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Myocardial bridge: a case report

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Abstract

Myocardial bridging (MB) is an anatomical variant in which an epicardial coronary artery passes under a bridge of myocardium. The most commonly affected vessel is the left anterior descending coronary artery (LAD), although other branches such as the marginal branches, diagonal branches and posterior descending right coronary artery may be occasionally involved. Technological advances in radiological techniques have enabled better diagnosis of myocardial bridges especially coronary angiography and coronary computed tomographic angiography (CCTA).

During a routine angiography by means of CCTA in a 60y old male patient with arrhythmia, a case of myocardial bridging was found in two segments of the posterior interventricular artery and a small segment of the right coronary artery,

Although most cases of myocardial bridges are asymptomatic, knowledge of its pathophysiology is of great clinical importance as some cases of MBs have been associated with acute coronary syndromes, ischemia, arrhythmias and even sudden death.

Keywords: myocardial bridges, intramyocardial coronary artery, right coronary artery, posterior interventricular artery, angiography, coronary computed tomographic angiography (CCTA)

INTRODUCTION

The heart is supplied by branches of the right and left coronary arteries (Sinnatamby, 2011) and because these vessels and their major branches course along the surface of the heart, they are called epicardial coronary arteries (Soran et al., 2000). Occasionally, however, a portion of the vessels may be embedded within the myocardium, and thus, the artery is said to have "tunneled" under a "bridge" of myocardium (Corban et al., 2014; Soran et al., 2000; Bruschke et al., 2013). This anatomical variation, which is a congenital anomaly (Alegria et al., 2005) is called a myocardial bridge. In other words, in myocardial bridging, as the coronary vessel travels along the epicardial surface of the heart, it then dips under the muscle tissue of the heart and then reappears again on the heart's surface (Bourassa et al., 2003).

The first anatomic description of myocardial bridges was made by Reyman in 1737 (Alegria et al., 2005; Kosinski & Grzybiak, 2001) and then by Black in 1805. This was then followed by the first post-mortem examination by Geiringer in 1951(Geiringer, 1951) and the first radiological description by Portsmann and Iwig in 1960 (Alegria et al., 2005; Lee & Chen, 2015).

The clinical significance of myocardial bridges is an area of controversy among researchers, with some investigators suggesting they are benign (Nasr 2014; Alegria et al., 2005; Soran et al., 2000) or asymptomatic (Möhlenkamp et al., 2002; Rogers et al., 2017) and others reporting complications associated with myocardial bridges (Bruschke et al., 2013; Gould & Johnson, 2007; Corban et al., 2014; Soran et al., 2000). Some of the clinical conditions associated with myocardial bridges include arrhythmias, ischemia and acute coronary syndromes and even sudden death (Corban et al., 2014; Soran et al., 2000; Alegria et al., 2005; Bourassa et al., 2003; Zeina et al., 2007).

The role of myocardial bridges in atherosclerosis is another point of controversy as Soran et al. (2000) and Loukas et al. (2006) suggest that they might have "protective effects" and Ishii et al. (1991), Lee & Chen, 2015 and Zeina et al (2007) described the bridged segment of the artery to be spared from atherosclerosis, even though the segment proximal to the bridged segment showed atherosclerotic changes. Schar et al. (2000) is of the opinion that the bridged segment is not protected from atherosclerotic changes.

This is a case report of myocardial bridging in 3 segments of the right coronary artery (RCA) as follows; a small segment of the terminal branch of the RCA and 2 segments of the posterior interventricular branch; in a 60y old male patient with arrhythmia.

CASE REPORT

This is a case report of a 60y old male patient who presented as a case of arrhythmia and routine angiography showed a case of myocardial bridging in 3 segments of the RCA.

The left coronary artery, after taking its origin from the left aortic sinus, it gives off the anterior interventricular branch (LAD) and circumflex branch, which showed normal caliber.

