Hair pin bends of epicardial coronary arteries - a unique feature in multiple myocardial bridges

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ABSTRACT

Myocardial bridge (MB) is an anatomical variant. Sometimes MB can cause compression over the coronary arteries and causes ischemic heart diseases. MB associated with bends of coronary arteries double the risk of coronary artery disease. So the present study aimed to find out the incidence of bends of the coronary artery along with the myocardial bridging. 100 heart specimens were obtained from routine dissection conducted for undergraduate students in the department of Anatomy IMS & SUM Hospital Bhubaneswar. After the simple dissecting procedure, epicardial coronary arteries, their branches and myocardial bridges and hairpin bends of coronary arteries were observed. Myocardial bridges present 41 (41%) over Left anterior descending artery (LAD) only. Among 41 hearts single myocardial bridge present in 37 (90.25%) hearts, double myocardial bridge were present in 3 (7.31%) hearts and triple myocardial bridges present in only one heart(2.44%). Hairpin bends of the coronary artery were present in double and triple myocardial bridged hearts only. No hairpin bends of the coronary artery was observed in the single myocardial bridge. Hair pin bends of the coronary arteries are the unique features of the myocardial bridges in multiple myocardial bridges, i.e. double and triple myocardial bridges. However, hairpin bends of coronary arteries were absent in single myocardial bridged hearts.

INTRODUCTION

A segment of an epicardial artery that is surrounded by muscular fibres or a band of myocardial tissue is variously described as a myocardial bridge (Tangkawattana et al., 1997). The epicardial coronary artery proximal to the bridge is called as prearterial segment passing deep to the bridge called as intramural part or bridged segment or tunneled artery, and distal to the myocardial bridge is called as post bridged segment (Angelini et al., 1983a). Myocardial bridges (MB) were first identified and described by Rayman in 1737 and then by Black in 1805. The first post-mortem examination of myocardial bridges was performed by Geiringer in 1951, and then the first radiological description was given by Portman & Ingrid in 1960 (Sujatha et al., 2015). The myocardial bridge (MB) is an anatomical variant that is often seen on the left anterior descending coronary artery (LAD) and located commonly over the middle segment of the LAD (Ishikawa et al., 2011). The transient narrowing of the coronary artery over the tunneled segment during systole may cause ischemic chest
pain (Noble et al., 1976a). These phenomena are called as “Milking effect” in which during systole of the cardiac cycle due to contraction of ventricular myocardium causes the transient compression of the coronary artery, and during diastole again the tunneled artery acquires its normal lumen (Noble et al., 1976a). Traditionally myocardial bridging (MB) has been considered a benign condition, but in some cases, angina, acute myocardial infarction, ventricular fibrillation, myocardial ischemia, cardiac arrhythmias, and sudden death have been reported in association with MB (Roul et al., 1999; Tauth and Sullebarger, 1997). Clinical and post-mortem studies indicate that atherosclerotic lesions on human vessel walls do not develop randomly and do not occur throughout the circulation but instead localize at certain selected sites in the arterial tree such as the branching sites, curved segments and at the bends or angles of arteries where the blood flow is disturbed, and separation of streamlines from the vessel wall and formation of eddies are likely to occur (Caro, 1973; Schwartz et al., 1962; Klues et al., 1997). There is a disturbed coronary hemodynamics in intramural segment of coronary artery in myocardial bridging and are characterized by a phasic systolic vessel compression with a localized peak pressure, persistent diastolic diameter reduction, increased blood flow velocities, retrograde flow, and a reduced flow reserve and these alterations may explain the occurrence of symptoms and ischemia in these patients (Montenegro, 1968). Myocardial bridging, along with the bends of coronary arteries, may be a risk factor for coronary artery disease. So this study is undertaken to find the myocardial bridging along with the bends of coronary arteries.

MATERIALS AND METHODS

The sample size used for this study is 100 heart specimens, and hearts used for this study were obtained from routine dissection conducted for undergraduate students from the Department of Anatomy, IMS & SUM Hospital Bhubaneswar. Institutional ethical committee clearance was taken. The hearts were preserved in 10% Formalin. Visceral pericardium and subepicardial fat were removed. Origin of right and left coronary arteries from the ascending aorta were identified. The course of the left coronary artery, right coronary artery and branches were traced. The hearts with the myocardial bridges were selected. A total of 41 myocardial bridged hearts were identified. Hairpin bends of coronary arteries in myocardial bridges were identified, noted, Photographs were taken, and data analyzed statistically.

