Study of Myocardial Bridges in the Hearts of the Human Cadavers

Dr. Shashanka M.J[1]

[1] DM - Wayanad Institute Of Medical Sciences / Kerala University Of Health Sciences

Received: 16 December 2013 Accepted: 4 January 2014 Published: 15 January 2014

Abstract

Background: Myocardial bridging is recognized as an anatomical variation of the human coronary circulation in which an epicardial artery lies in the myocardium for part of its course. Thus, the vessel is ?bridged? by myocardium. The possible clinical implications of myocardial bridging may vary from protection against atherosclerosis to systolic vessel compression and resultant myocardial ischemia. Materials and Methods: This study was carried out on 50 normal formalin fixed human heart specimens. Dissection was performed according to standard techniques. Percentage and distribution of myocardial bridges and its relationship with coronary artery dominance pattern of the heart were noted and documented. Results: Myocardial bridges were found in 35 (70

Index terms— anterior interventricular artery, coronary artery dominance, left coronary artery, myocardial bridges, right coronary artery.

1 Study of Myocardial Bridges in the Hearts of the Human Cadavers

Dr. S waroop N. ? , Dr. G. C. Poornima ? & Dr. Shashanka M. J ? Abstract-Background: Myocardial bridging is recognized as an anatomical variation of the human coronary circulation in which an epicardial artery lies in the myocardium for part of its course. Thus, the vessel is 'bridged' by myocardium. The possible clinical implications of myocardial bridging may vary from protection against atherosclerosis to systolic vessel compression and resultant myocardial ischemia.

Materials and Methods: This study was carried out on 50 normal formalin fixed human heart specimens. Dissection was performed according to standard techniques. Percentage and distribution of myocardial bridges and its relationship with coronary artery dominance pattern of the heart were noted and documented.

Results: Myocardial bridges were found in 35 (70%) of the hearts with a total of 46 bridges. Bridges were most often found over the anterior interventricular artery (28 MB), on its middle third (20 MB). Bridges were also found over the diagonal branch (4 MB) and over the left marginal branch (3 MB) branch of the left coronary artery. Out of 11MB found over the right coronary artery, 5 MB was found over the first segment and 6 MB over the posterior interventricular branch of the right coronary artery. Twenty seven (77.1%) of the hearts with bridges were right dominant. Six hearts (17.1%) were left dominant.

2 Introduction

uscle bridge/ myocardial bridge are structures consisting of heart muscle tissue which pass above the coronary arteries and their branches. The first description of myocardial bridge dates from 1737 -Reymann [1] , who observed that segments of the left coronary artery can be covered with the thin layer of heart muscle fibre. [2] The epithelial cells undergo epithelial -tomesenchymal transition controlled by the factors from the myocardium. The mesenchymal cells thus formed migrate through the spaces generated in the developing

myocardium finally forming the coronary arterial system. This migration of these mesenchymal cells through the developing myocardium could explain the embryogenesis of myocardial bridges over the portions of coronary arteries. [3] Myocardial bridge has been considered a benign condition, but the following complications have been reported: ischemia and acute coronary syndrome, coronary spasm, ventricular septal rupture, arrhythmias, exercise induced atrioventricular conduction block, stunning, transient ventricular dysfunction, early death after cardiac transplantation and sudden death.The degree of coronary obstruction by a myocardial bridge depends on factors such as location, thickness, length of Muscle Bridge and degree of contractility. The range of myocardial bridge in human cardia when assessed by angiography varies from 1.5% to 16%, but in some autopsy studies it was as high as up to 80%. [4] Thus in view of its above complication, myocardial bridge should be considered as an anatomical risk factor in evaluating coronary artery disease. There is a wide variation in percentage of heart showing myocardial bridges in every study reported. All these factors made to take up the present study, and perform detailed anatomical study of myocardial bridge in human heart by dissection method.

3 II.

4 Materials and Methods

The study was carried out on 50 formalin fixed human hearts from patients who had died of nonvascular causes and were autopsied. No gross abnormality of the heart was noted. Study was done without any grouping of specimens on the basis of sex and age. Dissection was performed according to standard autopsy techniques.The right and left coronary arteries were traced by cleaning the epicardium and fat piecemeal using the artery forceps, blunt forceps and mosquito forceps. The origins and course of the two coronary arteries were thus cleared.

The left coronary artery along with its branches was dissected as it passed between the auricle and pulmonary trunk. It was followed to its most distal end. The right coronary artery along with its branches was also dissected and followed to its most distal end. The presenceand location of the myocardial bridges were noted along with the part of the artery and or its branch it was crossing. Specimens showing myocardial bridges were photographed from various angles and were numbered.

The data were summarised using descriptive statistics like frequency (number of myocardial bridges), mean, standard deviation, range and 95% confidence interval. All the statistical calculations were performed using software SPSS for windows {Statistical Package for Social Service (SPSS) Inc, 2004, New York} version 13.0.

