

FREQUENCY AND ASSOCIATION OF MYOCARDIAL BRIDGING WITH ATHEROSCLEROTIC CORONARY ARTERY DISEASE IN PATIENTS UNDERGOING CORONARY ANGIOGRAPHY

Fahad Shah, Abid Sharif*, Nisar Ahmad**, Fatima Abid*, Amer Fakhr***

Pakistan Institute of Medical Sciences, Islamabad Pakistan, *Combined Military Hospital Multan/National University of Medical Sciences (NUMS) Pakistan, **Combined Military Hospital Rawalakot Pakistan, ***Pak Emirates Military Hospital/National University of Medical Sciences (NUMS) Rawalpindi Pakistan

ABSTRACT

Objective: To evaluate frequency and association of myocardial bridging with atherosclerotic coronary artery disease in patients undergoing coronary angiography.

Study Design: Cross sectional analytical study.

Place and Duration of Study: Department of cardiology, PIMS Islamabad, from Feb to Aug 2014.

Material and Methods: A total of 320 patients were selected for the study. Patients undergoing coronary angiography to determine the frequency of myocardial bridging and its relationship to atherosclerotic coronary artery disease. The angiography was done according to standard protocol. Myocardial bridges were seen by expert interventional cardiologist and degree of coronary artery narrowing proximal and distal to bridging was noted.

Results: The mean age of the patients was 60.35 ± 9.18 years and there were 205 (64.1%) male patients in the study. In the study 50 (15.6%) patients were diagnosed with myocardial bridging and in all these patients mid left anterior descending artery segment was found to be involved in myocardial bridging. Only 23 (7.19%) patients had atherosclerotic CAD and 21 (6.56%) patients had proximal and 2 (0.63%) patients had segment distal involved in atherosclerotic CAD. Out of 50 patients with myocardial bridging 23 (46%) patients had significant atherosclerotic CAD ($p < 0.001$). In almost all cases, atherosclerotic CAD was observed proximal to bridge segment (91.3%).

Conclusions: There was significant association between myocardial bridging and atherosclerotic coronary artery disease proximal to bridge segment and it might be an independent risk factor for atherosclerosis proximal to bridge segment.

Keywords: Coronary atherosclerosis, Coronary angiography, Myocardial bridging.

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INTRODUCTION

Many heart related diseases are congenital at the time of birth and are discovered later in life. One such abnormality is myocardial bridging which arises when coronary artery or its segment travels through myocardium which cause a tunneled arterial segment because the coronary artery usually travels on the surface of the myocardium. The myocardium bridging is not a threatening condition if it does not affect the hemodynamics of the patient. But its relationship with ischemia is yet debatable. The myocardial bridging become clinically important when it present with compression of regional hemodynamics¹.

Myocardial bridging usually do not have severe outcomes in terms of prognosis but in some patients it causes life threatening consequences including myocardial ischemia and infarction as well as sudden death in some atherosclerotic cases. Studies have the association of myocardial bridging with development of atherosclerosis proximal to tunneled artery². The intra myocardial bridges are formed when segments of coronary artery penetrate the myocardial tissue and bordered by muscular fibers³.

During the systole process these segments cause significant decrease in caliber due to external pressure on artery from myocardial fibers and this effect is termed as "milking". This reduction in flow to the distal segment of the artery causes the myocardial ischemia. First of all Postmann and Iwing described the myocardial bridge in

Correspondence: Dr Abid Sharif, HOD of Medicine Department, Combined Military Hospital Multan Pakistan
Email: sharif.abid@yahoo.com

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1960 through angiography and explained this process as systolic narrowing of left anterior descending coronary artery, which was observed in a 19 years old patient. Tunneled segments systolic compression is known as myocardial bridging and in most of the cases it remains asymptomatic. A main cause of coronary atherosclerosis in proximal left anterior descending artery (LAD) is myocardial bridging in patients with mid-LAD^{4,5}.

There are two main distinct mechanisms which originate coronary artery disease in patients having myocardial bridging. The first mechanism is when myocardial bridging directly compress the left anterior descending artery and second is when myocardial bridging adds to the natural history of coronary atherosclerosis in left anterior descending artery segment proximal to the myocardial bridging⁶. The atherosclerotic plaque is not uniformly distributed in human coronary arteries. For instance, in left anterior descending (LAD) the proximal segment has susceptibility of plaque formation but the septal branches have a safety mechanism against atherosclerosis. This phenomenon consist on many hemodynamic factors⁷.

