Myocardial bridging and prognosis: more evidence but jury still out

Giuseppe Tarantini1* and Filippo Cademartiri2,3

1Department of Cardiac, Thoracic and Vascular Sciences, University of Padua Medical School, Padua, Italy; 2Department of Radiology, Erasmus Medical Center University, Rotterdam, The Netherlands; and 3Cardiovascular Imaging Unit, Giovanni XXIII Clinic, Monaster, Treviso, Italy

Received 23 January 2013; accepted after revision 25 January 2013; online publish-ahead-of-print 14 February 2013

Myocardial bridging (MB) is a congenital variant of coronary anatomy in which a segment of a major epicardial coronary artery that normally has an epicardial course runs intramurally through the myocardium beneath the muscle bridge. It occurs most frequently in the mid-portion of the left anterior descending (Figure 1). It is also called ‘tunneled artery’. Geiringer1 first presented an in-depth analysis of autopsy samples in 1951, but clinical interest and systematic research were triggered by observed association of MB with myocardial ischaemia. In this regard, although traditionally considered a benign condition, MB may cause clinical symptoms including angina, myocardial infarction, life-threatening arrhythmias, and sudden death.2–4 It is widely accepted that MB might cause these ischaemic complications5,6 either from direct compression of the coronary artery during systolic contraction or by enhancement of the natural progression of atherosclerosis in the coronary segment. Both mechanisms are closely associated with changes in haemodynamic stress driven by the force of the MB compression through a combination of anatomical properties, such as the location, length, and thickness of the MB.7

The true prevalence of MB is not fully known because it is largely underestimated by conventional angiography. Cardiac computed tomography (CCT) should be the preferred non-invasive imaging modality because of its multiplanar and three-dimensional capabilities; it can visualize not only the coronary lumen, but also the vessel wall and the surrounding tissues, including the myocardium. MB can also be identified by CCT even when no significant ‘milking effect’ and/or change in vessel course at conventional coronary angiography are present.8 In fact, the concept of MB is an anatomical concept but is often reported as the functional compression of the tunneled coronary artery. In addition, the presence of an MB may often be missed on coronary angiography in cases of a severely stenotic lesion in the coronary segment proximal to the MB, because limited coronary pressure and flow to the distal artery can mask the typical milking effect. The reported prevalence of MB ranges from 0.8 to 15.8% in angiographic series and 4–58% in CCT studies, depending on the heterogeneity of the population (including age and gender), the type of CCT scanner, and the inclusion/exclusion of superficial MB.3,4 Considering that MB frequency is ~50% by autopsy, the recent introduction of CCT has remarkably improved the detection rate. However, the higher frequency of MB detection at autopsy than at CCT may be due to differences between these methods, because an MB thinner than 200 µm can only be detected by autopsy.

The study of Rubinshtein et al.9 in this issue of the journal reports on prognosis among patients clinically referred for CCT who were found to have MB but were without prior coronary heart disease or obstructive disease on CCT. Patients were followed for a mean of ~6 years for the outcome of cardiovascular death or non-fatal myocardial infarction ascertained using chart review and a national death registry. Out of 648 chest pain patients referred for 64-slice CCT in a 1-year screening period, 334 patients met the criteria for primary analyses. No angiographic control is present. One hundred and seventeen patients (35%) had MB on CCT, that was most frequently found in male, in case of left coronary dominance and at the level of the mid-left descending artery (71% of the patients). The event rate over the follow-up period was low (3.8%, 0.6%/year) in total population even though 52% of the patients had MDCT evidence of subclinical atherosclerosis, without statistically significant difference between patients with or without MB (5.1 vs. 3.2%, respectively).

Several important points warrant comment. First, the prevalence of the MB reported in the current study, as acknowledged by the authors, may be higher than in general population, as patients with more symptoms (or inconclusive stress test results) are more likely to be referred for CCT. However, the contrary cannot be excluded. For instance, the reported rate of MB may be lower than that of a population with typical chest pain without obstructive coronary artery disease, which is under-represented in the current study. Secondly, it is a retrospective analysis of a small, low-risk population with MB that comprised the cohort (117 patients), which limits broad generalizations and conclusions. Results of the current study are underpowered to assess the

The opinions expressed in this article are not necessarily those of the Editors of EHJCI, the European Heart Rhythm Association or the European Society of Cardiology.

