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Case Report

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Intravascular ultrasound application in the evaluation of left main coronary artery lesions

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ABSTRACT

Although atherosclerotic left main coronary artery stenosis (LMCA) has a low rate in the coronary angiography series, they have significant cardiovascular mortality and morbidity rates because their disease affects a significant proportion of the myocardium. Therefore, in severe cases (≥50% stenosis of the LMCA), coronary artery bypass grafting is the revascularization of choice. However, assessing LMCA disease severity involves anatomical and technical challenges. Coronary intravascular ultrasound may help to overcome these difficulties. In this article, we report a 73-year-old case of LMCA disease that was considered to be severe by visual assessment of coronary angiography, and surgical intervention was abandoned because of a minimal lumen area of more than 6 mm2 when IVUS was performed.

Keywords: Left main coronary artery, intravascular ultrasound, coronary artery disease

INTRODUCTION

Atherosclerotic left main coronary artery (LMCA) stenosis account for approximately 4% of all coronary angiograms.[1] The significance of LMCA disease is that almost 70% of the entire myocardium is at risk and is associated with a significantly higher risk of cardiovascular morbidity and mortality than disease of other coronary artery branches.[2] Current clinical practice guidelines recommend revascularization in patients with ≥50% stenosis of the LMCA.[3] Given the significant mortality and morbidity advantage, revascularization has traditionally been considered the gold standard for CABG.[4] Angiographical evaluation of the LMCA can be challenging. Some anatomic and congenital variations and some difficulties of the standard coronary angiography technique make this evaluation even more challenging.[5] In this article, we report a case in which the LMCA was judged to be non-critical by coronary intravascular ultrasound (IVUS) reassessment, although it appeared serious on coronary angiography.

CASE

A 73-year-old male patient was admitted to the cardiology outpatient clinic of another hospital with complaints of chest pain and shortness of breath and underwent coronary angiography. After evaluation, a coronary artery bypass grafting (CABG) operation was recommended, and the patient was referred to cardiovascular surgery. However, the patient refused to undergo surgery and applied to our hospital's cardiology outpatient clinic for re-evaluation. When the patient's coronary angiography CD was re-evaluated, LMCA stenosis was evaluated as suspicious in terms of severity, and it was decided to perform IVUS.

He had known coronary artery disease, hypertension, and diabetes mellitus, and continued to smoke. On examination, the general condition was good, and the cardiovascular system examination revealed S1, S2, with no additional sounds or murmurs. Respiratory sounds were normal, blood pressure was 135/92, and pulse rate was 88 beats/minute. Electrocardiography showed a normal sinus rhythm, and no evidence of ischemia was observed (**Figure 1**). Laboratory findings were normal, and troponin was not elevated (**Table**).

The patient was taken to the angiography laboratory for IVUS, and the procedure was performed using the transfemoral approach technique. A 7F diagnostic catheter was inserted into the LMCA. Visual assessment of the control coronary angiography revealed 60-70% restenosis of the LMCA, 70% in-stent restenosis after LAD D1, CX with diffuse disease, and RCA with plaque (**Figures 2, 3, and 4**). To evaluate the LMCA, a 0.14 mm guidewire was sent into the LAD lumen, and an IVUS catheter was advanced. The IVUS catheter was brought to the coaxial line, and LMCA images were obtained. Images were obtained from the distal, mid, and osteal sections of the LMCA, and measurements were made. The diameters of the LMCA were measured as distal 12.71 mm^2, mid 15.44 mm^2, and osteal 15.44 mm^2 (**Figures 5, 6, and 7**). The CABG operation was abandoned, and percutaneous transluminal coronary angioplasty (PTCA) was successfully performed on the lesion after LAD D1, and the patient was discharged from the cardiology service after adjusting his medical treatment.

