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INCIDENCE OF MYOCARDIAL BRIDGES OVER CORONARY ARTERIES IN HUMAN CADAVERIC HEARTS

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Abstract: Main coronary arteries and their major branches are usually subepicardial but those in atrio-ventricular and interventricular sulci are often deeply sited, occasionally hidden by myocardium or embedded in it. The muscle overlying it is called as 'Myocardial bridge'. The objective of present study is to find the incidence, length and relation of myocardial bridges to coronary dominance. The study was conducted on 94 human cadaveric hearts after ethical committee approval. Coronary arteries were dissected out and myocardial bridges were identified. The presence and location of myocardial bridges over coronary arteries and their major branches was observed and noted. Incidence of myocardial bridges was found to be 62.76%. In 51.06% of hearts left coronary artery and in 11.70% right coronary artery were involved. Maximum length of myocardial bridges on left coronary artery branches was found to be 6.42 cm while minimum length was 3.12 cm with the mean of 3.94 cm and S.D. 0.70. In right coronary artery maximum length was 2.45 cm and minimum length was 0.48 cm. The mean was 1.05 cm and S. D. was 0.58. p- value is <0.0001 which is highly significant. Myocardial bridges were seen in 59 hearts. Out of which 41 were right coronary dominant, 14 left coronary dominant and 4 were balanced dominant. Knowledge of myocardial bridges is essential for cardiologists to detect etiology of different heart related problems, to plan the mode of treatment and to predict their prognosis.

Introduction: Coronary artery disease is one of the major causes of death in developing countries[1]. An intimate knowledge of the anatomy of coronary arteries, the 'crown' of the heart, is a self-evident pre-requisite for a complete understanding of the coronary artery disease or for more intelligent planning of surgery.,"[2]

Main coronary arteries and their major branches are usually subepicardial but those in atrio-ventricular and interventricular sulci are often deeply seated, occasionally hidden by myocardium or embedded in it. The muscle overlying is myocardial bridge and underlying artery is termed as tunnel or mural artery. These bridges were considered as transitional stages in further development of coronary artery towards the subepicardial course which is found at the highest stage of development. Such bridges represent remainders of phylo-

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genesis which are repeated in the ontogenesis of man. Coronary arteries are of Type B arteries in which they are mainly epicardial but exhibit frequent intramyocardial course in short segments.[3]

Myocardial bridging is an attractive and intriguing area of research and should remain the focus for future studies. The clinical significance of myocardial bridges is uncertain and many patients are asymptomatic. It has been suggested that myocardial bridges may be a contributing factor in the development of myocardial ischaemia, circulatory problems, angina, myocardial infarction, sudden cardiac death, systolic compression and other cardiac disturbances that may require surgical intervention. Conversely, it has been proposed that myocardial bridges offer a 'protective effect' from atherosclerosis within the coronary artery that is bridged when compared with non-bridged vessels of the same heart[4].

The recent introduction of selective coronary arteriography that provides an accurate localisation of the anatomical variations and underlying pathology, the advances made in coronary arterial bypass surgeries and modern methods of myococardial revascularisation makes it imperative that a thorough, sound and complete knowledge of the normal and variant anatomy of coronary artery and circulation is required[1].

A cadaveric study in unsuspected population provides the basis for understanding the variations in the coronary arteries[1].

The aim of present study is to find the incidence, length and relation of myocardial bridges to coronary dominance.

Material and methods:

The present study was carried out in the Department Of Anatomy, Government Medical College after taking permission from Ethical Committee. The 94 heart specimens for this study were obtained from the Anatomy and Forensic departments. These were fixed in 10% Formalin solution. After opening the thorax, the pericardial cavity was opened, the great vessels were ligated and the specimen of heart along with great vessels was removed from the thoracic cage. The right and left coronary arteries were dissected out, noting down their origin, branching pattern and variations if any at sub-epicardial level. The coronary arteries may dip into the myocardium for varying lengths and then reappear on the heart's surface. This muscle overlying the intramyocardial segment of the epicardial coronary artery is termed as "Myocardial bridge". The presence and location of myocardial bridges over coronary arteries and their major branches was observed and noted. The extent was measured with the help of thread and Vernier calliper. Presence of myocardial bridges and dominance of coronary arteries was determined.. Parameters were written in Proforma and photographs were taken with digital camera