* Corresponding author: Giuseppe Tarantini, Division of Cardiology, Department of Cardiac, Thoracic and Vascular Sciences, Policlinico Universitario via Giustiniani, 2. 35128 Padova, Italy. Tel: +39 049 8211844; fax: +39 049 8212138. Email: giuseppe.tarantini.1@gmail.com

Published on behalf of the European Society of Cardiology. All rights reserved. © The Author 2013. For permissions please email: journals.permissions@oup.com
impact of MB on hard clinical endpoint, with a power of only 16%, although the outcome data confirm the generally good long-term prognosis in patients with isolated MB reported by others. To this regards, the MB group shows an at least numerically disturbing 37% increase in term of relative risk for cardiovascular death or myocardial infarction when compared with no MB patients; that trend would likely become significant with a larger sample size (1729 patients per group). Another caveat that limits broad generalization of the study conclusions is the impossibility to assess the impact of unmeasured confounders unbalance on the final study outcome results. For instance, considering that half of the patients have subclinical atherosclerosis that mandates aggressive medical therapy, an imbalance in the prevalence of aspirin, statins, beta-blockers may bias the results. Thirdly, out of 117 patients with MB, 27% had what is described by the authors as 'superficial variant of MB (partially covered with myocardium)', an entity that is not and cannot be well depicted in the current study. Our knowledge on this point is very limited. This subset may not be described as having a bridge (and may not have potential for systolic compression), although it has been shown that dynamic compression of the vessel may also occur in segments without fully overlying muscle by the entrapment of MB within the interventricular gorge with possible transient occlusion of prominent septal branches arising from or near the involved segment may occur.10,11

Another aspect that might have been treated more in depth by the Authors, concern the selected endpoints. Mortality and acute myocardial infarction are hard events that show major prognostic outcome. However, it should be considered the option to include softer events as endpoints. MB is under investigation and we know it may cause ischaemia; therefore, softer endpoints such as recurrent angina/chest pain, re-hospitalization for chest pain, repeated stress tests, and so forth. This information might not improve prognosis but it may improve treatment strategies and quality of life of some of these patients.

From the technical standpoint, one could also argue that the definition and classification of MB on CCT is still not widely accepted and recognized. In fact, in the study from Rubinshtein more attention has been paid to the so-called complete/deep intra-myocardial course of the coronary artery. As stated above, the prevalence of superficial intra-myocardial course is expected to be much higher. Some questions have to be answered, yet, concerning the reporting methodology. Systolic imaging can be performed on CCT; it could be asked whether measurements (i.e. depth, length) of the MB should be obtained also in this phase of the cardiac cycle.

Even with all the reported limitations that call for caution in interpreting the results of the current study, the authors need to be congratulated to have conducted an important analysis on the prognostic role of isolated MB as assessed by CCT disease that confirms a general good prognosis of these patients. The study highlights the need new imaging technology to match the unmet clinical need of improving our knowledge of the anatomical and functional characteristics of MB whether or not isolated.
The perspective is avoid to carry on as we do considering this entity simplistically as black or white picture—‘culprit or innocent bystander’. Since then, large multicentre clinical databases, based on standardized definition, are required to identify criteria that justify the link between clinical sign and/or symptoms and a given pattern of MB as the primary culprit and which move beyond the current empirical approach to the clinical management of this frequent coronary anomaly.9,10

Acknowledgements
The authors thank Prof. Cristina Basso of Institute of Pathology, University of Padova Medical School, for the pathology specimen presented in figure.

Conflict of interest: none declared.

References

Transcatheter closure of paravalvular leak secondary to left ventricular peri-annular pseudoaneurysm

Gian Paolo Ussia1,*, Valeria Cammalleri1, Pasquare De Vico2, Domenico Sergi1, and Francesco Romeo1

1Department of Cardiovascular Disease, Tor Vergata University of Rome, Viale Oxford, 81 00133 Rome, Italy and 2Department of Anesthesiology, Tor Vergata University of Rome, Rome, Italy

* Corresponding author. Tel: +39 06 20904009; fax: +39 06 20904008, Email: gpussia@gmail.com

Left ventricular (LV) pseudoaneurysm is a clinically rare condition, often difficult to diagnose; one-third of the occurrences result from a surgical procedure, mostly mitral valve replacement (MVR). The detailed anatomy of sac and its communication can be delineated with a transoesophageal echo-cardiogram (TOE), cardiac MRI, or contrast CT scan.

We report a case of a 77-year-old woman, who underwent an MVR with a mechanical prosthesis. After 3 years, she developed infective endocarditis. A TOE showed a wide posteromedial paravalvular leak, determining a severe regurgitant jet into the left atrium (LA) (Panel A); furthermore an LV recess was detected just below the origin of the jet confirmed by a contrast CT-scan (Panel C, arrow). The rupture was located in the posterior atrio-ventricular groove, creating a LV pseudoaneurysm communicating with the LA (Panel D, arrow). Because of a high surgical risk, a transcatheter closure of the defect was planned. The leakage was crossed with a retrograde approach. The Mullins catheter was advanced in the LV and an extra-stiff Amplatz wire was placed in the apex for positioning the 9F guiding catheter (Panel D), used for the implantation of an AMPLATZER忙碌

Duct Occluder 10/12 mm (S Jude, Inc., USA) (Panel E). Finally, successful leak closure of the defect was achieved (Panel F, asterisk). The patient was discharged after 5 days.

A catheter-based closure approach for a paravalvular leak and LV pseudoaneurysm has been described before. We report an uncommon case of transcatheter treatment of an LV peri-annular pseudoaneurysm ruptured in the LA, in a patient with a previous MVR and endocarditis.

Published on behalf of the European Society of Cardiology. All rights reserved. © The Author 2013. For permissions please email: journals.permissions@oup.com