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Original Article

Predictors of renal artery stenosis in patients undergoing cardiac catheterization for suspected coronary artery disease

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ABSTRACT

Aim: This study determined the prevalence of Renal Artery Stenosis (RAS) and established its predictors in patients undergoing cardiac catheterization for suspected Coronary Artery Disease (CAD).

Methods: 1266 patients underwent coronary angiogram for suspected CAD. Following coronary angiogram, bilateral selective renal angiogram was performed. Study population was split into cohorts with and without RAS. A binary logistic regression model was used to identify univariate predictors of RAS. Significant univariate predictors were used to build a multivariate logistic regression model. Comparative accuracy of various models in predicting RAS was estimated by computing areas under the Receiver Operating Characteristic (ROC) curve.

Results: Prevalence of significant RAS in study population was 6.0%. In univariate analysis, mean age ($p = 0.002$), diabetes mellitus ($p = 0.009$), hypertension of more than five years duration ($p = 0.034$), serum creatinine concentration of >1 mg per 100 ml ($p = 0.009$), peripheral arterial disease ($p = 0.019$), and significant CAD ($p = 0.037$) were predictors of RAS. In the multivariate analysis, serum creatinine concentration ($p = 0.002$), peripheral arterial disease ($p = 0.017$), Two-vessel CAD ($p = 0.043$), and Three-vessel CAD ($p = 0.007$) were independent predictors of RAS. Areas under the non-crossing ROC curves revealed that a simple model incorporating two-vessel CAD and three-vessel CAD had an acceptable accuracy in predicting RAS.

Conclusion: It may not be appropriate to extrapolate the findings of research conducted in other demographic settings to Indian patients. "Drive by" renal angiogram in Indian settings may be done only in patients with multi-vessel CAD presenting with indisputable clinical indications. However, in the long run, we should be open to new research.

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1. Introduction

Renal Artery Stenosis (RAS) is an important comorbid condition in patients with Coronary Artery Disease (CAD). Atherosclerosis is the underlying cause of both these conditions. RAS is the most common cause of secondary hypertension[1] and also contributes towards ischemic renal disease leading to chronic renal insufficiency and end-stage renal disease.[2] Renal dysfunction, in turn, is a predominant risk factor for CAD.[3]

RAS is a potentially correctable cause of ischemic nephropathy and secondary hypertension. Notably, current endovascular therapies provide high procedural success rates with excellent long term patency rates. However, at present, there are no clear-cut, evidence-based guidelines to indicate which patients should undergo renal angiography during coronary catheterization. Current ACC/AHA guidelines recommend a 'drive by' renal angiography in "at-risk patients" based on independent variables such as hypertension, age of onset, accelerated course, kidney size discrepancy, flash pulmonary edema, worsening renal function and multi-vessel atherosclerosis elsewhere.[4]

The reported prevalence of significant RAS (≥50%) among patients undergoing coronary angiography ranges from 6.2% to as high as 28%.[5] A positive association between the presence and severity of RAS and CAD has been described and the presence of RAS has been associated with poor cardiovascular outcome. In recent years, efforts have been made worldwide to determine the prevalence of RAS and its predictors among patients with peripheral and coronary artery disease. However, in the Indian context, little information is available on the prevalence and predictors of RAS among patients undergoing coronary angiography. This study aimed to determine the prevalence of RAS and to establish its predictors in patients undergoing cardiac catheterization for suspected CAD in a tertiary care teaching hospital in South-India.

2. Methods

2.1. Study design

This is a prospective study conducted between January 2012 and August 2014 at a tertiary care specialty hospital in South India. 1266 patients underwent coronary angiogram for suspected CAD based on history of angina, ischemic ECG changes and positive stress test. A detailed medical history including preexisting co-morbidities, a thorough clinical examination and all relevant blood investigations were carried out. The Ethics Committee of the institute approved the study, and written informed consent was obtained from each patient before enrollment.

2.2. Diagnostic criteria

Hypertension was defined as blood pressure of ≥140/90 mmHg recorded on at least two different occasions. Diabetes was defined as fasting plasma glucose of >126 mg per 100 ml on at least two different occasions or patients on current anti-diabetic therapy. Hyperlipidemia was defined as total cholesterol of >200 mg per 100 ml or a history of elevated serum total cholesterol during the previous 6 months resulting in prescription of a lipid lowering agent. Current tobacco users consuming smoking tobacco and/or smokeless tobacco products were considered tobacco consumers. Individuals currently consuming more than 12 standard drinks per week in case of males and more than 18 stand drinks per week in case of females – 1 standard drink equivalent to approximately 10 g of absolute alcohol – were considered alcohol consumers. Significant CAD was defined as more than 50% reduction in diameter of at least one or more major epicardial arteries. Significant RAS was defined as more than 50% reduction in vessel diameter.[4,6] In case of a significant RAS, hemodynamic assessment of the lesion was subsequently performed by measuring the gradient. A pressure gradient of >20 mm Hg was considered suitable for revascularization.[4,7]

2.3. Exclusion criteria

Patients with serum creatinine of more than 1.5 mg per 100 ml on two separate measurements were excluded from this study. Patients with acute coronary syndromes or those on renal replacement therapies were also excluded.

2.4. Catheterization procedure

Cardiac catheterization was performed with ionic contrast via femoral approach using Judkins technique. Following coronary angiogram, bilateral selective renal angiogram was performed manually with approximately 2 cc of contrast. To make the entire procedure less time consuming and more cost effective, and to reduce the adverse effects on account of frequent change of catheters, the same right Judkins catheter was used in both the angiograms. The entire angiographic data were reviewed and visually estimated by two senior cardiologists in order to define the severity of CAD and RAS. Disagreements between the two were resolved through arbitration.

2.5. Statistical analysis

The study population was split into cohorts with and without RAS. A binary logistic regression model with the presence or absence of RAS as the dependent variable was used to identify univariate predictors of RAS. Significant univariate predictors were used to build a multivariate logistic regression model. Comparative accuracy of various models in predicting RAS in patients undergoing cardiac catheterization for suspected CAD was estimated by computing the area under the Receiver Operating Characteristic (ROC) curve for a given model.

Continuous data are presented as mean ± standard deviation (SD); ratios are presented as percent. Between-group continuous variables were compared by *t*-test; categorical variables were compared by chi square test. P value of <0.05 was considered statistically significant. The 95% CI are given, wherever appropriate. These computations were carried out in SPSS software – version 15.