Materials used during dissection procedure:

1. Scissors 2. Forceps 3. Thread 4. Digital Vernier Calliper 5.Billa for numbering the hearts 6. Digital camer

Observation and Results:

Table 1 : Incidence of myocardial bridges over left and right coronary arteries

Name of Artery	Total No Of Hearts	Myocardial Bridges	Percentage
Left coronary artery	94	48	51.06%

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Right coronary artery	94	11	11.70%

Myocardial bridges were seen in 51.06% of hearts over left coronary artery. In 11.70% of hearts myocardial bridges were seen over right coronary artery. Thus overall incidence of myocardial bridges was found to be 62.76%.

Table 2 : Incidence of Myocardial Bridges over Major Branches of Coronary Arteries (N-59)

Myocardial Bridges over Left Coronary Artery N=48				**Myocardial Bridges over Right Coronary Artery N=11**	
Anterior Interventricular A.			**Cicumflex Artery**	**1st Segment**	**Post Interventricular Artery**
Proximal 1/3	**Middle 1/3**	**Distal 1/3**			
15	29	4	0	11	0
31.25%	60.41%	8.34%	0	100%	0

Myocardial bridges were present in 59 hearts.Out of these 48 hearts had myocardial bridges on the anterior interventricular branch of left coronary artery.Maximum number of myocardial bridges 60.41% were found on the middle segment of anterior interventricular artery.31.25 % were present on proximal third and 8.34% were seen on distal segment of anterior interventricular artery. Myocardial bridges were not seen on circumflex artery. In remaining 11 cases (100%) myocardial bridges were found over first segment of Right coronary artery. Myocardial bridges were not seen on Posterior interventricular branch.

Table 3 : Extent (length) of the bridges in different coronary arteries

Length(cm)	**Left coronary artery branches**	**Right coronary artery**	**t-value**	**p-value**
Maximum	6.42	2.45	12.66	<0.0001
Minimum	3.12	0.48		
Mean	3.94	1.05		
S.D.	0.70	0.58		

Above table shows the extent (length) of myocardial bridges on left coronary artery branches and right coronary artery. Maximum length of myocardial bridges on left coronary artery branches was found to be 6.42 cm while minimum length was 3.12 cm with the mean

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of 3.94 cm and S.D. 0.70. In right coronary artery maximum length was 2.45 cm and minimum length was 0.48 cm. The mean was 1.05 cm and S. D. was 0.58. p- value is <0.0001 which is highly significant.

Table 4 Percentage and number of specimen with regard to coronary dominance in myocardial bridged coronary arteries (n=59)

Dominance of coronary arteries	**No. of specimen**	**Bridges over left coronay artery**	**Bridges over right coronary artery**
Right coronary dominance	41	39(66.10%)	2(3.39%)
Left coronary dominance	14	6(10.16%)	8(13.55%)
Balanced dominance	4	3(5.09%)	1(1.70%)
Total	59	48(81.35%)	11(18.64)

Analysis of above table shows that myocardial bridges were seen in 59 hearts. Out of which 41 were right coronary dominant, 14 left coronary dominant and 4 were balanced dominant. Out of 41 right coronary dominant hearts, 39 (66.10%) hearts had myocardial bridges over left coronary artery and in 2 (3.39%) hearts, bridges were present on right coronary artery. While in 14 left coronary dominant hearts, myocardial bridges were present on left coronary artery in 6 (10.16%) hearts and over right coronary artery in 8 (13.55%) cases. Similarly in 4 balanced dominant hearts 3 (5.09%) hearts had myocardial bridges over left coronary artery and in 1 (1.70%) over right coronary artery.

