May Preoperative Coronary Angiography Images Suggest About the Intramyocardial Course of Left Anterior Descending Coronary Artery?

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Abstract

Objective: The aim of this study is to define the correlation between intramyocardial left anterior descending artery (IMLAD) and coronary artery angiography (CAG); our clinical intraoperative experiences. Material and Methods: Between January 2014 and May 2019, 196 patients underwent coronary artery bypass grafting (CABG) surgery in Bozok University Medicine Faculty Hospital. The correlation between the typical "wide-U" image of left anterior descending artery (LAD) depression(Cicekcioglu sign) on CAG and our intraoperative surgical observations of the patients were studied. Results: Of the 196 patients, 5 were excluded due to the total occlusion of proximal LAD. 30 had a typical "wide-U" image(Cicekcioglu sign) on CAG and 22 were observed to have an IMLAD. Of the 25 patients being observed to have IMLAD intraoperatively, 3 had a normal preoperative CAG imaging. The prevalence of the IMLAD was 13%. Sensitivity of CAG was measured as 88% and specificity of CAG was 95.1%. Discussion: In CAG, in case of LAD composing a "wide-U" imaging(Cicekcioglu sign) the image of LAD course is often observed to have a correlation with the intraoperative detection of IMLAD.

Introduction

Main coronary arteries show a behavior of proceeding subepicardial on the surface of the heart and get into the myocardium almost at the termination part.[1,2] However, in some cases it may become possible to observe the coronary arteries proceeding intramyocardially even in proximal and mid parts or all the course.[3,4]

Intramyocardial coronary arteries have always been a challenging situation for the cardiac surgeons during coronary artery bypass grafting (CABG) surgery due to the difficulties of targeting distal anastomosis area leading to inadequate coronary revascularization and intraoperative complications such as extended bypass time, a prolonged ischemic interval, ventricular and coronary arterial injuries resulting with intraoperative bleeding. [1,5-7]

Coronary artery angiography (CAG) is the gold-standard diagnosing technique for coronary artery diseases (CAD). [1,3-5] Sometimes typical images of the coronary arteries would suggest a typical anatomic variation. Thus, a "wide-U" image of left anterior descending artery (LAD) especially in right anterior oblique position would refer an intramyocardial location.

In this research, we aimed to define the correlation between the typical image of LAD in CAG and intraoperative observation of LAD course. In the literature, there are many samples of researches made on intramyocardial course of LAD and possible complications following surgery. However, our research is the first to study the sensitivity and specificity of CAG.

Material and Methods

Study design and patient population: This retrospective cohort research was studied in Bozok University Medicine Faculty Hospital Cardiovascular Surgery Department and approved by the Ethics Committee of Bozok University Medicine Faculty Hospital (Yozgat, Turkey)(2017-KAEK-189_2020.01.08_17). This study complies with the standards defined by the Declaration of Helsinki. Between January 2014 and May 2019, 196 patients had undergone CABG in Bozok University Medicine Faculty Hospital. Of the 196 patients, five were excluded from the study due to the total occlusion of proximal LAD. All the cases were reported by the single surgeon who had done the CABGs. The intramyocardial LAD (IMLAD) was identified by not being visualized on the surface of the heart in any part of its entire course. Each CAG images and reports of the patients contributing the study were analyzed prospectively by consulting with Cardiology Department.

The main limitation of our research is the inadequate numbers of cases in terms of statistical analysis. Therefore, the patient enrollment process continues and a yearly report of results and statistics is planned at the end of each 12 months.

Statistical Analysis

All data were entered in SPSS software (Statistical Package for Social Sciences for Windows, version 16.0, Chicago, IL, USA) and analyzed. Continuous variables were expressed as Mean±SD or medians (25^{th} and 75th percentiles) according to their distributions and qualitative data were presented as numbers or percentages. The prevalence, sensitivity and specificity of CAG were calculated.

Results

Of the 191 patients, 106 (55.4%) were male and 75 (44.6%) were female and the average age was 66±5.8 (Table 1). Of the 30 patients having IMLAD image on CAG, 8 were observed to have an epicardial LAD and 22 had an intramyocardial course. Of the 25 patients being observed to have IMLAD intraoperatively, 3 had a normal preoperative CAG imaging. (Figure 1) In CAG group, of the 30 patients, 20 (66.7%) were male and 10 (33.3%) were female and average age was 64±6.2. In CABG group, of the 25 patients, 15 (60%) were male and 10 (40%) were female, and the average age was 63±4.9.

