

RESEARCH ARTICLE

Hypoplastic Left Anterior Descending Coronary: Early Assessment by Transthoracic Coronary Ultrasound

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Abstract

The presence of a hypoplastic coronary is a relatively rare condition and it is seldom reported. Hypoplastic coronary can lead to severe ischemic consequences and appears to be poorly sensitive to invasive treatment. The case of a patient evaluated by transthoracic echocardiographic ultrasound (TTE-US) of the coronary tree is here reported. A poor visualization of the left anterior descending (LAD) coronary, generally well visible by this technique was noted. A few months later the patient underwent a myocardial infarction (MI) in the LAD territory. The coronary angiogram noted a hypoplastic LAD, poorly expanded by the stent. This finding was confirmed by repeated US,

The potential implication of this case report is that a more frequent use of a coronary TTE-US evaluation may at times indicate the presence of a poorly visible major coronary. The presence of a hypoplastic coronary artery should be considered.

Keywords: hypoplastic coronary, transthoracic echocardiographic ultrasound evaluation, NSTEMI (Non ST elevation myocardial infarction), MI in hypoplastic coronary territory

Transthoracic echocardiographic evaluation (TTE) of the coronaries by ultrasound (US) is slowly gaining interest, because of simplicity, low cost and repeatability¹. There are, however, limits to its application and in some cases unexpected findings can occur. In a patient examined in our Institution, with an apparently normal coronary pattern, the left anterior descending (LAD) coronary, generally well visualized by TTE-US, was found to be poorly visible. This finding was

later followed by an anterior myocardial infarction (MI) in the LAD territory. This led to the angiographic finding of a hypoplastic LAD, later confirmed by repeat TTE-US.

This clinical case underlines the potential importance of the use of TTE-US for coronary diagnostics in clinical practice, as an indication for further invasive procedures or, in some cases, per se as a direct diagnostic tool.

Case presentation

A 60-year old male, in generally good clinical conditions, non smoker, carrier of Gilbert syndrome, with modest hypercholesterolemia, had been followed by this Institution for over 10 years. Basal lipid levels were: total cholesterol 263, triglycerides 155, HDL 55 and Lp(a) 6 mg/dl. The patient was totally asymptomatic and was followed on a low lipid diet with phytosterols (1.6 g/day) keeping his low density lipoprotein (LDL)-cholesterol around 100-120 mg/dl. The patient had no known allergies; family history was negative for CV events and positive for dyslipidemia in his mother. He had recurrent prostatitis and had a prior episode of nephro-lithiasis, with elimination of a kidney stone.

In 2015, an evaluation of the carotid intima media thickness (IMT) showed an IMTmean of 1.07 mm (60-70^o percentile) and an IMTmax of 1.5mm (40^o percentile). These are normal values in our institution as well in the large European IMPROVE Study². During this carotid evaluation, he underwent a non invasive assessment of the coronaries by TTE-US³. Coronary evaluation noted a normal right coronary artery (RCA) for the first 4 cm of length (Fig. 1) and, similarly, a wide caliber circumflex (Cx) in the mid area bordering the mitral valve (Fig.2). A significant narrowing of the left anterior descending (LAD) after bifurcation of the left main coronary (LMCA) about 3.5 cm after emergence from the aorta (Fig. 3) was clearly observed in this first evaluation. The patient was warned of this finding but no further procedures were planned.

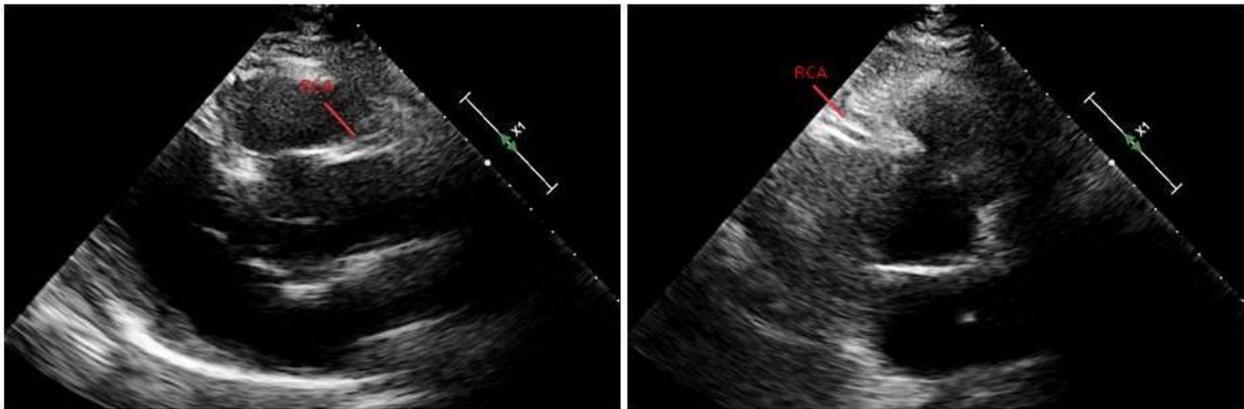


Figure 1. Ultrasound (US) evaluation of the right coronary artery (RCA) in the patient. The RCA, followed for proximally 4 cm appears to be of a normal caliber and with normal wall thickness.