After taking its origin from the right aortic sinus, the right coronary artery passes in front of the pulmonary trunk giving off branches before passing in the coronary sulcus to the posterior aspect of the heart. Here, it gave off a large posterior interventricular branch which showed a small myocardial bridge immediately after its origin. After coursing on the surface of the heart, the posterior interventricular artery entered the interventricular groove and then dips significantly into the myocardium before reappearing on the surface. The terminal branch of the right coronary artery continues still continues in the coronary sulcus, and presents a small myocardial bridge close to where the posterior interventricular branch is given off.

The bridged segment showed systolic compression on the CCTA. No evidence of atherosclerotic changes in the bridged segment or proximal to it. Eventhough, there is significant bridging in the posterior interventricular branch of the RCA, the radiology report for the CCTA could not establish the MB as the cause of the arrhythmia. The arrhythmia only occurred transiently and there was no repeat episode since then. All other clinical assessments of the patient were essentially normal (Fig. 1).

DISCUSSION

Coronary arteries and their branches normally course in the epicardium, however, in some areas, a segment of the artery or its branches is partly covered by myocardium, a condition called myocardial bridging (Nasr 2014). Myocardial bridges are mostly found on the middle segment of the LAD (Lee & Chen 2015; Kosinski & Grzybiak, 2001; Nasr, 2014), although they can occur in any epicardial coronary artery, such as diagonal branches, posterior descending right coronary artery or marginal branches of the circumflex artery (Bourassa et al., 2003). The

current case report showed a significant bridging of the middle segment of the posterior interventricular branch of the RCA. Corban et al (2014) reported 67-98% of cases of myocardial bridges occurring in the LAD while Möhlenkamp et al (2002) reported incidences of 18% and 40% for diagonal and marginal branches, respectively. Polacek (1961) recorded a frequency of 70% in LAD, 40% in left circumflex artery and 36% in the right coronary artery. Nguyen et al (2007) described a rare case of substantial myocardial bridging in the 2nd posterolateral branch and some bridging in the 1st posterolateral branch of the right coronary artery.

Myocardial bridges can be classified as superficial or deep (Lee & Chen, 2015; Gould & Johnson, 2007; Alegria et al., 2005; Rogers et al., 2017; Corban et al., 2014; Ferreira et al., 1991) on the basis of its depth in the myocardium; and there could be multiple bridged segments in one vessel (Rogers et al., 2017), as is the case in the current case study which presents 2 bridged segments in the posterior interventricular artery. Superficial myocardial bridges are commoner (Gould & Johnson, 2007; Alegria et al., 2005; Ferreira et al., 1991; Lee & Chen, 2015) than the deep bridges with an incidence of 75% and 25% respectively (Ferreira et al., 1991). Riezzo et at (2006) reported a superficial bridging in the descending branch of the right coronary artery about 1cm from its origin.

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Another classification has been described by Corban et al (2014) as myocardial bridges being complete when the LAD is completely covered by myocardial tissue, and incomplete when the bridged segment is only covered by a thin layer of connective tissue and fatty tissue. In the current case report, the bridged segments could be classified as 2 incomplete segments in the terminal branch of the RCA and the 1st part of the posterior interventricular branch, as these segments were only covered by a thin layer of connective tissue; and a complete bridged segment of the remaining part of the posterior interventricular branch.

Nasr (2014) studied 60 adult cadaveric human hearts and reported 13.8% cases of bridging in the posterior interventricular artery. The current case report also showed significant

bridging of the posterior interventricular artery. Kosinski & Grzybiak (2001) dissected 100 adult human hearts and recorded only 4% of myocardial bridging in the posterior interventricular branch.

The prevalence of myocardial bridges vary between autopsy studies and diagnostic methods with some researchers reporting frequencies of up to 15-85% on autopsy and 0.5-2.5% demonstrated radiographically (Ferreira et al., 1991; Zeina et al., 2007; Möhlenkamp et al., 2002). Some researchers report estimated frequencies of 1.5-16% in coronary angiography and 80% for autopsy cases (Corban et al., 2014; Geirenger, 1951; Rossi et al., 1980). Although coronary angiography is the most common diagnostic technique, CT angiography has shown higher detection rates of myocardial bridges (Lee & Chen 2015).