The prevalence of the intramyocardial LAD in patients undergoing CABG was 13%. Sensitivity of CAG was measured as 88% and specificity of CAG was 95.1%.

Of the 25 IMLAD cases, 20 (80%) had a superficial course and five (20%) had a deeper course through the interventricular septum. In 20 cases, including the two deeply located IMLAD, LAD was grafted distally where it became visible. In five cases, LAD was not visible even in distal part. Great cardiac vein was used as a leading mark in order to visualize IMLAD and LAD was grafted within the myocardium. No intra/postoperative complication was observed in any of the IMLAD cases.

Discussion

Intramyocardial course of a coronary artery is an inborn anomaly and defined as the intramural location of the artery through the myocardium. [8,9] According to pathological serious the prevalence of intramyocardial course ranges from 5% to 86% [10,11] and from 0.5% to 33% in angiographic series [13-14]. E A Vanker et al, observed IMLAD in 293 patients undergoing CABG out of 1349 and reported the prevalence of IMLAD as 21.7%. [1] In our study, the prevalence of the IMLAD in patients undergoing CABG was 13%.

Thanks to the advantages of revealing the properties of coronary artery obstructive lesions, conventional CAG remains the gold standard imaging procedure for the diagnoses of coronary artery diseases.[15,16] In some of the CAG procedures, LAD is seen diving into the myocardium at an acute angle and coming back to the epicardial layer following a variable length of course composing a "wide-U" imaging(Cicekcioglu sign), which is seen more clearly on the right anterior oblique position. This LAD depression sign was observed to have a correlation with the intraoperative detection of IMLAD.

In case of an IMLAD as a target artery to be bypassed, there may be compelling situations for the surgeon

in terms of distal anastomosing process. There are several options for locating IMLAD during surgery. One is "Blind dissection" which is applied by dissecting myocardium in the epicardial region of the anterior interventricular groove. This technique may cause a severe damage to the subepicardial myocardium resulting with the perforation of the ventricles. [17-19] Another solution is using the great cardiac vein, which usually has a course in the epicardial fat and stays more superficially than the artery, as a leading point. Using a coronary probe, which is inserted to the artery from the distal visible part, is another technique. However, the risk of perforating the coronary artery may cause serious intraoperative morbidities. [20] Performing doppler ultrasound with a color doppler microprobe, intraoperative fluorescence angiography and cineangiography are other less invasive but respectively more expensive techniques for locating IMLAD. [21-24]

Conclusion:

The anterior cardiac wall infarction is usually a result of the atherosclerosis of LAD, which has the highest ratio of intramuscular course in comparison to remaining coronary arteries. LAD is the most common affected coronary artery,and mostly the left internal mammary artery (LIMA) is preferred to graft it. In case of predicting and locating IMLAD preoperatively, it would be able to avoid many intraoperative management complications. Therefore, we planned to investigate whether CAG could be used as a predictive test for IMLAD, and a sensitivity score of 88 % was encouraging in terms of predicting IMLAD before surgery.

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Figure 1. LAD depression and "wide-U" (Cicekcioglu sign) (arrow) [a. Right caudal b. Right cranial oblique c. Right cranial oblique d. Anterior-posterior cranial]

Table 1. Demographic data of the participants

	All Patients	CAG Group	CABG Group	P
Age	66±5.8	64±6.2	63±4.9	>0,05
Gender Male Female	106 70	17 10	13 9	>0,05 >0,05

Note to the Editor: The current study has been presented in 15th Congress of Turkish Society of Cardiovascular Surgery, 26-29 October 2018 Antalya/TURKEY and published in the Congress Abstract Book

