

## Cardiac Catheterization: Beyond Stenoses

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Coronary angiography remains the gold standard for the clinical assessment of atherosclerotic heart disease. Findings other than percent stenosis can often enhance mortality risk determinations.

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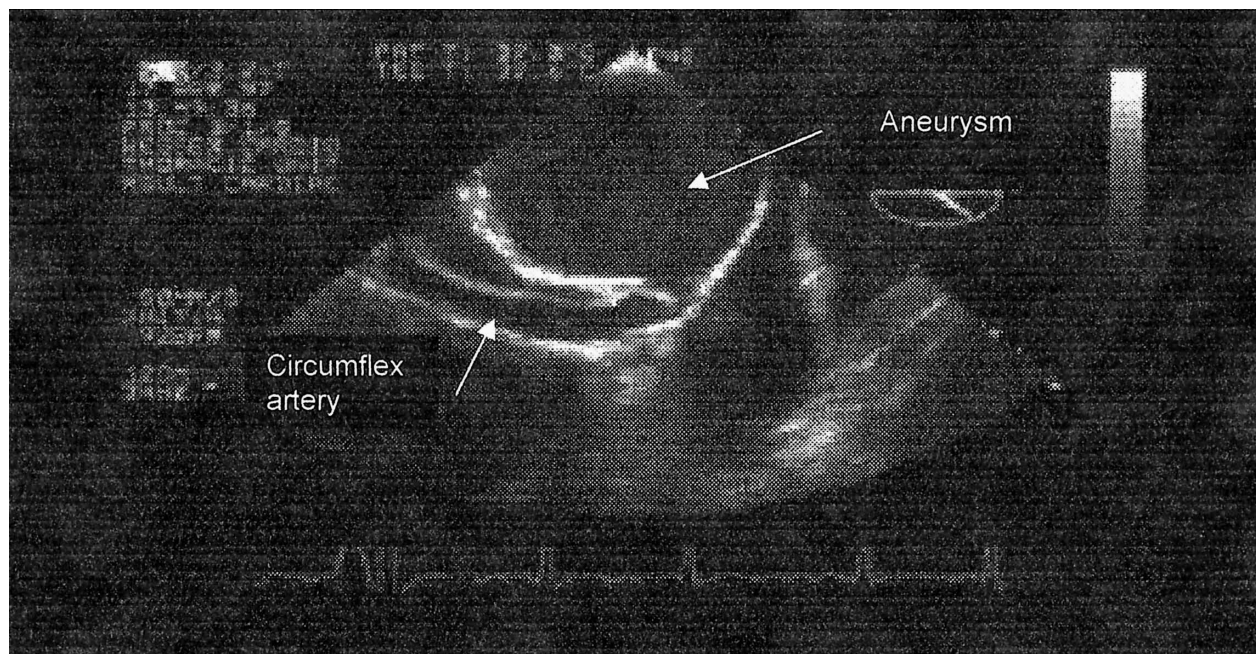
**M**ortality risk assessment in coronary artery disease becomes much more precise when the available records include a cardiac catheterization report outlining the number of stenotic or occluded coronary arteries. However, there's a lot more information in the cath report useful to fine tune that risk assessment even further and may make a big difference in determining the insurability of the applicant.

### CORONARY STENOSES

Significant coronary arterial stenosis is usually defined as a 50% reduction in arterial diameter, which translates to a flow-limiting 75% reduction in arterial area. The number of vessels with stenosis clearly has prognostic importance and may relate to the degree of ongoing ischemia and to the extent of vulnerable plaque. Beyond that, though, the description of the vessels themselves is also quite relevant. The caliber of the vessel, the length and eccentricity of the stenosis, as well as the characteristics of the vessel distal to the

stenosis are all factors to consider in assessing severity of disease. A smaller vessel may experience flow limitation at lesser degrees of arterial diameter reduction. Longer, more eccentric lesions located close to arterial branches are usually more flow limiting. These vessels, especially when accompanied by poor postlesion flow (distal runoff), are usually more difficult to revascularize. Collateral flow, a compensatory phenomenon that may well preserve regional left ventricular function, has not been found to be a good prognostic indicator. After angioplasty or bypass surgery, cardiac catheterization can provide important information on the status of the native circulation and bypass grafts, but this information is probably less important than follow-up stress testing for prognostic purposes.

