

## “A study to find out the incidence of myocardial bridges in the formalin fixed hearts and its co relates”

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### **Abstract:**

**Background:** Myocardial Bridges are structures consisting of cardiac muscle fibers which pass above the coronary arteries and their branches. It is regarded as a common anatomic variant rather than a congenital anomaly

### **Objectives:**

1. To find the incidence of myocardial bridges in the formalin fixed hearts.
2. To study its distribution and its correlates in the different coronary arteries.

**Material & Method:** A total of 60 formalin fixed hearts were dissected. All the cadavers hearts were adults hearts. After cleaning hearts were numbered and dissected and Coronary Vessels were then traced from the aortic sinus to their termination by cleaning the epicardium and perivascular fat tissues. The origins and courses of two coronary arteries were thus cleared. Once a myocardial bridge had been identified, it was cleaned properly and numbered. The exact locations from the beginning till the end of myocardial bridges were defined. The length of each bridge as well as its distance from the sinus was measured directly by using thread and measuring scale.

**Result:** Of the total 60 formalin fixed hearts dissected, myocardial bridges were present in 22 hearts(36.7%). The incidence of myocardial bridges was statistically significantly higher in the left coronary artery (36.7%) as compared to the right coronary artery. Its clearly shows that incidence of myocardial bridging is highest in anterior interventricular artery(AI)

**Conclusion:** The present study hereby observed that incidence of myocardial bridges are quite common in the human being. They are most commonly observed in the left anterior descending artery and t their branches.

**Keywords:** Myocardial bridges, cadaveric heart, morphology of heart.

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### **I. Introduction:**

Myocardial Bridges are structures consisting of cardiac muscle fibers which pass above the coronary arteries and their branches. It is regarded as a common anatomic variant rather than a congenital anomaly<sup>(1)</sup>. Usually coronary artery and their branches run through the subepicardial tissues and penetrate the myocardium but there are exceptions to this rule. It is reported that coronary artery may penetrate the myocardium and then rise again to the surface. The fibers overlying the intramyocardial segment of an epicardial coronary artery are then termed as myocardial bridges

The artery crossing within the myocardium is called as tunneled artery.

### **Incidence:**

AG Ferriera et al<sup>(2)</sup> in 1991 in a study of 90 hearts found myocardial bridges in 55.6%. The left anterior descending artery was reported to be the most commonly affected artery.

The Frequency of a myocardial bridge in the left anterior descending coronary artery is high, some times > 50% by autopsy,<sup>(3,4)</sup> but its < 5% by angiography.<sup>(5,6)</sup> Because myocardial bridges have been identified angiographically indirectly through a “milking effect” phenomenon induced by systolic compression of the myocardial bridge, a thin or short myocardial bridge is often missed<sup>(7)</sup>. In subjects with anigiographically normal coronary arteries, the use of provocation test may enhance the systolic compression and thereby reveal the myocardial bridges in ≤ 40% of cases. On average, myocardial bridges are present in about one third of adults.

Although the postmortem incidence of Myocardial Bridges may approaches 30%-40%, a much lower proportion of about 5% of general population is reported to have coronary narrowing.

A high incidence has also been reported in heart transplant recipients and in patients with hypertrophic obstructive cardiomyopathy (HOCM). In the latter, more vigorous contraction may unmask otherwise undetectable bridges. Myocardial bridging may be found at multiple sites in HOCM, but also in patients without. De novo, previously nonexistent myocardial bridging has been suggested for both transplanted hearts and HOCM, but conclusive proof is lacking.

So the present study was carried out with the following objectives:

1. To find the incidence of myocardial bridges in the formalin fixed heart.
2. To study its distribution and its correlated in the different coronary arteries.

## **II. Material & Methods:**

### **Study Area:**

The present study was carried out in the Department of Anatomy, Gandhi Medical College, Bhopal

**Study Period:** One and Half year from 1<sup>st</sup> July 2012 to 30<sup>th</sup> Dec 2013

**Study Design:** The present study was a Dissection ( Hospital) based Cross sectional Descriptive study

**Sample Size and Sample Selection:** A total 60 hearts were included in this study irrespective of age and sex. They were procured from dissection room cadaver from Department of Anatomy, Gandhi Medical College, Bhopal. All the cadavers were adults. These hearts were collected, cleaned and numbered before keeping it separately with all the aseptic precautions in 10% formalin.