5 III.

6 Observations and Results

In the present study the overall prevalence of the myocardial bridging was found to be 70%, Out of total 35 hearts 6(17.14%) showed myocardial bridges on right coronary artery only, 24(68.57%) showed myocardial bridges on the left coronary artery only and 5(14.29%) showed myocardial bridges on both the right and left coronary arteries. Out of 35 hearts having myocardial bridges, 27(77.1%)of hearts were right dominant. 5(14.3%) of these had myocardial bridges over right coronary artery, 19(54.3%) on left coronary artery and 3(8.6%)over both right and left coronary artery.6 hearts were left dominant. One of these had myocardial bridges over right coronary artery, 3(8.6%) over left coronary artery and 2(5.7%) over both right and left coronary artery. The remaining 2(5.7%) hearts were co-dominant and in both myocardial bridges were present on left coronary artery. Even though the percentage of myocardial bridges were more on left coronary artery with right coronary dominance than others, it was not statistically significant(p value 0.5%).

7 IV.

8 Discussion

Muscle fibres of myocardium overlying coronary artery were first mentioned by Reymann [1] in 1737. They were described as 'myocardial bridges' by Geiringer [5] in 1951. The myocardial bridge is a distinctive anatomical entity whose pathophysiological role has evoked much controversy. Studies have shown that these bands are present from birth and their development is closely associated with the growth of the adjacent artery.

9 Prevalence of myocardial bridges(%) Comment

AUTOPSY METHOD 1 Geiringer [5] 100 23 AIV 2

Edwards et al [6] 276 5 All coronaries, 87% in AIV 3

Polacek [7] 70 86 AIV -60% 4 Giampalmo et al [8] 560 7 All coronaries, 95% in AIV only 5 Lee and Wu [9] 108 58 AIV 6 Ferreira et al [10] 90 56 All coronaries 7

Baptista and Didio [11] 82 54 All coronaries, 35% in AIV 8

Kosinski and Grzybiak [2] 300 31 All coronaries 9

Stankovic and Jesic [12] 23 56 All coronaries 10 Vaishaly K Bharabe et al [3] 50 56 All coronaries 11

Present study 50 70 All coronaries ANGIOGRAPHIC METHOD 12 Angelini et al [13] 1100 4.5% All patients 13 Harikrishnan et al [14] 3200 0.6% All patients 14

AyferMavi et al **??**15] 7200 0.4% All patients

The prevalence varies substantially among studies with a much higher rate at autopsy versus angiography. Variation at autopsy may in part be attributable to the care taken at preparation and selection of hearts.Polacek [7] , who included myocardial loops, reports the highest rate with bridges or loops in 86% of cases. The present study is 70% which was less than Polacek [7] but more than other studies.

Bridging of coronary arteries in otherwise angiographically normal arteries generally is not hazardous to the patient. However strenuous physical exertion results in compression of a portion of a coronary artery by a myocardial bridge.

Observations were made on the number of myocardial bridges on the hearts in the present study. Geringer [5] 1951 did not observe double and triple myocardial bridges, the analyses of majority of investigators tabulated below and our own observation confirms that these can potentially occur either over one or more coronary arteries. Ferreira AG et al [10] 90 50(55.6%) 70 35(38.9%) 10(11.1%) 5(5.5%) 3

10 Volume XIV Issue

Kosinski A et al [2] 300 94(33.3%) 114 75(24.9%) 18(5.9%) 1(0.3%) 4

Loukas M et al [16] 200 69(34.5%) 81 59(29.5%) 8(4%) 2(1%) 5

Stankovic I [12] 23 13(57%) 18 9(39.4%) 3(13.1%) 1(4.3%)

All the studies tabulated above showed the single MB in majority of cases followed by double and triple MB. But the percentages of MB are high in the present study when compared with others.

In the light of previous studies by Ferreira AG [10] 1991, Vanildo Junior de Melo Lima [17] 2002, Kosinski A [2] 2004, AyferMavi et al **??**15] 2008, Vaishaly K B et al [3] 2008,MB are most often associated with the left coronary artery on AIV, mainly the middle 1/3 rd of this. These results are consistent with our observation.The searching for the nature of this co-existence should probably focus on analysis of the processes connected with the development of the coronary vessels during foetal life. The formation of superficial arterial system begins between 5 and 6 weeks after fertilization and before the development of the myocardium has been arising. The earlier development of the artery leads to a completed. It is likely that the coincidence of these processes is a prerequisite for a myocardial bridge geater probability of some fibres of the myocardium forming a myocardial bridge over it. Initially arteries occur in grooves along the places with maximum concentration of connective tissue. The AIV stands apart as the first and MB are observed most frequently over this artery.

Observations were made on the distribution of hearts having MB on main coronary arteries in relation to the coronary arterial dominance pattern of heart. We found MB were distributed more over LCA in right coronary dominant hearts which is similar with the results of Vaishaly K B [3] 2008. Whereas the study done by Loukas [16] 2006 showed that MB were distributed more over LCA in left dominant hearts.

