Coronary dominance pattern in Myocardial bridged hearts

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ABSTRACT

Posterior interventricular artery (PIA) present in the posterior interventricular groove over the inferior surface of the heart. Human hearts consist of either Right coronary predominance or Left coronary predominance. Left coronary predominant people are more prone to get ischemic heart diseases. In left coronary predominance entire left ventricle except a part of the right ventricle adjoining anterior interventricular groove supplied by the left main coronary artery. Left coronary dominance has a poor prognosis in acute coronary syndrome when compared with the right coronary predominance. Myocardial bridging may be benign or malignant. So myocardial bridging with left coronary dominance may be a risk factor to the ischemic heart disease. The aim of the present study is to find out the coronary dominance pattern in myocardial bridged hearts in cadavers. Ninety cadaveric hearts were procured from the Department of Anatomy, IMS & SUM Hospital Bhubaneswar. After a simple dissecting procedure, myocardial bridges and coronary dominance patterns were observed. Myocardial bridging was present over the left anterior interventricular artery in 51 (56.7%) hearts. Out of 51 myocardial bridged hearts, right coronary predominance is present in 45 (88.24%) hearts and left coronary predominance present in 6 (11.76%) hearts. Along with the left dominance, if myocardial bridge present over the left epicardial coronary artery, there may be an increased frequency of myocardial ischemia.

INTRODUCTION

Normally the epicardial coronary arteries run in the atrioventricular sulcus and in the interventricular grooves, but some times during the course anterior interventricular artery submerged under myocardium and again comes out of the myocardium and runs epicardially. The part of the coronary artery is covered by a few fibers of myocardium called myocardial bridging. (Kumar et al., 2015) Due to the MB, part of the artery lies deep to the myocardium during its course, thus termed as tunneled artery (Kumar et al., 2015). The artery initial to the bridge is called a prearterial segment and distal to the bridge is called a post arterial segment. Angina pectoris, acute coronary syndrome, arrhythmias and sudden cardiac arrest reported with MBs and ome researchers opine that thick myocardial bridging may be one of the causes of sudden death or myocardial infarction in young athletes (Ishii et al., 1998; Konen et al., 2008; Ripa et al., 2007). Myocardial bridge (MB) is a congenital anomaly that is often seen on the Anterior interventricular artery (AIV) and frequently occurs over anterior descending artery (Das et al., 2010). Poste-
terior interventricular artery, if it arises from the right coronary artery then called right coronary predominance and if the posterior descending artery arises from the left circumflex artery called left coronary predominance. If the posterior interventricular artery arises from both the right coronary artery (RCA) and the left circumflex (LCX) artery, then it is called a balanced pattern (Banchi, 1904). The Right predominance, left predominance, and codominant or balance type of classification first introduced by Banchi in 1904 (Gawlikowska-Sroka et al., 2010).

Schlesinger described that right or left coronary artery, which crosses the crux point of the heart and gives its branches to the inferior surface of the heart called as respective coronary predominance and mixed type if the diaphragmatic surface of the heart supplied by both arteries (Abuchaim et al., 2009). Left dominance was related to increased sudden death due to acute coronary syndrome and a high prevalence of atherosclerosis (Yu et al., 2015). Myocardial bridging (MB) sometimes considered being one of the risk factors for myocardial ischemia (Ilia et al., 2001). If MB is present along with left dominance, then the combined risk for coronary artery disease might be increased. So this study was undertaken to find out the coronary dominance in myocardial bridging (MB).

MATERIALS AND METHODS

Cadaveric hearts procured from the Department of Anatomy, IMS & SUM Hospital Bhubaneswar and 90 specimens were used for the present study. Institutional ethical committee clearance was taken. The samples were preserved in 10% Formalin and coronary arteries and its branches were identified and traced till their termination. The posterior interventricular artery running in the posterior interventricular groove was identified, traced along its course up to its termination and its origin observed. Pictures were taken, and data analyzed statistically.