### **Methodology:**

The clean and numbered hearts were dissected and Coronary Vessels were then traced from the aortic sinus to their termination by cleaning the epicardium and perivascular fat tissues by using different types forceps and scalpel

The origins and courses of two coronary arteries were thus cleared.

- Left Coronary Artery: The left coronary artery along with its branches was dissected as it passed between the left auricle and pulmonary trunk. It was followed to its most distal end.
- Right Coronary Artery: The right coronary artery along with its branches was also dissected and followed to its most distal end.

The presence and location of myocardial bridges were noted during the course in these vessels along with the part of the artery or its branch it was crossing.

### **Myocardial Bridges:**

Once a myocardial bridge had been identified, it was cleaned properly and numbered. The exact locations from the beginning till the end of myocardial bridges were defined. The length of each bridge as well as its distance from the sinus was measured directly by using thread and measuring scale. For position of myocardial bridge, each artery investigated was divided into three equal divisions during its course. The frequency of occurrence and location of myocardial bridge or bridges were then calculated.

Both proximal and distal parts of coronary arteries associated with bridges were colored by the use of brush and fabric color. Specimens showing myocardial bridges were photographed by Sony digital camera of 12 mega pixel intensity from various angles.

### **Statistical Analysis:**

Descriptive statistics was used for the analysis and interpretation of the results. Descriptive statistics in the form of mean, percentage, proportions and Standard Deviation (SD). The difference in the mean between the two segment was compared using student un paired t test. The level of significance was kept at  $p < 0.05$  at 95% Confidence Interval (CI)

## **III. Result:**

Of the total 60 formalin fixed heart dissected, myocardial bridges was present in 22 hearts, thus the incidence of myocardial bridges in the present study is 36.7%. The incidence of myocardial bridges was statistically significantly higher in the left coronary artery (36.7%) as compared to the right coronary artery. (Table 1). All the heart who should the presence of myocardial bridges in the Right Coronary Artery had a subsequent presence in the left coronary artery also.

The comparative incidence of total myocardial bridging over individual artery was found to be statistically significant. ( $p < 0.05$ ) Its clearly shows that incidence of myocardial bridging is highest in anterior interventricular artery (AI) followed by posterior interventricular branch (PI), of right coronary artery. Myocardial bridge was exclusively found over the AI branch of left coronary artery and PID branch and right coronary artery. (Table 2).

The average length of bridge is 18.42 mm in Left Coronary Artery (Range from 9mm to 61mm) compared to 15.53 mm in Right Coronary Artery (Range from 14 mm to 17mm).

## **IV. Discussion:**

In the present study of the 60 formalin fixed heart dissected, 22 heart reported to have one or more myocardial bridges, thus the incidence of myocardial bridges in this study is 36.7%. (Table -1). This correlate well with the studies carried out by different researches like Saidi H et al (2010)<sup>(8)</sup>, Stefan et al (2002)<sup>(9)</sup>,

Kosinski et al (2001)<sup>(10)</sup> and Loukas et al (2006)<sup>(11)</sup> However, the incidence is higher than the findings reported by Geiringer et al (1951)<sup>(3)</sup> and lower than that of Ferreira et al (1991)<sup>(2)</sup>. This difference could be attributed to the fact that there is some variation in the number of the hearts examined.

In the present study the incidence in the anterior interventricular artery is 36.67 % (Table-2) where as in Geiringer<sup>(3)</sup>, Polacek<sup>(12)</sup> and Loukas<sup>(11)</sup> it was 23%, 25 % and 17.5% respectively.

High incidence of myocardial bridges over anterior interventricular artery reported in the present study correlates with the finding of Stefan et al (2002)<sup>(9)</sup> and Vanildo et al (2002).<sup>(13)</sup>

In the study by Angelini (1983)<sup>(14)</sup> and Harikrishnan (1999)<sup>(5)</sup> using the method of angiography all the bridges reported were on anterior interventricular artery but the incidence was lower than the present study. It was 5.5% and 0.6% respectively. This difference in the incidence of myocardial bridge between the present study and the study carried out by Angelini(1983)<sup>(14)</sup> and Harikrishnan (1999)<sup>(5)</sup> could be attributed to the different method of identification of myocardial bridges.

