Original Article

FREQUENCY OF MYOCARDIAL BRIDGING IN PATIENTS WITH CORONARY ARTERY DISEASE

Badar Ul Ahad Gill[a*], Tariq Abbas[a], Muhammad Ikram Farid[a], Masood Ahmed[a]

Abstract

OBJECTIVE:To delineate the frequency of myocardial bridging on computed tomographic coronary angiography in patients with coronary artery disease (CAD).

MATERIAL AND METHODS:This cross-sectional study was conducted in Multan from May 2017 to November 2017. Men and women aged 40-70 years suffering from coronary artery disease were included in the study. Computed Tomographic (CT) coronary angiography was carried-out of all participants and presence of myocardial bridging was recorded. Data regarding gender, age, coronary risk factors and duration of CAD was also collected.

RESULTS:Two hundred and nineteen patients were enrolled. Mean age of the participants was 51.53+7.05 years and 175 (79.9%) were males. Myocardial bridging (MB) was diagnosed in 18 (8.2%) patients.

CONCLUSION:Frequency of myocardial bridging was 8.2% using CT angiography in patients with CAD.

KEYWORDS:Myocardial bridging, coronary artery disease, computed tomographic angiography

(J Cardiovasc Dis 2018;14(3):73 -76)

INTRODUCTION

Myocardial bridging (MB) is a condition in which a segment of coronary artery takes its course from within the myocardium in spite of its normal epicardial course; this results in tunneling of the arterial segment [1]. Atherosclerotic changes often affect the portion proximal to the myocardial bridge, thus further worsening myocardial ischemia. This produces ischemic symptoms in a substantial proportion of patients with coronary artery disease (CAD) [2]. The recent gold standard for diagnosing MB is conventional coronary angiography (CCA) where MB is diagnosed by the milking effect and a "step down-step up" phenomenon which happens when there is systolic compression of the intra-myocardial segment of the vessel [3]. There is a great variation in the reported occurrence of MB between autopsy findings (15% to 85%) [4,5] and those of conventional angiography (0.5% to 16%) [6-7].This disagreement is because CCA is not so sensitive in diagnosing a milking effect with superficial MB [3].

Using computed tomographic angiography (CTA), Nakaura et al (2014) observed myocardial bridging in 57 out of 188 patients (30.3%) with CAD in Japanese Population[2]. En-sen et al. (2013) reported that myocardial bridging was present in 336 out of 2462 such patients (13.6%) in Chinese population[8]. Donkol et al. in 2013 and Leschka et al. in 2008 reported the occurrence of MB on CTA to be 22.5% and 26% respectively in Saudi and French populations [1,9]. In addition to population variance, a possible explanation for this variation among studies can be the equipment or hardware used for analysis; using 16 slice CT, reported frequency of MB varies from as low as 8.7% of 276 patients in Taiwan [10] to as high as 48.7% of 235 patients in Italy [11] while using 64 slice CT reported frequency of MB varies from as low as 5.8% in Italy [12] to as high as 58% in Taiwan [13]. On the other hand, Hwang et al. mentioned 46% of 1275 patients with MB among Korean population [3].

Thus CT angiography is better than conventional coronary angiography and increases the probability of detection of MB. The reported frequency of MB varies greatly in the exiting literature which might be attributable to equipment and population differences and at the moment no such study has been conducted in local population. Knowing the frequency of myocardial bridging will give an insight into the magnitude of problem and will enable selection or omission of myocardial bridging from list of probable differential diagnosis in patients with coronary artery disease.

METHODOLOGY:

[d]CPE Institute of Cardiology, Multan

* Corresponding author:
Email: badargill1@hotmail.com

Date of Submission : 19-11-2018
Date of Revision: 20-11-2018
Date of Publication: 28-12-2018

After taking permission from the hospital ethical committee and informed consent from the patients, 219 patients presenting in the outdoor of Choudhary Pervez Elahi (CPE) Institute of cardiology, Multan from either gender, aged 40-70 years and suffering from coronary artery disease were included in the study. Presence of coronary artery disease was established if any of the following features was found: history of typical angina symptoms, history of acute coronary syndrome or a positive stress test. Presence or absence of classic coronary risk factors (family history of premature CAD, hypertension, diabetes mellitus, smoking and dyslipidemia) was also recorded. Patients with pacemaker and those with history of Coronary artery bypass grafting (CABG), Coronary stenting and chronic total occlusions on conventional coronary angiography were excluded from the study.

