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ANATOMICAL STUDY OF THE MYOCARDIAL BRIDGES

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Abstract : Myocardial bridging is a congenital anomaly, in which an epicardial coronary artery lies in the myocardium for part of its course. The bridged segment of the coronary artery is susceptible to various pathophysiological mechanisms leading to myocardial ischemia, especially when associated with other cardio vascular diseases. Recently , myocardial bridges have become a main topic of interest owing to its probable causation of sudden cardiac deaths in young athletes. The aim of this study is to provide more information on the arteries with myocardial bridges, the length of the bridged segment , histopathological findings and the relative conco dance or discordance between cadaveric and radiologic studies. Fifty formalin fixed hearts were dissected . Myocardial bridges were found in 18 (36) hearts with a total of about 28 bridges. Most common artery involved was the anterior inter ventricular artery, which even had multiple bridges over it. The mean length of the bridges was 26.54mm. Of the five tunneled arterial segments studied histologically, all had normal features of a muscular artery . The incidence of myocardial bridges were highest in cadaveric and CT Angiographic studies, but least in conventional angiographic studies.

Keyword :myocardial bridging, myocardial ischemia, atherosclerosis, tunneled artery

INTRODUCTION:

Myocardial bridging is a congenital anomaly, where a segment of an epicardial coronary artery is undercover of myocardial fibres for a variable distance and the underlying arterial segment is described as a mural coronary artery or a tunneled artery1 **(Fig. 1).**

Fig.1 Arrow indicates the extent of a myocardial bridge

The history of myocardial bridges dates back to 1737 when it was first recognized by Reyman 2 and then by Black 3 in 1805. The first detailed post mortem examination of myocardial bridges was done by Geiringer4 in 1951 and the first radiological description was given by Portmann and Iwig5 in 1960. The myocardial bridges were initially thought to be innocent bystanders in the development of acute coronary syndromes. But in the last two decades , the outlook gets changed with the increasing incidence of sudden cardiac deaths in young athletes, where myocardial bridges were the only finding at autopsy6. The mechanism by which the myocardial bridges induce clinical symptoms is uncertain, but among the proposed are vasospasm, thrombus formation, endothelial dysfunction and impaired coronary flow reserve. Most important of these is the dynamic systolic compression of the tunneled artery with sustained early diastolic diameter reduction7.

EMBRYOLOGICAL CONSIDERATION:

Embryologically , there are two theories for the development of myocardial bridges.

i) The myocardial bridges are primary structures, which are isolated from the rest of the myocardium by the sudden, intra myocardial course taken by the coronary artery.

ii) The myocardial bridges are secondary structures, which are formed by the migration of the myocytes over the sub-epicardial coronary artery.

COMPARATIVE ANATOMY:

The coronary arteries are classified into three types with respect to the presence or absence of the myocardial bridges.

TYPE I: Coronary arteries are intra myocardial as seen in rodents, goats and sheep.

TYPE II: Coronary arteries are predominantly sub epicardial; myocardial bridges are occasionally present as in humans, gorilla and carnivores.

TYPE III: Coronary arteries are always sub epicardial as seen in horses and pigs.

MATERIALS :

· 50 formalin fixed hearts from the Institute of Anatomy, Madras Medical College, Chennai-3.

· 10 64 slice CT Coronary Angiograms from the Barnard Institute of Radiology, Rajiv Gandhi Government General Hospital, Chennai-3.

METHODS:

i. Conventional dissection study
ii. Radiological study
iii. Histological study

OBSERVATION:

A) CADAVERIC STUDY:

i) NUMBER OF BRIDGES:

Of the 50 hearts studied, 18 (36%) hearts had about 28 myocardial bridges. Of these, 9 (18%) hearts had single bridge, 8(16%) hearts had double bridges and one (2%) heart had triple bridges.

No. of myocardial bridges	No. of hearts
Single	9 (18%)
Double	8 (16%)
Triple	1 (2%)

ii) VESSELS INVOLVED:

Of the vessels involved, the most common was over the anterior inter ventricular artery (66.6%) **(Fig.2)** ,followed by left marginal artery(27.7%), left diagonal artery(16.7%), right coronary artery (11.2%) and left circumflex artery(5.5%) in decreasing order**.**

Fig.2 Myocardial bridge over AIVA

Vessel involved	No. of hearts
Anterior inter ventricular artery	12 (66.6%)
Left marginal artery	5 (27.7%)
Left diagonal artery	3 (16.7%)
Right coronary artery	2 (11.2%)
Left circumflex artery	1 (5.5%)

iii)DOUBLE BRIDGES:

