Myocardial Bridges

K V Venkateshu*, V R Mysorekar**, M B Sanikop***

Recently, many cases of sudden death on strenuous exercise attributed to muscular bridges on the coronary arteries have been reported in the literature. The incidence of such bridges, pooling all reports, is 5.4-85.7% of autopsies. In the present study, 30 hearts from postmortems and 76 hearts from departmental collections from embalmed cadavers (making a total of 106 hearts) were studied. Fifteen hearts (14.2%) showed muscular bridges. The length of the bridges varied from 4mm to 40mm, the majority being 10-19mm in length. Only two arteries viz, the left anterior descending artery and the left diagonal artery showed muscular bridges.

Key words : **Myocardial bridges, left anterior descending artery, left diagonal artery.**

Muscular bridging of the coronary arteries, which commonly involves the left anterior descending artery (LADA), was first recognised over 200 years ago. In 1951, Geiringer[1] referred to overbridged arteries as "mural" coronaries and suggested that, in their intramyocardial segments, these vessels are protected from obstructive atherosclerosis. James[2] stated that it is erroneous to use the terms "intramural or intramyocardial arteries", and it is not unusual for a significant segment of a large coronary artery to course some distance within the ventricular wall and thus also be an intramural artery.

It has been suggested[3] that intramural location of the LADA may represent a potentially lethal anatomic variant. Recently, many cases of sudden death on strenuous exercise associated with such overbridged coronaries have been reported. The incidence of such bridges after pooling all reports is 5.4 - 85.7% of autopsies. Data on its incidence are hardly available in Indian literatures and the present work was undertaken to have a glimpse of the picture.

Material and Method

Thirty hearts, of known sex and age taken out at the time of postmortems at the Karnataka Medical College (KMC), Hubli and 76 hearts of unknown sex and age from the collection in the departments of anatomy of the Jawaharlal Institute of Postgraduate Medical Education and Research (JIPMER), Pondicherry, Vijayanagara Institute of Medical Sciences (VIMS), Bellary and Sri Devaraj Urs Medical College (SDUMC), Kolar were studied. The course of the right and left coronary arteries and their branches over the surface of the heart were studied in detail. The presence of muscular bridges (of the myocardium), the extent of the bridges, their number, location, and relationship to the coronary vessels and surfaces of the heart were noted in all the specimens.

Observations

The age of the postmortem hearts ranged from 19 to 65 years and 23 hearts were of males and 7 of females. Of the 23 male hearts, 9 (39.1%) showed myocardial bridges, while of the 7 female hearts only 2 (28.6%) showed myocardial bridges (Figs 1 & 2). Since the number of postmortem hearts was rather small, the observations on the myocardial bridges in these hearts and the remaining hearts of unknown age and sex, have been pooled. Table 1 analyses the findings in 106 hearts.

Discussion

It has been suggested by various workers that myocardial bridges, by reducing myocardial blood flow during systole, are responsible for cardiac ischaemia[4], acute myocardial infarction[5,6], ven-

Department of Anatomy, Sri Devaraj Urs Medical College, Kolar 563101
*MS(Anat),DNB,Associate Professor
**BSc,MBBS,MSc(Med),PhD(Anat),Professor
***MS(Anat),Professor and Head of the Department
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Table 1 — *Analysis of Myocardial Bridges in Studied Hearts(n=106)*

College	No of hearts	No of hearts where arteries involved		Length of bridges (mm)				
		LADA	LADA+LDA	0-9	10-19	20-29	30-39	40*
KMC	30	10	1*	2	6	2	1	1
JIPMER	22	4	-	4	-	-	-	-
VIMS	20	-	-	-	-	-	-	-
SDUMC	34	-	-	-	-	-	-	-

*The bridge on the LADA was 10mm, and that on the left diagonal artery (LDA) was 5mm in length

tricular fibrillation[7] and sudden death[3]. Hadziselimovic[8] studied muscle bridges on the coronary arteries of 60 male and female newborns taken at random and found them in 60% of the neonatal hearts, and 25 hearts had one bridge on the LADA.