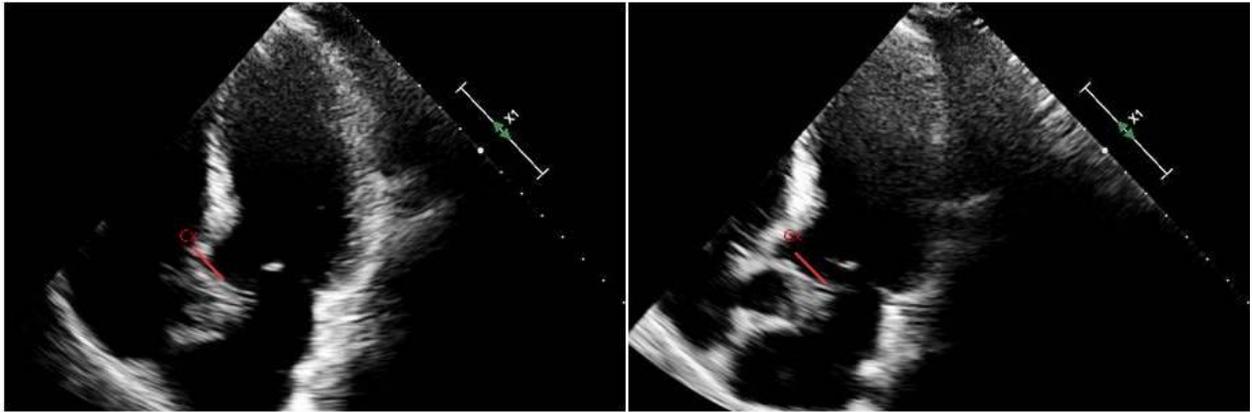


Figure 2. US evaluation of the mid portion of the Cx. The artery appears of a normal, possibly elevated caliber by this technology.