RESULTS AND DISCUSSION

The present study was done on a total of 100 heart specimens, out of which 41(41%) had myocardial bridges. Single myocardial bridge (MB) (Figure 1) were present in 37(90.25%) cadaveric hearts, double myocardial bridges (Figure 2) were present in 3(7.31%) cadaveric hearts and triple myocardial bridges (Figure 3) were present in only one cadaveric heart (2.44%). All myocardial bridges were present on the left anterior interventricular artery or left anterior descending artery only. Hair pen bends of the coronary artery were present in Double myocardial bridged heart (Figure 2) and Triple myocardial bridged hearts (Figure 3) only. No hairpin bends present in the hearts with a single myocardial bridge (Figure 1).

Table 1: Distribution single double and triple myocardial bridges over the LAD

<table>
<thead>
<tr>
<th>Distribution of MB over the LAD</th>
<th>Single MB</th>
<th>Double MB</th>
<th>Triple MB</th>
</tr>
</thead>
<tbody>
<tr>
<td>NO of MB</td>
<td>37(90.25%)</td>
<td>3(7.31%)</td>
<td>1(2.44%)</td>
</tr>
</tbody>
</table>

MB – Myocardial bridge.
LAD - Left anterior descending artery.

In the present study, 41(41%) hearts reported to have myocardial bridges. Thus, the incidence of myocardial bridges in this study is 41%. This incidence of the myocardial bridge in the present...
study correlates with the studies done by some researchers, (Lujinović et al., 2013; Monika et al., 2014). The incidence of MB in present study correlated with the incidence of MB in angiographic studies carried by Irvin (1982); Noble et al. (1976b); Kramer et al. (1982); Juillière et al. (1995); Angelini et al. (1983b), the angiographic prevalence of MB was ranges from 3.2% to 7.5%. The angiographic incidence of myocardial bridging was very low, with comparision of the incidence of MB in the present study. Low prevalence of MB in coronary angiographic studies may be due to the asymptomatic nature of MB, i.e. the effect of MB on the coronary circulation very less or no significant effect. In the present study single myocardial bridges were present in 37 (90.25%) hearts, double myocardial bridges were present in 3 (7.31%) cadaveric hearts, and triple myocardial bridges were present in only one cadaveric heart (2.44%) (Table 1). This study also found the almost similar incidence of multiple myocardial bridges compared with the studies done by (Kosiński and Grzybiak, 2001; Loukas et al., 2006; Nalinakumari et al., 2015). Coronary artery tortuosity caused by myocardial bridges associated with chest pain, slow flow coronaries and compromised blood flow and atherosclerosis reported by Gaibazzi et al. (2011); Kantarcı et al. (2011); An et al. (2018). In the present study in contrast to tortuous coronary arteries in myocardial bridging hairpin bends of coronary arteries were present in myocardial bridged hearts, i.e. in multiple myocardial bridges, but no hairpin bends present in single myocardial bridged hearts (Table 2). In the literature, coronary artery tortuosity in myocardial bridging was reported, but no reports were available about hairpin bends of the coronary artery in multiple myocardial bridging. Thus, first-time hairpin bends of coronary arteries were reported in multiple myocardial bridging in the present study.

Table 2: Distribution of hair pin bends of coronary artery

<table>
<thead>
<tr>
<th>Myocardial bridges</th>
<th>Single MB</th>
<th>Double MB</th>
<th>Triple MB</th>
</tr>
</thead>
<tbody>
<tr>
<td>Presence of Hair pin bends of artery over LAD</td>
<td>NO</td>
<td>YES</td>
<td>YES</td>
</tr>
</tbody>
</table>

MB – Myocardial bridge.
LAD - Left anterior descending artery.
CONCLUSIONS

In the present study, it was observed that the incidence of myocardial bridges are frequent. They are more commonly observed over the left anterior descending artery. Hair pin bends of the coronary arteries are the unique features of the myocardial bridges in multiple myocardial bridges, i.e. double and triple myocardial bridges. However, hairpin bends of coronary arteries were absent in single myocardial bridged hearts. So hairpin bends of coronary arteries is a unique feature in multiple myocardial bridges. Multiple myocardial bridges with hairpin bends of coronary arteries may be a risk factor to develop the ischemic heart diseases due to alterations of hemodynamics in the coronary circulation.

REFERENCES


Schwartz, C. &amp; R, A., Mitchell, J. 1962. Observa-

