Research Article

Interventional Cardiology

Role of coronary angiography in severe left ventricular systolic dysfunction and dyspnoea. Do we really follow the guidelines?

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Introduction: Role of coronary angiography is not well established in left ventricular dysfunction patients coming with dyspnoea. The aim of our study is to evaluate in a 8 year retrospective sample of patients with severe systolic dysfunction and suspicion of underlying coronary artery disease, the diagnostic value of coronary angiography in relation to the patient's clinical and traditional cardiovascular risk factors.

Methods: We analyse 1022 patients observing coronary disease in 288 (28.2%) and risk factors show that diabetes, smoking, male gender and age above 65 years are the most powerful predictors of coronary disease.

Results: Regarding the extent of CAD, classic cardiovascular risk factors contributes significantly in those patients with a single coronary vessel disease, probable incidental finding without being responsible for systolic dysfunction. Only diabetes and gender male reach statistical significance as independent predictors in the three-vessel disease, where the CAD actually plays a role in the pathogenesis of systolic left ventricular dysfunction.

Conclusions: The results of our work invited to question the need for coronary angiography only in certain groups of patients, based on their cardiovascular risk profile as part of the study of severe left ventricular systolic dysfunction.

Keywords: Heart failure; Coronary angiography; Coronary artery disease; Cardiovascular risk factors

Introduction

In patients with ventricular dysfunction and ischemic suspicion, the study of the coronary anatomy persists as type IIa when ischemia may be contributing to heart failure in the AHA/ACC Heart Failure Guidelines [1]. Also in the recent ESC Guidelines for the diagnosis and treatment of acute and chronic heart failure, it is recommended when angina recalcitrant to therapy, ventricular arrhythmias or aborted cardiac arrest (Class I) and in intermediate to high-pre-test probability of Coronary Artery Disease (CAD) and the presence of ischemia in non-invasive stress tests (Class IIa) [2].

Approximately 1-2% of the adult population in developed countries suffer heart failure, with prevalence of above 10% in patients over 70 years of age [3] and presenting systolic dysfunction of the left ventricle in at least 50%. Coronary heart disease is responsible for up to two thirds of these cases. A study discussing cardiovascular risk factors and the presence of coronary artery disease (CAD) in patients with severe systolic dysfunction was recently published. The authors conclude that their analysis for the prediction of CAD is a tool with high sensitivity (98%) but low specificity (18%) [4]. It is not clear the real value of coronarography in patients undergoing to the catheterization laboratory with dyspnoea and left ventricular Ejection Fraction (LVEF) less than 35% in the daily practice, even when CAD was suspected.

The aim of our study is to assess the diagnostic value of coronary angiography in a group of patients with dyspnoea and severe systolic dysfunction less than 35% referred for coronary angiography. We also analyse the presence and degree of extension of CAD, determining the relationship with the patient's functional capacity measured by the scale of NYHA dyspnoea, the basic

electrocardiogram rhythm and classic cardiovascular risk factors: diabetes, hyperlipidemia, hypertension, smoking and ex-smoking (more than 1 year without smoking).

Methods

We studied retrospectively from June 1, 2008 until June 1, 2016, patients who were referred for coronary angiography in the context of dyspnoea and LVEF <35% suspecting CAD by their physician. We excluded those with known CAD, significant valvular heart disease and patients with prior heart transplantation. CAD was defined as coronary stenosis >70% by angiography.

Statistical methods

Continuous variables are expressed as mean ± standard deviation, and categorical data are presented as numbers and percentages. Differences between dichotomous and categorical variables were assessed with the chi-square or Fisher exact tests, while continuous variables were assessed by the student t test. Independent predictors study was performed with multivariable logistic regression. Data analysis was performed using SPSS version 17 (SPSS Inc.; Chicago, Illinois, United States).

Results

A total of 1022 patients (74.3% male) was analysed with a mean age of 65.1±11.1 years. The mean LVEF was 31.1±3.3%. Coronary Artery Disease was observed in 288 patients (28.2%), of which 128 had one vessel disease (44.4%), 76 two vessels (26.4%) and 84 (29.2%) three-vessel disease. Analysing lesion distribution, we found Left Main (LM) lesions in 17 cases (5.9%), Left Anterior Descending (LAD) 191 (66.3%), Circumflex 155 (53.8%) and Right Coronary Artery (RCA) 182 (63, 2%). Basal characteristics of the sample are shown in Table 1.

Table 1: Basal characteristics of the sample.