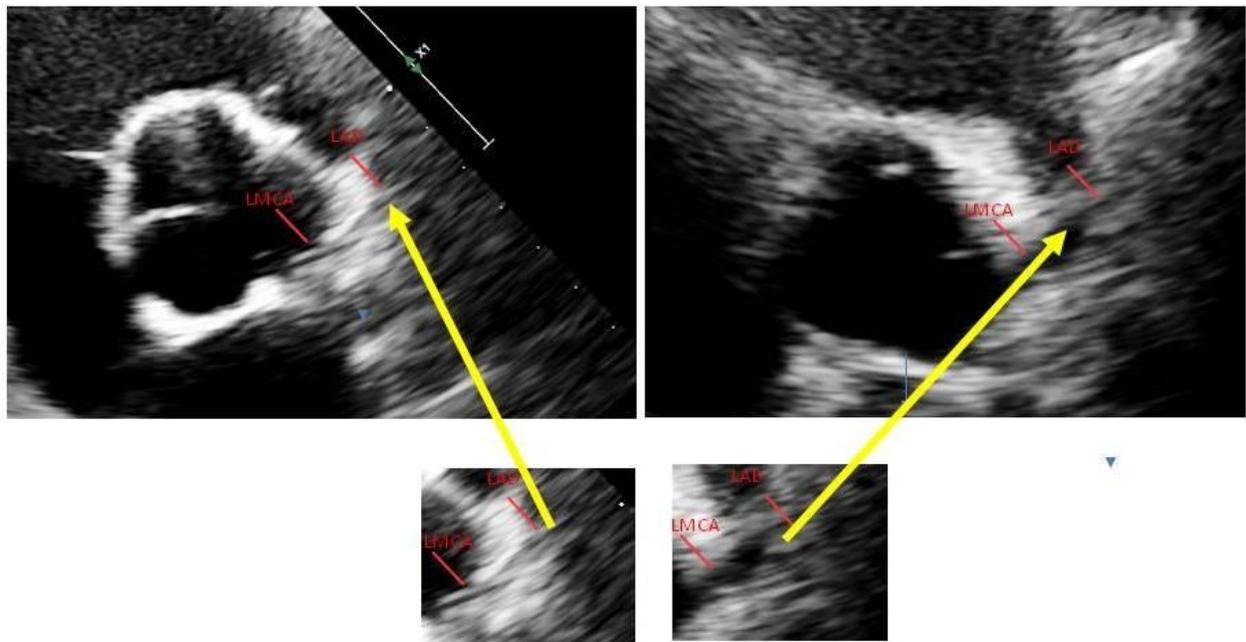


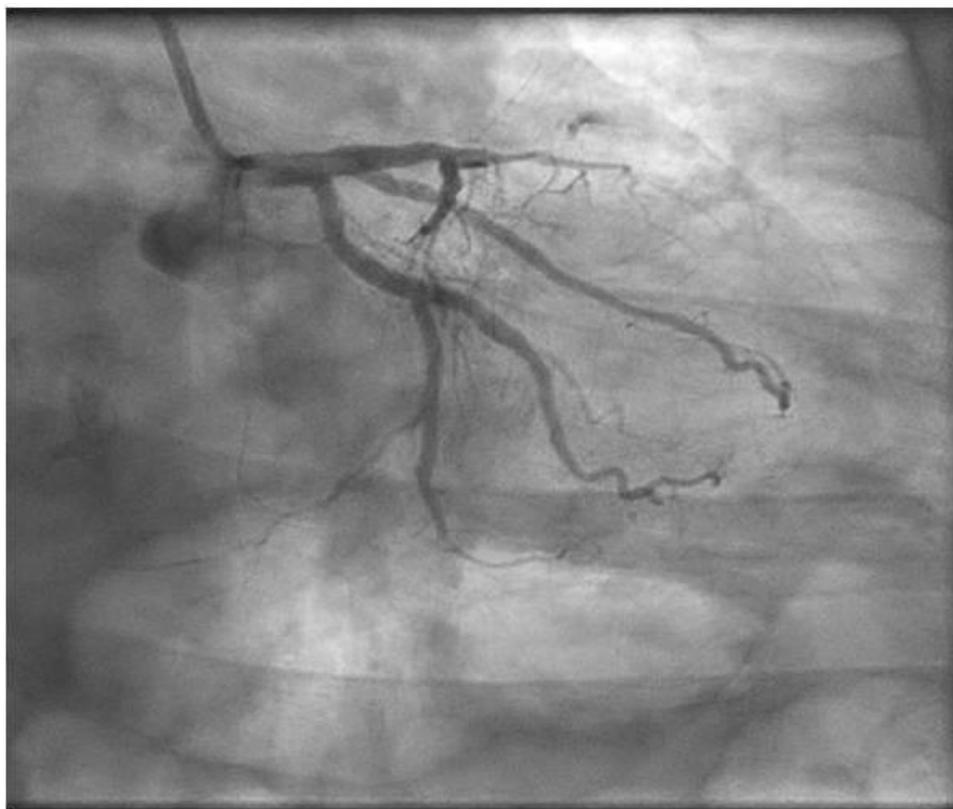
Figure 3. US evaluation of the left main coronary artery (LMCA) before and after the bifurcation to left anterior descending (LAD) and circumflex (CX). The LMCA appears to be of a normal caliber but contrary to expectations, the LAD is barely visible by US.

In September 2016, the patient reported acute chest pain and was treated for a Non-STEMI (NSTEMI) with moderately elevated troponin levels. Upon coronary angiography, a large dominant RCA was noted (Fig. 4) and a significant hypoplasia of the LAD, responsible for the ischemic event (Fig. 5A).

A stent was positioned at the initial part of the narrowing but lumen enlargement was minimal (Fig. 5B). He had an uneventful dismissal on a combination of bisoprolol 1.25 mg/d, P_Y₁₂ antagonist (prasugrel 10 mg/d) and atorvastatin 20 mg/d.



Figure 4. Angiogram of the RCA of the patient. The angiogram appears to be normal and consistent with a dominant RCA.