CONCLUSIONS

Myocardial bridges are congenital anomalies involving mostly the left anterior descending coronary artery although any epicardial vessel can be involved. Due to the high incidence of myocardial bridges, detailed knowledge of the pathophysiology is of great clinical significance and will go a long way in improving patient care.

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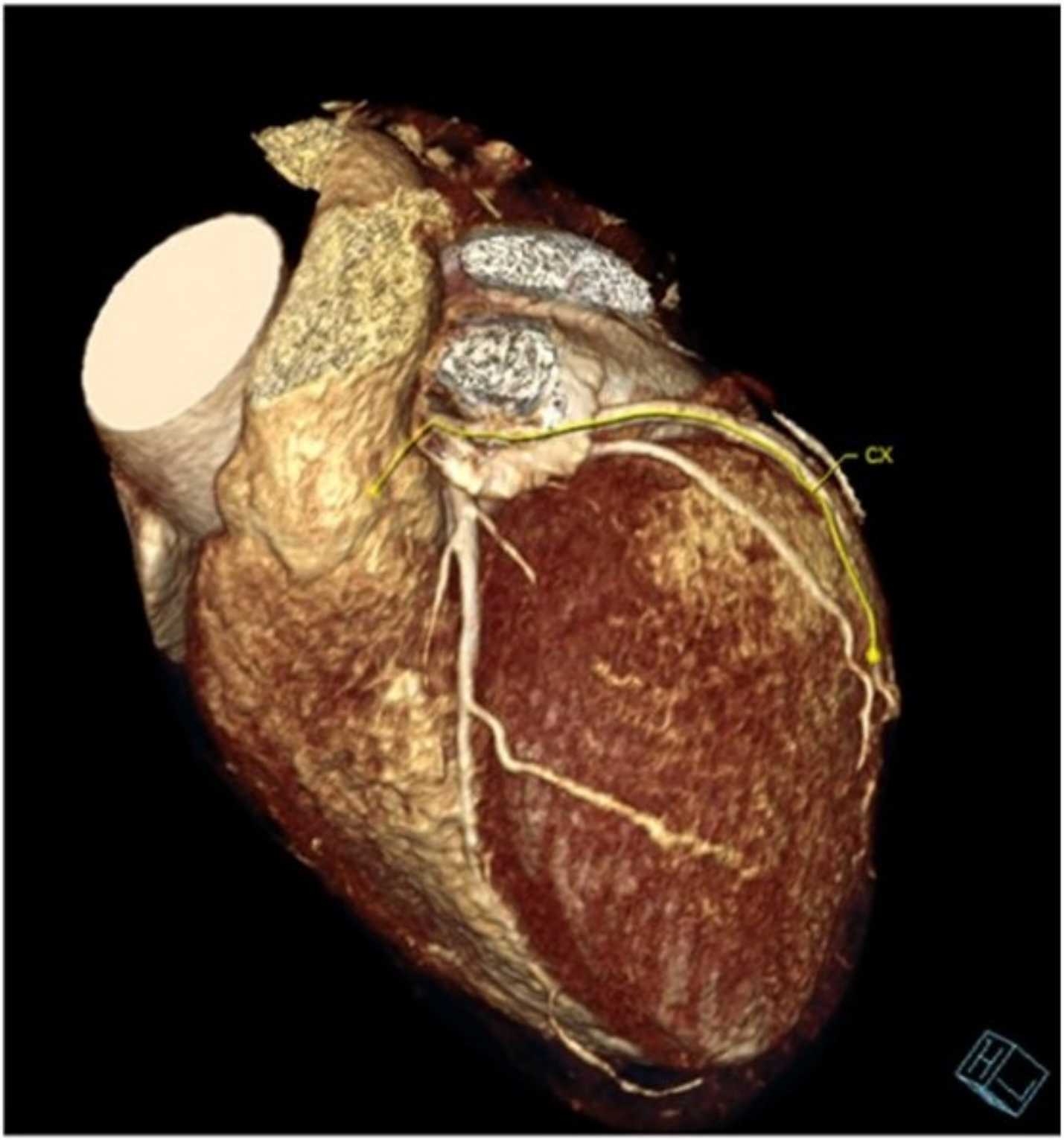
Figure 1. (Postero-inferior view) CCTA volume rendered image showing a small tissue crossing the terminal branch of the RCA (a) and the initial segment of the posterior interventricular artery (b); and a significant myocardial bridging of the posterior interventricular artery (c)


