Looking beyond angioplasty: the importance of left ventricular dysfunction

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This editorial refers to ‘Impact of left ventricular function in relation to procedural outcomes following percutaneous coronary intervention: insights from the British Cardiovascular Intervention Society,’ by M.A. Mamas et al., on page 3004.

The study by Mamas et al. is an observational analysis of 230,464 cases entered into the British Cardiovascular Intervention Society (BCIS) angioplasty database for the years 2006–2011. The influence of left ventricular ejection fraction (LVEF) on early and late mortality after percutaneous coronary intervention (PCI) was studied. The authors reported a three-fold increase of 30-day mortality after PCI in patients with moderately impaired LVEF (30–49%) and a seven-fold increase in patients with poor LVEF (≤30%) when compared with patients with preserved LVEF (≥50%). You may say that it is not such a novel and revolutionary message, but the sheer size of the database, the universal patient inclusion, and the similar findings in an equally large previous US study make the conclusions compelling and widely applicable.

Well-conducted large national databases have become a welcome source of scientific information complementing dedicated studies, and their reliability is gradually improving. Data completeness of compulsory national databases is one of the parameters used to determine the level of NHS funding to hospitals in the UK, and the outcome data come from the National Institute of Statistics, tracking 100% of patients at least for mortality. It is somewhat annoying that data on LV function were collected in less than half of the almost half million PCIs performed in England, Wales, and Northern Ireland in the study period. You can be sure that this is going to improve in the next iteration of this analysis. Data on operator and hospital mortality coming from this database are now available to the public (www.bcisc.org.uk), and quite sophisticated correction parameters ensure that the mortality of operators and hospitals performing more complex procedures in higher risk patients is properly adjusted. Based on this study, I am sure that the BCIS will ask that data on LV function are also introduced among the correction factors, prompting operators to enter the data more consistently.

There is another limitation more difficult to overcome, but important to ensure we make the correct changes in our treatment policy to address the problem of a higher mortality in patients with poor LV function. The definition of the cause of death is difficult and reliability is low, even when the individual death certificates are reviewed. In this study no attempt is made to distinguish cardiovascular and non-cardiovascular causes of death, let alone more subtle differences among sudden death, new ischaemic events, cancer, etc. This article tells us that a successful PCI is not sufficient to revert the trend to higher mortality in patients with low LVEF, but does not tell you whether this is correctable and how. Preventable deaths can be caused by an inadequate treatment of heart failure, an insufficient use of implantable cardioverter defibrillators (ICDs), a poor angioplasty technique leading to high incidences of restenosis and stent thrombosis, or an incomplete initial revascularization. Let us focus on the deaths caused by the last two interventional pitfalls that can be potentially prevented by improving the quality of the work done during the initial PCI.

The study probably used a mixture of first- and second-generation drug-eluting stents (DESs), with some bare metal stents still used in patients with acute myocardial infarction, as suggested in the old National Institute of Health and Care Excellence (NICE) recommendations for ST-segment elevation myocardial infarction (STEMI) treatment (www.nice.org.uk). There is overwhelming evidence from single studies, meta-analyses, and large registries that second-generation DESs have a lower thrombosis and restenosis rate than first-generation DESs.3–5 Bare metal stents should not be used unless there is an absolute specific indication for a super short period of double antiplatelet treatment because they lead to a much greater risk of restenosis which often manifests itself as a new acute coronary syndrome. There is also a greater early stent thrombosis rate and no demonstrable advantage for late stent thrombosis when compared with second-generation DESs, and this has been specifically demonstrated in patients with STEMI.6–8 Stent thrombosis is higher in the presence of a low EF,9 and an acute
thrombotic episode or a severe restenosis in these frail patients more easily lead to catastrophic events such as death.

The issue of incomplete revascularization is more complex, and some of the considerations below are hypothetical because of the lack of key information. The incidence of multivessel PCI in this study is low in all groups (22.8% on average). Of course it cannot be excluded that staged procedures have increased the number of patients eventually receiving complete revascularization, but it is probably correct to hypothesize that few patients with low EF who were older, had a previous myocardial infarction in >50% of patients, and a previous coronary artery bypass graft (CABG) in 14.6%, received a complete revascularization. This may call for a wider use of CABG, especially in diabetic patients and in patients with a high SYNTAX score or for a more aggressive angioplasty. The barriers to complete revascularization with angioplasty are different in patients with elective angioplasty and angioplasty for acute coronary syndromes. In the first group, the main limitation is the absence of complete coronary occlusion, that represents almost 20% of the critical lesions observed with angioplasty and is approached in <5% of cases in the UK (www.bcis.org.uk). There is convincing data, the most recent also coming from the BCIS registry, that successful PCI of a chronic total occlusion improves outcome, and mechanistic studies with various techniques confirm an improvement of LV volumes and EF when viability and hibernation are present.

