

Clinical Usefulness of Coronary Angiography in Patients with Left Ventricular Dysfunction

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Abstract

Background: Performing a coronary angiography in patients with heart failure of unknown etiology is often justified by the diagnostic assessment of ischemic heart disease. However, the clinical benefit of this strategy is not known.

Objective: To evaluate the prevalence of ischemic heart disease by angiographic criteria in patients with heart failure and reduced ejection fraction of unknown etiology, as well as its impact on therapy decisions.

Methods: Consecutive outpatients with heart failure and systolic dysfunction, who had an indication for coronary angiography to clarify the etiology of heart disease were assessed from 1 January 2009 to December 31, 2010. Patients diagnosed with coronary artery disease, positive serology for Chagas disease, congenital heart disease, valve disease or patients undergoing cardiac transplantation were excluded from the analysis. The sample was divided into two groups according to the indication for catheterization. Group-1: Symptomatic due to angina or heart failure. Group-2: Presence of ≥ 2 risk factors for coronary artery disease

Results: One hundred and seven patients were included in the analysis, with 51 (47.7%) patients in Group 1 and 56 (52.3%) in Group 2. The prevalence of ischemic heart disease was 9.3% (10 patients), and all belonged to Group 1 ($p = 0.0001$). During follow-up, only 4 (3.7%) were referred for CABG; 3 (2.8%) patients had procedure-related complications.

Conclusion: In our study, coronary angiography in patients with heart failure and systolic dysfunction of unknown etiology, although supported by current guidelines, did not show benefits when performed only due to the presence of risk factors for coronary artery disease. (Arq Bras Cardiol 2012;98(5):437-441)

Keywords: Coronary angiography/utilization; ventricular dysfunction, left; myocardial ischemia; heart failure

Introduction

Ischemic heart disease accounts for approximately two thirds of cases of patients with heart failure with reduced ejection fraction in the U.S.¹, being currently the main etiology also in Brazil^{2,3}. This etiological differentiation is crucial in clinical practice for several reasons. Patients with heart failure of ischemic origin have a poorer prognosis when compared to other etiologies⁴. The potential benefit of myocardial revascularization procedures and pharmacotherapy in the secondary prevention of cardiovascular disease is also a key factor that should be considered in therapeutic decision-making.

Patients with heart failure are considered as having ischemic etiology when they have a history of myocardial infarction, revascularization procedure, or angiographic evidence of obstructive coronary artery disease, as shown in a previous publication⁵.

Noninvasive methods to assess myocardial ischemia in this population are of limited use, as the presence of perfusion deficits and alterations in segmental mobility are often present in patients with non-ischemic heart disease^{6,7}. Thus, the assessment of the coronary anatomy by means of cardiac catheterization is considered the procedure of choice for the investigation of ischemic heart disease in patients with heart failure with reduced ejection fraction of unknown etiology⁸.

According to current guidelines of chronic heart failure, one must consider the performance of cardiac catheterization in patients with left ventricular dysfunction of unknown etiology in the presence of risk factors for coronary artery disease, symptoms of heart failure or refractory angina⁸. However, due to the lack of literature data on the diagnostic yield of the invasive strategy in this population, in addition to the potential for vascular complications of the procedure, its indication becomes unclear.

Objective

To evaluate the prevalence of ischemic heart disease using angiographic criteria in patients with heart failure and reduced ejection fraction of unknown etiology according to different indication criteria, as well as its impact on treatment decision-making.

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Methods

Design

Cross-sectional study followed by a retrospective cohort.

Sample

We analyzed data from patients treated at the outpatient clinic for surgical treatment of heart failure in a tertiary institution that is a referral for high complexity cases, between January 1 2009 and December 31, 2010. We verified all elective coronary angiographies performed during this period and, subsequently, the sample characteristics were retrospectively accessed. The collected variables included: echocardiographic data between one year before or after the procedure, with calculation of left ventricular ejection fraction by Teicholz method, New York Heart Association functional class; previous diagnosis of arterial hypertension, diabetes mellitus, hypercholesterolemia (patients on statins or LDL – cholesterol > 160 mg/dL), family history of early cardiovascular disease (men < 45 years and women < 55 years), chronic kidney disease (estimated creatinine clearance < 60 mL/min), current smoker status or smoker in the past 10 years, presence of coronary artery disease (history of myocardial infarction or coronary artery bypass grafting or percutaneous intervention).

We also assessed the serologic results for Chagas disease (indirect immunofluorescence method and enzyme linked immunosorbent assay), presence of congenital or valvular heart disease, and demographic characteristics.

We selected only patients with heart failure and reduced ejection fraction that persisted with an unknown etiology after initial non-invasive clinical assessment. Inclusion criteria were: left ventricular ejection fraction < 45% and age ≥ 18 years. Patients with coronary artery disease, positive serology for Chagas disease, congenital heart disease, or severe valvular disease and those submitted to heart transplantation were excluded from the analysis.