It was reported[9] that the intramural stretch of the coronary artery to be visualised in a human coronary angiogram, although anatomic verification was lacking. Kramer *et al*[4] reviewed 658 normal angiograms performed and found myocardial bridging in 81 patients (12%) involving the LADA in all cases. Seventy per cent of these 81 patients were men and 30% were women and their ages ranged from 20 to 70 years.

Morales *et al*[3] reported 3 cases of sudden death with strenuous exercise, all associated with myocardial overbridging on the left circumflex artery, the LADA, or the right coronary artery beyond the origin of the acute marginal branch. Cheitlin[10] reported 3 cases of sudden death with exercise. All, unequivocally, had a portion of their LADA pass intramurally and all showed evidence of myocardial necrosis and fibrosis in the areas subserved by the bridged coronary arteries consistent with both old and recent myocardial injury, probably ischaemic. Their first case, 8 years before death, showed in cardiac catheterisation a "milking" of the LADA consistent with a myocardial bridge. Faruqui *et al*[11] reported 2 cases of symptomatic overbridging involving the LADA or the LADA and its large diagonal branch vessel. Both patients underwent surgical debridging (myotomy) and a by-pass with relief of symptoms. Feldman and Baughman[5] reported a case of myocardial damage occurring in a previously asymptomatic woman having a LADA myocardial bridge as the only identifiable cause.

Ge *et al*[12] performed intracoronary ultrasound and Doppler in 14 patients, all of whom had typical or atypical angina with angiographic evidence of systolic vessel compression (milking effect) in the LADA. They found no atherosclerotic lesions in the bridged or the distal segment in 8 patients in whom the intravascular ultrasound (IVUS) catheter was successfully advanced through the entire myocardial bridge. However, atherosclerotic plaques were found in the segments proximal to the bridge in 12 (86%) out of 14 patients.

Fig 1 — Heart Showing 40 mm Long Myocardial Bridge (Marked with Arrow)

Myocardial bridges are present since birth, yet, symptoms, morbidity or mortality in children have not been reported. Kramer *et al*[4], from their investigations came to the conclusion that in patients with normal coronary arteries and normal left ventricular function, myocardial bridging as an isolated finding is benign and should not be considered as an indication for coronary surgery. According to Feldman and Baughman[5], the clinical significance of myocardial bridges is controversial. The coronary arteriogram is not a sensitive test for demonstrating myocardial bridges because such bridges may be found in 60% of autopsy specimens after meticulous anatomic dissection but appear in only about 5% of patients at coronary angiography. They feel that despite increased interest, our understanding of this clinical and anatomic variant is limited. These bridges were considered as transitional stages in the further development of the coronary arteries towards the subepicardial course which was found at the highest stage of development[8]. Such bridges represent remainders of phylogenesis which are repeated in the ontogenesis of man. Myocardial bridges do not depend on age as they are found in all age groups.

In the present series myocardial bridges were found in 15

Fig 2 — Heart Showing 10 mm Long Myocardial Bridge (Marked with Arrow)

hearts (14.2%). Surprisingly, of the hearts from VIMS and SDUMC, none showed any myocardial bridges. Also, the percentage of postmortem hearts showing the bridges (11 out of 30 hearts) was very high as compared to the preserved hearts from embalmed cadavers, only 4 out of the 76 hearts showing such bridges. The cause of death in the postmortem hearts was from non-cardiac conditions (mostly accidents). Two discrepancies in this series are puzzling : (a) Why hearts from VIMS and SDUMC did not show any bridges and (b) why postmortem hearts showed a very high percentage of the bridges. At present there are no explanations to offer for these discrepancies.

The length of the bridges varied from 4mm to 40mm. Majority of the bridges were 10-19 mm in length. Only two arteries viz, the LADA and the left diagonal artery (LDA) showed the bridges.

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