The problem is different in unstable syndromes and specifically acute myocardial infarction, and here its importance is also greater because the mortality gradient between normal and moderate-low LVEF is steeper than for elective PCI. In unstable syndromes and especially STEMI, operators almost universally limit treatment to the culprit lesion, with other critical lesions not treated unless they cause recurrent angina symptoms, a rare instance in patients who already have exercise limitation due to poor LV function and are diabetic in 27% of cases. The Preventive Angioplasty in Myocardial Infarction (PRAMI) trial, another UK multicentre trial showing absolute risk reduction of death from cardiac causes or non-fatal myocardial infarction of 7% at 23 months in STEMI patients with complete immediate revascularization, has been heavily criticized because no triage of the residual lesions with provocative tests was performed in the control group. This is certainly the standard recommended in the European Society of Cardiology (ESC) Guidelines but probably not the practice in the UK where patients after primary angioplasty are often returned to the care of their District General Hospital or general practitioner.

In the end, this is the most powerful message of this study. Opening an artery is not enough to improve prognosis consistently, which is determined by many other clinical factors, with the level of impairment in LV function as one of the most powerful. Physicians are under pressure to cut hospital stay and streamline the perioperative protocols. We are aware of patients with a large anterior myocardial infarction leaving hospital 3–4 days after successful primary angioplasty without having had an echocardiogram, completed optimization of medical treatment, or having had a personalized discussion on risk factor control. Imagine how a prolongation of hospital stay to undergo a second procedure on a non-culprit but 90% stenotic left anterior descending lesion will be received! A rapid turnover may look great in the spreadsheets of administrators only concerned with hitting targets but may worsen prognosis and, if the cost of follow-up events is considered, may fail to achieve a true economization of resources spent in healthcare. The only target cardiologists should be concerned about is the maintenance of a medical practice that allows a holistic approach to a patient’s care, refusing a diminished role as plumbers of stenotic arteries.

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References


Multimodality imaging of thrombus in transit

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A 58-year-old woman with no past medical history underwent right shoulder surgery for rotator cuff tear. The surgery was uneventful and patient was discharged the next day to continue outpatient physical therapy. However, on post-operative sixth day, she presented to emergency department complaining of chest pain and dyspnoea with exertion which she never had before. An electrocardiogram was performed and revealed sinus tachycardia, with a right bundle branch block and an S1-Q3-T3 pattern. This raised the suspicion of pulmonary embolism and she underwent computed tomographic angiography, which identified a ‘saddle embolus’, with an extensive thrombus burden in both the right and left pulmonary artery (Panel A, arrow). She was started on unfractionated heparin intravenously and transthoracic echocardiogram was done, which was significant for extensive thrombus in both the right and left atria, with long extensions seen prolapsing into both ventricles during diastole (Panel B, arrow) (Supplementary material online, Video S1). This was followed with transoesophageal echocardiography which showed long thrombus, which continued across the foramen ovale forming a ‘saddle embolus’ appearance (Panel C, arrow) (Supplementary material online, Video S2). Owing to her a significant systemic thrombus burden, the case was discussed with the cardiovascular surgery team and the decision was made to perform a thrombectomy. Intra-operative images confirm the presence of a continuous biatrial thrombus traversing across the atrial septum (Panel D, arrow). Intracardiac and pulmonary artery thrombus were excised (Panel E). Patient did well after surgery was discharged on warfarin for anticoagulation.

Computed tomographic angiography reveals a ‘saddle embolus’ at the pulmonary artery bifurcation (arrow) (Panel A). Supplementary material online, Video S1 (Panel B). Throracic echocardiography shows mobile masses in both atria, with segments prolapsing into the ventricles during diastole (arrow). Supplementary material online, Video S2 (Panel C). Transoesophageal echo images identify a likely thrombus crossing a patent foramen ovale (arrow), with additional thrombus seen in the right atrium. An intra-operative photo shows a long thrombus in the right atrium that is seen crossing the patent foramen ovale into the left atrium (Panel D). A photo taken intra-operatively of the thrombus excised from the atria and the pulmonary arteries (Panel E).

Supplementary material is available at European Heart Journal online.