Discussion:

Myocardial bridging (MB) is an important cardiological entity which has led to many controversies. The incidence varies from report to report and also depends on method of study. Reymon (1737)[5]was the first to mention muscle fibres of myocardium overlying coronary artery. Geiringer (1951)[6]presented an in depth analysis of myocardial bridges studied by dissection method on autopsy samples and reported an incidence of 23% with predominance of myocardial bridges on anterior interventricular artery. He described myocardial bridging for the first time.Polacek (1961)[7] reported an incidence of myocardial bridges of 85.7% and opined that myocardial bridges played a role in sclerotic process since intimal hyperplasia of the arteries was observed, proximal to the bridges. The morphological study on MB shows wide variations. In the Present study the incidence of myocardial bridging was found to be 62.76% which is comparable with Ferreira A.G.(1991)[8] : 55.60%, Ballesterosle L.E.(2008)[9] : 70.90%, Bharambe V.et al(2008)[10]: 56% and Sabnis A.S.(2013)[3] :

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65.70%. While low incidence was found by Soram O.(2000)[11] : 5%,LoucasM (2006)[4] : 34.50%, Kosinksi A (2004)[12] : 31.30% and Jothi S (2012)[13] : 0.61% whereas De melo lima (2002)[14] and Bandipadhyay M (2010)[15] found high incidence of 86.66% and 90.4% respectively as compared to Present study. Myocardial bridging were found to be significantly more common on the Anterior Interventriclar artery (AIVA). All the above mentioned authors found MB more common on AIVA which coincides with present study.
The term 'dominant' is used to refer to the coronary artery giving off the posterior interventricular (descending) branch, which supplies the posterior part of the ventricular septum and often part of the posterolateral wall of the left ventricle. Variability in the origin of the posterior interventricular artery (PIVA) is expressed by the term "Dominance". The term right or left "Coronary Preponderance" or "Dominance" was used to show which coronary artery irrigates the heart's diaphragmatic surface, based on the origin of the posterior interventricular artery. Origin of the PIVA from the right coronary artery (RCA) was termed 'right dominance'; from the circumflex artery was called 'left dominance'. Origin from both the RCA and the circumflex artery was known as 'balanced' dominance.

Table 5 Comparison of incidence of MB seen over dominant and non-dominant arteries with present study

Authors	**MB over LCA in RCAD**	**MB over RCA in RCAD**	**MB over LCA in LCAD**	**MB over RCA in LCAD**	**MB over LCA in Balanced**	**MB over RCA in Balanced**
Loucas(2006)	3%	6%	21%	2%	2%	1%
Bharambe(2008)	40%	6%	6%	0%	6%	2%
Present Study	66.10%	3.39%	10.16%	13.55%	5.09%	1.70%

(MB-Myocardial bridge, LCA-Left coronary artery, RCA-Right coronary artery, RCAD-Right coronary artery dominance, LCAD- Left coronary artery dominance)

In the Present study maximum incidence of myocardial bridges was observed over the left coronary artery in case of right coronary dominance as (66.10%). This incidence is higher than 40% incidence reported by Bharambe et al (2008)[10] and much higher than the 3% incidence reported by Loucas M. (2006)[4]. Incidence of myocardial bridges over right coronary artery in right coronary dominant heart was 3.39% and left coronary artery in left coronary dominant heart was 10.16%. Loucas M (2006)[4] reported a 21% incidence of myocardial bridges over the left coronary artery dominance which is much higher than the incidence reported in present study. In balanced dominance the incidence of myocardial bridges over left coronary artery was 5.09% and over right coronary artery 1.70% which is almost similar with the findings of Bharambe et al (2008)[10].

Clinical significance of Myocardial Bridges: In case of obstruction of the left coronary artery due to myocardial bridging, the wider distribution of right coronary artery in right coronary dominant heart may result in lesser part of myocardium suffering from an infarct.

In case of obstruction of the dominant artery due to it being covered by myocardial bridge would result in widespread effects due to larger percentage of myocardium being supplied by the dominant artery.