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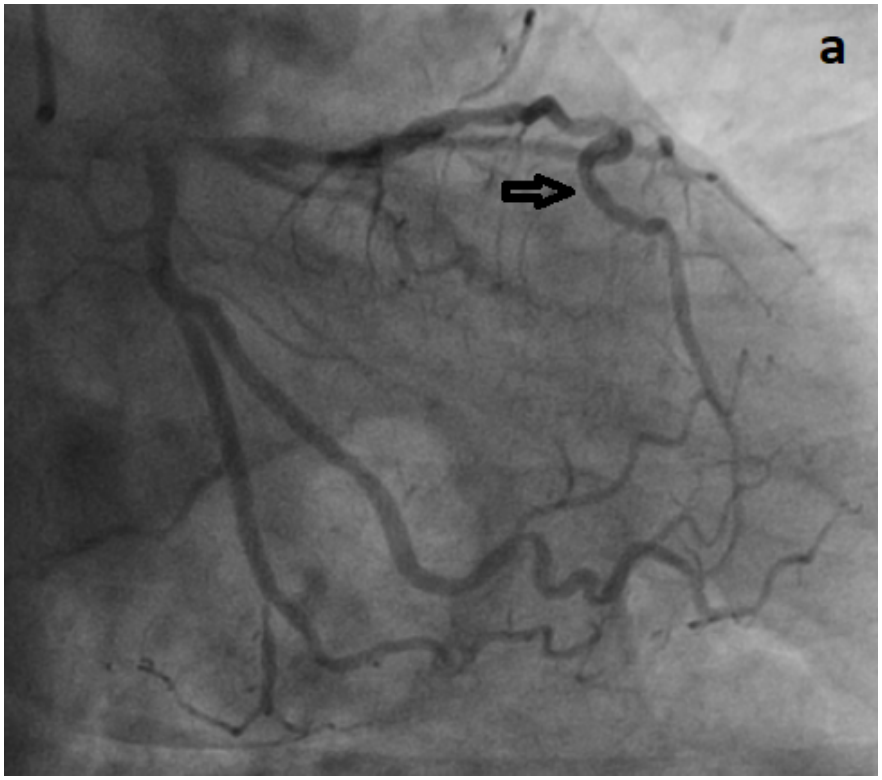
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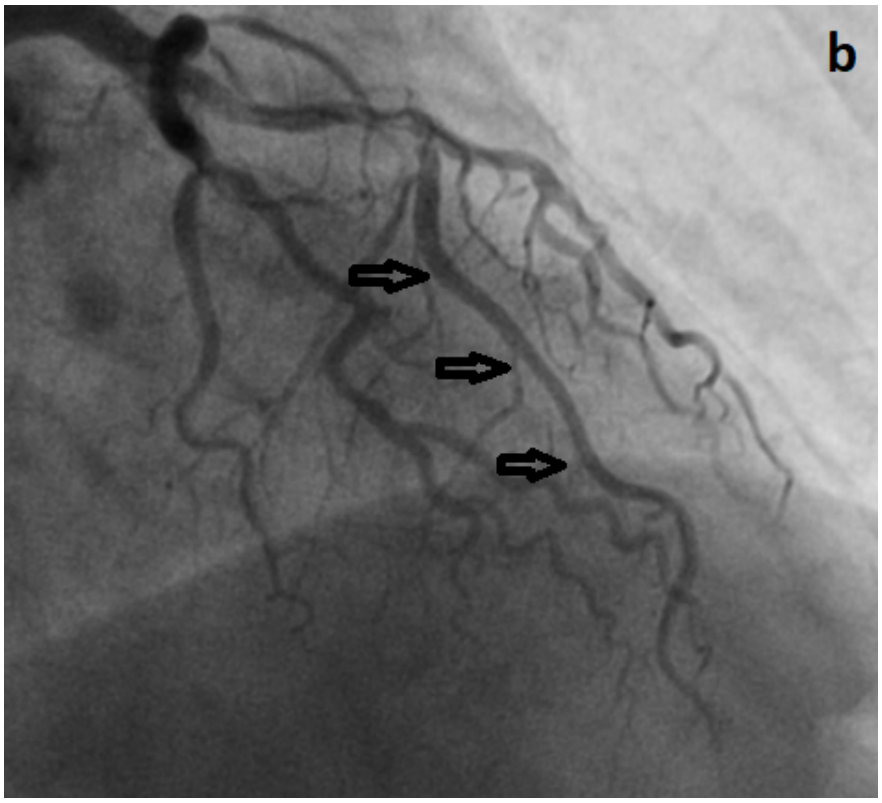