These patients underwent CT coronary angiography. CT angiography was done with the dual source CT scanner (Somatom Definition, Siemens Germany), scanning in a cranio-caudal direction covering the region from 1 cm caudal to the level of the tracheal bifurcation to the diaphragm. Coronary artery segments with a luminal diameter of ≥1.5mm were included for analysis. Myocardial bridging was diagnosed when segment of a coronary artery was completely surrounded by myocardium on CT Coronary Angiographic image. All the CT coronary angiographies were performed on a single machine and interpreted by a single consultant radiologist (10 years' experience) to eliminate bias and confounding variables were controlled by exclusion.

SPSS version 20 was used to analyze the collected data. Variables i-e age and duration of coronary artery disease were presented as mean ±SD. Categorical variables i-e gender, risk factors (smoking, hypertension, positive family history, diabetes mellitus and hyperlipidemia) and presence of MB were presented as frequency and percentage. Data was stratified for age, gender, risk factors (positive family history, smoking, controlled and uncontrolled hypertension (HTN), controlled and uncontrolled diabetes mellitus (DM) and hyperlipidemia) and duration of coronary artery disease to address effect modifiers.

RESULTS:

Mean age of the patients was 51.53+7.05 years. Minimum age was 40 years and maximum age was 70 years. There were 175 (79.9%) male patients and 44 (20.1%) female patients in our study (Figure 1). Out of 219 patients, 18 (8.2) had myocardial bridging on CTA. Regarding occurrence of risk factors of CAD, there were 55 (25.1%) patients who had a positive family history of CAD. Out of 219 patients, 86 (39.3%) had history of smoking. Dyslipidemia was diagnosed in 25 (11.4%) and hypertension in 93 (42.5%) patients. Out of 93 hypertensive patients, 73

Table 1: Stratification of Age to determine the effect of Age on Myocardial Bridging

Age Groups (years)	Myocardial Bridging		P-value
	No	%	
40-50 - n=120	7	6	0.35
51-60 -n=69	8	11.6	
61-70 -n=30	3	10	

Table 2: Stratification of Patients on the basis of Gender

Gender	Myocardial Bridging		P-value
	No	%	
Male-n=175	12	7	0.43
Female-n=44	6	13.6	

Figure 1: Frequency of Gender

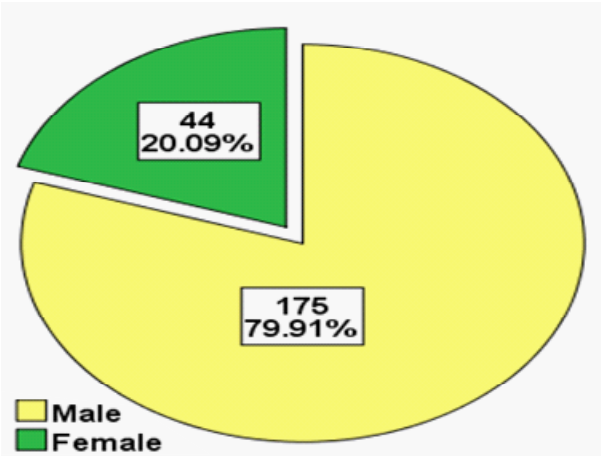
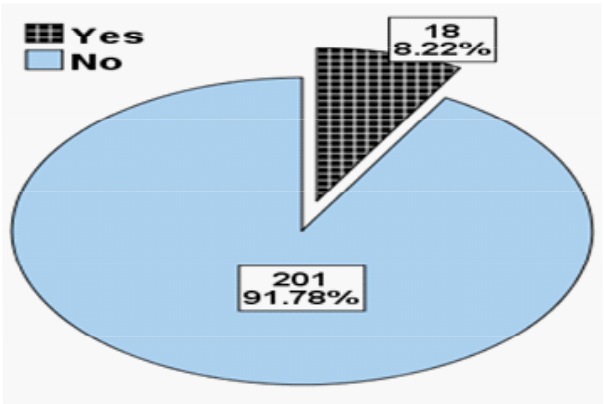