Despite its position as the gold standard, angiography is subject to significant limitations in interpretation.<sup>1</sup> Some lesions, particularly if located at the orifice or branching point of a major coronary artery, may be underestimated or missed completely. Conversely, foreshortening or catheter-induced



*A large balloon-like ectatic aneurysm (center) related to the left circumflex artery (left), as seen with transesophageal echocardiography. From the Wessex Cardiac Unit, Southampton General Hospital, Southampton, England. With permission.*

spasm of the coronary vessels may give the false impression of a significant stenosis where none exists. Overall, estimation of the degree of coronary stenosis may vary by as much as 20% between experienced angiographers, who may also differ in reports of the number of vessels with significant stenoses by as much as 30%.<sup>2</sup>

### CORONARY ECTASIA

Ectasia of the coronary arteries occurs in up to 5% of coronary angiograms, but its significance remains controversial.<sup>3</sup> Usually attributed to atherosclerotic disease, coronary ectasia has also been noted in association with certain congenital defects. Other postulated links include those with certain inflammatory (Kawasaki disease), collagen vascular (scleroderma, polyarteritis nodosa, lupus), and connective tissue diseases (Ehlers-Danlos, Marfans Syndrome). Histologically, wall thinning and arterial dilatation are the result of destruction of the arterial media by atherosclerotic plaque. Dilatation of the artery can be severe enough to disrupt the normal flow patterns, leading to delayed filling, segment backflow, turbulence, and blood pooling.

These arteries are subject to thrombus formation, spasm, and intracoronary dissection, leading to myocardial infarction in up to one third of cases.<sup>4</sup>

### CORONARY LUMINAL IRREGULARITIES

The finding of coronary luminal irregularities must be assessed cautiously with the realization that myocardial infarction often occurs with the rupture of a lipid-laden, non-stenotic plaque. Further, investigations using newer angioscopic techniques have detected significant obstructive disease in some of these irregular arterial segments.<sup>5</sup>

### CONGENITAL CORONARY ABNORMALITIES

Congenital abnormalities of the coronary circulation can be found in 1–2% of the population. Left and right coronaries may originate from the same sinus of Valsalva or may take a variety of anomalous paths along the epicardium and are usually of no significance. Rarely, one of the major vessels may pass between the walls of the pulmonary

trunk or may originate from the main pulmonary artery. These anomalies will eventually become symptomatic, often in childhood or adolescence, and require surgical correction. The finding of a coronary artery fistula is often incidental and benign. At times, however, these may be associated with a continuous heart murmur and have been known to become symptomatic through progressive increase in shunt blood flow. Finally, angiography will occasionally detect some degree of myocardial bridging, where the usually epicardial coronary artery courses within the myocardium for some varying length before returning to the surface. Again, this is usually not significant, although, rarely, episodes of myocardial ischemia have been attributed to this anomaly.

#### NONARTERIOGRAPHIC FINDINGS

Systolic and diastolic left ventricular function are both critical prognostic factors in CAD. Cardiac catheterization can provide this important information in the form of left ventricular ejection phase indices derived from the ventriculogram. In fact, these measurements have been the gold standard for comparison with noninvasive methods such as echocardiography. Ventriculography is also helpful in wall-motion analysis, where the significance of a borderline coronary stenosis can be correlated with the presence of hypokinesis or akinesis of the corresponding left ventricular wall segment. Diastolic dysfunction, a predictor of significant morbidity

and some degree of excess mortality in the elderly, can be assessed from the ventricular pressure curve.<sup>6</sup> Elevated end-diastolic pressures above 18–20 mm Hg, along with a delay in the left ventricular relaxation curve, are the classic findings.

Right-sided heart catheterization may also provide significant information. Elevation of pulmonary vascular resistance or pulmonary hypertension can be of importance in congenital and valvular heart disease. Finally, occult but hemodynamically significant mitral regurgitation can often be uncovered by the presence of a large “v” wave on the pulmonary capillary wedge tracing.

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