Usually the myocardial bridges are asymptomatic and these could be found incidentally during the process of coronary angiography done for any other reason. Along with this incidental finding the patients with myocardial bridges could present with different complications like acute myocardial infarction, cardiac arrhythmias and unstable angina. The presentation of myocardial bridging could be severe and can result in sudden cardiac death⁸.

The diagnosis of myocardial bridging is very important and should be kept in mind while investigating disease related to heart. Its detection become essential when any patient present with clinical symptoms. After diagnosis myocardial bridging should be managed with specific medical or surgical intervention depending upon the condition of the patient⁹. In the patients diagnosed with myocardial bridging incidentally

or with symptomatic presentation, the clinical challenge is management of myocardial bridging through unroofing of the bridge or with any other method. The main deficiency in its prognosis is that there are no guidelines or recommendations have been set by any authority even internationally for optimum management of myocardial bridging.

In the light of previous literature the management of myocardial bridges remained a controversial subject on the basis of clinical, hemodynamic and prognostic significance. Because some investigators have a view that MB is a benign condition without any severe outcomes. On the other hand some researchers have found it as an instigator for severe cardiac events and clinical symptoms. In the patients who are diagnosed as having myocardial bridging, quite a high number have an associated disease called atherosclerosis. The atherosclerosis has its own consequences related to clinical outcome and planning of treatment strategy¹⁰.

Establishing the association between frequency of myocardial bridging and its relationship with atherosclerotic coronary artery disease is important because early aggressive management of the atherosclerotic disease would halt the progression of the disease and would give symptomatic relief to the patients.

MATERIAL AND METHODS

This cross sectional analytical study was conducted on patients undergoing coronary angiography to determine the frequency of myocardial bridging and its relationship to atherosclerotic coronary artery disease in Cardiology Department, Pakistan Institute of Medical Sciences, Islamabad, from 18th Feb 2014 to 17th Aug 2014.

A total of 320 patients were selected for the study by non-probability consecutive sampling method. The sample size was calculated with the help of WHO sample size calculator, using 16% prevalence⁹ of myocardial bridging, taking 95% confidence level, and 5% margin of error. Patients between age of 40-70 years, both genders and suspected or known coronary artery disease

undergoing angiography were included in the study. Patients having previous CABG/ percutaneous coronary intervention, severe renal dysfunction, intolerance to aspirin, clopidogrel and heparin or iodine- containing contrast medium were excluded from the study.

Hospital ethics committee approved the study prior to initiating the study. All the patients were briefly described about the study and its purpose and informed written consent was taken before participating in the study. The inclusion and exclusion criteria was followed based upon detailed examination and history. All patients underwent an echocardiogram and routine pre-procedure care prior to a coronary angiography. The angiography was done according to standard protocol. Myocardial bridges were seen by expert interventional cardiologist and degree of coronary artery narrowing proximal and distal to bridging was noted as percentage of stenosis. Measurements were performed in the left anterior oblique position and included systolic lumen diameter reduction and length.

All collected data was entered and analyzed in the Statistical Package for Social Sciences (SPSS) Version 21. Descriptive statistics for qualitative and quantitative variables were computed and presented. Mean and standard deviation was used for quantitative variables, while frequency and percentage was used for qualitative variables. Chi-square test/Fisher's exact test was applied to find out the association of different variables. p -value ≤ 0.05 was taken as significant.

RESULTS

The mean age of the patients was 60.35 ± 9.18 years with a range of 40 to 70 years. There were 95 (29.69%) patients of age range of 40-55 years, 225 (70.31%) patients of age range of 56-70 years. There were 205 (64.1%) male patients in the study, while 115 (35.9%) patients were female. Male to female ratio was 1.78:1. Out of 320 patients, 50 (15.6%) patients had myocardial bridging while 270 (84.4%) patients findings showed that there are no any signs of myocardial bridging. In all 50 patients mid LAD segment was

found to be involved in myocardial bridging. In our study sample only 23 (7.19%) patients had atherosclerotic coronary artery disease (CAD) and remaining 297 (92.81%) did not had atherosclerotic CAD. In overall sample majority 21 (6.56%) of the patients who presented with atherosclerotic CAD had proximal to bridge segment involved in atherosclerotic CAD and only 2 (0.63%) patients had distal to bridge segment

Table-I: Distribution of different characteristics of the patients.

