Surgical management of combined atherosclerotic coronary artery lesion and myocardial bridge: case series from Iraqi Centre for Heart Diseases

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ABSTRACT

INTRODUCTION: Myocardial Bridge is a congenital anomaly in which a band of myocardium is covering the epicardial coronary artery to variable distances and has a variable thickness. Its presentation ranges from being completely asymptomatic to a lesion leading to ischemia and acute coronary syndromes what may need medical treatment, percutaneous intervention with intracoronary stent or surgical myotomy.

OBJECTIVE: is to define the rate of myocardial bridging in patients underwent coronary artery bypass grafting and to present the outcomes of myotomy.

METHODS: This case series was conducted in June 2019. We reviewed the records of patients underwent coronary artery bypass grafting at the Iraqi Centre for Heart Diseases in Baghdad from January 2013- September 2017. Any patient who discovered peroperatively to have myocardial bridge was included in this study. Extent of the bridging and outcomes of surgical treatment by myotomy were calculated.

RESULTS: Twenty patient (9.85 %) out of 203 who underwent CABG found to have myocardial bridging. Fifteen of them were men (75%) and 5 (25%) were women. Nine patients (45%) were in age group of 60-69 years. LAD was the commonest artery involved 20 (100%). One patient has developed perforation of the chamber which was sutured successfully another patient developed blood ooze at the edge of the myotomy and only one patient has diet peroperatively due to refractory ventricular arrhythmia. .

CONCLUSION: Myocardial bridging is still encountered during CABG surgery. Although it adds a burden on the surgeon, most of the cases can be dealt with without any serious complications.

Key words: myocardial bridging, CABG, myotomy.

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INTRODUCTION

Myocardial bridge (MB) is a band of myocardium covering the epicardial coronary artery to variable distances and the band can have variable thickness to. It was first described by Reyman in 1737 on a cadaver and it has been given different names like "myocardial bridge," "intramural coronary artery," "mural coronary artery," "coronary artery overbridging" and "myocardial loop.[1] The first angiographic description of myocardial bridge in vivo was given by Porstmann and Iwig in 1960.[2,3] Most of the MBs seen in autopsy are not detected angiographically.[3,4] And the incidence of MB ranged from 0.5 % to 2.5% in coronary angiographic studies[5] and in autopsy 5% to 86%.[6] MB can be broadly classified as superficial or deep, depending on the thickness of the covering muscle layer, furthermore the superficial type can be classified as complete or incomplete.[6] Hwang et al examined 557 cases of myocardial bridging, and reported that two-thirds of myocardial bridging segments were of the superficial type.[7] MB is most commonly found in the middle segment of the left anterior descending coronary artery (LAD).[4,6]

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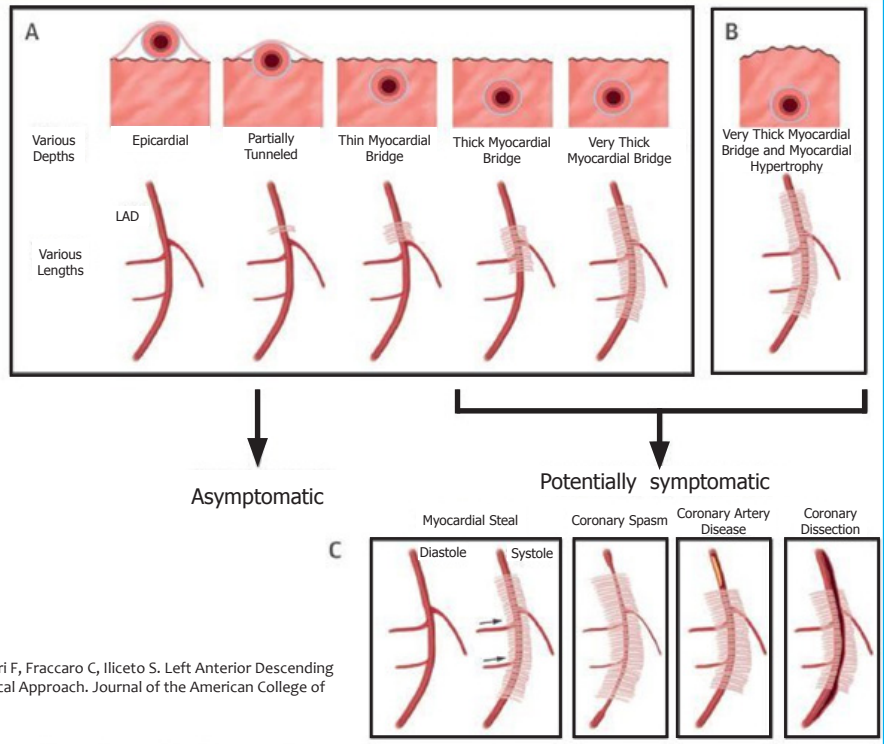

Figure 1: Severity of myocardial bridge according to the length of the band and depth. Some of the types are potentially symptomatic and lead to variety of coronary artery diseases.[6]

[6] Tarantini G, Migliore F, Cademartiri F, Fraccaro C, Iliceto S. Left Anterior Descending Artery Myocardial Bridging: A Clinical Approach. Journal of the American College of Cardiology. 2016;68(25):2887-99.