a
b
Cx
c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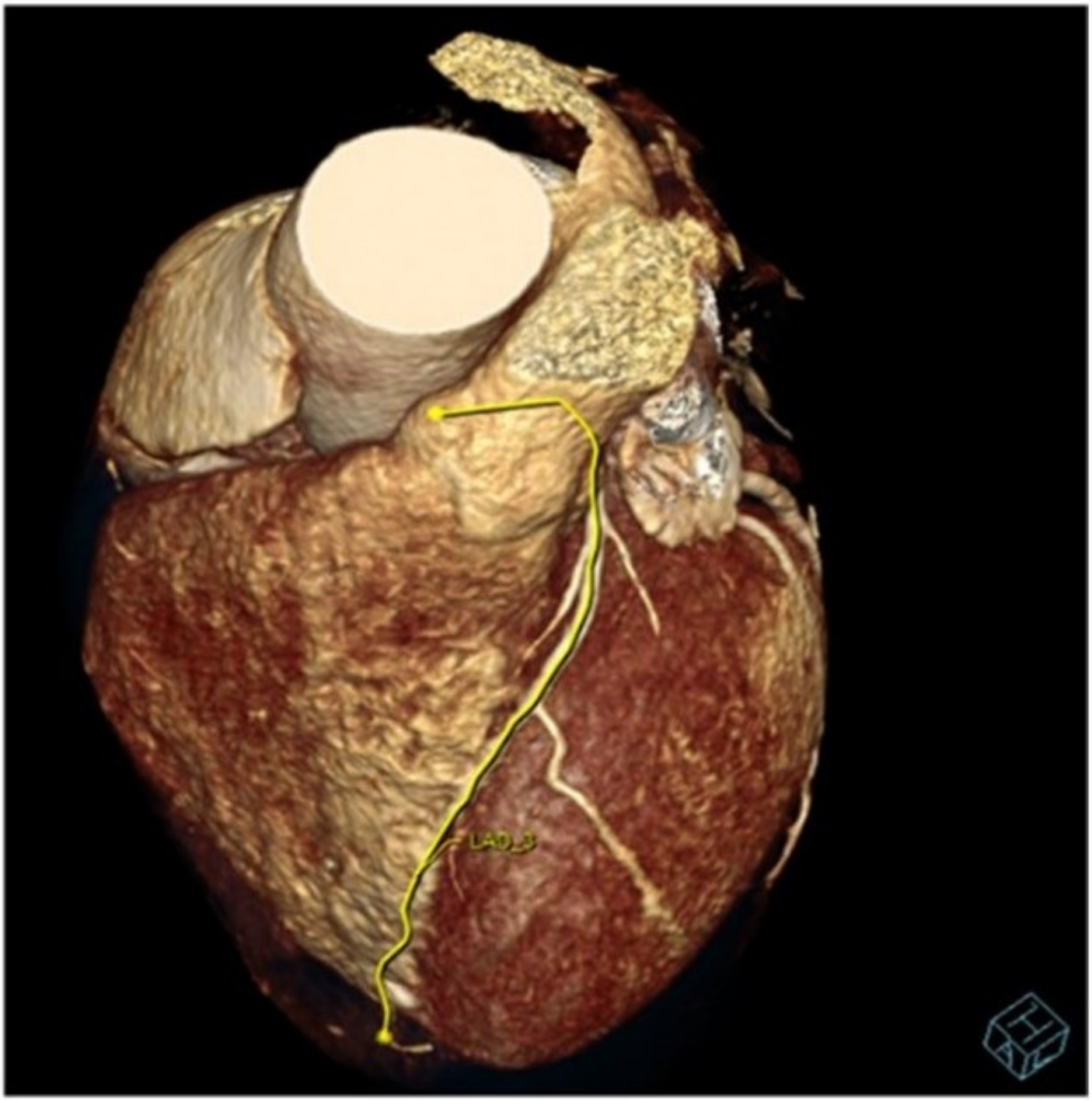
