

# Hyper-dominant Left Anterior Descending Artery in the coronary circulation as a rare coronary anomaly.

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## Abstract

Hyper-dominant left anterior descending artery is rarely seen in the coronary distribution. Its involvement in ACS can often be detrimental as it supplies most of the anterior and inferior part of the Right and Left ventricles in compared to other variants of LAD artery. It is required to be recognized earlier and management strategies should be ascertained. Our report here describes such a case of anomalous coronary artery which is less commonly encountered during Coronary Angiography. This was case of a 60 year old hypertensive male who presented with atypical chest pain had normal ECG, echocardiography and cardiac biomarkers but TMT was positive, subsequent Coronary angiographic evaluation came up with LAD artery which was going beyond apex in the posterior interventricular groove up to Crux forming PDA with 20 to 30% stenosis in proximal to distal part. Such a large LAD running into the interventricular groove forming PDA is known as “Hyper-dominant” LAD artery. The Right Coronary artery was non-dominant. Fortunately, there was no significant coronary artery disease to explain the cause of his chest pain, but the artery had unusual distribution provided that it has sole territorial supply to larger part of the myocardium which can worsen the clinical status if coronary artery disease progresses. He was kept under medical management and was doing good. The “Take away” lesson is that there are very few subjects with Hyper-dominant LAD artery till date and most other cases with this anatomy had presented with myocardial infarction and thus such anatomical variant of LAD artery ought to be matter of concern and further research in the field of cardiology.

**Keywords:** Acute coronary syndrome (ACS), Hyper-dominant Left anterior descending artery, Posterior descending artery.

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## Introduction

Coronary artery anomalies are one of the nature's abilities to modify usual anatomical structures. Coronary artery anomaly can be defined as a coronary pattern or feature that is encountered in less than 1% of the general population<sup>1</sup>, until now it is difficult to quote prevalence of Hyper-dominant LAD artery as only few have been mentioned in literature. Anomalous Coronary arteries are incidental findings and rare anatomical variations in their origin, course, and supply might be associated with other congenital abnormalities. Overall, they are observed in around 1–2% of the general population in those who undergo conventional or computed tomographic coronary angiography, as reported in a different case series<sup>2</sup>. The left anterior descending artery (LAD) continuing as posterior descending artery is known as Hyper-dominant LAD artery or super-dominant LAD. In an article, Jariwala et al. had mentioned nineteen reports of the hyper-dominant LAD artery until 2018.<sup>3</sup> Coronary anatomy need to be defined as it is essential to intervene the diseased artery during ischemia and sometimes anatomical variation too can have angina like presentations. In approximately 85% of people the coronary

circulation is right dominant with the posterior descending artery (PDA) arising from the right coronary artery (RCA). In only about 10–15% of cases, PDA arises from the circumflex artery (LCX), or even less commonly from both RCA and LCX (7%). The artery of posterior interventricular groove being a continuation of LAD is very unusual<sup>4</sup>.

We report a case of a patient who presented with atypical chest pain. Being male gender, smoker and hypertensive, exercise stress test was planned after baseline lipid, cardiac biomarkers and echocardiography were found normal. He showed positive Treadmill test with significant ST depression in V5 chest lead in Stage2 Bruce protocol. On coronary angiography there was long LAD artery continuing beyond the apex into interventricular groove up to the crux as posterior descending artery. There was diffuse lesion in proximal to distal LAD with multiple plaque having maximum 25% to 30% stenosis and the right coronary artery was non-dominant. The LAD gave rise to PDA with no other arteries found supplying the inferior territory of the heart and as RCA and LCX were non-dominant, we named LAD artery as Hyper-dominant LAD.

## Case report

A 60-year-old male hypertensive who was also a smoker presented with complain of epigastric discomfort for two to three months which increased for two days. As he had coronary disease risk factors, we took twelve lead ECG that showed normal sinus rhythm without any ST-segment changes (figure 1). Echocardiography finding was normal with ejection fraction of 60%. Blood investigations were normal. He was not doing well with conservative treatment, and we planned exercise stress test, and it showed significant ST segment depression in V5 in stage 2 Bruce protocol (figure 2).

