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ST-segment elevation myocardial infarction: the new ESC Guidelines

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ST-segment elevation myocardial infarction or STEMI continues to be one of the most dangerous acute complications of coronary artery disease.[1] Although huge progress has been made in its management in the last decades,[2] in-hospital mortality is still in the range of 5–8%.[3] To allow for further optimization of the management of STEMI, considering also the most recent evidence, a task force of the ESC published updated guidelines. This Focus Issue on STEMI contains the updated '**2017 ESC Guidelines for the management of acute myocardial infarction in patients presenting with ST-segment elevation: The Task Force for the management of acute myocardial infarction in patients presenting with ST-segment elevation of the European Society of Cardiology (ESC)**'.[4] Nowadays, patients with STEMI undergo rapid revascularization, most commonly with primary percutaneous coronary intervention. Although these procedures allow for immediate relief of ischaemia and pain associated with it, reperfusion injury is thought to represent another insult to the ischaemic pre-conditioning myocardium.[5] Many drugs and antibodies,[6] as well as[7] have been tested in an attempt to reduce reperfusion injury with commonly little effect.[8] In their *Brief Communication* entitled '**A single-chain antibody–CD39 fusion protein targeting activated platelets protects from cardiac ischaemia/reperfusion injury**',[9] Karlheinz Peter and colleagues from the Baker Heart Research Institute in Melbourne, Australia report on the therapeutic potential of CD39, a cell membrane NTPase with anti-inflammatory and anti-platelet effects. In a quest to avoid haemostatic problems, they designed a fusion protein consisting of the extracellular domain of CD39 and a single-chain antibody (Targ–CD39) that specifically binds to activated glycoprotein (GP)IIb/IIIa and thus only to activated platelets. Using an ischeamia/reperfusion mouse model, they achieved remarkable protection of the reperfused tissue with Targ–CD39 compared with control. Targ–CD39 restored the ejection fraction and fractional shortening to a level indistinguishable from pre-injury status, while controls showed functional deterioration. Employing advanced, clinically relevant methods of ultrasound analysis, they observed that both radial and longitudinal strain and strain rate showed infarct-typical changes of myocardial deformation in controls, but not in Targ–CD39-treated mice. Histological assessment confirmed strong reduction of infarct size and an increase in neovascularization. Thus, again, at least experimentally, Targ–CD39 holds promise for treatment of myocardial infarction. The translational value of these findings is put into context in an **Editorial** by Meinrad Gawaz from the University Hospital Tübingen in Germany.[10]

While plaque rupture[11] or erosion[12] with concomitant platelet activation is the most common cause of acute coronary syndromes, functional alterations of epicardial coronary arteries (i.e. vasospasm) or of the coronary microcirculation may be the underlying cause of myocardial infarction in patients with non-obstructive coronary arteries, i.e. in MINOCA[13] and in Tako Tsubo syndrome.[14] In a clinical research manuscript entitled '**Patients with acute myocardial infarction and non-obstructive coronary arteries: safety and prognostic relevance of invasive coronary provocative tests**', Giampaolo Niccoli and colleagues from the Catholic University of the Sacred Heart in Rome, Italy evaluated the prognostic value of intracoronary provocative tests in patients presenting with MINOCA.[15] Immediately after coronary angiography, an invasive provocative test using acetylcholine or ergonovine was performed in 80 consecutive patients. Provocative tests were positive in 46% due to epicardial spasm in 66% and due to microvascular spasm in 35%. After a median follow-up of 36.0 months, patients with a positive test had a significantly higher occurrence of death from any cause and readmission for acute coronary syndromes, as well as a worse angina status as compared with patients with a negative test (*Figure 1*). Thus, in patients presenting with myocardial infarction and non-obstructive coronary arteries, a positive provocative test for spasm is safe and identifies a high-risk subset of patients. These important findings are further discussed in an **Editorial** by Juan C. Kaski from St George's at the University of London.[16]

In a further clinical research article entitled '**Long-term survival and causes of death in patients with ST-elevation acute coronary syndrome without obstructive coronary artery disease**', Hedvig Bille Andersson and colleagues from the Rigshospitalet in Copenhagen, Denmark aimed to study survival and causes of death in 4793 consecutive patients with ST-elevation acute coronary