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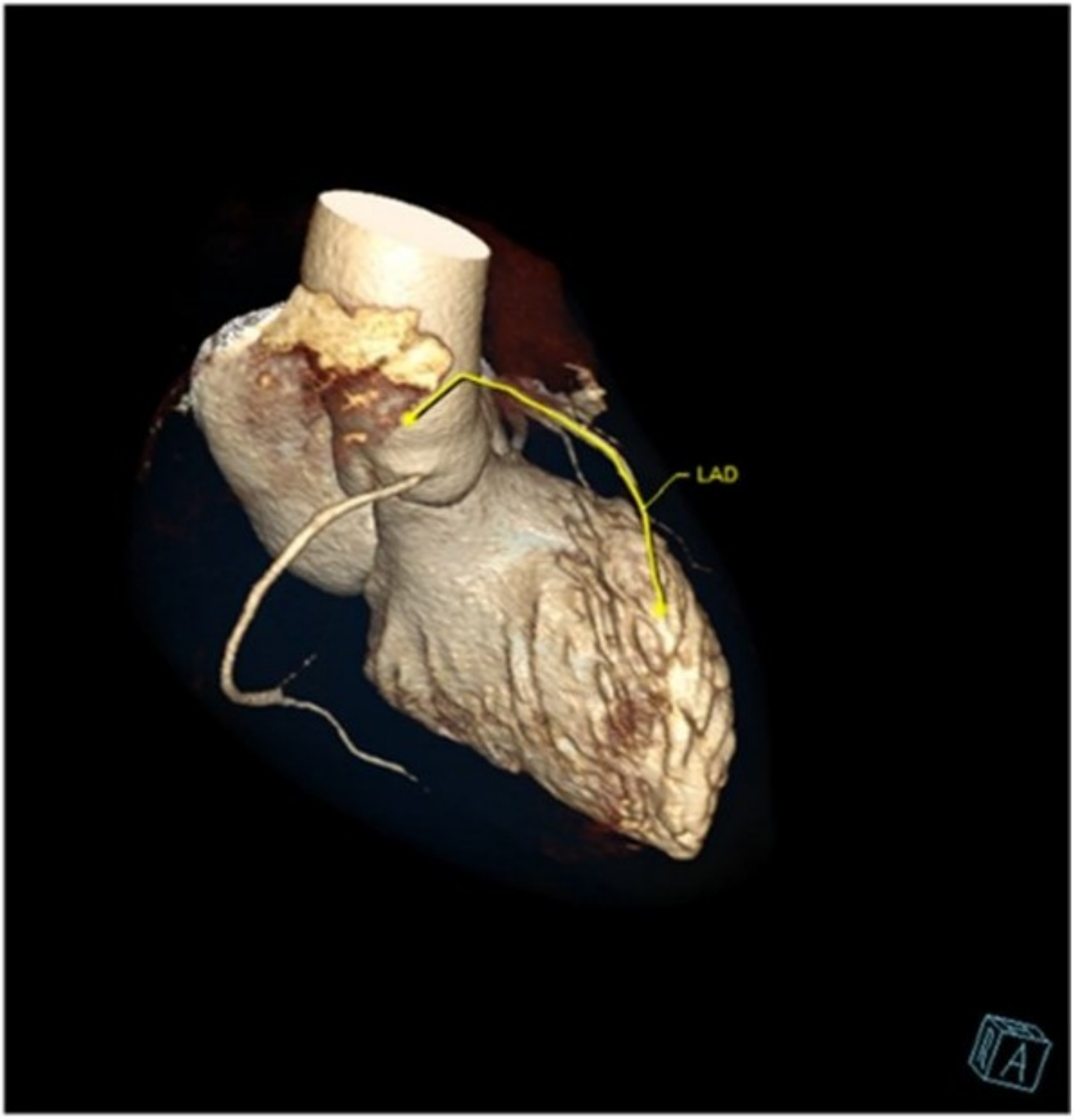
LAD
A

