Has the Prognosis of Cardiogenic Shock Post Myocardial Infarction Changed?

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In the last two decades, the treatment of myocardial infarction has advanced constantly. Improved understanding of the pathophysiology of acute coronary syndromes, the development of novel drugs, and the application of new myocardial revascularization strategies have made it possible to progressively reduce the mortality of myocardial infarction in patients admitted to centers that have adequate resources. Nonetheless, the incidence of postinfarction cardiogenic shock has remained stable in the range of 5% to 15%.[1,2] In the present issue, Rohlfs et al[3] describe the tendencies observed in the incidence and prognosis of patients with lung edema and/or cardiogenic shock over a decade based on information obtained from the REGICOR registry of Spain. These authors report an incidence of cardiogenic shock of 5.9% that has remained stable over time. It is likely that differences in incidence are influenced by the demographic characteristics of each registry, regardless of clinical management at admission. As has been seen in other community registries, mortality due to heart failure and cardiogenic shock has shown a sustained decline, although it is still extremely high, over 50%.

Age, a history of diabetes mellitus or previous angina, and anterior location of the infarction appear to be variables associated with a greater risk of Killip III-IV heart failure in the REGICOR registry.[3] In practically all the studies related to acute coronary syndromes, advanced age is associated with a greater risk of mortality and serious complications. This is due, on the one hand, to the fact that older patients more often have a history of coronary disease and more risk factors, which means that coronary disease is more diffuse. On the other hand, physiological changes in the adult heart lead to a reduction in compliance due to an increase in collagen tissue.[4] The case of diabetes is similar. Diabetes often affects women over the age of 60 years and is associated with a greater frequency of arterial hypertension, a higher proportion of three-vessel disease, and more deterioration of left ventricular function.[5] A history of angina or previous myocardial infarction is also more frequent in patients who develop severe postinfarction heart failure, which may indicate a lower coronary reserve and greater predisposition to recurrent ischemia or multiple infarction, both of which are common complications in patients who experience cardiogenic shock. The anterior location of infarction is also associated with a greater risk of heart failure and higher mortality, probably because myocardial necrosis is more extensive. On the contrary, the prevalence of inferior infarction in patients with cardiogenic shock is not only lower, but also associated with a higher percentage of patients with previous myocardial infarction.[6]

The angiographic characteristics of patients with cardiogenic shock must be added to the demographic and clinical predisposing factors analyzed above. In the multicenter registry of the SHOCK Trial, 748 patients, out of a total of 1190 registered, had undergone coronary arteriography. The data in the registry indicate that patients with cardiogenic shock have a significantly higher rate of involvement of the common trunk of the left coronary artery (15.5%), which was the cause of infarction in 6.4% of these patients. At the same time, critical disease of three coronary arteries was found in 53.4% of patients.[7] These angiographic findings coincide with post mortem findings that show a high prevalence of patients with three diseased coronary arteries (75%) and diffuse coronary disease (84%). At the same time, there is a correlation between the extension of coronary disease in the coronary arteriography and the mortality of patients with shock, which reaches 50.8% in patients with three-vessel disease and 78.6% when the culprit artery is the common left coronary trunk.[8] In light of these results, it

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could be concluded that the main factors that contribute to triggering cardiogenic shock in the course of myocardial infarction and worsening its prognosis are related to the extension and severity of coronary artery disease and the presence of previous deterioration of left ventricular function.

An interesting parameter to analyze is the time lapse between the onset of symptoms of myocardial infarction and the presentation of cardiogenic shock, which could be important for selecting therapeutic strategies. In the SHOCK Trial registry, 74.1% of the patients developed clinical symptoms of shock in the first 24 h.[9] This finding could indicate that there is a time window in which aggressive myocardial revascularization strategies can be implemented that could reduce mortality. At the same time, measures that might predispose to arterial hypotension or hypovolemia could be avoided in patients with a critical hemodynamic situation. Nevertheless, the average time between the onset of symptoms of infarction and the beginning of shock was only 4.6 h, which underlines just how narrow the time window for an aggressive strategy is. The mortality of the patients who developed early cardiogenic shock was 62.6%, in contrast with 53.6% in the patients who developed shock after 24 h.[9] The possibilities for reducing this high mortality are limited to prompt diagnosis and the availability of facilities for applying therapeutic strategies that include hemodynamic support with a counterpulsation balloon followed by thrombolysis or direct myocardial revascularization, which vary widely from one center to another.