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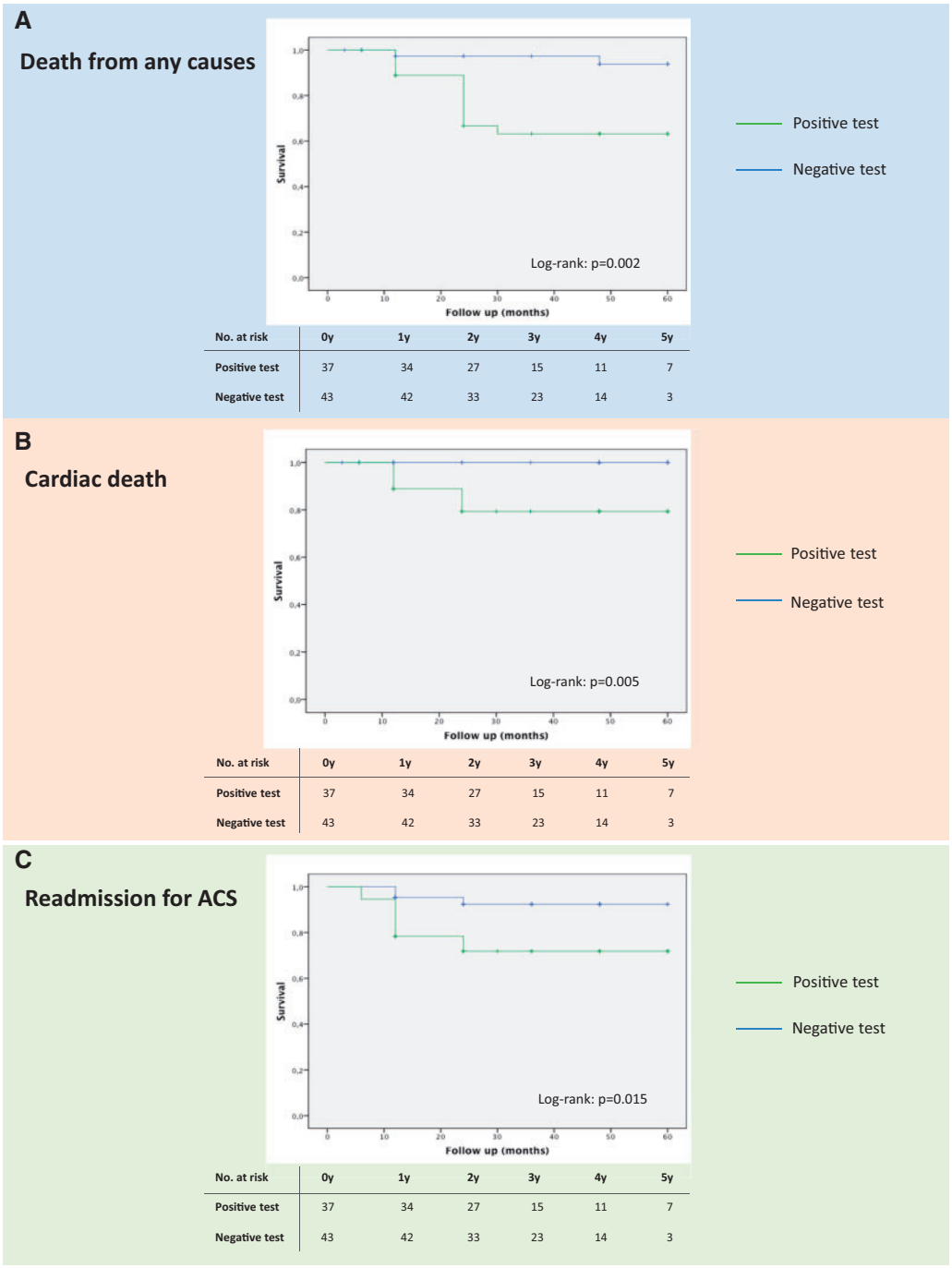

Figure 1 Survival Kaplan–Meier curves for death from any cause (*A*), for cardiac death (*B*), and for readmission for acute coronary syndrome (*C*) according to provocative test response. Curves are compared by the log-rank test. We had no patient loss at follow-up (from Montone RA, Niccoli G, Fracassi F, Russo M, Gurgoglione F, Cammà G, Lanza GA, Crea F. Patients with acute myocardial infarction and non-obstructive coronary arteries: safety and prognostic relevance of invasive coronary provocative tests. See pages 91–98).

syndrome with and without obstructive coronary artery disease.[17] Of these, 88% had obstructive coronary artery disease, 6% non-obstructive coronary artery disease, and 5% normal coronary arteries. Patients without obstructive coronary artery disease were younger and more often female, with fewer cardiovascular risk factors. During 2.6 years, the short-term hazard of death was lower in patients with both non-obstructive coronary artery disease and normal coronary arteries than in those with obstructive coronary artery disease (*Figure* 2). In contrast, the long-term hazard of death was similar in patients with non-obstructive coronary artery disease and higher in patients with normal coronary arteries, regardless of troponin levels. The causes of death were cardiovascular in 70% of patients