The sample was divided into two groups according to the criteria for referral to cardiac catheterization. Group 1: Symptomatic due to angina or refractory heart failure (i.e., NYHA functional class III or IV despite optimal drug therapy), regardless of the profile of risk factors for coronary artery disease. Group 2: patients without angina and in functional class I or II with the presence of ≥ 2 risk factors for coronary artery disease (age > 45 years for men and 55 for women, hypercholesterolemia, smoking, hypertension, chronic kidney disease, family history of premature cardiovascular disease or diabetes mellitus).

After the procedure, patients were classified as patients with ischemic or nonischemic etiology. The angiographic criteria used were based on previously published definitions by Felker et al⁵, which considered as ischemic etiology patients with obstructive lesions (≥ 75%) in two or more epicardial vessels or left main coronary artery or the proximal anterior descending branch⁵. Patients defined as having ischemic heart disease were evaluated for the indication for surgical or percutaneous revascularization during follow-up, according to the attending physician's discretion. The starting date of follow-up was the

time of coronary angiography and the last date of follow-up was considered as the day of revascularization or the last outpatient visit recorded in electronic medical records.

Statistical analysis

Continuous variables were expressed as means ± standard deviation and were compared using the Student's *t* test. Categorical variables were compared using Fisher exact test.

Results

A total of 1970 patients were evaluated during the study period. After the initial outpatient evaluation and use of eligibility criteria, only 107 (5.4%) patients had heart failure with left ventricular systolic dysfunction of unknown origin and were included in the analysis. Demographic data according to the indication for catheterization are shown in Table 1.

Fifty-one patients belonged to Group 1 and 56 to Group 2. Patients had a mean of 2.5 (± 1.3) risk factors for coronary artery disease, with 2.3 (± 1.4) in Group 1 and 2.7 (± 1.2) in Group 2 (*p* = 0.19).

The prevalence of angiographic alterations consistent with ischemic heart disease was 9.3% (10 patients) among the 107 patients included, all from Group 1 (*p* = 0.0001). During follow-up, only 4 (3.7%) were referred for percutaneous or surgical revascularization (Table 2).

When analyzing patients from Group-1, 19 patients had angina and 32 had symptoms of heart failure. The prevalence of ischemic heart disease in these subgroups was 26.3% (5 patients) and 15.6% (5 patients), respectively.

Three patients (2.8%) submitted to catheterization had procedure-related complications: one patient had acute occlusion of the radial artery, the second had acute occlusion of the brachial artery, and the third had ischemic cerebrovascular accident.

All patients were alive at the end of the analysis and none were lost to follow-up. The mean follow-up was 15.6 months (± 7.6).

Discussion

The present study was the first in our country that investigated the impact of coronary angiography as a diagnostic tool for ischemic heart disease, as well as its influence on therapeutic decision for revascularization in patients with heart failure and reduced ejection fraction of unknown etiology.

According to the recommendations of current guidelines for chronic heart failure, cardiac catheterization should be considered in the etiological investigation of patients with left ventricular dysfunction in the presence of risk factors for coronary artery disease, angina, or refractory symptoms of heart failure⁸.

This study adds value to the literature on this subject as it deals with the use of these recommendations in a "real-life" sample of patients.

In the population studied, the coronary angiography confirmed the ischemic etiology of heart disease in 9.3%

of patients, but only 3.7% had indication for therapeutic intervention with coronary revascularization. In a separate analysis by subgroups, no patient among those who had an indication given only by the presence of risk factors for coronary artery disease, showed angiographic criteria consistent with ischemic heart disease.

Previous work with cardiac catheterization in patients with heart failure have shown a prevalence of ischemic heart disease that varies between 13% and 65%^{4,5,9}. These differing results may be explained by the lack of uniformity of the angiographic criteria for ischemic heart disease and the difference in the characteristics of the studied population.

The present study included only patients who persisted with an unidentified etiology for ventricular dysfunction after the initial assessment, excluding those with already established coronary artery disease.

The inclusion of mildly symptomatic patients in functional class I and slightly reduced ventricular function may also have contributed to the low prevalence of ischemic heart disease in our population.

In Brazil there are few data on the prevalence and etiology of heart failure with reduced ejection fraction. Similar to international case series, ischemic heart disease is the main cause, accounting for about 32% of cases³.

It is important to mention that the definition used for ischemic heart disease in this study was developed from the concept, widely accepted and quoted in the literature, that ischemic etiology has a worse survival when compared to other forms of heart failure with reduced ejection fraction. Thus, patients with single-vessel lesions and no history of myocardial infarction or

revascularization are classified as nonischemic, as they have a better prognosis^{4,5}.