11 Conclusion

Myocardial bridges are still an open issue. The discussion whether it is a variation of physiology is still on going. In most of the individuals they do not cause symptoms but particularly in those with long and deep myocardial bridges, the anatomical relation of the myocardial fibres can distort the artery that can be identified angiographically. The possibility of bridges should be borne in mind in individuals with ischemia but no evidence of coronary atherosclerosis. [1]

1

Sl No.	Study	Sample size

Figure 1: Table 1 :

2

Year

Figure 2: Table 2 :

[1]

3

Studies	No. of hearts with MB(%)	Myocardial Bridges								
		Right dominant hearts			Left dominant hearts			Co-dominant hearts		
		LCA	RCA	Both LCA & RCA	LCA	RCA	Both LCA & RCA	LCA	RCA	Both LCA & RCA
Present study	35 (70%)	19 (38%)	5 (10%)	3 (6%)	3 (6%)	1 (2%)	2 (4%)	2 (4%)	-	-
Vaishaly K B [3]	30 (60%)	20 (40%)	3 (6%)	-	3 (6%)	-	-	3 (6%)	1 (2%)	-
Loukas [16] V.	69 (35%)	6 (3%)	11 (6%)	-	42 (21%)	4 (2%)	-	4 (2%)	2 (1%)	-

Figure 3: Table 3 :

[Jorge R Alegria et al. ()] , Joerg Jorge R Alegria , David R Herrmann , Amir HolmesJr , Lerman . *Charanjit S Rihal. Myocardial bridging* 2005. 26 p. . (European Heart Journal)

[Edwards et al. ()] 'Arteriosclerosis in the intramural and extramural portions of coronary arteries in the human heart'. J C Edwards , C Burnsides , R L Swarm . *Circulation* 1956. 13 p. .

[Harikrishnan et al. (1991)] 'Clinical and angiographic profile and follow up of myocardial bridges: A study of 21 cases'. S Harikrishnan , K R Sunder , J Thakaran , T Titus , A Bhat , S Sivasankaran . *Indian Heart J* 1991 Sep. 51 (5) p. .

[Reyman (1737)] 'Disertatio de vasiscordispropriis'. H Reyman . *Med DissUniv Gottingen* 1737 Sep 7. p. .

[Grzybiak and Skwarek ()] 'Distribution of muscular bridges in the adult human heart'. Adam Kosinski Marek Grzybiak , Magdalena Skwarek , Jolantahreczecha . *Folia Morphol* 2004. 63 (4) p. .

[Vanildo Junior De Melo and Lima (2002)] 'Jennecy Sales Cavalcanti, Tetsuo Tashiro. Myocardial bridges and their relationship to the anterior interventricular branch of the left coronary artery'. Vanildo Junior De Melo , Lima . *Arq Bras Cardiol* 2002 Sep. 79 (3) p. .

[Angelini et al. ()] 'Myocardial bridges: a review'. P Angelini , M Tivellato , J Donis . *ProgCardiovasc Dis* 1983. 26 p. .

[Ferreira et al. ()] 'Myocardial bridges: morphological and functional aspects'. A G Ferreira , Jr , S E Trotter , B KonigJr , L V Decourt , K Fox , E G J Oslen . *British Heart J* 1991. 66 p. 364.

[Polacek and Kralove ()] 'Relation of myocardial bridges and loops on the coronary arteries to coronary occlusions'. P Polacek , H Kralove . *Am Heart J* 1961. 61 p. .

[Giampalmo et al. ()] 'Sulla minor compromissioneateroscleroticadellearteriecoronarie quandosiano (per varianteanatomica) in situazione intramiocardica'. A Giampalmo , E Bronzini , T Bandini . *GiornaleItal Arterioscl* 1964. 2 p. .

[Stankovic and Milicajesic ()] 'The morphometric characteristics of myocardial bridges'. Ivan Stankovic , Milicajesic . *Journal of EMSA on Medical and Scientific Affairs* 2006. p. .

[Geiringer ()] 'The mural coronary artery'. E Geiringer . *Am Heart J* 1951. 41 p. .

[Baptisda and Didio ()] 'The relationship between the directions of myocardial bridges and the branches of the coronary arteries in the human heart'. Cac Baptisda , Lja Didio . *SurgRadiolAnat* 1992. 14 p. .

[Loukas et al. (2006)] 'The relationship of myocardial bridges to coronary artery dominance in adult human heart'. M Loukas , B Curry , M Bowers , R G Louis , A Bartozak , M Kiedrowski . *Journal of Anatomy* 2006 Jul. 209 p. .

[Lee and Wu ()] 'The role of the mural coronary artery in prevention of coronary atherosclerosis'. S S Lee , T L Wu . *Arch Pathol* 1972. 93 p. .

[Vaishaly and Bharambe ()] 'The study of myocardial bridges'. K Vaishaly , Vasantiarole Bharambe . *J AnatSoc India* 2008. 57 (1) p. .