Figure 2: Overall Frequency of Myocardial Bridging



(33.3%) patients had controlled hypertension. Diabetes mellitus was found in 82 (37.6%) patients and it was well controlled in 66 (30.1%) patients. Mean duration of coronary artery disease at the time of computed tomography angiography was 3.63+1.52 months. Minimum duration of disease was 1 month and maximum duration of coronary artery disease was 6 months (Table 2).Out of 219 patients, myocardial bridging was diagnosed in 18 (8.2%) patients (Fig. 2).

There were 7 patients in age group 40-50 years who were diagnosed of having myocardial bridging (MB), 8 patients in 51-60 years and 3 patients in age group 62-70 years having MB. There was no effect of age groups on the frequency of MB with a p-value of 0.35 (Table 1). There were 12 males out of 175 who had MB and 6 females out of 44 had MB with no significant statistical difference (p-value 0.14) (Table 2).

DISCUSSION:

In our study population, one out of every 12 patients with IHD had myocardial bridging on computed tomographic coronary angiography. Myocardial bridging is mostly taken as benign abnormality. However, at times it is linked with clinical signs. To date coronary angiography is taken as gold standard for its diagnosis.[14] In the pre-MDCT (multi-detector CT) era, conventional coronary angiography (CCA) was the only test used to detect MB. However angiography is an invasive procedure with all its attendant complications and only the deep type of bridges appears significant on angiography[15]. Moreover, CCA has a low sensitivity (2). The prevalence of MB detected by CCA was only 0.5–16% [16], which is significantly lower than that detected at autopsy (15–85%) [17].

Mean age of our participants was 51.53 years. In a similar study, conducted in China, mean age of study participants was 59 years [18]. A study conducted in Japan found the mean age of study participants 63 years[19]. In a study conducted in Taiwan the mean age of study participant was 57 years [20]. Mean age in our study was less as compared to the other study patients because there is an early onset of coronary artery disease in this region.

In our study, the occurrence of MB was 8.2%; a previous study, conducted in Pakistan, reported a frequency of 12.0% [21]. Chen et al. found myocardial bridging in 8.7% out of 276 patients [22]. Ou et al. found myocardial bridging in 5.4% out of 2530 patients in China [23]. while occurrence of MB with 64 slice CT were 6.42%, 30%, 22.5%, 5.8%, 10.4%, 17%, 18.6%, 50%, 37%, 58%, 23%, 44% and 30.5% [1,24]. With the use of dual source MDCT, Hwang et al found that 46% of 1275 patients had MB [25]. The worldwide occurrence of MB (if we exclude the lower and higher results) from 07%-40% [26].

In our study, we found a lower frequency of MB in patients with CAD. Donkol et al. have supported the concept that MB is a common type and has no clinical signs or symptoms as not a single participant required specific medical or invasive treatment for MB. These results are also hold by Kramer et al. and Nakanishi et al. who documented that MB is an incidental result linked with an excellent survival rate of 97% at 5 years [27, 28]. They suggested that the clinical significance of a MB appears to be linked with the anatomic properties of a tunneled portion of coronary artery, the presence of related myocardial ischemia, and the presence of proximal and distal atherosclerotic disease.

There are many benefits of MDCT angiography as compared to conventional angiography in assessment of MB; it is a non-invasive imaging modality that allows evaluation of the coronary artery lumen, wall, and surrounding myocardium [29]. Extra information can also be obtained about depth, length and specific location of atherosclerosis linked with MB [30]. Broadly MB can be categorized as superficial or deep, depending on the thickness of the covering muscle layer. The superficial type can be more classified as complete or incomplete. Evaluation by MDCT may help to elucidate, if there is a causal association between the type of MB and atherosclerosis.