Literature data show a low overall rate of complications (1.7%) when cardiac catheterization is performed for diagnostic purposes in unselected patients from experienced centers¹⁰. However, patients with dilated cardiomyopathy or with symptoms of heart failure are at high risk for complications, having the risk increased by 3.3 and 2.2 times, respectively¹¹. The rate of procedure-related complications in the study sample was 2.8%, whereas only 3.7% of patients benefited from a therapeutic intervention based on information obtained from the coronary angiography. Thus, the rate of complications compared with the potential benefit of the procedure should be considered at the moment when the indication for the examination is made.

It is known that some patients with myocardial infarction develop partial or complete recanalization of the culprit coronary artery that caused the event, resulting in their misclassification as an important cause of ischemic cardiomyopathy by the coronary angiography. In a study using cardiac magnetic resonance imaging in patients with dilated cardiomyopathy and coronary angiography without obstructive lesions, 13% showed patterns of late enhancement with gadolinium indistinguishable from those shown in coronary artery disease¹².

On the other hand, the presence of asymptomatic coronary artery disease in patients with dilated cardiomyopathy, with no evidence of previous infarction or hibernating myocardium, does not demonstrate causality, especially when other etiologies for heart failure are present (hypertension, alcoholism, myocarditis). The development of severe coronary obstruction was demonstrated in a study with 55 patients undergoing

Table 1 – Basal characteristics of the two groups

| Variable | Group-1 (n = 51) | Group-2 (n = 56) | p |
|----------------------|------------------|------------------|------|
| Male Sex | 38 (74.5%) | 39 (69.6%) | 0.67 |
| Age (years) | 53.1 (±9.8) | 52.9 (±12.2) | 0.95 |
| Diabetes | 13 (25.5%) | 16 (28.6%) | 0.83 |
| Hypertension | 30 (58.8%) | 41 (73.2%) | 0.15 |
| Smoking | 9 (17.6%) | 11 (19.6%) | 0.81 |
| FH CAD | 4 (7.8%) | 6 (10.7%) | 0.74 |
| Hypercholesterolemia | 20 (39.2%) | 25 (44.6%) | 0.69 |
| CKD | 7 (13.7%) | 10 (17.9%) | 0.61 |
| LVEF | 27.6% (±7.7) | 28.2% (±7.6) | 0.57 |

FH CAD – family history of early coronary artery disease; CKD – chronic kidney disease; LVEF – left ventricular ejection fraction.

Table 2 – Stratified results according to the indication for coronary angiography

| | Group-1 (n = 51) | Group-2 (n = 56) | p |
|----------------------|------------------|------------------|--------|
| Ischemic cardiopathy | 10 | 0 | 0.0001 |
| Revascularization | 4 | 0 | |

cardiac transplantation with a pre-transplant diagnosis of idiopathic dilated cardiomyopathy¹³.

All patients had angiographically normal coronary arteries during a period of up to 10 years before transplantation and had no history of myocardial infarction. The examination of the explanted heart disclosed critical lesions in at least one coronary segment in 15 patients (27%) with no evidence of myocardial fibrosis. Similar findings were demonstrated in a report of 291 patients with biventricular dysfunction and no history of myocardial infarction that underwent coronary angiography and endomyocardial biopsy due to symptoms of progressive heart failure. Seven (2.4%) had significant obstructive lesions, but biopsy in all cases showed histological alterations with definitive criteria for myocarditis¹⁴. Once again, it was not possible to discriminate the predominant etiology of ventricular dysfunction in these patients.

The current advances in computed tomography with multiple detectors provided a noninvasive assessment of coronary anatomy without loss of specificity of other noninvasive methods. A recent study compared the method with cardiac catheterization in 93 patients with dilated cardiomyopathy and found a 95% accuracy in the diagnosis of ischemic heart disease when compared to catheterism¹⁵. However, the use of this method is relatively recent in this population, requiring further studies to establish its actual usefulness.

Finally, the study has some limitations. This is a retrospective analysis, thus subject to biases inherent to this methodology such as obtaining data on the indication of coronary angiography (selection bias) or the presence of symptoms, which are

sometimes underreported (measurement bias). Another limitation is the fact that it was a single-center study with a sample referred to a subspecialty outpatient clinic of a tertiary hospital. Furthermore, the number of patients included in the analysis was relatively small.

Conclusion

In our study, the performance of coronary angiography in patients with heart failure and reduced ejection fraction of unknown etiology, although supported by current guidelines, showed no benefits when indicated solely by the presence of risk factors for coronary artery disease. In patients with symptoms of refractory heart failure or angina, the coronary angiography showed to be a good tool for the diagnosis of ischemic heart disease. However, even in this population, few were referred for myocardial revascularization procedure.

Potential Conflict of Interest

No potential conflict of interest relevant to this article was reported.

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Study Association

This study is not associated with any post-graduation program.

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