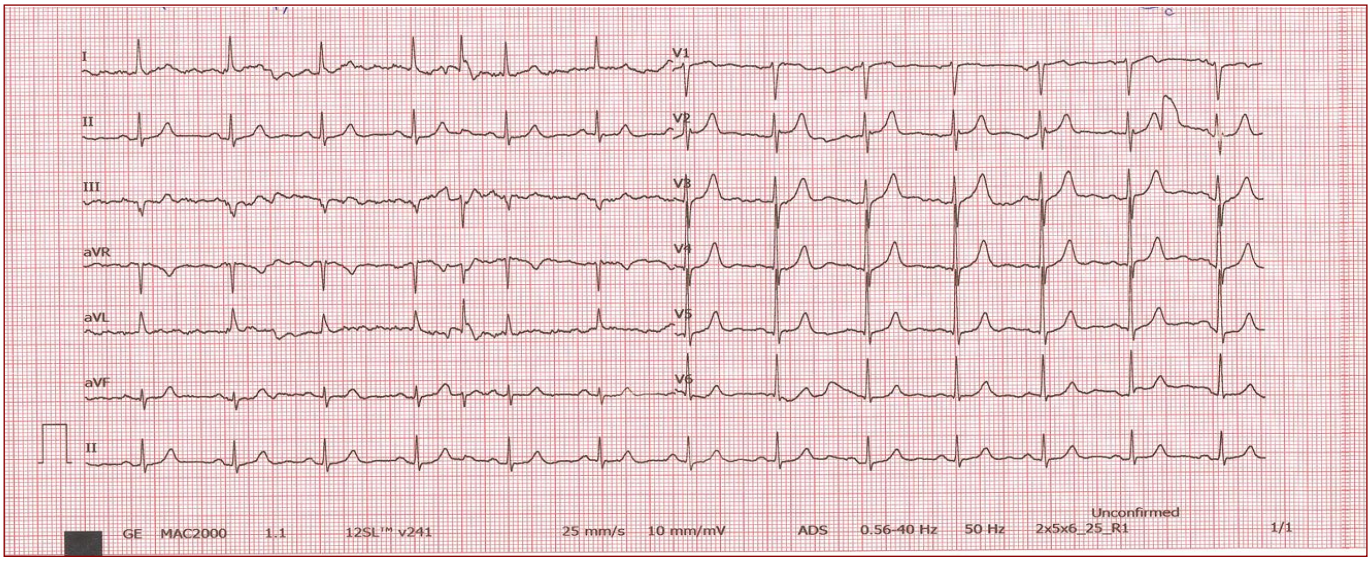

Figure 1. Initial electrocardiographic image of the patient on admission to the cardiology service

Table. Laboratory findings of LMCA case	
Glucose (mg/dl)	132 (70-110)
Creatinine (mg/dl)	0.9 (0.8-1)
AST (U/L)	21 (0-40)
ALT (U/L)	25(0-41)
Total cholesterol (mg/dl)	204 (0-200)
High density lipoprotein cholesterol (mg/dl)	42 (30-60)
Low density lipoprotein cholesterol (mg/dl)	142 (0-130)
Triglyceride (mg/dl)	112 (0-150)
Hemoglobin (mg/dL)	14.3 (13-17)
Platelets (10^3/ µL)	233 (150-450)
WBC (10^3/ µL) Troponin (µg/l)	8.1 (4.5-10) 13 (0-14)

