

Evaluation of Left Ventricular Function after Complete Revascularization by Percutaneous Angioplasty in Multitrunk Coronary Patients

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Abstract

Original Research Article

Multitrunk coronary disease is usually defined by the presence of angiographic stenosis of more than 50% in at least two of the three epicardial coronary vessels. This multitrunk disease is associated with a pejorative prognosis, especially in cases of proximal VIA stenosis and/or left ventricular dysfunction. The aim of this Study is: To analyze the left ventricular function before and after complete revascularization by angioplasty of multitrunk coronary patients and to determine the place of angioplasty in the complete revascularization of the multitrunk coronary patients. Through a series of 19 multitrunk coronary patients who underwent complete revascularization by angioplasty during the period from January 2018 to July 2019.

Keywords: Multitrunk coronary disease, Angioplasty, Atherosclerosis, Acute coronary syndrome, Systolic evaluation, Diastolic evaluation.

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INTRODUCTION

Multitrunk coronary disease is usually defined by the presence of angiographic stenosis of more than 50% in at least two of the three epicardial coronary vessels. This multitrunk disease is associated with a pejorative prognosis, especially in cases of proximal VIA stenosis and/or left ventricular dysfunction [1]. Patients with multitrunk disease are considered to be older, with more comorbidities, with multiple cardiovascular risk factors. The diffuse and aggressive nature of atheroma disease exposes myocardium more to ischemia [2]. Thanks to the technical development and improvement of the pharmacological environment, coronary angioplasty has established itself as a safe and effective therapeutic alternative for multitrunk patients. Numerous studies in the literature have shown the clinical benefit of complete angioplasty revascularization in multi-trunk patients in terms of mortality, major cardiovascular events and the use of new revascularizations. However, its effect on left ventricular function is poorly evaluated in the literature.

MATERIAL AND PATIENTS

This is a descriptive and analytical prospective study, which covered a period of 19 months from January 2018 to July 2019.

This study included all known coronary multitrunk patients who underwent complete revascularization by angioplasty (in one time or in several times).

The data were collected manually on an exploitation sheet, then they were entered and processed on SPSS version 16 software.

RESULTS

Our study consisted of 65 multitrunk patients including 25 bitroncular and 40 tritroncular patients over 18 months with 19 patients who received a complete myocardial revascularization. Our study is characterized by a clear male predominance with a sex ratio at 1.71 with an average age of 62+/-8 years. All of our patients had at least one cardiovascular risk factor: high blood pressure and tobacco consumption equal in 57.89% of cases, diabetes in 47.36% of cases, dyslipidemia in 42.9% of cases, obesity in 26,31% of cases, menopause in 26.31% of cases without any notion of coronary heredity. Compared to functional signs, chest pain is the master symptom in coronary artery disease, typical angina pain was reported by 57.89% of our patients presented, atypical by 31.57% and not angina or without chest pain in 10,52%, dyspnea was reported in 21.05% of cases highlighting that it is a symptom to be considered currently in the

context of chronic coronary syndrome according to the new recommendations of the European society of cardiology. The physical examination had shown signs of left heart failure in two patients. In the case of coronary heart disease, electrocardiogram is a fundamental examination and is practically part of the clinical examination, an ST segment elevation was found in 52.63% of cases, negative T-waves in 89.47% of cases, a left branch block in 15.78% of cases and right in 5.26% of cases, one ST segment depression in 26.31% of cases and one atrioventricular block in a single patient.

For the transthoracic echocardiography performed at the admission of patients to our department, our results were as follows:

Table-I: LV Dimensions

Parameters	Average
LVDD (mm)	45,20±3,32
LVSD (mm)	32,10±2,43
LVDV (ml)	113,22±20,63
LVSV (ml)	55,32±10,32

Table-II: Systolic Function Parameters

Parameters	Average
LVEF (%)	45,45±13,12
Aortic VTI (cm)	16,31±2,24
Subaortic VTI (cm)	15,21±2, 41

84.21% of our patients had hypokinetic-type segmental kinetics disorders in 73.68% of the cases and akinesia in 26.31%.