In the present study highest incidence of bridges 33.3% was observed over middle one third of anterior interventricular artery (Table-3). Vanildo(2002)<sup>(13)</sup> also reported a high incidence (88.6%) of bridging over the middle one third of anterior interventricular artery, though the percentage of incidence reported is much higher than that reported in present study.

It was observed in the present study that the incidence of myocardial bridges in the anterior interventricular arteries (36.7%) is higher than the Loukas study<sup>(11)</sup> which was 17.50%. In the present study no cases of Myocardial bridges is reported in the Diagonal branch of the left coronary artery while in Loukas study<sup>(11)</sup> which was 7%

In the present study no cases of Myocardial Bridges reported in Marginal Branch of Circumflex artery. Incidence of Myocardial Bridges in Posterior interventricular branch of Right Coronary artery is 5% which is near to the study of Loukas<sup>(11)</sup> where incidence of Myocardial Bridges in marginal branch of Circumflex artery was 2.5% and posterior interventricular branch of right coronary artery was 4%. However the total percentage of Myocardial Bridges was seen quite similar in the present study 36.7% in comparison with 34.5% observed by Loukas<sup>(11)</sup>.

Average lengths of Myocardial Bridges over both arteries were also lower in comparison with the Saidi H et al<sup>(8)</sup> in which the average length is 22-23mm. Value is also lower if compared with Ferreira et al<sup>(2)</sup> in which average length is 20-21 mm measured. In a study by Ko SM et al<sup>(15)</sup> the length of tunneled artery was between 5 and 27mm with a mean of 15.7mm which value is closer to over study.

According to Dan Dermengiu et.al. (2010)<sup>(16)</sup> the length of typical myocardial bridge is usually within the 10-30 mm range, only rarely exceeding 40mm. A longer Myocardial Bridges seem to be associated with more significant hemodynamic effect and more severe clinical symptoms

Some report attribute the clinical symptoms of myocardial bridges to their extensive length (Kramer et al,1982<sup>(17)</sup>, Angelini et al,1983<sup>(14)</sup>, Juilliere et al 1995<sup>(18)</sup>). Both angiography and autopsy reports have shown that the length of Myocardial Bridges varies widely from 4 to 40 mm which is similar to current finding (Polacek 1961<sup>(12)</sup>, Hansen 1982<sup>(19)</sup>, Ferreira et al 1991<sup>(10)</sup>). It has been shown experimentally that the length of coronary arterial narrowing markedly influences coronary hemodynamic (Feldman et al 1978)<sup>(20)</sup>. This may explain why relatively long bridges are observed in symptomatic patients (Bourasa et al 2003)<sup>(21)</sup>

Although Geiringer<sup>(3)</sup> did not observed double and triple Myocardial Bridges, the analysis of majority of investigators and in the present study it was observed that they can potentially occur (over one or more coronary arteries) Ferreira et al<sup>(2)</sup> ascertain the existence of triple Myocardial Bridges related to different arteries in five heart and Baptista and Didio<sup>(22)</sup> found double Myocardial Bridges

## V. Conclusion:

The present study hereby observed that incidence of myocardial bridges are quite common in the human being. They are most commonly observed in the left anterior descending artery and their branches. The present study also concludes that myocardial bridges most commonly occur as single bridge but multiple bridges also cannot be ruled out.

## References:

- [1]. Konen E, Goitein O, Di Segni E. Myocardial bridging, a common anatomical variant rather than a congenital anomaly. Semin Ultrasound CT MR,2008; 29: 195-203.
- [2]. Ferreira AG, Trotter SE, König B Jr, Decourt LV, Fox K, Olsen EG. Myocardial bridges: morphological and functional aspects. Br Heart J 1991;66:364-7.
- [3]. Geiringer E. The mural coronary. American heart Journal, 1951; 41: 359-368
- [4]. Burnside C, Edwards JC, Lansing AI, Swarm RL. Atherosclerosis in the intramural and extramural portion of Coronary arteries in the Human Heart. Circulation,1956;13: 235-41.
- [5]. Harikrishnan S, Sunder KR and Tharakan J et al., Clinical and angiographic profile and follow-up of myocardial bridges: a study of 21 cases. Indian Heart Journal , 1999;51: 503-507.
- [6]. Resar JR, Brinker JA. Bridge work. Cathet Cardiovascular Diagnosis, 1997;41: 421-422.

