Myocardial bridging in Asian patients diagnosed by CT coronary angiography

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Aims and objectives

Myocardial bridging is a congenital anomaly in which a segment of a coronary artery takes a "tunneled" intramuscular course under a "bridge" of overlying myocardium. This may cause vessel compression in systole, resulting in haemodynamic changes that may be associated with angina, myocardial ischaemia, acute coronary syndrome, left ventricular dysfunction, arrhythmias, and even sudden cardiac death [1].

Myocardial bridging, first described anatomically by Reyman in 1737 [2] is a congenital variant of a coronary artery in which a portion of an epicardial coronary artery (most frequently the middle segment of the left anterior descending artery, LAD) takes an intramuscular course [3]. This arrangement of a "tunneled" segment of the artery under the "bridge" of overlying myocardium can result in vessel compression during systole. While frequently asymptomatic, this condition in many cases may be responsible for adverse complications including angina, myocardial ischaemia [4], acute coronary syndromes [5-7], left ventricular dysfunction, arrhythmias [8-10] and even sudden cardiac death [11]. This anomaly is more frequently seen in patients with hypertrophic cardiomyopathy; the prevalence rating is up to 30% on coronary angiography [12]. The anomaly is also seen with increased prevalence in patients who have undergone heart transplantation [13]. The real prevalence of myocardial bridging is still unknown, ranging from 0.5% to 4.9% in angiographic series and from 15% to 85% in autopsies [14]. Since Multidetector Computed Tomography (MDCT) has been widely used for the non-invasive evaluation of coronary artery disease (CAD) radiologists have encountered myocardial bridging more frequently than previously reported [15]. Konen et al [16] defined three useful anatomical patterns of myocardial bridging in the LAD according to the depth and course of the tunneled segment on MDCT: the "superficial" type seen in 29% of all intramuscular LAD segments, in which the tunneled segment had a superficial course along the interventricular LAD septum and was covered by a thin layer of tissue (<1mm thick); the "deep" type, seen in 41% of all tunneled LAD segments, in which the tunneled segment penetrated the interventricular septum at a depth between 1 and 6.2mm; and the "right ventricular" type, seen in 29% of all tunneled LAD segments, in which the tunneled segment crossed through the right ventricular anterior wall adjacent to the interventricular septum.

Purpose:

The aim of the study is to evaluate the patients diagnosed with myocardial bridging by Computerised tomographic angiography (CTA) over a three and a half year period in our centre.
Methods and materials

CTA was performed using prospective electrocardiogram gating on 128-slice, dual-source CT scanner, (Somatom Definition Flash, Syngo CT 2011A, Erlangen, Germany). Patients were positioned appropriately in supine position, ECG leads were attached, and large intravenous access (18 gauge) was established for the injection of the contrast agent (Omnipaque 350 or Visipsake 320) followed by normal saline at a rate of 6ml/s. Most of the patients were pre-medicated with short-acting nitroglycerin sublingual spray and the intravenous beta-blocker (5-15mg of intravenous metoprolol) given only for the patient with a heart rate higher than 70 beats per minute.

A CT volume data set for the coronary arteries was acquired; the data set covers the entire heart from the proximal ascending aorta (approximately 1-2cm below the carina) to the diaphragmatic surface of the heart. The scan is acquired in a single breath-hold during inspiration and starts with the injection of a non-ionic contrast agent. Both axial images and multiplanar reformatted (MPR) images are used in detecting the presence of myocardial bridging. Curved MPR images, curved MIP images and 3-dimensional volume rendering technique images were also helpful and can provide a general overview of the cardiac and coronary anatomy. The scans were performed for patients with typical or atypical chest pain or for screening in high risk patients or as a pre-operative work-up.
Results

2999 CTA's were performed with 70 cases of myocardial bridging identified (incidence 2.4%), in patients with an age range of 29-82 years and an average age of 49.5 years (median). There were 52 males (74%) and 18 females (26%). 60 cases had myocardial bridging involving the LAD only, 5 cases involved the right coronary artery (RCA) only, 2 cases involved the LAD and the obtuse marginal (OM) artery, and 1 involved the Ramus Intermedium (RI) only. 2 patients had a malignant course of the RCA associated in one with an LAD bridge and in the other LAD and RI bridges. 3 of the 5 RCA bridges were in females. There were 3 hypertrophic cardiomyopathy patients among the 70 cases all with LAD bridges. No patient required intervention for the myocardial bridges.
Fig. 1: The figure shows MID RCA deep myocardial bridging

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Fig. 2: The figure shows LAD and first Diagonal Branch myocardial bridging.

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**Fig. 3:** The figure shows LAD and first Obtuse Marginal Branch myocardial bridging.

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**Fig. 4:** The figure shows abnormal origin with malignant course of RCA and LAD superficial myocardial bridging.

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Conclusion

Myocardial bridges were an uncommon finding with the majority being found in male patients, with 86% of cases involving the LAD. RCA bridges seemed to be more common in women and interestingly we had 2 malignant course RCA's in the bridging patients. MDCT coronary angiography is accepted as a reliable non-invasive method for the diagnosis of myocardial bridging because MDCT directly depicts the length and depth of the tunneled segment, along with its degree of compression during systole. MDCT is also efficient in showing the presence of other coronary artery anomalies as well as the presence of stenotic coronary artery disease which are important in treatment planning.
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