Table-III: Diastolic Function Evaluation

Parameters	Average
E (cm/s)	65,25±10,11
A (cm/s)	75,21±10,23
E/A	0,98±0,45
EDT (ms)	153,43±13,80
IRT (ms)	94,35±8,85
E' (cm/s)	9,64±1,89
E/E'	9,05±2
Left atrium (ml/m ²)	27±2,53
Vmax TI (m/s)	2,54± 0.75

A coronary angiogram was performed on our patients either directly at admission as part of an acute coronary event or later in patients with conditions deemed stable. Panoply of coronary involvement was found:

Table-IV: Location of Coronary Lesions

Location	Frequency	Percentage
Left main	3	15,78%
AIV artery	18	94,73%
AIV I	7	36,84%
AIV II	10	52,63%
AIV III	9	47,36%
CX artery	11	57,94%
CX I	8	42,10%
CX II	4	21,05%
CX II	5	26,31%
RC artery	15	86,5 %
RC I	9	47,36%
RC II	6	31,57%
RC III	3	15,78%
Diagonal artery	2	10,52%
Marginal artery	3	15,78%
PIV artery	1	5,26%

Table-V: Lesion Length

Lesion Length	Frequency	Percentage
≤ 10 mm	5	9,43%
10– 20 mm	10	18,86 %
>20 mm	25	57,16%

Compared to the therapeutic component, all patients received a complete revascularization by percutaneous coronary angioplasty. The procedures were successfully carried out in 95% of the cases with exclusive use of active stents. The evolution was perfect for all patients with improved functional signs. This evolution was also evaluated by transthoracic echocardiography three months after complete revascularization.

Table-VI: Correlation between LV dimensions before and after 3 months of angioplasty

	Before PCI	After PCI	p
LVDD (mm)	45,20±3,23	46,46±7,03	0,651
LVSD (mm)	32,10±2,43	33,77±5,10	0,152
LVDV (ml)	113,22±20,63	112,57±20,21	0,643
LVSV (ml)	55,32 ±10,32	51,75±11,17	0,101

For left ventricle systolic function, the ejection fraction increased significantly from 45,45% to 50,42% three months after PCI (p:0,001).

Akinesia kinetic disorders decreased from 26.31% to 15.78%. This decrease was statistically significant (P: 0.002)

Table-VII: Correlation between parameters systolic function before and after 3 months of angioplasty

	Before PCI	After PCI	p	
LVEF (%)	45,45±13,12	50,41±10,86	0,001	
Aortic VTI (cm)	16,31±2,24 (cm)	19,63±2,45 (cm)	0,001	
Subaortic VTI (cm)	15,21±2,24 (cm)	17,21±231 (cm)	0,312	
S'LV (cm/s)	9,55±1,87	9,01±2,35	0,523	
K.	Akinesia	26,31 %	15,89%	0,001
	Hypokinesia	73,68%	57,89%	0,441

Regarding the diastolic function of the left ventricle, there is a marked improvement after complete revascularization.

Table-VIII: Correlation between parameters of diastolic function before and after 3 months of angioplasty

	Before PCI	After PCI	p
E (cm/s)	65,25±10,11	78,21±10,56	0,001
A (cm/s)	75,21±10,23	63,43±10,56	0,021
E/A	0,98±0,45	1,10±0,52	0,011
EDT (ms)	94,35±8,85	93,11±5,21	0,015
IRT (ms)	153,43±13,80	151,61±15,22	0,017
E' (cm/s)	9,64±1,89	10,32±2,46	0,011
E/E'	9,05±2	8,51±3,12	0,031
Left atrium (ml/m2)	2,54±0,75	2,53±0,76	0,54
Vmax TI (m/s)	27±2,53	27,21	0,432

