



Encasement of the Left Anterior Descending Coronary Artery: Association with Takotsubo Syndrome, and Diagnostic and Therapeutic Options.

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Abstract

Myocardial bridging is a rare event, which leads to chest pain, arrhythmias and discussable Takotsubo syndrome (cardiomyopathy). We collected 41 patients (33 females, mean age 68.4 years) with all forms of Takotsubo cardiomyopathy in most cases and 6 cases with chest pain and echocardiographic mid-ventricular hypokinesia. Left ventricular angiography revealed apical ballooning in 30 patients, mid-ventricular ballooning in 3 cases, and basal ballooning in one case.

The correct diagnosis of myocardial bridging can be best made by intravascular ultrasound (IVUS) and fractional flow reserve (FFR) with either adenosine or dobutamine injection.

Beyond atherosclerosis, myocardial bridging is a prominent cause of chest pain, although ischemia is difficult to verify.

Keywords: Myocardial bridging; Takotsubo cardiomyopathy; intravascular ultrasound; fractional flow reserve; apical ballooning

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Introduction

Atherosclerotic lesions, but also myocardial bridging or vasospasm, can cause chest pain, myocardial infarction and sudden cardiac death [1].

Myocardial bridging generally presents with systolic impairment when the main vessel proceeds into the myocardium. A special form of myocardial bridging is complete or partial encasement of the vessel characterized by a rigid straightening without systolic lumen reduction described by Migliore et al. [2]. In these cases myocardial bridging can be best diagnosed by computed tomography. By computed tomography encasement can be diagnosed in 76% of cases, by coronary angiography only in 40%.

Meanwhile it is discussed whether Takotsubo syndrome can be caused by encasement of the left anterior descending coronary artery with chest pain, and aborted sudden cardiac death due to recurrent episodes of ventricular fibrillation [3, 4].

Definitely, chest pain can be caused by encasement mainly of the left anterior descending coronary artery, but also of other vessels [5].

Methods

The collective consists of 41 patients (33 females, mean age 68.4 years) with apical ballooning in 30 cases, 3 cases with mid-ventricular ballooning (in one case additional basal ballooning and recurrent ventricular fibrillation), one case with isolated basal ballooning and 6 cases with chest pain, echocardiographic mid-ventricular hypokinesia, but without any ECG changes.

In all cases coronary angiography was performed. In neither case was computed tomography performed.

Results

In all cases coronary angiography ruled out any atherosclerotic lesion of the coronary vessels. Again, in all but one cases a rigid straightening of the mid-portion of the left anterior descending coronary artery suggesting complete encasement was evident.

Systolic lumen reduction of the main vessel could be ruled out in all but one case, but systolic compression of septal (and in two cases diagonal branches) could be seen in all but one case. In a single case systolic lumen reduction was evident in the mid-portion of the circumflex artery suggesting incomplete or partial encasement.

Patients with apical ballooning had a wrap-around phenomenon of the LAD, in cases of atypical mid-ventricular or basal ballooning wrap-around phenomenon of the LAD could be excluded.

A typical example of rigid straightening of the mid-portion of the left anterior descending coronary artery (complete encasement) can be seen in figure 1.

Discussion

Myocardial bridging is a diagnostic dilemma. It is a supposed cause of chest pain, although the evidence of ischemia is hard to demonstrate. Compared to coronary angiography, both intravascular ultrasound (IVUS) and CT-angiography provide morphological aspects of myocardial bridging (complete or partial encasement). However, these modalities are limited in defining the hemodynamic and clinical significance of myocardial bridging. Fractional flow reserve (FFR) after adenosine infusion has been used to assess the hemodynamic significance of myocardial bridging, but FFR after adenosine induced hyperemia underestimates the significance of myocardial bridging. On the other hand, high-dose dobutamine by increasing the contractility of the bridging segment unmasks ischemia [6]. FFR under high-dose dobutamine can be divided into two aspects: mean FFR and diastolic FFR. Only then ischemia prolongs in diastole, the clinical significance of myocardial bridging is confirmed. In these terms, diastolic FFR is more important than mean FFR [7].

Under stress or happiness conditions, myocardial bridging can cause Takotsubo syndrome (or reversible cardiomyopathy). In all but one case included in this study group, a rigid straightening of the mid-portion of the left anterior descending coronary artery could be revealed as a hint for encasement of the LAD. In many cases myocardial edema in Takotsubo syndrome produces reversible myocardial bridging [8].

Only in a few cases, does encasement of the LAD result in systolic lumen reduction [9]. The definition of myocardial bridging by rigid straightening of the mid-portion of the LAD without systolic lumen reduction in coronary angiography is a relevant finding and could be described elsewhere [2].

This study group represents a mixture of Takotsubo cardiomyopathy and chest pain, although the performance of the left ventricle revealed segmental impairment in all but one case. Concealed mid-ventricular ballooning with either inferomedial or anteromedial hypokinesia by angiography or echocardiography has found its place in the literature [10].

One case with recurrent ventricular fibrillation was due to reversible basal and mid-ventricular ballooning after gall bladder removal under complex psychotic medication.

Beyond atherosclerosis, myocardial bridging is a prominent cause of chest pain, although ischemia is difficult to verify.

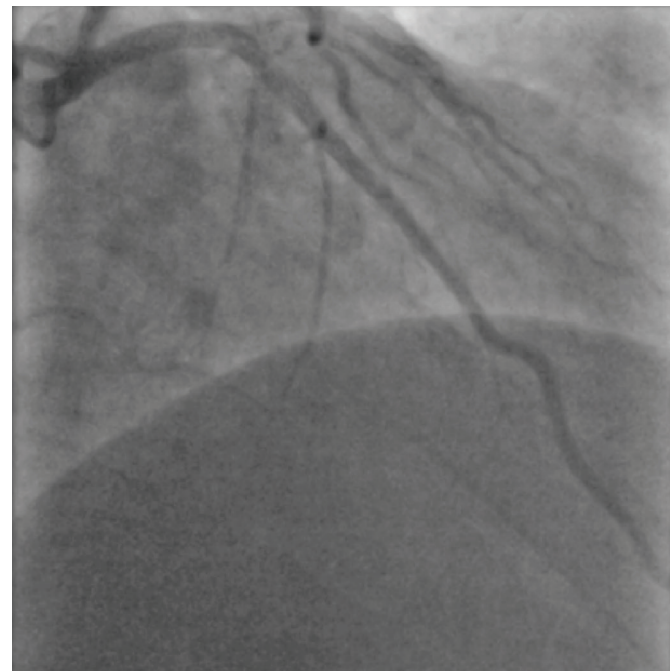


Figure 1
Typical rigid straightening of the mid-portion of the left anterior descending coronary artery.

Limitations

In this study only 41 patients were reported. Myocardial bridging is a rare event, causing chest pain, ventricular arrhythmias and takotsubo cardiomyopathy with either apical ballooning, or mid-ventricular, or basal ballooning.

Conclusions

In many cases myocardial bridging predominantly of the left anterior descending coronary artery is the reason for takotsubo cardiomyopathy with transient dysfunction of the left ventricle.

Declarations of Interest

The author declares no conflicts of interest.

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The author agrees to abide by the requirements of the „Statement of publishing ethics of the International Cardiovascular Forum Journal [11].

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