RESULTS AND DISCUSSION

Ninety cadaveric hearts were obtained from routine dissection conducted for undergraduate students. Out of 90 hearts, 51 (56.7%) heart specimens with myocardial bridges were found. All the myocardial bridges were present over the left anterior descending artery (LAD) (Figure 1). PDA originated from RCA in 45 hearts (88.24%) (Figure 2) and from left circumflex artery in 6 (11.76%) hearts (Figure 3). Right coronary dominance is present in 45 heart specimens and left coronary dominance present in 6 heart cases. Balance type of coronary dominance was 0. (Table 1)
Table 1: Distribution of origin of Posterior descending artery showing the predominance of the heart (n=51)

| Dominance pattern | Number of hearts | Percentages (%) |
|-------------------|------------------|-----------------|
| Right dominance   | 45               | 88.24%          |
| Left dominance    | 6                | 11.76%          |
| Balance           | 0                | 0 %             |

Table 2: Dominance pattern compared with other studies

| Author                  | Rt.dominance (in %) | Lt.dominance in (%) | Balanced in (%) |
|-------------------------|---------------------|---------------------|-----------------|
| (Blumgart et al., 1940) | 108 %               | 41 %                | 76%             |
| (Das et al., 2010)      | 70%                 | 18.57%              | 11.43%          |
| (Hadzislimovic, 1978)   | 42 %                | 6 %                 | 12 %            |
| (Didio and Wakefield, 1975) | 73.5 %            | 19.4 %              | 7.1%            |
| (Jain and Hazary, 1958) | 17%                 | 3 %                 | 10%             |
| (Jaiishree and ., 2015) | 83%                 | 14.5%               | 2.5%            |
| (Kalpana, 2003)         | 89 %                | 11 %                | 0%              |
| Present study           | 88.24%              | 11.76%              | 0%              |

Rt – Right, Lt- Left

There are two coronary predominances, i.e., Right coronary predominance and Left coronary predominance. The left coronary dominant heart was more associated with high sudden death rate than the right dominant heart and mixed type and in left coronary predominance, the length of left circumflex artery (LCX) will be more and supplies the greater part of myocardium, whereas in the right dominant people posterior interventricular artery (PIVA) artery which is a branch of right coronary artery supplies only the inferior surface of the heart. So in lesions of the left coronary vessel (LCA) in left coronary dominant people, most of the myocardium will be damaged, leading to heart failure (Mehreen et al., 2016). In left dominant people, if an inferior wall myocardial infarction, the arterial supply AV node will be cut off and so complete heart block can occur (Elmali et al., 2008).

Myocardial bridge (MB) present in the heart causes compression of the epicardial coronary artery during systole and may be responsible for ischemia (Porstmann and Iwig, 1960). Myocardial bridges (MB) in the angiography can be recognized by the presence of a milking effect on the coronary artery during systole. Milking effect (ME) is described as a narrowing of part of the coronary artery during systole and widening during diastole during coronary angiogram Arya et al. (2013). Milking effect (ME) was first described by Portman & Ingrid in 1960 in coronary angiogram (Arya et al., 2013). Radiological and microscopic studies proved that the bridged segment and post bridged segment are spared of atherosclerotic plaque while the bridged segment of the vessel showed atherosclerotic plaques (Blumgart et al., 1940). Right dominance was reported by most of the authors and in the present study, also 88.24% of right dominance was observed in the present study. Balance type of predominance is 0% in present study which is similar to found by some authors (Kalpana, 2003) (Table 2) The variation...
between the present study and above authors is, in the present study dominance pattern was observed in the myocardial bridged hearts whereas in other studies dominance pattern was observed in nonmyocardial bridged hearts (Table 2). Statistical analysis done by using the Chi-square test to the distribution of origin of the posterior interventricular artery from RCA or LCA, the p-value is <0.0001 and shows that the right dominance is statistically significant followed by left dominance and balance pattern is insignificant in distribution.

CONCLUSION

There may be an increased frequency of myocardial ischemia if the myocardial bridge present over the epicardial coronary artery. If the myocardial bridged heart associates with left coronary dominance, there may be an increased risk of coronary artery disease.

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