DISCUSSION

Coronary disease is defined by all disorders due to insufficient oxygen supply to the myocardium, due to the development and complications of atherosclerosis in the coronary arteries. Occlusion of the coronary arteries may be more or less complete and more or less brutal demonstrating the dynamic and evolutionary character of this pathology [3]. The resulting lack of oxygen can lead to myocardial lesions of varying severity, from ischemia to myocardial necrosis. Atherosclerosis is a disease affecting the arteries of large and medium caliber and characterized by the appearance of atheroma plaques which correspond to a reversible remodeling of the intima of the arteries of large and medium caliber by segmental accumulation of lipids, complex carbohydrates, blood and blood products, fatty tissues, calcium deposits and other minerals. Among other things, it is responsible for coronary heart disease. At later stage of its evolution, the plaque will rupture. At the coronary level, plate rupture will be responsible for the sudden occurrence of a total or subtotal occlusion of arterial light resulting in the development of acute coronary syndrome. Two-thirds of the plates that break have less than 50% stenosis and 97% of patients have less than 70% arterial light before they break. The plates most sensitive to rupture thus appear as soft, lipid-rich, yellowish-to-angiography, contrasting with the tighter, gray, hard, fibrous and stable plates of patients with chronic angina. The characteristics of these unstable plates, however, should not make us forget that these small lipid-rich plates are likely to be extremely common throughout the arterial tree and that only some of them will rupture. However, plate failure is not the only mechanism that causes plaque complications and acute coronary syndromes. Superficial erosion of the plaque without breaking the fibrous sheath can also be a determining mechanism in the occurrence of arterial thrombosis and acute coronary syndrome [4, 5]. Clinically, these lesions result in different symptoms, from stable angina to acute coronary syndrome. Myocardial suffering can also cause heart rhythm disorders and cause sudden coronary death. In addition,

myocardial lesions can cause heart failure, either acute or chronic. Multi-trunk disease is defined by the presence of a significant 50 % stenosis on at least two major coronary epicardial trunks including the anterior interventricular and its branches and/or the circumflex artery and its branches and/or the right coronary artery and its branches and/or the presence of stenosis of the left main up than 50% isolated or associated with other lesions [2]. Several definitions have been proposed for full revascularization however no consensus is currently known. Anatomically, it is the revascularization of any vessel with a diameter of 1.5mm with a stenosis greater than or equal to 50%. Functionally, it is defined as the treatment of any lesion considered to be functionally significant, based on the results of non-invasive examinations, in particular the study of viability or ischemia in the corresponding territory, or by intra-operative assessment using techniques such as IFR or FFR of the impact of one or more lesions [6]. The prevalence of multitrunk coronary involvement in our series is 56%, this rate remains relatively equal to the different studies consulted. This multitrunk coronary involvement is likely to be two to three times more common in diabetics with generally diffuse and calcified lesions [7-10]. This coronary impairment is almost dominant in the male population in the almost exclusive nature of the studies consulted and this can be explained by cardiovascular risk factors much more frequent compared to the opposite sex with leading consumption of tobacco. The incidence of this disease is usually due to the cumulative effects of different cardiovascular risk factors and comorbidities at a somewhat advanced age. Our average age is 62, which is similar to the various series consulted in particular that of H.DRISSA [7] 60 years old, H. Ben Ahmed *et al.* [1] 60.7 years old, N. Ketata *et al.* [11] 62.4 years old. We can't talk about coronary disease without talking about cardiovascular risk factors. Tobacco is the most important modifiable risk factor for cardiovascular disease. Its harmful role is clearly demonstrated by several studies [12, 13]. Dyslipidemia is also a major risk factor contributing to the acceleration of the evolution of this pathology. Compared to diabetes, the prevalence of diabetic coronary heart disease is very high two to three times that of the non-diabetic population. A linear relationship between increased blood pressure and the development of atherosclerosis has been dismantled in addition to its role as an extrinsic vulnerability factor of this plaque [13]. Menopause leads to increased cardiovascular and coronary risk by loss of hormonal protection, associated with an increase in the prevalence of traditional cardiovascular risk factors, which explains the incidence of disease at an older age in women. At the same time, comorbidities play a major role in the development or otherwise in the treatment of the disease with the presence of kidney failure, anemia, hyperthyroidism, chronic lung disease and neoplasia. Since the advent of coronary angiography in 1945, this examination constitutes the cornerstone of the