MYOCARDIAL BRIDGE: A Case Report

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Keywords: Myocardial bridges, intramyocardial coronary artery, right coronary artery, posterior interventricular artery, angiography, coronary computed tomographic angiography (CCTA).

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Figure-1

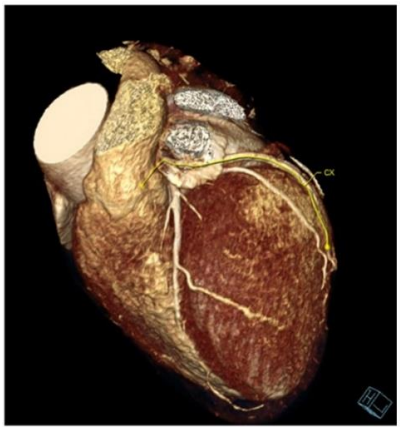

Figure-2

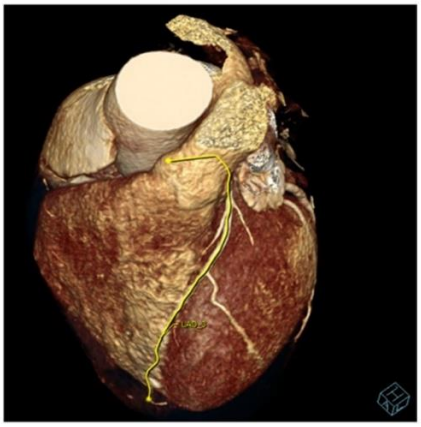

Figure-3

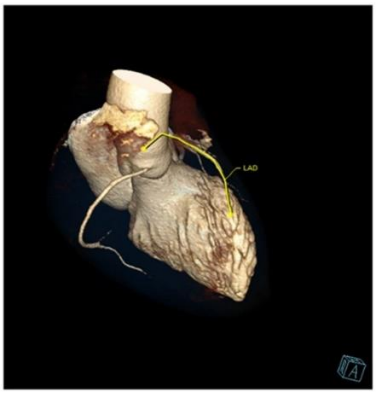

Figure-4 Figure-5

Figure 1. (Postero-inferior view) CCTA volume rendered image showing a small tissue crossing the terminal branch of the RCA (a) and the initial segment of the posterior interventricular artery (b); and a significant myocardial bridging of the posterior interventricular artery (c)

Figure 2. (Supero-lateral view) volume rendered image showing the left coronary artery (LCA) branches. The circumflex branch is marked Cx.

Figure 3. Volume rendered image showing the LAD running down the anterior interventricular groove (Antero-superior view)

Figure 4. CT angiogram showing the right and left coronary arteries taking their origin from the aortic sinus (anterior view from the right)

Figure 5. Volume rendered CT angiogram showing the circumflex branch and other branches of the left coronary artery (posterior left view)

Discussion:

Myocardial bridges are mostly found on the middle segment of the LAD (Lee & Chen 2015), although they can occur in any epicardial coronary artery, such as diagonal branches, posterior descending right coronary artery or marginal branches of the circumflex artery (Bourassa et al., 2003). Corban et al (2014) reported 67-98% of cases of myocardial bridges occurring in the LAD while Möhlenkamp et al (2002) reported incidences of 18% and 40% for diagonal and marginal branches, respectively. Polacek (1961) recorded a frequency of 70% in LAD, 40% in left circumflex artery and 36% in the right coronary artery. Nguyen et al (2007) described a rare case