Double bridges were present in 8(16%) hearts. Of these 8 hearts, multiple bridges over a single artery were found in 3 (17%) hearts, involving only the anterior inter ventricular artery **(Fig.3).**

Fig.3 Double bridging over AIVA

Of these 8 hearts, 5(28%) hearts had multi arterial bridging, involving the anterior inter ventricular artery(AIVA) and the left marginal artery(LMA) in 3(17%) hearts; involving the anterior inter ventricular artery and the left diagonal artery (LDA) in 2 (11%) hearts **(Fig.4).**

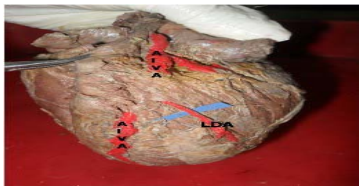

Fig.4 Multi arterial bridging - over AIVA and LDA

Multi arterial bridging	**5 (28%)**
1.AIVA & LMA	3 (17%)
2.AIVA & LDA	2 (11%)

iv) TRIPLE BRIDGES:

Only(2%) one heart had three myocardial bridges, all over the anterior inter ventricular artery **(Fig.5).**

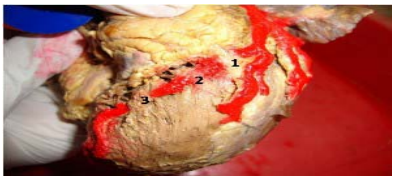

Fig.5 Triple bridging over AIVA

v) LENGTH OF THE MYOCARDIAL BRIDGES:

The length of the bridges ranged between 3 and 44 mm with a mean of about 26.54mm**. (Fig.6 and Fig.7)**

Fig.6 Longest myocardial bridge- 44mm

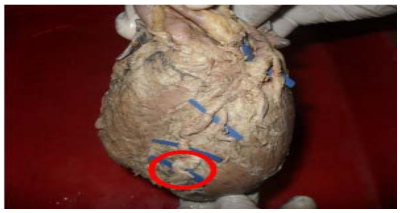

Fig.7 shortest bridge (3mm) depicted in the circled area.

B). RADIOLOGICAL STUDY:

Of the ten 64 slice CT CORONARY Angiograms studied, none had myocardial bridges.

C) HISTOLOGICAL STUDY:

Of the five tunneled arterial segments processed, stained and histologically examined, all had features of normal muscular artery. Tunica intima (TI), tunica media (TM) and tunica adventitia (TA) were seen. Tunica media had abundant smooth muscle fibres suggestive of muscular artery. Internal and external elastic laminae (IEL,EEL) were clearly seen (**Fig.8 and Fig.9**)

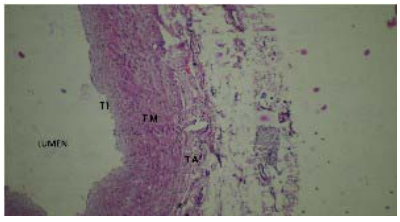

Fig.8 Histology of the Tunneled artery

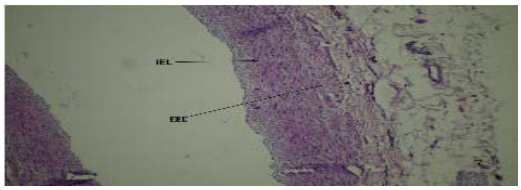

Fig.9 Histology of the Tunneled artery

DISCUSSION:

i) INCIDENCE OF MYOCARDIAL BRIDGES:

Edwards8 (1956) observed myocardial bridges in 0.5% hearts. Polacek9 (1961) reported the presence of myocardial bridges in 86% hearts. Ferreira10 (1991) reported bridges in 56% hearts. Baptista11(1992) observed myocardial bridges in 54% hearts. Pelech12 (2006) reported bridges in 25% hearts. In the present study, myocardial bridges were observed in 36% hearts which is midway between the above values.

STUDY	INCIDENCE OF MYOCARDIAL BRIDGES
Polacek	86%
Ferreira	56%
Baptista	54%
Pelech	25%
Edwards	05%
Present study	36%

ii) ANTERIOR INTER VENTRICULAR ARTERY (AIVA) INVOLVEMENT:

Edwards8 (1956) quoted the involvement of AIVA in 87% hearts. Polacek9(1961) observed bridges over AIVA in 60% hearts. Baptista11(1992) found the affection of AIVA by the bridges in 35% hearts. In the present study, myocardial bridges were observed over the anterior inter ventricular artery in 67% of the hearts which is close to that of Polacek's study.