The pathophysiological mechanisms that lead to cardiogenic shock differ in relation to the duration of infarction. These mechanisms may explain, in part, the differences in mortality that are observed between early and later stages. Patients that develop early cardiogenic shock usually have a more extensive initial area of necrosis, with paradoxical systolic expansion. This leads to a reduction in the ejection fraction and cardiac debit as well as to increased left ventricular end-diastolic pressure, all of which can help to bring on a state of shock. Patients who develop shock later generally do so because of expansion of the area of ischemia or infarction. In fact, in the SHOCK Trial registry the incidence of recurrent ischemia in the patients who developed late shock was 38%, compared with 13.2% in the patients who developed early shock.[9] Consequently, it is likely that with the increased use of procedures designed to produce early myocardial reperfusion it will be possible to reduce the incidence and mortality of late cardiogenic shock.

In the analysis of Rohlfs et al 3 a significant change was observed in the therapeutic strategies, whether pharmacological or invasive, used over the time interval analyzed. The use of platelet antiaggregants, thrombolytics, beta-blockers, and invasive procedures significantly increased toward the end of the period covered by REGICOR (1994-1997). A similar phenomenon was observed in the community registry of Worcester and the North American national registry (NRMI-2), which analyzed a similar period. In these registries, the use of ACE inhibitors, aortic balloon counterpulsation, and myocardial revascularization procedures also increased in this period. In the Girona study and the North American registries, increased use of these treatments was associated with a tendency toward lower mortality in patients with cardiogenic shock.[1,2]

The impact of the use of thrombolytic agents on the lethality of cardiogenic shock in patients has been a topic of debate. In large multicenter studies in which the effect of thrombolytic agents on infarction has been evaluated, such as GISSI-1 and GUSTO-1, thrombolytics have shown no advantages in patients with cardiogenic shock.[10,11] As a result, a hypothesis has developed that the associated use of aortic balloon counterpulsation could contribute to improving hemodynamic stability by improving coronary perfusion and facilitating the effect of thrombolytic agents in dissolving the thrombus in the responsible artery. All of this could contribute to reducing the size of the infarction and mortality due to pump failure. This hypothesis was evaluated in the prospective SHOCK Trial registry, which confirmed that patients in shock who were treated with a combination of thrombolytic agents and balloon counterpulsation had a significantly lower mortality (47%) than those treated with balloon counterpulsation alone or thrombolysis alone (52% and 63%, respectively). The mortality was even higher (77%) in patients who did not receive any of these treatments.[12] It must be noted, however, that the patients who were treated with a combination of thrombolytic agents and balloon counterpulsation had a lower risk profile in terms of age, risk factors, and history of cardiovascular disease, which reveals a bias in the interpretation of these results. In the analysis of REGICOR, no figures are offered on use of balloon counterpulsation, but the good results obtained with thrombolytic agents is confirmed, as has also reported in other retrospective analyses.[1-3]

Primary angioplasty seems to be the therapeutic strategy that has the greatest impact on mortality due to myocardial infarction, being superior to thrombolysis in recent multicenter studies. It was hoped, therefore, that its use in patients with cardiogenic shock would have a much better effect than thrombolysis in this clinical situation. This hypothesis was evaluated in both the SHOCK Trial and the REGICOR registry on which this study was based. Surprisingly, the mortality rates associated with primary angioplasty, with or without balloon counterpulsation associated with the procedure, were 46% and 47%. The results obtained for the association of balloon counterpulsation and thrombolysis were similar. We could thus speculate

that early re-establishment of coronary flow, independently of the method used, is the best strategy in patients with shock secondary to infarction. These results are encouraging for professionals working in hospitals that are not equipped for performing primary angioplasty, but do have access to the use of thrombolytic agents and balloon counterpulsation. The results of early coronary surgery merit separate discussion, inasmuch as they were associated with the lowest mortality of all (39%). Nevertheless, the patients referred for surgery were younger and had a less frequent history of cardiovascular disease and better ventricular function. Interpretations of changes in the lethality of cardiogenic shock secondary to infarction must be made with caution, inasmuch as most new hemodynamic support and myocardial revascularization treatments have been made in patients with a lower risk profile.

In conclusion, the information provided by infarction registries has established that the incidence of cardiogenic shock has remained stable with time, since it depends fundamentally on demographic factors, the prevalence of coronary risk factors, and a previous history of cardiovascular disease. At the same time, a sustained tendency toward a lower mortality due to cardiogenic shock has been observed. The lesson that the prospective registry of the SHOCK Trial has taught us is that early myocardial revascularization procedures can and should be attempted if the patient´s clinical characteristics allow it. In other words, use of these procedures is changing the prognosis of postinfarction cardiogenic shock, although it continues to be ominous.

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