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The Table of Truth: Value of Coronary Angiography in the Evaluation of Patients with Heart Failure Syndromes☆

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The benefit of an invasive strategy in patients with acute coronary syndromes and individuals with symptomatic stable ischemic heart disease is well established. For these indications, coronary angiography defines the extent and severity of obstructive coronary artery disease (CAD), informs our revascularization decisions and is the basis for the excellent outcomes observed for these conditions over the past decades. However, these indications represent only a fraction of the clinical uses of coronary angiography. Cardiac catheterization is frequently used to search for obstructive CAD in other syndromes. These include atypical chest pain or dyspnea in the setting of negative or indeterminate non-invasive tests, Type II non-ST elevation MI and heart failure syndromes. Unlike acute coronary syndromes and symptomatic stable CAD, there is a paucity of data defining the value of coronary angiography in these situations. In fact, most patients undergoing coronary angiograms for these indications are found to have no significant CAD. For example, Patel et al. found that only about a third of patients undergoing elective coronary angiography for a variety of indications had obstructive CAD [1].

Patients with heart failure syndromes are a particularly important subgroup. Both systolic and diastolic heart failure affect millions of Americans and result in one of the most frequent reasons for adult hospital admission. In the modern era, ischemic heart disease represents one of the most common underlying causes of heart failure [2]. Thus, clinicians often contemplate the presence of obstructive CAD as an explanation for a new diagnosis or an exacerbation of heart failure. In addition to suggesting an underlying etiology for heart failure, the clinician uses angiography to seek out severe three vessel or left main coronary artery disease and therefore justify surgical revascularization in the hope of improving outcome [3]. How then, should we best search for coronary artery disease in patients with heart failure? Should an ischemic evaluation always start with non-invasive techniques or, instead, should these patients be referred directly for coronary angiography? If so, what is the diagnostic yield of angiography and how often will it change our management?

There is surprisingly little data to inform our decisions. Both the American and European guidelines are based primarily on expert consensus and consider an ischemic evaluation (both non-invasive and invasive) to be "indicated" for management of heart failure [4,5]. The European guidelines recommend angiography if there is angina recalcitrant to medical therapy, arrhythmias, or ischemia on non-invasive testing with at least intermediate pre-test probability of CAD [5]. Despite these guidelines, there is great variation in the use of coronary angiography in patients admitted with heart failure with rates of angiography ranging from 12 to 17% [6–8]. This is likely due to a lack of solid data demonstrating a clear benefit of an invasive approach in this population. It is unclear if we should be doing more or less angiography.

There are two reasons to perform coronary angiography in patients with heart failure. The first is to determine if obstructive coronary disease is the cause of an exacerbation of heart failure and the second is to determine if revascularization is indicated. The diagnostic yield of coronary angiography in patients with heart failure varies depending on the population studied and the definition of obstructive CAD. In general, the yield is poor. One of the first studies to explore this question was published over 20 years ago and included patients with systolic heart failure and no angina or MI. In this population, the yield of coronary angiography was low; 70% of patients had no significant CAD and only 7% had severe three vessel disease with only about half of these patients possessing vessels suitable for revascularization [9]. More contemporary studies show somewhat higher rates of "significant" CAD, yet severe, obstructive CAD is still observed in little more than about a third of the population studied [10,11]. Importantly, demonstration of "significant" CAD does not necessarily imply causation. The widespread prevalence of coronary atherosclerosis would naturally lead to the peaceful coexistence of obstructive CAD with systolic dysfunction in many patients. It is not uncommon to find a severe stenosis in the mid segment of one or two epicardial vessels in a patient with an ejection fraction of 25%; in such patients the degree of ventricular dysfunction is clearly out of proportion to the extent of CAD and likely represents bystander disease. Further, with the exception of left main or three vessel disease, there is no data to suggest that revascularization of lesser extents of CAD improve prognosis or well-being in patients with systolic

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heart failure in the absence of another indication such as angina. Thus, using coronary angiography in patients with heart failure without angina with the goal of performing revascularization in the presence of obstructive CAD, is somewhat troublesome.

Patients presenting with acute systolic heart failure in the setting of hypertensive crisis represent a specific subset of the heart failure population. In such patients, is heart failure and systolic dysfunction due primarily to uncontrolled hypertension or does coronary disease play a significant role? During the acute presentation, many of these patients have elevations of troponin and this causes a clinician further angst regarding suspicion of underlying coronary disease. What is the value of routine coronary angiography in this specific group?

The study by Davis et al. sheds light on this interesting subgroup [12]. In this single center, retrospective study, 205 patients presenting with new systolic heart failure in the setting of hypertensive urgency or emergency and without known CAD underwent coronary angiography. Similar to other heart failure studies, obstructive coronary artery disease (>70% stenosis) was observed in 33%. By univariate analysis, patients with obstructive CAD were older and had a higher proportion of diabetes, stroke and regional wall motion abnormalities on echo and less likely to be African American. Anginal chest pain was present in about one third of patients and was not different between patients with and without obstructive CAD. Interestingly, troponin elevations were seen in >70% of patients and also did not differ between those with and without obstructive CAD. By multivariate analysis, only race and regional wall motion abnormalities remained predictors. The authors created a score to predict obstructive disease and determined that about 36% of patients could have avoided a coronary angiogram.

This study is a valuable addition to the literature regarding the value of coronary angiography in heart failure and suggests that a simple model could be used to help clinicians more appropriately select patients presenting with acute systolic heart failure and hypertensive crisis for angiography. Other investigators have created similar models to help predict CAD in patients with systolic heart failure. A notable study found that about 1/3 patients had CAD and 17% had severe CAD warranting revascularization [11]. Predictors of CAD included diabetes, Q waves or LBBB on ECG and at least two, non-diabetic, atherosclerotic risk factors. CAD was likely if one or more of these predictors were present, and clinicians could use this to target the most appropriate patients for angiography.

Disappointingly, this and other studies still leave unanswered the value of identifying CAD in patients with systolic heart failure syndromes. How does demonstrating significant CAD change what we do? Are there improved outcomes if obstructive CAD is demonstrated and aggressively treated with revascularization? Does extent of disease matter? Until we know the answers to these important questions, it remains unclear which patients with heart failure syndromes should undergo coronary angiography.

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