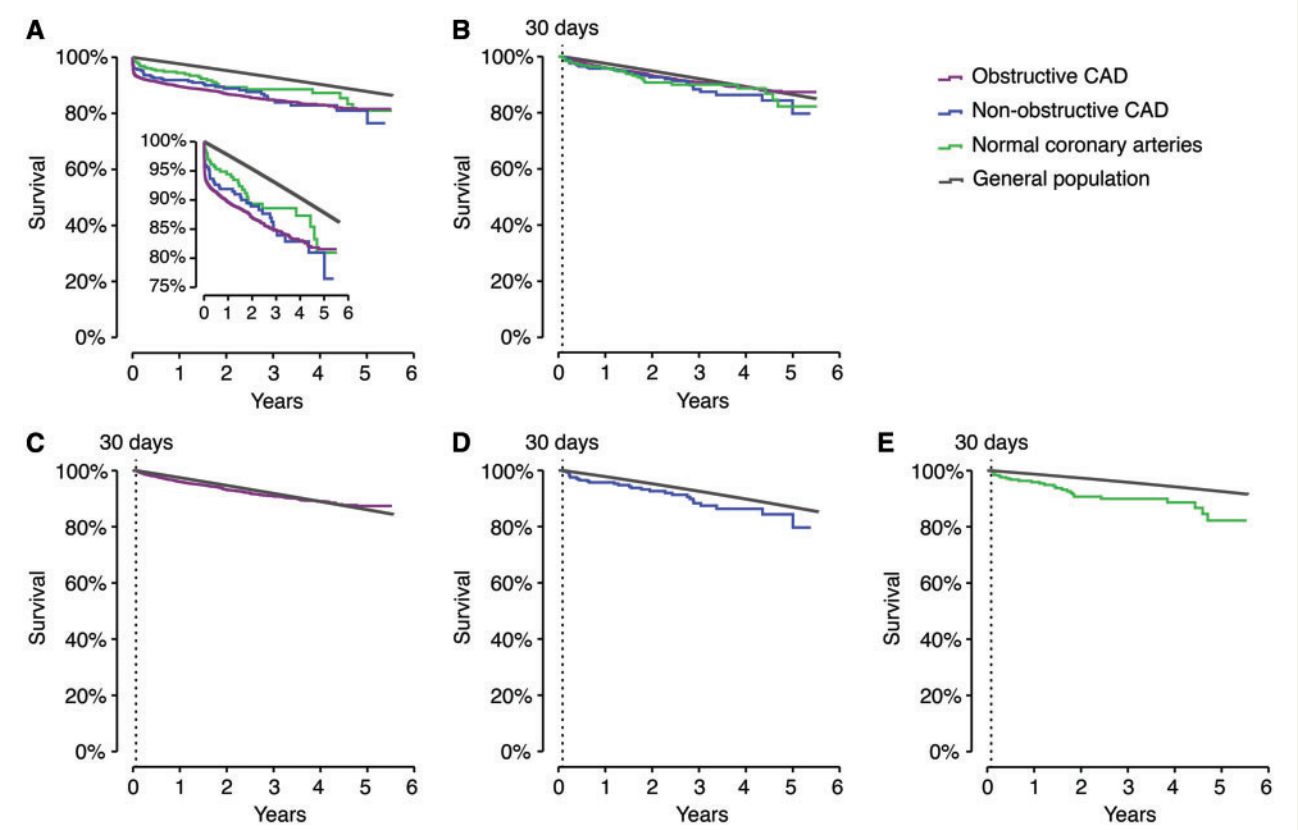

Figure 2 Kaplan–Meier survival curve for patients with ST-elevation acute coronary syndrome compared with an age and sex-matched general population. Panel (*A*) shows overall survival using two different scales. The remaining panels show 30-day landmark analyses for all patients (*B*) and separately for patients with obstructive coronary artery disease (*C*), non-obstructive coronary artery disease (*D*), and normal coronary arteries (*E*). Matching to the general population on age and sex was done separately for each subgroup. CAD, coronary artery disease (from Andersson HB, Pedersen F, Engstrøm T, Helqvist S, Jensen MK, Jørgensen E, Kelbæk H, Räder SBEW, Saunamäki K, Bates E, Grande P, Holmvang L, Clemmensen P. Long-term survival and causes of death in patients with ST-elevation acute coronary syndrome without obstructive coronary artery disease. See pages 102–110).

with obstructive coronary artery disease, 38% in those with non-obstructive disease, and 32% in those with normal coronary arteries. Finally, patients without obstructive coronary artery disease had lower survival compared with an age- and sex-matched general population. Thus, ST-segment elevation acute coronary syndrome patients with non-obstructive coronary artery disease had a long-term risk of death similar to or higher than that of patients with obstructive disease. However, the causes of death were less often cardiovascular. This suggests that, contrary to common practice, ST-elevation acute coronary syndrome patients without obstructive coronary artery disease warrant medical attention and close follow-up.

The editors hope that this issue of the *European Heart Journal* will be of interest to its readers.

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