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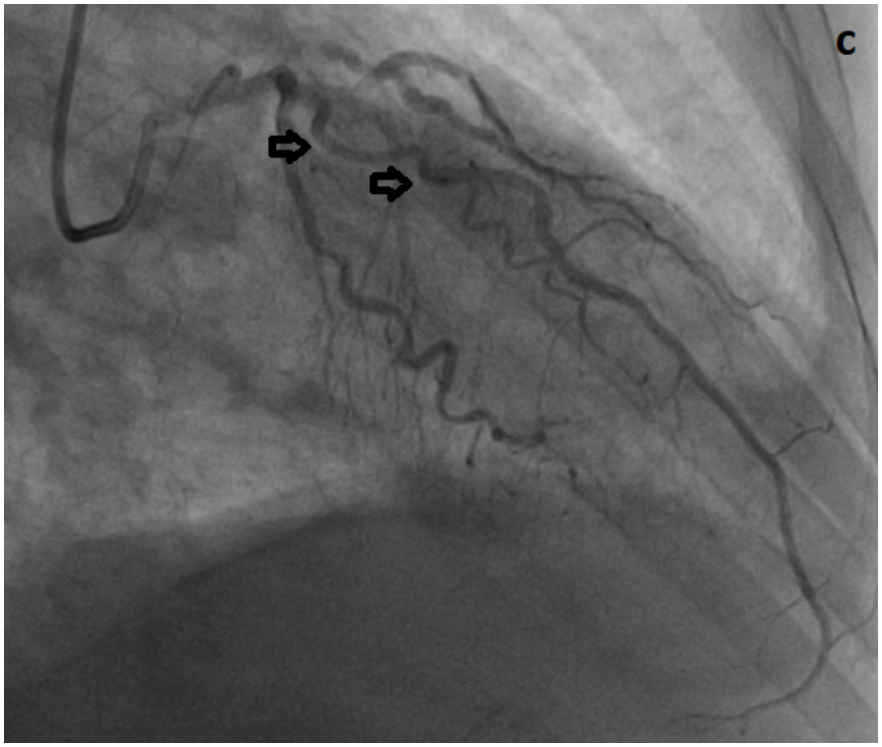
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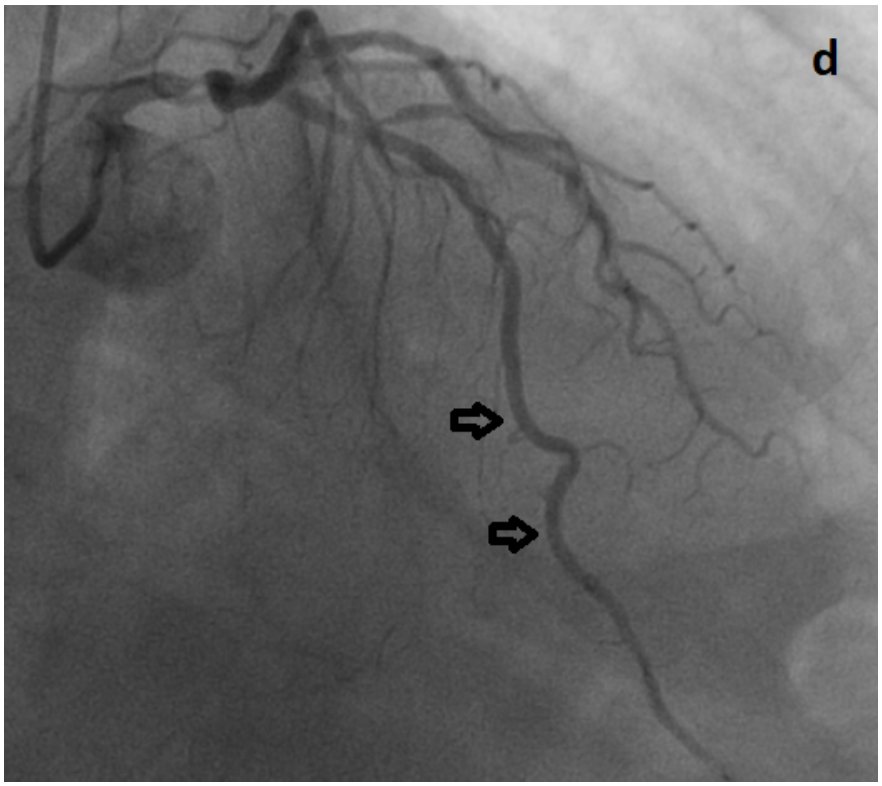
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