Coronary Artery Disease			
	NO (N=734)	YES(N=288)	P
Gender (Male)	520 (70.8%)	239 (83%)	<0.001
Age	64.1±11.1	67.8±10.3	0.007
Hemoglobine (g/dl)	15.4±7.4	14.6±5.9	0.65
Creatinine Clearance (ml/min)	64.6±24.7	63.8±22.5	0.786
Electrocardiogram rhythm			
* Electrocardiographic rhythm	482 (65.7%)	216 (75%)	
* Sinus rhythm			0.07
	191 (26%)	51 (17.7%)	
* Atrial Fibrillation			
	10 (1.4%)	2 (0.7%)	
* Pacemaker			
	23 (3.1%)	8 (2.8%)	
Dyspnea. NYHA Functional Class			
* NYHA I			
* NYHA II	30 (4.1%)	9 (3.1%)	0.211
* NYHA III	298 (40.6%)	135(46.9%)	
* NYHA IV	253 (34.5%)	98 (34.0%)	
	39 (5.31%)	16 (5.5%)	
Diabetes	191 (26%)	118 (38.2%)	< 0.001
Hyperlipidemia	344 (46.9%)	160 (55.6%)	0.012
Hypertension	428 (58.3%)	185 (64.2%)	0.08
Smoking	127 (17.3%)	74 (25.7%)	0.002
Ex-smoking	261 (35.6%)	106 (36.8%)	0.709

The analysis of predictors of CAD shows that diabetes is associated significantly with the presence of CAD (OR 1.88, 95% CI 1.39-2.56), hyperlipidemia (OR 1.50, 95% CI 1.12-2.02), current smoking (OR 2.79, 95% CI 1.83-4.28), ex-smokers (OR 1.43, 95% 1.00-2.04) male (OR 1.96, 95% CI 1.33-2.98) and being older than 65 years (OR 1.86, 95% CI 1.37-2.53). When we analysed the different cardiovascular risk factors and their relationship to the extent of CAD, statistical significance was observed with any specific risk factors in each group (Table 2).

Table 2: Analysis of predictors of the presence and extension of Coronary Artery Disease (CAD).

Predictors of Presence of Coronary Artery Disease (CAD)				
RISK FACTORS	OR	CI 95%		p
Diabetes	1.88	1.39	2.56	<0.001
Hypertension	1.25	0.92	1.71	0.16
Hyperlipidemia	1.50	1.12	2.02	0.01
Smoking	2.79	1.83	4.28	<0.001
Ex-smoking	1.43	1.00	2.04	0.05
Gender (Male)	1.96	1.33	2.88	0.001
Age over 65 years old	1.88	1.39	2.56	<0.001

Predictors of Extension of Coronary Artery Disease (CAD)					
NUMBER OF VESSELS DISEASE	RISK FACTORS	OR	CI 95%		p
1 VESSEL	Diabetes	1.15	0.75	1.77	0.53
	Hypertension	1.35	0.89	2.05	0.16
	Hyperlipidemia	1.69	1.13	2.51	0.002
	Smoking	3.41	1.91	6.08	<0.001
	Ex- smoking	2.17	1.32	3.56	0.01
	Gender (Male)	1.25	0.76	2.08	0.38
	Age over 65 years old	1.88	1.24	2.84	0.002
2 VESSELS	Diabetes	2.42	1.45	4.04	0.001
	Hypertension	1.40	0.81	2.42	0.22
	Hyperlipidemia	1.38	0.84	2.28	0.21
	Smoking	3.33	1.66	6.66	0.001
	Ex-smoking	1.23	0.66	2.27	0.51
	Gender (Male)	2.60	1.26	5.39	0.01
	Age over b65 years old	2.24	1.31	3.83	0.003
3 VESSELS	Diabetes	3.05	1.87	4.95	<0.001
	Hypertension	1.01	0.61	1.68	0.97
	Hyperlipidemia	1.34	0.83	2.16	0.24
	Smoking	1.86	0.95	3.66	0.07
	Ex-smoking	0.89	0.50	1.57	0.68
	Gender (Male)	3.24	1.59	6.62	0.001
	Age over 65 years old	1.57	0.95	2.59	0.08

Special subgroups

We analysed women subgroup, 67.8±10.1 years-old *vs.* 64.3±11.2 years-old in men (p=0.015), finding that CAD was only observed in 46 women (18.3%) *vs.* 242 male (31,9%) (p<0.001).Women presented one vessel disease in 26 *vs.* 101 (10.4% *vs.* 13.3%), two vessel disease in 10 *vs.* 65 (3.9% *vs.* 8.6%) and three vessel disease in 10 *vs.* 73 (3.9% *vs.* 9.6%) (p<0.001). Regarding the distribution of the lesions and comparing with the male group, only one patient had LM *vs.* 16 (0.4% *vs.* 2.1%; p=0.06), RCA in 23 patients *vs.* 156 men (9.1 *vs.* 20.6%, p<0.01), circumflex in 16 *vs.* 138 (6.4% *vs.* 18.2%, p<0.001) and LAD 36 *vs.* 153 (14.3% *vs.* 20.2%, p=0.04). We found associated with CAD being active smoking (OR 3.81; 95% CI 1.23-11.81) (p=0.021) and diabetes (OR 3.06; 95% CI 1.49-6.23) (p=0.002) while Hypertension (OR 1.63; 95% CI 0.72-3.66) (p=0,240), ex-smoker (OR 2.75; 95% CI 0.86-8.77) (p=0.088), age over 65 years (OR 1.55; 95% CI 0.64-3.79)(p=0.336), hyperlipemia (OR 1.62; 95% CI 0.80-3.90) (p=0.177), dyspnoea NYHA (p=0.923) and electrocardiogram rhythm (p=0.812) were not independent predictors of CAD.