Characteristics	Frequency	Percentage (%)
Age of patient		
40-55	95	29.69
56-70	225	70.31
Mean \pm SD	60.35 \pm 9.181	
Gender of patient		
Male	205	64.06
Female	115	35.94
Myocardial Bridging		
No	270	84.38
Yes	50	15.63
Segment Involved		
None	270	84.38
Mid LAD	50	15.63
Atherosclerotic CAD		
No	297	92.81
Yes	23	7.19
Relationship of Bridge Segment to Atherosclerotic CAD		
None	297	92.81
Proximal	21	6.56
Distal	2	0.63

involved in atherosclerotic CAD as elaborated in (table-I).

According to the results all 50 patients had bridging in mid LAD segment, not a single case with bridging in other segments of left anterior descending artery, LCX, RCA was observed. Out of 50 patients with myocardial bridging 23 (46%) patients had significant atherosclerotic CAD (coronary artery narrowing $>70\%$). In almost all cases, atherosclerotic CAD was observed proximal to bridge segment (91.3%), while only two cases had disease distal to bridge segment (8.7%).

The inferential analysis of the data showed that there was no significant (p -value >0.05)

association between age of the patient and myocardial bridging with rate of myocardial bridging in 40-55 years and 56-70 years age intervals as 16.84% and 15.11% respectively. Similarly there was no significant (p -value >0.05) relationship between gender and myocardial bridging. The rate of myocardial bridging in males was 16.58% and in females it was 13.91%. There was significant (p -value <0.05) association between atherosclerotic CAD and myocardial bridging and it was observed that in all 23 (46%) patients having atherosclerotic CAD had myocardial bridging in comparison to 27 (54%) patients who presented with myocardial bridging without atherosclerotic

sclerotic disease spared the area below myocardial bridging while this disease is developed in proximal area^{13,14}. The rate of proximal segment of the myocardial bridging involvement has been noted up to 46%, due to different degrees of CAD. The main reason of atherosclerosis in the proximal segment of the bridge is disorders in blood flow which contribute to the development of atherosclerosis¹⁵, the other causes might be controlling of vasoactive substance through endothelial cells, affecting vascular cell functions such as the thrombogenic potential, blood flow regulation and vascular tone^{16,17}.

Table-II: Association of age, gender and atherosclerotic CAD with myocardial bridging.

Characteristics	Myocardial bridging		Total	<i>p</i> -value
	No	Yes		
Age of the patients				
40-55	79 (29.3%)	16 (32%)	95	0.697
56-70	191 (70.7%)	34 (68%)	225	
Gender of the patients				
Male	171 (63.3%)	34 (68%)	205	0.528
Female	99 (36.7%)	16 (32%)	115	
Atherosclerotic CAD				
No	270 (100%)	27 (54%)	297	<0.001
Yes	0	23 (46%)	23	

CAD as elaborated in (table-II).

DISCUSSION

Coronary angiography is considered as a standard diagnostic tool for myocardial bridging presenting with "milking" effect and "step up and step down" phenomenon resulting in due to tunneled segment compression^{11,12}. In a study conducted in China the prevalence of myocardial bridging was observed 16.1% among 5525 cases undergoing coronary angiography. The main factors which affect the angiographic expression include length and thickness of intra myocardial segment, the reciprocal orientation of the artery and muscle fibers, and the nature of the tissue interposed between them¹¹⁻¹⁴.

The association between atherosclerosis and myocardial bridging is not very clear yet and several studies have been done to identify this relationship. Studies have elaborated that athero-

Researches have also concluded that patients diagnosed with myocardial bridging have significantly increased risk for cardiac events and clinical symptoms. A very common finding among patients with myocardial bridging is atherosclerosis, which can be of two types muscular or valvular heart disease. Atherosclerosis has its own complications including clinical outcomes like myocardial bridging. It also affects the prognosis and treatment strategy of the patients⁹.