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In case of balanced dominance effects of obstruction due to myocardial bridging would be less due to the interventricular septum being supplied by both right and left coronary arteries.

Thus the knowledge of myocardial bridges is essential for cardiologist to detect etiology of different heart related problems to plan the mode of treatment and to predict their prognosis.

Summary and Conclusion

The study was also carried out to know the dominance of coronary arteries and myocardial bridges.In all 94 human cadavers (66 males and 28 females) have been studied. The ages varied from 21 years to more than 70 years. The study was carried out after taking permission from ethical committee. The dissection method was followed and following observations have been made.

1. Incidence of myocardial bridges on left coronary artery was 51.06% and 11.70% on right coronary artery.
2. Maximum incidence of myocardial bridges was found on anterior interventricular artery.
3. Length of myocardial bridge on left coronary artery ranged from 3.12 to 6.42 cm with the mean of 3.94±0.70 cm. The range of length of myocardial bridge on right coronary artery was 0.48-2.45cm and the mean was 1.05±0.58cm.
4. There was maximum incidence of myocardial bridge on left coronary artery in case of right dominant heart.

   Thus the study was discussed and it was concluded that knowledge of myocardial bridges is essential for cardiologists to detect etiology of different heart related problems, to plan the mode of treatment and to predict their prognosis.

Work done in the present study was just like exploring the tip of iceberg. The rest of it needs to be explored.

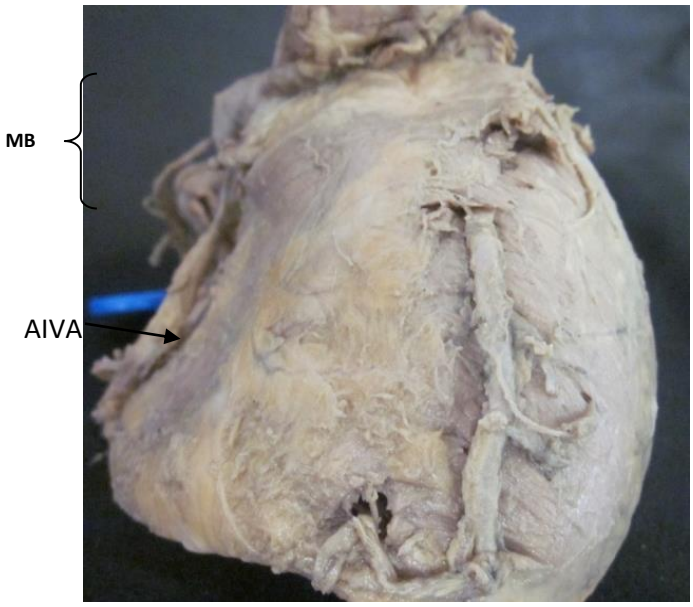

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Figure 1. Showing myocardial bridge (MB) on proximal segment of anterior interventricular artery (AIVA).

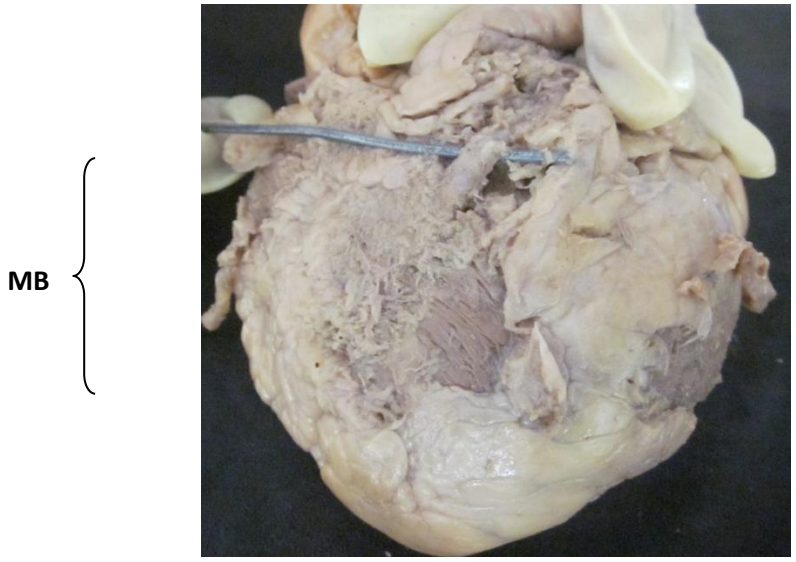

Figure 2. Showing myocardial bridge (MB)on middle segment of anterior interventricular artery