Figure 3. Angiographic image of the LMCA from the left-caudal angle

Figure 2. Angiographic image of the LMCA from the right-cranial angle

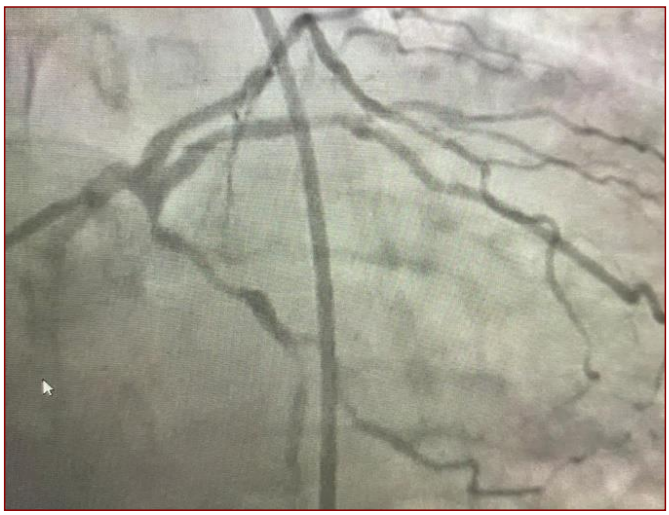

Figure 4. Angiographic image of the LMCA from the right-caudal angle

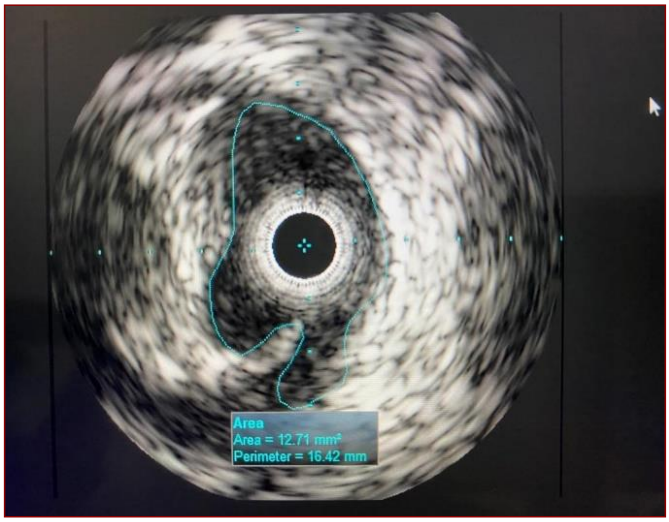

Figure 5. IVUS appearance and diameter measurement of the distal LMCA

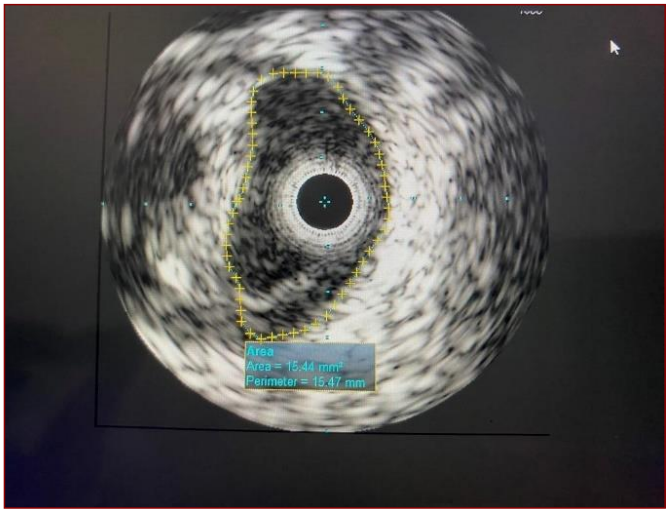

Figure 6. IVUS appearance and diameter measurement of the mid LMCA

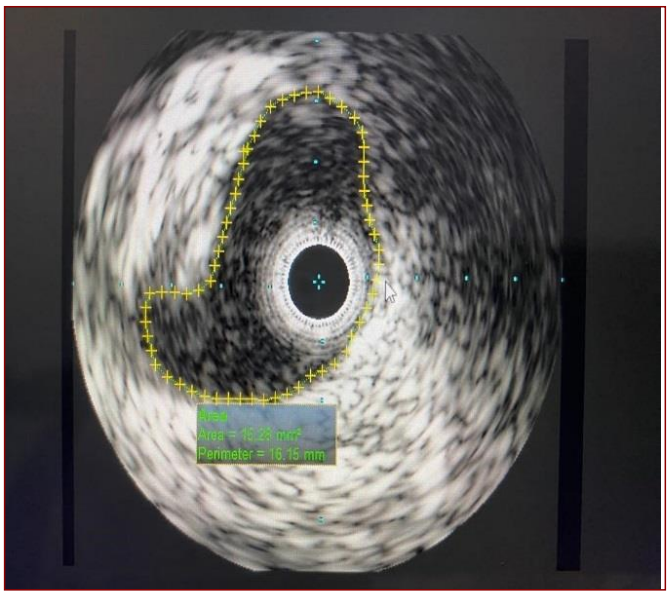

Figure 7. IVUS visualization and diameter measurement of the proximal LMCA

DISCUSSION

This article emphasizes the importance of visual assessment and re-evaluation with an imaging modality, such as IVUS in patients with LMCA, before making the decision to perform CABG.

Standard coronary angiography has been and continues to be indispensable in the evaluation of the coronary tree, including the LMCA. Until recently, LMCA interventions with PTCA were recommended in isolated cases, such as patients who were hemodynamically unstable and/or at high risk for CABG operations.4 Recent data have shown that, in some cases, PTCA may be as safe as CABG for LMCA interventions.[6-8] In particular, it showed that CABG and PTCA had similar outcomes at 1 and 5 years in patients with low or intermediate SYNTAX scores.[9]

Angiographic evaluation of the LMCA can be challenging. LMCA disease is particularly difficult to accurately assess on angiography, as the arterial segment is usually short, calcified, and often has disease involving the bifurcation. Not surprisingly, the significance of angiographically assessed stenosis at this particular location is observer-dependent, and reproducibility of results is low even among experienced clinicians.[10] Given the critical importance of the LMCA for coronary circulation and thus its high prognostic value, accurate lesion assessment is crucial in guiding clinical management.

IVUS was first used to evaluate LMCA lesions in the 1990s.[11] It provides precise and detailed information on atherosclerotic burden, plaque extension and plaque morphology from the aorto-ostial junction to the distal segment and ostia of both the left anterior descending and left circumflex arteries. This information, together with other clinical data, can provide guidance on the need for revascularization or deferral based on a minimal lumen area. IVUS may also be a useful tool to plan PCI strategy and optimize outcomes in terms of stent size, lesion extent, stent apposition, dilation, and detection of edge dissection.[5]

Several studies have proposed a wide range of MLA cut-off values (between 4.5 and 7.5 mm^2) to guide medical therapy versus revascularization, especially in LMCA lesions, based on the ability to significantly correlate with an FFR <0.8. The MLA cut-off of 6 mm^2 was frequently used as the standard for deferring revascularization, as it was validated in the prospective multicenter (LITRO) study.[5] The studies emphasize that an IVUS-defined MLA cutoff of >6 mm^2 appears to be a safe deferral threshold for revascularization in Western and Asian populations. A meta-analysis of 10 non-IVUS studies found that IVUS-guided PCI to the LMCA significantly reduced all-cause mortality by 40% and cardiac death by 53%, as well as the risk of stent thrombosis and target organ revascularization.[12]

CONCLUSION

IVUS is helpful in assessing the severity of the LMCA lesion, overcoming many limitations of angiography in this anatomic segment. It should not be overlooked that patients with LMCA stenosis should be evaluated with IVUS before deciding on CABG.

ETHICAL DECLARATIONS

Informed Consent: All patients signed and free and informed consent form.

Referee Evaluation Process: Externally peer-reviewed.

Conflict of Interest Statement: The authors have no conflicts of interest to declare.

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Author Contributions: All of the authors declare that they have all participated in the design, execution, and analysis of the paper, and that they have approved the final version.

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