Myocardial bridging is common finding and usually remains asymptomatic among normal healthy population. It has been considered as anatomical variation without any complications. But in patients who present with complications have different cardiac related morbidities like myocardial infarction and angina pectoris. The symptomatic presentation can be severe resulting in sudden death. Middle segment of the left

anterior descending coronary artery is frequently occurring site of myocardial bridge¹⁸.

Previous researches who assessed myocardial bridging with angiographic findings have reported the myocardial bridging as a non-threatening disease from a long time. These studies have reported a good long term prognosis among patients presented with myocardial bridging in left anterior descending artery. A lot of literature have reported that myocardial ischemia might be caused due to myocardial bridging^{16,19}. Up till now two distinct mechanisms of myocardial bridging have been reported in the literature, which can cause the myocardial ischemia. The first one is compression of MCA directly through myocardial bridging and the second one is enhancement of coronary atherosclerosis causing stenosis of coronary artery proximal to myocardial bridging²⁰.

This present study shows that out of 320 patients, 50 (15.6%) patients had myocardial bridging. In all these patients mid left anterior descending artery segment was found to be involved in myocardial bridging. Only 23 (7.19%) patients had atherosclerotic CAD and remaining 297 (92.81%) did not had atherosclerotic CAD. In overall sample 21 (6.56%) patients had proximal and 2 (0.63%) patients had distal to bridge segment involved in atherosclerotic CAD.

The prevalence of myocardial bridging has great variation in different studies ranging from 0.5% to 19% in most of the studies. Multiple studies have reported similar prevalence based upon angiographic findings. The reported prevalence is 18.9% of 228 patients²¹, 15.8% of 148 patients²² and 8.7% of 276 patients²³.

In this study the prevalence of myocardial bridging was very much in accordance with previous studies. The variation in frequency of myocardial bridges in different population may be dependent on the cut off value used as in some studies it was used <50% while <70% systolic narrowing in some other studies was required for the designation of myocardial bridge. Another tempting speculation might be

genetic variations that may contribute in the different incidence of myocardial bridges among different populations¹⁸.

The results of this study had supported the belief that myocardial bridging has no clinical consequences with a good prognosis in patients diagnosed with myocardial bridging, because none of our patient required any medical or invasive treatment for myocardial bridging. The proximal segment with myocardial bridging has increased risk of atherosclerosis, although the tunneled segment is spared. Myocardial bridging in the mid-LAD is an independent risk factor for coronary atherosclerosis in the proximal left anterior descending artery. Close attention should be paid to the development of coronary atherosclerosis in the segment proximal to the site of myocardial bridging.

Myocardial bridging can cause accelerated atherosclerosis in the coronary segment immediately proximal to the bridged segment. The bridged portion itself is "spared" from atherosclerosis, likely through favorable shear forces resulting in increased expression of vasoactive agents as well as morphological changes in endothelial and smooth muscle cells in the area. Hemodynamic effects of bridging include systolic coronary flow reversal proximal to the bridge, as well as a decrease in coronary flow reserve²⁴.

Previous studies had demonstrated that computed tomographic angiographic findings frequently identify the intramural course of coronary arteries but the rate of systolic compression is not so common and only 29% of them have systolic compression. The abnormal myocardial perfusion through vasodilator stress has no relation with myocardial bridging. Atherosclerotic lesions were located predominantly proximal to the intramural coronary arteries²⁵.

A very common finding with myocardial bridging is atherosclerosis and it is thought that myocardial bridging accelerate the atherosclerosis and can cause acute myocardial infarction. Myocardial bridging should be given more attention with respect to atherosclerosis in patients

presenting with angina like myocardial ischemia or chest pain as compared to low risk patients diagnosed to have asymptomatic myocardial bridging. The main management of this is through medical treatment but it requires more awareness in common population. The medical management is preferred until the recurrent events when the surgical management become necessary.

CONCLUSION

In the study 50 (15.6%) patients diagnosed with myocardial bridging and in all these patients mid left anterior descending artery segment was found to be involved in myocardial bridging. only 23 (7.19%) patients had atherosclerotic CAD. So there is significant association between myocardial bridging and atherosclerotic coronary artery disease proximal to bridge segment (p -value<0.001) and myocardial bridging is considered to be an independent risk factor for atherosclerosis proximal to bridge segment.

CONFLICT OF INTEREST

This study has no conflict of interest to be declared by any author.

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