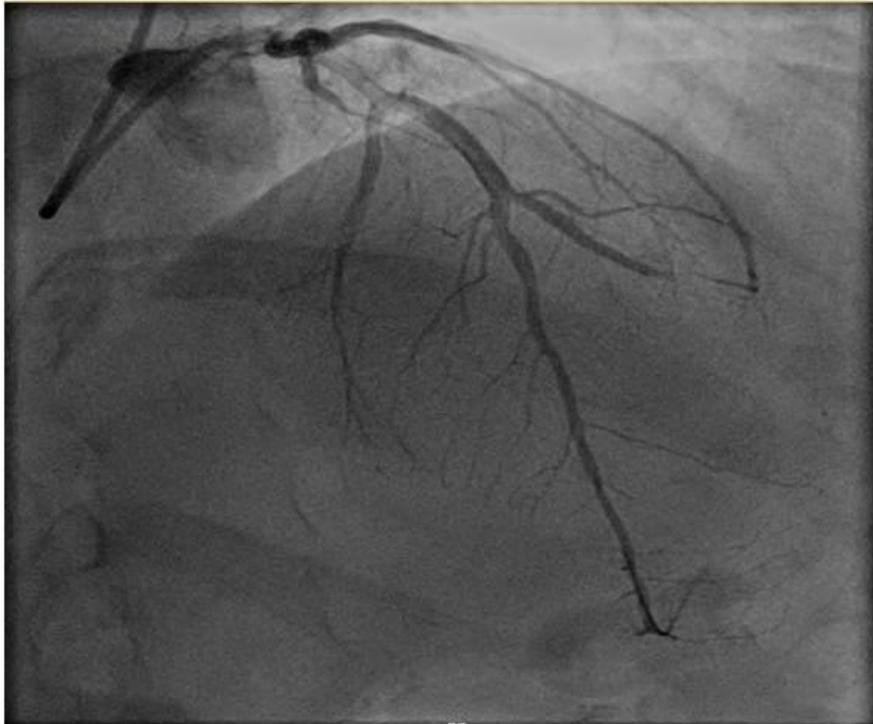


Figure 5. A- The post non-STEMI angiogram shows a definitely thin, apparently hypoplastic, left anterior descending (LAD).

B- The post-stent angiogram shows a very modest increase in diameter of the LAD, confirming a hypoplastic condition.

The LAD was reevaluated by TTE-US, with a similar technology. This confirmed the hypoplasia of the LAD even after stent placement. For the viewer's information, we report on the right side of Fig. 3 the echogram of a normal caliber LAD by TTE-US.

Discussion and conclusions

The presented patient had normal carotid IMT, well controlled BP and lipid levels, but underwent an unexpected coronary event. The patient had a dominant RCA and normal Cx and a hypoplastic LAD that was poorly visible with TTE-US. After the MI in the LAD territory the LAD did not dilate as expected after stent positioning.

This rare type of coronary anomaly can

cause angina-like symptoms and outright MI⁴⁻⁶.

The described patient, previously asymptomatic, presented with typical angina followed by a NSTEMI. In the earlier TTE-US in this patient the presence of a reduced size LAD was hypothesized. Re-evaluation by TTE-US after NSTEMI and stent placement confirmed a definitely low caliber LAD, with a normal lumen LMCA. The normal LMCA was followed by narrowing of the LAD apparently not modified by the stent.

Coronary US by TTE is, at present, still a growing technology and does not constantly allow full monitoring of the total length of the major coronaries³. This technique, while offering maximal benefit in the evaluation of the left main coronary wall thickness⁷, can

also detect coronary malformations as well as coronary lumen changes occurring in the more proximal parts of the coronaries³. The interesting aspect of the presented case was, in fact, the observation of the unexpected narrowing of the LAD lumen examined by TTE-US. This technique is used today only in a few clinical institution but in a growing number it is being evaluated particularly for use in examination of coronary flow reserve (CFR). According to many authors, in fact the determination of CFR may offer a non-invasive low cost evaluation, providing direct information on coronary function. Advances in US technology should probably allow in the non so distant future a full-length evaluation of the major coronaries.

The present case reports a NSTEMI event in a patient with a hypoplastic LAD, earlier suspected after US evaluation by TTE. The observation of a lack of visibility of the LAD brought the suspicion that some anatomical problems might be present. However, the present day inadequate experience in the monitoring of LAD by TTE-US did not encourage further evaluation, possibly by an invasive technology.

A growing use of TTE-US will probably allow to see more cases where a suspicion of anatomical alterations of a major coronary may lead to an earlier evaluation by angiography, potentially preventing coronary events, as later observed in the present case. TTE-US is also an effective approach for the determination of coronary flow velocity reserve for the functional assessment of coronary artery disease⁸. The two techniques, i.e. coronary flow velocity reserve and fractional flow reserve can both be approached by TTE-US for the assessment of coronary artery disease. The very recently published ORBITA Study⁹ further indicates that an early detection of coronary narrowing in one or more coronaries by angiography may lead to

different clinical decisions. In ORBITA, two invasive procedures were needed. With the TTE-US system instead, a significant stenosis in a single coronary can be assessed with confidence, thus allowing the patient to proceed to the following step, i.e. the invasive procedure, leading or not to stent placement.

The presently reported case, i.e. a rare coronary syndrome characterized by the presence of a hypoplastic major coronary, provides therefore an important contribution on the present role of non invasive coronary evaluation. The possibility that unexpected findings from TTE-US may lead to procedures preventing further complications from the syndrome, makes it expectable that other similar conditions will be reported by users of this novel technology. Evolution in the quality of imaging will allow more cases to just follow this simple approach to coronary diagnostics.

Declaration:

The patient signed an informed consent form allowing publication of his clinical findings.

Data and materials are fully available if requested.

The authors declare no competing interest. No specific funding was provided for this investigation. The authors equally contributed to the publication.

List of abbreviations:

US: ultrasound

TTE: Transthoracic Echocardiography

RCA: Right Coronary Artery

LAD: Left Anterior Descending

LM: Left Main

Cx: circumflex

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