exploration of the coronary tree carried out today in a common way with miniaturized tools in digitized technique, it evaluate coronary pathology in all its forms. It will highlight stenosis responsible for myocardial ischemia and assess risk lesions in order to propose a therapeutic approach (medical treatment, angioplasty or surgery). Although this technique is invasive, it has the major advantage of allowing the lesion to be treated at the same time [14]. The COURAGE study on revascularization of multitrunkulars showed a 5% reduction in ischemia associated with a significantly lower rate of myocardial death and infarction [15]. A historical meta-analysis of 89,883 patients clearly demonstrated the clinical benefits of complete revascularization regardless of the definition adopted. Complete revascularization was associated with a significant reduction in mortality (risk ratio [RR]: 0.71, p 0.001), further ischemic thrust (RR: 0.78, p = 0.001) and the need for further revascularizations (RR: 0.74, p 0.001) [16]. It is then reasonable to consider the complete revascularization of the multi trunk as a therapeutic objective to be achieved in the case of chronic coronary syndrome [17]. In acute coronary syndrome with ST segment elevation, about 50% of patients with acute coronary syndrome have significant coronary lesions in addition to the culpable lesion. The strategy of revascularization of non-guilty lesions was the subject of several debates. Several revascularization schemes have been reported. A study comparing complete preventive revascularization by angioplasty of non-criminal lesions versus revascularization of the culpable artery alone showed a significant reduction in subsequent cardiovascular events over an average follow-up of 23 months. Despite the heterogeneity of test designs and target populations, the superiority of complete revascularization, whether in the acute phase or in several stages, has been demonstrated [17]. In acute coronary syndrome without ST segment depression, several observational studies have shown that angioplasty of several vessels is associated with better clinical outcomes compared to angioplasty of the culpable lesion alone in coronary arteries with acute coronary syndrome with no ST-segment depression. Although the determination of the culpable lesion is difficult in acute coronary syndrome without the ST segment offset, full revascularization is indicated if technically feasible. Compared to transthoracic echocardiography after complete revascularization. Our study showed that the diastolic function of patients who received complete revascularization by angioplasty improved within 3 months, which is consistent with the literature. At the same time, one study had aimed at improving diastolic function after complete revascularization but with no significant difference from the incomplete revascularization group [18]. Several studies have shown an improvement in left ventricular function after complete revascularization; this is consistent with the results of our study [19, 20]. Contrary to others demonstrating the lack of benefit with respect to left

ventricular function [21, 22] indicating that at present the benefit is still controversial. Thus, the trial of Andrzej Ochala *et al*. [19] had shown that, despite the recovery of flow during primary angioplasty, the presence of multi-trunk disease was correlated with the absence of a significant improvement in ejection fraction; in this case, the complete revascularization in a single time was associated with a significant improvement in the ejection fraction. The two-step approach was also effective in terms of improving the LVEF, but this improvement was only pronounced after full revascularization. A study published in 2010 by Sharon W.Kirschbaum *et al*. [20] comparing the effect of complete versus incomplete revascularization on left ventricular function after percutaneous angioplasty in multitrunk coronary patients with altered ejection fraction demonstrated significant improvement after revascularization complete (46 12% to 51 13%; p =0.0001), while the ejection fraction did not change in patients after incomplete revascularization (49 11% to 49 10%; p = 0.88) highlighting that the assessment was based on magnetic resonance imaging. The EXPLORE study was the only study to examine the impact of angioplasty in multitrunk patients over time. Analysis showed a significant improvement in LV function after complete revascularization by angioplasty. This information may generate assumptions, but there is not enough information at this time to support recommendations for optimal management of acute coronary syndrome and multi-trunk coronary complex lesion disease; additional testing is required to inform physicians [23].

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