Traditionally, myocardial bridging has been considered a benign condition, yet different complications have been reported, like ischemia and acute coronary syndromes, coronary spasm, ventricular septal rupture, and arrhythmias.[8] There is still controversy with regard to therapy for symptomatic patients who are refractory to medical management.[2] Percutaneous coronary intervention (PCI) with intracoronary stent placement have been proposed as treatments for MBs because of favorable short- term clinical and angiographic results.[9] But because of the risk of in stent restenosis rate[10] surgical myotomy (unroofing) offered complete cure of clinical symptoms and is ensures reversal of local myocardial ischemia and leads to increase in coronary flow, however surgical myotomy in patients with muscle bridging and a deep coronary artery has the risk of ventricular rupture, aneurysm formation, and postoperative bleeding.[8] The muscle bridge may be too long and too thick and may be difficult to dissect in some patients.[11] LAD-MBs may significantly differ anatomically with respect to depth (superficial: > 1 to 2 mm versus deep: >2 mm) and length of encasement[12] as seen in **figure 1**.[6]

Pathological studies have shown clearly that MB is associated with the development of atherosclerosis proximal to the MB segment in the coronary artery.[13, 14] And recently with the advanced multi-detector computed tomography (MDCT) have facilitated the non-invasive and accurate assessment of coronary arteries better than conventional angiography and suggested that myocardial bridging is a common finding on MDCT and associated with the development of atherosclerosis proximal to the MB segment.[15] Myocardial bridging should be regarded as is an independent risk factor for coronary atherosclerosis and is considered as an important risk factor for coronary heart dis-

Table 1: Distribution of myocardial bridging with gender and age groups.

Character	No	%
Gender		
Man	15	75
Woman	5	25
Age group in years		
40-49	1	5
50-59	6	30
60-69	9	45
70-79	3	15
80 and above	1	5
Total	20	100

Table 2: Distribution of myocardial bridge with coronary arteries and its association with significant stenosis*.

Coronary arteries	Associated > 70 % stenosis.*	Associated with MB	Site of MB in the artery†	
			Mid to distal	Only Mid
LAD	20	20	13	7
Ramus intermedius	3			
D1	8	1†		
D2				
Om1	11	1†		
Om2	7			
PDA	5			
RCA	6			

* Significant stenosis: Reduction of arterial diameter of > 70 %, due to atherosclerosis.
† This is applicable for the relatively long arteries like LAD, PDA, and RCA.
† More than one MB is found in single patient.
MB: myocardial Bridge, LAD: Left anterior descending, D1: first diagonal, D2: second Diagonal, OM1: First obtuse marginal, OM2: second obtuse marginal, PDA: posterior descending artery, RCA: right coronary artery.

ease.[4] So, having a combined coronary artery lesion and MB is a scenario every cardiac surgeon should expect and be prepared to handle Peroperatively. In this study we are describing the management of cases with combined coronary artery disease requiring CABG with concomitant peroperative finding of MB.

METHOD

Setting and study design: a retrospective record-based case series study was conducted at the Department of Surgery, Iraq Centre for Heart Diseases (ICHD) in Baghdad from January to June 2019. We reviewed the records of all patients who underwent coronary artery bypass grafting (CABG) from January 2013- September 2017.

Ethical considerations: This study was conducted after obtaining the agreement from the administration of the ICHD and implemented according to the regulations of the Ministry of Health in Iraq. Code of Ethics in research was implemented during all steps of the study.

Table 3: Rate of myocardial bridging in patients underwent CABG distributed on years

Year	CABG with MB (%)	CABG without MB (%)	Total
2013	7 (11.1)	56 (88.9)	63
2014	5 (8.8)	52 (91.2)	57
2015	3 (11.1)	24 (88.9)	27
2016	3 (8.8)	31 (91.2)	34
2017	2 (9.1)	20 (90.9)	22

CABG: Coronary Artery Bypass Graft, **MB**: Myocardial Bridge

Definition of the cases, Inclusion and exclusion criteria: we enrolled any patient who was diagnosed as myocardial bridging in patients underwent CABG. Myocardial bridging was defined in our study as peroperative finding of a band of myocardium covering the epicardial coronary artery to variable distances. All cases fulfilling the criteria of enrolment were included in this study and no one has been excluded.

Data extraction: The data of the patient were extracted into a pre-designed form, the following variables were taken: patient's age and gender, coronary vessels involved by stenosis, coronary vessels involved by bridging, length and position of the myocardial bridge; divided into those located in the mid part of the artery and those located mid and distal part of the arteries. Immediate postoperative complications were searched for like Perforation of the chamber, bleeding from edge of myotomy, death due to refractory ventricular

Data analysis: the variables were presented on excel sheet in numbers and percentages. The sample was small to calculate the p value to test the significance of any difference in percentages.