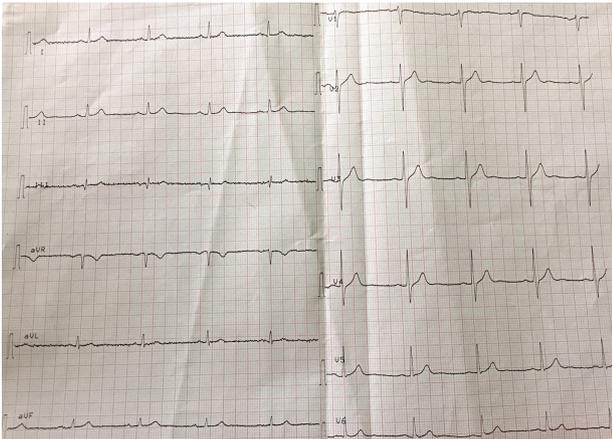


Figure 1. This is the ECG of the patient with normal rate and rhythm and has no ischemic changes.

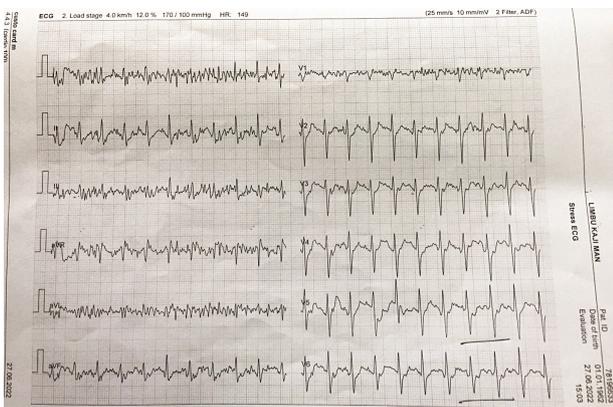


Figure 2. This was the TMT test that showed Significant ST depression in V5 in Bruce stage 2.

We did coronary angiography which revealed hyper-dominant LAD wrapping and going beyond the apex in the interventricular groove up to the crux (Figure 3a and Figure 3b). The right coronary artery was non-dominant (Figure 4). There was insignificant multiple plaque in LAD with insignificant LCX disease. The patient was counselled and discharged with ACE inhibitor and amlodipine for hypertension along with risk factor modification strategies. He was doing well in follow-up visits.

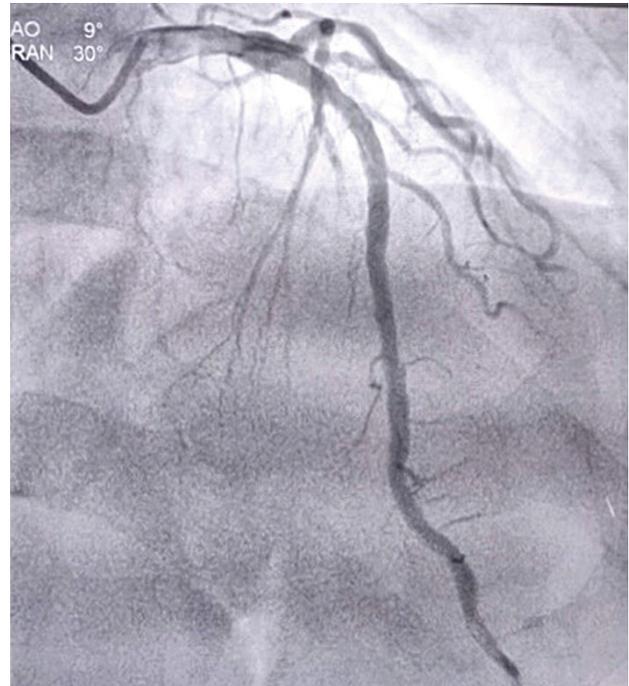


Figure 3a. The coronary angiogram of the patient with frame showing flow in the Proximal, Mid, and Distal LAD artery with insignificant stenosis. The LCX is of small caliber artery in this angiogram and non-dominant.