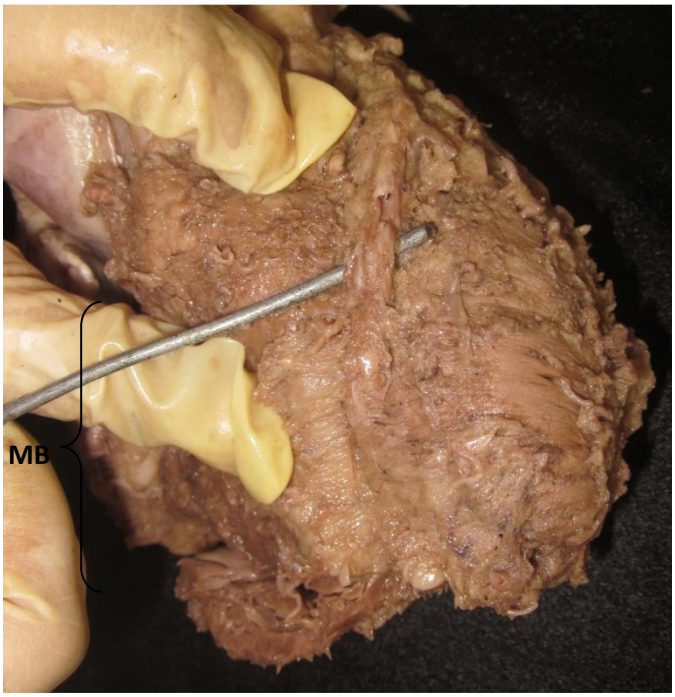

Figure 3 Showing myocardial bridge on distal segment of anterior interventricular artery

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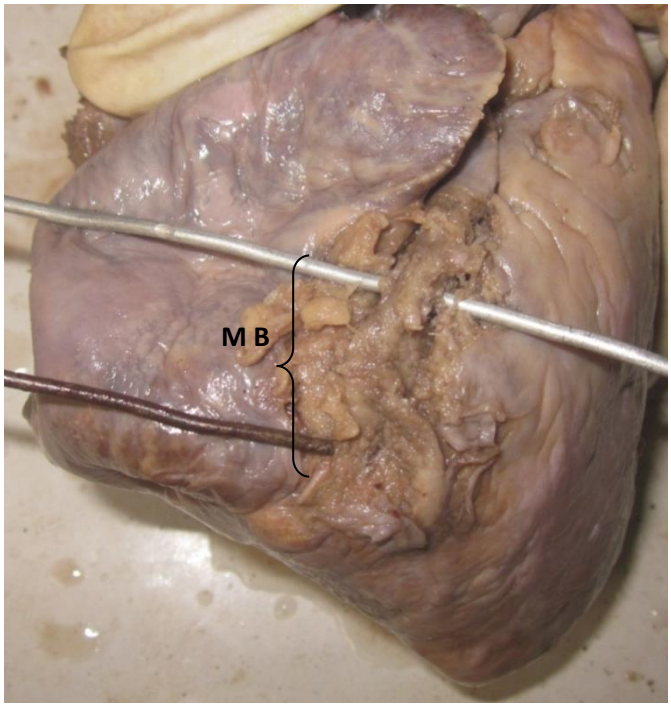

Figure 4. Showing myocardial bridge on right coronary artery.

Abbreviations

MB-Myocardial bridge
LCA-Left coronary artery
RCA-Right coronary artery
RCAD- Right coronary artery dominance
LCAD- Left coronary artery dominance

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