RESULTS

Out of total 203 patients underwent CABG in the studied period, only 20 patients (9.85 %) were discovered peroperatively to have myocardial bridge distal to the coronary lesion and necessitating unroofing of the coronary to do the distal anastomosis of the coronary graft. Male were 15 (75 %) while 5 (25 %) were female, the commonest age group to have bridging is 60-69 years were 9 (45%) out of 20. Table 1

Table 2 shows the types of the coronary arteries involved by myocardial bridging. Table 3 shows the distribution of MB over the years 2013-2017.

Based on the morphologic classification developed by Tarantini in journal of American college of cardiology[6] all the cases had very thick LAD MB along with proximal LAD coronary atherosclerotic lesion. Retrograde tracing either of distally visible part of LAD or a diagonal branch was used to dissect and unroof the necessary segment of LAD to provide site for distal anastomosis. No significant postoperative complica-

tions reported apart from one case had inadvertent entry to right ventricle during unroofing which was repaired immediately without leak. Other case had oozing from site of MB unroofing which necessitated leaving the sternum open for delayed closure later same day. All the cases required extensive myotomy of the MB to expose a segment of the coronary artery to do the distal anastomosis of the graft.

DISCUSSION

Symptomatic myocardial bridge patients are usually taken care of by the cardiologist[9] rather than the surgeons, and only few of those with isolated MB are referred to surgical unroofing or CABG.[8, 16-19] Very few studies have been published about role of CABG in isolated MB.[20, 21] Yet we were not able to find any paper in the literature talking about the combined coronary lesion and MB which requires surgical correction for both.

In all the 20 cases in our series we operated upon, none of them had preoperative diagnosis of MB and it was a peroperative finding which necessitated a surgical decision and action. The reason for myotomy in all the cases was because MB was covering long segment of the mid to distal LAD. This peroperative anatomical finding made it difficult to find a landing zone immediately distal to the coronary lesion without doing myotomy. So, the indications of myotomy in all those cases were unique and different from what is written in the literature where it is done for patients without coronary lesion.[16-18] And it is believed that in patients with severe bridging and concomitant coronary artery disease whom are undergoing CABG, myotomy improves flow to branches proximal to anastomosis and distal to coronary lesion.[22] This retrograde perfusion of the branches proximal to distal anastomosis was visually obvious peroperatively when we routinely perform the manual injection of cardioplegic blood through the graft to the native coronary artery to check flow, patency and the integrity of the anastomosis. Yet unfortunately it was not possible to confirm this assumption more objectively angiographically in our cases and we can't tell whether the post- operative improvement in symptoms is due to the CABG alone or to the myotomy itself.

Adding surgical myotomy to CABG is not without risk of inadvertent entry to the right ventricle, bleeding from dissection site and aneurysm formation.[18,20] However, we had reasonably low number of such events in our series. This relatively low complications were because we followed meticulous dissection technique yet in one case the LAD was so deep that we couldn't avoid making a whole in the adjacent RV wall. This is usually reported especially in cases with extensive MB which is defined by many authors as any MB longer than 2.5 cm and deeper than 0.5 cm[18] and all our cases fall in this category. Bleeding from the edges of the myotomy is another problem which faces the surgeon. To minimize that risk we followed two techniques depending on the thickness of the MB. We cauterized those with relative shallow edge while we sutured the thicker edges using 6/0 Prolene to overrun the bleeding small branches on both sides of the myotomy. This helped to minimize the risk of postoperative bleeding to one case only.

Literature shows that MB is independent risk factor for developing atherosclerotic coronary lesion and the prevalence of LAD MB is between 23%-29%,[4] yet in our series it was (9.85 %). Obviously, the reason is that we usually don't see the cases with pure MB referred to surgery and this number does not reflect the actual prevalence of MB among all patients who undergo diagnostic coronary angiography. Yet we couldn't find any article reporting the incidence of combined CAD and MB among patients undergoing CABG.

We had the following limitations in the study; because of the retrospective nature of the study we didn't have a long follow up for the cases to assess the impact of myotomy on long term outcome in term of myocardial perfusion and graft patency, or if any complication developed like left ventricular aneurysm at site of myotomy.

CONCLUSION

Combined coronary artery atherosclerotic disease and myocardial bridge is an anatomical scenario which cardiac surgeons may encounter. Myotomy in this scenario is either a necessity to make a landing place for the distal anastomosis or to provide better coronary perfusion to area distal to coronary lesion and proximal to

distal coronary anastomosis.

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Abbreviation list: Coronary Artery Bypass Graft (**CABG**), First diagonal (**D1**), First obtuse marginal (**OM1**), Iraq Centre for Heart Diseases (**ICHD**), Left anterior descending artery (**LAD**), Percutaneous coronary intervention (**PCI**), Multi-detector computed tomography (**MDCT**), Myocardial bridge (**MB**), Posterior descending artery (**PDA**), Right coronary artery (**RCA**), Second Diagonal (**D2**), Second obtuse marginal (**OM2**)

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