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Conclusion:

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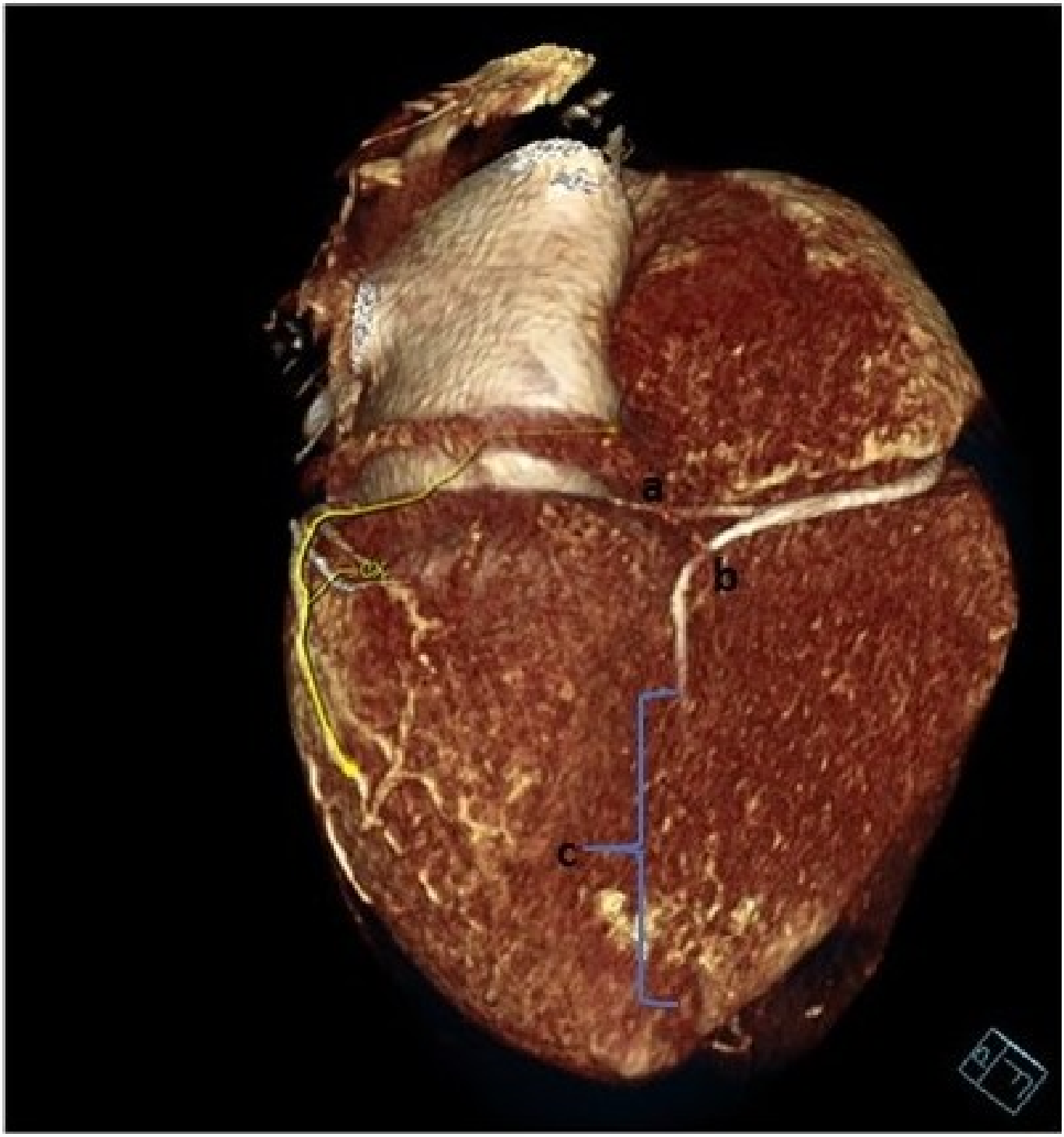
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