

## EDITORIAL COMMENT

# Cardiogenic Shock: Is There Light at the End of the Tunnel?\*

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Over the last 20 years, the short- and long-term prognosis of myocardial infarction (MI) has markedly improved. The mortality rate, which was approximately 19% in 1986 (1), now approaches 5% to 6%, at least in contemporary clinical trials and registries (2–4). There are several potential reasons for this decrease, one of which is the introduction of effective techniques of myocardial reperfusion. It has been clearly demonstrated that an important determinant of prognosis in MI is the rapidity, extent, and durability of reperfusion. Primary percutaneous coronary intervention (PCI), which results in a higher reperfusion rate, has been shown to be superior to fibrinolytic treatment, although the latter is more widely available and can be administered more quickly (5). New strategies, including pre-hospital thrombolysis with transfer to an interventional center for possible rescue angioplasty, have been proposed and may be appropriate in situations where primary angioplasty is not feasible for all patients (6,7). Despite these major advances, there remains a black zone where progress has been less striking. This is the case with cardiogenic shock, which remains the severest clinical complication of MI.

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The incidence of cardiogenic shock remains approximately 7% to 8% in a recent series of the literature (8,9), and apparently, this incidence has not declined with modern treatment. Cardiogenic shock can be present upon hospital presentation or may develop at a later stage. It is very likely that the heterogeneity in the timing of onset of cardiogenic shock reflects the varying and complex underlying pathophysiologic mechanisms. In this field, we have only partial and limited information from small groups of patients who underwent coronary angiography. In this issue of the *Journal*, Sanborn et al. (10) describes extensively the angiographic characteristics of 243 patients enrolled in the Should We Emergently Revascularize Occluded Coronaries for Cardiogenic Shock (SHOCK) trial (11). This was a multicenter, randomized trial conducted at 36 international centers that compared two treatment strategies: one included emergency revascularization, and the other included

initial medical stabilization. This trial showed a significantly better survival at one year in patients who underwent emergency revascularization (47%) compared with patients who were initially medically stabilized (34%) ( $p = 0.025$ ). As previously reported, 64% of the patients had severe triple-vessel disease, and 21% had significant left main stenosis. The most frequent culprit vessel was the left anterior descending artery (49%), whereas the right coronary artery was the infarct-related artery in 29% of cases. Two-thirds of the infarct-related arteries had TIMI 0 to 2 flow at the culprit lesion, and this was more frequent in the group with initial medical stabilization than in patients with emergency revascularization. Disease severity was not correlated with one-year survival in this latter group, whereas a significant correlation ( $p = 0.02$ ) was noted in the initially medically treated group.

Although left ventricular (LV) ejection fraction was strongly correlated with one-year survival, it appears that LV function was moderately but not severely depressed, suggesting that besides the extent of myocardial necrosis, other factors, mainly peripheral, can play an important role. The severity of mitral regurgitation (MR), which is correlated with the mortality rate, is also important.

This report suggests for the first time the importance of early reperfusion before revascularization, and these important data raise two issues. First, would earlier reperfusion with pre-hospital fibrinolysis reduce the incidence of cardiogenic shock? Recent data from the Comparison of Angioplasty and Prehospital Thrombolysis in Acute Myocardial Infarction (CAPTIM) trial (7) showing a lower rate of cardiogenic shock in the pre-hospital fibrinolytic group support this hypothesis.

Second, this angiographic study demonstrates clearly the impact of severe triple-vessel disease and left main narrowing. This suggests that complete myocardial revascularization could be of importance, as suggested in other limited numbers of cases. Although coronary artery bypass grafting is a high-risk procedure in these patients, it would be a good way to tackle the key elements involved in cardiogenic shock, that is, extension of coronary artery disease, left main narrowing, and MR. With the exception of MR, modern PCI with modern (drug-eluting) stents, as well as adjunctive pharmacologic therapy (GP IIb/IIIa and clopidogrel), could also play a more important role in the future. These issues are addressed in a second report in this issue of the *Journal* by Webb et al. (12), who examined the clinical, angiographic, and procedural characteristics determining survival among 82 patients who underwent PCI.

Percutaneous coronary intervention was performed at a median time of 11 h in patients with a median time of 5.1 h from onset of MI to shock. Although 81% of patients had multivessel disease, most of them (87%) underwent a single-vessel procedure. However, this trial was conducted between 1993 and 1998, and thus, the rate of stenting and GP IIb/IIIa usage does not reflect current practice in

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interventional cardiology. On average, one-third of the patients had stent implantation at the site of the culprit lesion, mainly as a backup for a failed balloon procedure. The rate of coronary stenting culminated at 74% in the last two years of the study. Similarly, the rate of GP IIb/IIIa use, which was low (<7%) in the first two-thirds of the study, markedly increased over the last two years (81%).

It is important to note that the procedural success was relatively low (76%) and significantly lower than the rate currently achieved with modern angioplasty in acute MI. This is of paramount importance because the survival rate was 65% at 30 days and 61% at 1 year in those patients with successful procedures. The corresponding survival rates in patients in whom the procedure was unsuccessful were 20% at 30 days and 15% at 1 year. Over time, and despite significant advances (stents and GP IIb/IIIa), the one-year survival rate remained unchanged. Thus, one can reasonably ask the following question: Is there any hope for the future in patients with cardiogenic shock?

The following three issues deserve consideration:

1. Faced with severe multiple-vessel disease in patients with cardiogenic shock, interventional cardiologists should strongly consider the option of complete or almost-complete myocardial revascularization. New tools have made it possible to treat more and more lesions effectively, but this may require lengthy procedures, and it increases the contrast load in these fragile patients. It is important to note that in the study of Webb et al. (12), the outcome of single-stage multivessel procedure was rather disappointing because the one-year survival rate was only 20% compared with 55% after single-vessel angioplasty. Among the few patients in this trial who underwent emergency coronary artery bypass grafting, survival was 38%.
2. Mitral regurgitation seems to be an important predictor: The survival rate was 64% in patients undergoing PCI who did not have MR compared with only 18% for those who had severe MR.
3. Hence, when confronted with severe lesions affecting the three major vessels and associated MR, one might ask whether it would not be a more reasonable option to consider emergency coronary bypass surgery as an alternative to the relatively disappointing impact of PCI in this subgroup.

Further trials are needed to assess the impact of modern, innovative technologies and pharmacologic treatment. Several techniques are under evaluation that might help reduce the final infarct size. Systemic hypothermia has shown initial promise in patients with relatively uncomplicated acute MI, and several trials are underway to evaluate the real

clinical benefit (13). Other percutaneous options, such as LV assist devices to allow time for recovery in partially infarcted myocardium, also are under investigation (14). However, for the moment, the prognosis of patients with acute MI and cardiogenic shock remains extremely guarded.

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