[7]. Mohlen S, Hort W, Ge J, Erbel R. Update on Myocardial Bridging. *Circulation*,2002; 106: 2616-2622.

[8]. Saidi HS, Olumbe AO, Kalebi A. The anatomy and pathology of coronary arteries in adult Kenyans. *EAMJ*, 2002; 76: 323-7.

[9]. Stefan M, Waldemar H, Junbo Ge, Raimund E. Update on Myocardial Bridging. *Circulation.*, 2002;106:2616-2622

[10]. Kosinski A, Grzybiak M. Myocardial bridges in the human heart: morphological aspects. *Folia Morph*, 2001;60: 65–68.

[11]. Loukas M, Curry B, Bowers M, Louis Jr RG, Bartczak A, Kiedrowski M et al. The relationship of myocardial bridges to coronary artery dominance in the adult human heart. *J. Anat.*,2006;209: pp43–50.

[12]. Polacek P, Zechmeister A (1968) The occurrence and significance of myocardial bridges and loops on coronary arteries. *Opuscula Cardiologica. Acta Facultatis Medicae Univesitatis Brunensis, Brno.*

[13]. Vanlido Jr, Jenney SC, Tetsuo T. Myocardial bridges and their relationship to the anterior interventricular branch of left coronary artery. *Arq. Bras. Cardiol*, 2002; 79: 219-222.

[14]. Angelini P, Trivellato M, Donis J, Leachman RD. Myocardial Bridges : A review. *Progr Cardiovasc Dis*,1983;26:75-88.

[15]. Ko SM, Choi JS, Nam CW, Hur SH. Incidence and clinical significance of myocardial bridging with ECG-gated 16-row MDCT coronary angiography. *Int J Cardiovasc Imaging*. 2008 Apr;24(4):445-52.

[16]. Dermengiu D, Vovolis I, Hostiuic S, Curcă GS, Rusu RS, Luca3 L. Morphological features in myocardial bridging. *Rom J Leg Med*, 2010;18: 163 – 170.

[17]. Kramer JR, Kitazume H, Proudfit WL and Sones FM Jr. Clinical significance of isolated coronary bridges: benign and frequent condition involving the left anterior descending artery. *American Heart Journal*, 1982;103: 283-288.

[18]. Juilliere Y, Berder V, Suty-Selton C, Buffet P, Danchin N, Cherrier F (1995) Isolated myocardial bridges with angiographic milking of the left anterior descending coronary artery: a long term follow up study. *Am Heart J*,1995 ;129: 663–665.

[19]. Hansen BF. Myocardial covering on epicardial coronary arteries. Prevalence, localization and significance. *Scand JThorac Cardiovasc Surg* 1982;16:151-5.

[20]. Feldman AM, Baughman KL. Myocardial infarction associated with a myocardial bridge. *Am Heart J*, 1986;111:784-7.

[21]. Bourasa MG, Butnaru A, Lesperance J, Tardif JC. Symptomatic myocardial bridges: overview of ischemic mechanisms and current diagnostic and treatment strategies. *J Am Coll Cardiol*, 2003; 41: 351–359.

[22]. Baptista CAC, DiDio LJA. The relationship between the directions of myocardial bridges and the branches of the coronary arteries in the human heart. *Surg Radiol Anat*. 1992;14:137–140.

**Tables:**

**Table 1: Comparison of incidence of myocardial bridges (MBs) over left coronary artery (LCA) and right coronary artery (RCA)**

Distribution of myocardial bridges in the different coronary arteries	LCA	RCA	P value
Number of Hearts showing myocardial bridges	22	3	<b>P= 0.0024 df=1 <math>\chi^2 = 9.191</math></b>
Percentage of heart showing myocardial bridges	36.67%	5%	

LCA: Left Coronary artery : RCA Right Coronary Artery

**Table 2: Total incidence of myocardial bridging and its comparative incidence over individual artery**

Myocardial bridges run over	Left coronary artery			Right Coronary artery	
	AIV artery	Diagonal branch	Marginal branch of circumflex artery	Over First segment of right coronary artery	PIV br. of RCA
Number of heart showing MB	22	0	0	0	03
Percentage of heart showing MB	36.7	0	0	0	5
P value	<b>P= 0.0064 df=1 <math>\chi^2 = 7.445</math></b>				

AIV: Anterior Interventricular artery; PIV: Posterior Interventricular artery; RCA Right Coronary Artery