CONCLUSION:

Frequency of myocardial bridging in our study was 8.2% using computed tomography angiography in coronary artery disease patients.

Author's Contribution

BUAG: Conducted the study and wrote the article. TA: Re-analyzed data, reviewed and corrected the article.MIF and MA: Helped in conducting the study and was research coordinator

REFERENCES

1.Donkol RH, Saad Z.Myocardial bridging analysis by coronary computed tomographic angiography in a Saudi population.World J Cardiol 2013;5(11):434-41.
2.Nakaura T, Nagayoshi Y, Awai K, Utsunomiya D, Kawano H, Ogawa H, et al. Myocardial bridging is associated with coronary atherosclerosis in the segment proximal to the site of bridging.J Cardiol 2014;63(2):134-9.
3.Hwang JH, Ko SM, Roh HG, Song MG, Shin JK, Chee HK, et al. Myocardial bridging of the left anterior descending coronary artery: depiction rate and morphologic features by dual-source CT coronary angiography.Korean J Radiol 2010;11(5):514-21.
4.Zeina AR, Odeh M, Blinder J, Rosenschein U, Barmeir E. Myocardial bridge: evaluation on MDCT.AJR Am J Roentgenol 2007;188(4):1069-73.
5.Konen E, Goitein O, Di Segni E.Myocardial bridging, a common anatomical variant rather than a congenital anomaly. Semin Ultrasound CT MR 2008;29(3):195-203.
6.Pugliese F, Mollet NR, Runza G, van Mieghem C, Meijboom WB, Malagutti P, et al. Diagnostic accuracy of non-invasive 64-slice CT coronary angiography in patients with stable angina pectoris.Eur Radiol 2006;16(3):575-82.
7.Nakanishi R, Rajani R, Ishikawa Y, Ishii T, Berman DS.Myocardial bridging on coronary CTA: an innocent bystander or a culprit in myocardial infarction?J Cardiovasc Comput Tomogr 2012;6(1):3-13.
8.Ma E, Ma G, Yu H, Wu W, Li K. Assessment of myocardial bridge and mural coronary artery using ECG-Gated 256-Slice CT angiography: a retrospective study.Sci World J 2013;2013:947876.
9.Leschka S, Koepfli P, Husmann L, Plass A, Vachenauer R, Gaemperli O, et al. Myocardial bridging: depiction rate and morphology at CT coronary angiography--comparison with conventional coronary angiography.Radiology 2008;246(3):754-62.
10.Chen YD, Wu MH, Sheu MH, Chang CY.Myocardial bridging in Taiwan: depiction by multidetector computed tomography coronary angiography.J Formos Med Assoc. 2009;108(6):469-74.
11.De Rosa R, Sacco M, Tedeschi C, Pepe R, Capogrosso P, Montemarano E, et al. Prevalence of coronary artery intramyocardial course in a large population of clinical patients detected by multislice computed tomography coronary angiography.Acta Radiol 2008;49(8):895-901.
12.La Grutta L, Runza G, Lo Re G, Galia M, Alaimo V, Grassedonio E, et al. Prevalence of myocardial bridging and correlation with coronary atherosclerosis studied with 64-slice CT coronary angiography.Radiol Med 2009;114(7):1024-36.
13.Chen CC, Chen MT, Lei MH, Hsu YC, Chung SL, Sung YJ.Assessing myocardial bridging and left ventricular configuration by 64-slice computed tomography in patients with apical hypertrophic cardiomyopathy presenting with chest pain.J Comput Assist Tomogr 2010;34(1):70-4.
14.Hwang JH, Ko SM, Roh HG, Song MG, Shin JK, Chee HK, Kim JS. Myocardial bridging of the left anterior descending coronary artery: depiction rate and morphologic features by dual-source CT coronary angiography. Korean J Radiol 2010; 11: 514-521.
