarct-related artery (r=0.81) and the average "best estimate" of two experienced angiographers (r=0.80). However, the standard error of the estimate was large for either parameter (12.5% and 10.5% of the left ventricle, respectively). Once infarct location was known, the "best estimate" had a weak correlation with %LVRISK in patients with anterior MI but not inferior/lateral MI:

MI Location	n	%LVRISK	r	p
Anterior	10	57 ± 11%	0.61	.06
Inferior/lateral	11	24 ± 14%	0.11	NS

Multivariate analysis demonstrated that no other angiographic parameter (proximal vs. distal, collaterals, vessel diameter, branches, or length) added to infarct location or "best estimate."

Conclusion: Although angiographic estimates do correlate with %LVRISK, their ability to predict the wide variability in %LVRISK is limited in anterior infarcts and negligible in inferior/lateral infarcts.

DETECTION OF SILENT LEFT VENTRICULAR DYSFUNCTION DURING DAILY ACTIVITIES IN CORONARY ARTERY DISEASE PATIENTS BY THE NUCLEAR VEST.

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LV function is a marker of myocardial ischemia and is subject to changes during daily activities. Coronary artery disease (CAD) Pts may show abnormal response to such activities in the absence of chest pain. This can be detected using an ambulatory radionuclide recording device: The Nuclear VEST. 17 pts with suspected CAD studied with routine supine rest and exercise GBP imaging were monitored with the VEST for 60 min while sitting (baseline) (SIT); standing in place (STD); walking (WK); eating (ET) in 6 Pts; and urinating (UR) in 4 Pts.

The correlation of resting VEST ejection fraction (EF) with radionuclide angiography was .90 at rest. None of the Pts had angina or ECG changes during the monitoring period. An abnormal exercise GBP study was seen in 12/17 Pts (70%). Transient VEST LV dysfunction occurred in 10/17 Pts (59%) at rest. LV dysfunction was detected in 10/16 Pts (62%) during (WK) in whom the mean EF increased only by 1.6±18% compared with baseline (SIT). Standing did not change the EF significantly. During ET, EF remained unchanged in 3/6 pts (50%) while the rest showed a slight increase. Urination decreased EF by 17±12% (p<0.05).

Conclusion: Deterioration in LV function in ordinary daily activities may occur in Pts with CAD in the absence of symptoms and the VEST may be a useful tool for their detection.