Figure 3b. The coronary angiogram in the subsequent frame shows LAD artery is going beyond the apex up to the crux as posterior descending artery. It is very unusual to find Posterior interventricular artery as continuation of LAD artery.

There is no such supply from LCX or RCA in the inferior part of the heart, hence this was a rare variant known as Hyper-dominant LAD artery unlike type III LAD where PDA can be observed originating from LCX or RCA. The reason it is named Hyper-dominant or Superdominant LAD was that it gave rise to origin of PDA and no any other source for this posterior interventricular artery was found except LAD.

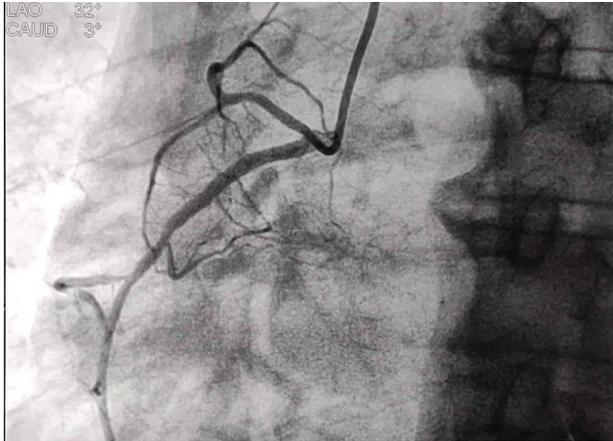


Figure 4. The angiogram of the right coronary artery seems essentially of normal caliber, but it ends shortly in atrioventricular groove having no further supply and is non-dominant.

### Discussion

Coronary artery anomalies are not too uncommon in presentation unlike that of LAD giving rise to dominant posterior descending artery. Type III LAD is common finding but its continuation as PDA is defined as type IV LAD<sup>5</sup>. Anomalous arteries of such type are rarely seen and can present as frank CAD and left ventricular dysfunction and even cardiogenic shock. As the blood supply to the entire interventricular septum is derived from this "hyper-dominant" LAD system, stenosis of LAD can be life threatening<sup>6</sup>. Musselman et al was the first to describe PDA originating from LAD and going up to crux similar to our case<sup>7</sup>. As mentioned in the similar literature by Jariwala et al there was abnormal PDA and other branches from RCA. These variations also pose difficult surgical interventions. Coronary anomalies arise due to defect in embryogenesis and lead to multiple anatomic variations like the one mentioned in this case report<sup>2</sup>. Coronary anomalies are involved in 12% of sports-related sudden cardiac deaths versus 1.2% of non-sports-related deaths so these anomalies need to be screened earlier. It is rare for the PDA to originate from LAD. To the best of knowledge it is found to be extremely rare case where LAD continues as PDA in the posterior interventricular groove<sup>8</sup>.

### Conclusion

Hyper-dominant LAD is anomalous coronary artery which supplies most of the cardiac tissue making it super-dominant. We found one such case during work-up for atypical chest pain in our patient. Early lifestyle modification and addressing any co-morbid illness can be of substantial benefit. Dominance of blood supply mostly by LAD territory can lead to subtle presentations as well. Our case report along with various others mentioned in literature would help in diagnosing earlier and implementing better management plans of such an uncommon anatomic entity. The main clinical implication of this anomaly is that when PDA arises from the LAD instead of the left circumflex artery (LCX) or RCA, it is Hyper-dominant LAD artery. The importance of this anomaly is that if a hyper-dominant LAD is occluded, it will cause massive myocardial infarction affecting the anterior wall, septum and inferior wall. This could potentially lead to cardiogenic shock with high morbidity and mortality unless there is timely management and intervention. Hence interventional Cardiologists, Physicians and Cardiac Surgeons should be aware of such rare anomalies as it has remarkable impact on clinical outcome.

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