STUDY	INCIDENCE OF AIVA INVOLOVEMENT
Edwards	87%
Polacek	60%
Baptista	35%
Present study	67%

iii) COMPARISION BETWEEN CADAVERIC & CONVENTIONAL ANGIOGRAPHIC STUDY:

Noble13 et al (1976) observed myocardial bridges in 0.5% of the angiograms. Binet 14 et al(1978) reported myocardial bridges in 0.7% of angiograms. Rossi 15 et al (1980) found myocardial bridges in 4.5% of the angiograms.

STUDY	INCIDENCE OF MYOCARDIAL BRIDGES
Noble	0.5%
Binet	0.7%
Rossi	4.5%
Present cadaveric study	36%

In the present cadaveric study, myocardial bridges were found in 36% of hearts and this incidence does not correlate with the conventional angiographic studies. The detection of bridges is rather indirect in such studies because, luminal narrowing caused by an undetected external structure is the only evidence to document the presence of myocardial bridge **(Table.6).**

iv) COMPARISION BETWEEN CADAVERIC AND CT CORONARY ANGIOGRAPHIC STUDY:

Kim16 et al(2007) reported the presence of myocardial bridges in 58% of the CT Angiograms. Leschka17 et al(2008) observed myocardial bridges in 26% of the CT Angiograms.

STUDY	INCIDENCE OF MYOCARDIAL BRIDGES
Kim	58%
Leschka	26%
Present cadaveric study	36%

In the present cadaveric study, myocardial bridges were present in 36% of hearts which is a little close to the observations of Leschka et al**.** Comparing the accuracy of Conventional Coronary Angiography and CT Coronary Angiography in detecting the myocardial bridges, CT Angiography is superior in that , it correlates with the observations of cadaveric study and is the best diagnostic modality for screening of myocardial bridges.

CONCLUSION:

From the present study, we infer that the presence of myocardial bridges in an unsuspected population is relatively higher. The definitive role of these bridges in acute coronary syndromes is yet uncertain. But owing to its higher rate of detection in those with myocardial ischemia, it is better to screen for the bridges along with other etiological factors and treat the patients prophylactically. Of the imaging modalities, CT Coronary Angiography is found to be the investigation of choice. In the near future, holistic studies involving cadaveric, radiologic and clinical data are mandatory in researching the myocardial bridges.

REFERENCES:

1. Angelini P, Trivellato M (1983) Myocardial bridges: A review. Prog Cardiovasc Dis;26:75-88.
2. Reyman H C (1737) Dissertation de vasis cordis propriis. Haller Bibl Anat;2:366.
3. Black S (1805) A case of angina pectoris with dissection. Memoirs Med Soc Lond;6:41.
4. Geiringer E (1952) The mural coronary. Am Heart J ; 41:359-68.
5. Portmann W, Iwig J (1960) Intramural coronary vessels in the angiogram. Fortschr Geb Rontgenstr Nuklearmed; 92:129-33.
6. Cutler D (1997) Myocardial bridging in a young patient with sudden death. Clin Cardiol;20:581-83.
7. Bourassa G, Butnaru A (2003) Symptomatic myocardial bridges;41:351-59.
8. Edwards J et al (1956) Arteriosclerosis in the intramural and extramural portions of coronary arteries in the human heart.Circulation;13:235-41.
9. Polacek P et al (1961) Relation of myocardial bridges and loops on the coronary arteries to coronary occlusion. Am Heart J;61:44-52.
10. Ferreira A G et al(1991) Myocardial bridges: morphological and functional aspects. Br Heart J;66:364-67.
11. Baptista C A et al (1992) The relationship between the directions of myocardial bridges and of the branches of the coronary arteries in the human heart. Surg Radiol Anat;14:137-40.
12. Pelech A N (2006) Coronary artery anomalies.www.emedicine.com.
13. Noble J et al(1976) Myocardial bridges and milking effect of the left anterior descending artery. Am J Cardiol;37: 993-9.
14. Binet J P et al (1978) Angine de poitrine et pont musculaire sur lartare interventriculaire anterieure. A propos de 3 cas operes. Arch Mal Coeur Vaiss;71:251-8.

15. Rossi L et al (1980) Myocardial bridges and ischemic heart disease. Eur Heart J;1:139-45.
16. Kim J et al(2007) Comparision of frequency of coronary spasm in Korean patients with versus without myocardial bridging. Am J Cardiol;100:1083-86.
17. Leschka S et al (2008) Myocardial bridging: depiction rate and morphology at CT coronary angiograms: Comparision with conventional coronary angiograms. Radiology; 246:754-62.