Another special subgroup was patients less than 65 years-old (<65 years) in whom CAD was observed in 122 (23.8%) *vs.* 166 (33.3%) over 65 years-old (p=0.002). We observed one vessel disease in 56 patients from <65 years *vs.* 71 (10.9% *vs.* 14.3%), two vessel disease 29 *vs.* 46 (5.7% *vs.* 9.2%) and three vessel disease 37 *vs.* 46 (7.2% *vs.* 9.2%) (p=0.014). Regarding distribution of the lesions, LM disease was in 8+9 (1.6% *vs.* 1.8%; p=0.76), RCA in 84 *vs.* 95 (16.4% *vs.* 19.1%, p=0.267), Circumflex in 63 *vs.* 91 (12.3% *vs.* 18.3%, p=0.008) and LAD in 75 *vs.* 114 (14.6% *vs.* 22.9%. p<0.001). When analysing independent predictors of CAD, active smoking (OR 3.5; 95% CI 1.69-6.33) (p<0.001), hyperlipemia (OR 1.69; 95% CI 1.01-2.68) (p=0.026) and diabetes (OR 2.19; 95% CI 1.33-3.6) (p=0.002) were statistically significant, while hypertension (OR 1.3; 95% CI 0.84 to 2.01) (p=0.236), ex-smokers (OR 1.5; 95% CI 0.82-2.61) (p=0.202), male (OR 1.64; 95% CI 0.90-3.00)(p=0.105), NYHA class (p=0.54) and electrocardiogram rhythm (p=0.35) did not reach statistical significance.

Discussion

Coronary Artery Disease in patients with severe systolic dysfunction and dyspnoea in our sample, had a low prevalence (around 30%), unlike the classic series standing at 40-50%. The probability of coronary heart disease in patients with global hypokinesia has been previously studied, with a prevalence of 27% [5].

Symptoms in these patients are sometimes no specifics and dyspnoea could be considered as an ischemic equivalent. It was reported that patients undergoing stress testing, those evaluated for dyspnoea had a significant increase in all-cause mortality but did not have higher rates of ischemia compared with patients presenting with chest pain [6]. In a recent study, the patients with dyspnoea (HR 2.2, 95% CI 1.1–4.3, p=0.03) still had significantly reduced survival compared to the other two groups, while those with typical angina did not (HR 1.2, 95% CI 0.6–2.6, p=0.62). They concluded that dyspnoea is also associated with increased mortality rate compared to patients with typical angina and those with neither of these symptoms among patients undergoing CCTA [7].

Even the more, in patients admitted to Chest Pain Units (CPUs) in German Registry presenting with dyspnea, the 3 month mortality was fourfold higher compared to patients without dyspnoea (8.6% *vs.* 2.1%, p<0.05, OR death: 4.40 95% CI 3.14-6.03) [8].

When we analyse risk factors, diabetes, smoking, gender male and age above 65 years-old were significantly associated with the presence of CAD. This relationship is well known for many years, but in older (above 65 years-old) men, this fact is particularly important because they are non-modifiable risk factors. On the other hand, women have an increased risk of CAD on smoking and diabetes, with age playing a secondary role. Regarding the extent of CAD, classic cardiovascular risk factors contribute significantly in those patients with a single coronary vessel disease, probable incidental finding without being responsible for systolic dysfunction. Only diabetes and gender male reaches statistical significance as independent predictors in the three-vessel disease, where the CAD actually plays a role in the pathogenesis of systolic left ventricular dysfunction. Otherwise, the functional status of the patient by the NYHA dyspnoea scale and rhythm of electrocardiogram are not predictors of CAD. We have several limitations about our study. First, it is a retrospective registry from an historic database of our hospital centre. Second, some interesting clinical data, not being collected at the base, could not be studied (i.e.: cerebrovascular disease, peripheral artery disease).

Conclusion

In conclusion, our results show uncertainty about the need for coronary angiography in a regulated way in patients with severe systolic dysfunction with dyspnoea, especially in the absence of diabetes, smoking, patients under 65 years-old and women. However, it seems mandatory to roll out CAD in male over 65 years-old even when no risk factors are present. We suggest studying with more patients to strengthen the hypothesis of our work.

Executive Summary

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