15.Dominguez B, Valderrama V, Arrocha R, Lombana B. Myocardial bridging as a cause of coronary insufficiency. Rev Med Panama 1992;17:28e35.
16.Li JJ, Shang ZL, Yao M, Li J, Yang YJ, Chen JL, Qiao SB, Ma WH, Qin XW, Liu HB, Wu YJ. Angiographic prevalence of myocardial bridging in a defined very large number of Chinese patients with chest pain. Chinese Med J. 2008;121(5):405-8.
17.Bourassa MG, Butnaru A, Lespérance J, Tardif JC. Symptomatic myocardial bridges: overview of ischemic mechanisms and current diagnostic and treatment strategies. J Am Coll Cardiol. 2003;41(3):351-9.
18.Liu G, Qu Y, Chen X, Liao M, Hu H, Cao Y, Tian Z. Measurements of myocardial bridges on computed tomography predict presence of clinical symptoms and outcomes of adverse heart events: a retrospective study in a large population from China. Acta Radiol. 2017;58(9):1068-76.
19.Sheu MH, Chen YD, Kuo YS, Wu MH, Chen CK, Chang CY. Myocardial bridging in Taiwanese: Noninvasive assessment by 64-detector row coronary computed tomographic angiography. J Chinese Med Assoc. 2011;74(4):164-8.
20.Nakaura T, Nagayoshi Y, Awai K, Utsunomiya D, Kawano H, Ogawa H, Yamashita Y. Myocardial bridging is associated with coronary atherosclerosis in the segment proximal to the site of bridging. J Cardiol. 2014;63(2):134-9.
21.Tuyyab F, Naeem MY, Iqbal T, Hassan F. Multislice computed tomographic patterns of muscle bridging of left anterior descending artery and their relation to atheromatous coronary artery disease. Pak Armed Forces Med J. 2012;62(1):29-34.
22.Chen YD, Wu MH, Sheu MH, Chang CY. Myocardial bridging in Taiwan: depiction by multidetector computed tomography coronary angiography. J Formosan Med Assoc. 2009;108(6):469-74.
23.Ou SX, Li XR, Peng GM, Zhang L, Li SN. Imaging of congenital coronary artery anomalies by dual-source computed tomography angiography. Zhongguo yi xue ke xue yuan xue bao. Acta Acad Med Sinic. 2010;32(6):690-4.
24.Kim SY, Lee YS, Lee JB, Ryu JK, Choi JY, Chang SG, Kim KS. Evaluation of myocardial bridge with multidetector computed tomography. Circ J. 2010;74(1):137-41.
25.Hwang JH, Ko SM, Roh HG, Song MG, Shin JK, Chee HK, et al. Myocardial bridging of the left anterior descending coronary artery: depiction rate and morphologic features by dual-source CT coronary angiography. Korean J Radiol. 2010;11(5):514-21.
26.Jodocy D, Aglan I, Friedrich G, Mallouhi A, Pachinger O, Jaschke W. Left anterior descending coronary artery myocardial bridging by multislice computed tomography: correlation with clinical findings. Eur J Radiol. 2010;73(1):89-95.
27.Kramer JR, Kitazume H, Proudfit WL, Sones FM. Clinical significance of isolated coronary bridges: benign and frequent condition involving the left anterior descending artery. Am Heart J. 1982;103(2):283-8.
28.Nakanishi R, Rajani R, Ishikawa Y, Ishii T, Berman DS. Myocardial bridging on coronary CTA: an innocent bystander or a culprit in myocardial infarction? J Cardiovasc Computed Tomograph. 2012;6(1):3-13.
29.Aksakal A, Urumdaş M, Yaman M, Ateş AH, Arslan U. Prevalence and three-year follow-up of patients with isolated myocardial bridge in the mid-Black Sea region: a retrospective single-center study. Turk Kardiyol Dern Ars. 2016;44(3):203-6.
30.Kim KU, Choi JK, Oh HM, Woo JY, Park HS, Moon SY, Seo WW, Han KR. Myocardial Ischemia by Aggravation of Myocardial Bridging. J Lipid Atheroscleros. 2015;4(2):137-40.