Surgical treatment of acute myocardial infarction

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Key words:
Cardiogenic shock; Left ventricular assist device; Myocardial infarction; Surgical myocardial revascularization.

Background. **The role of surgical revascularization in the treatment of acute myocardial infarction (AMI) has changed considerably over the last 30 years along with improvement in intraoperative management and techniques of myocardial protection. The aim of this work was to analyze the long-term results of our experience of emergency myocardial surgical revascularization for AMI.**

Methods. **Between January 1986 and October 2003, 237 patients (85.3% males; mean age 59.6 ± 9.6 years) underwent emergency coronary artery bypass graft for severe AMI. At admission 82 patients (34.6%) were in cardiogenic shock, while 124 patients (52.3%) presented major preoperative complications (acute pulmonary edema, mechanical ventilation, intra-aortic counterpulsation, cardiac arrest). Preoperative intra-aortic counterpulsation was performed in 125 patients (52.7%). The mean time interval between symptom onset and surgery was 9.4 hours. Three-vessel disease was detected in 107 patients (45%), with main left stenosis in 12.9%.**

Results. **There were overall 50 hospital deaths (21.1%). Amongst patients with major preoperative complications, mortality was 36.2% (45 cases out of 124); mortality for cardiogenic shock was 40.2% (33 patients out of 82). Survival of the first 140 patients undergoing operation and then discharged was 97.8% at 1 year and 79.6% at 5 years. The survival rate of the first 60 patients in cardiogenic shock operated on and then discharged is 98.8% at 1 year and 81.2% at 5 years. The ejection fraction in 102 echocardiographically controlled patients was 37.2 ± 8.5% preoperatively and 44.0 ± 10.1% at pre-discharge (p = 0.0001).**

Conclusions. **Surgical revascularization for AMI, especially if complicated by cardiogenic shock, is a valid therapeutic option that carries a high periprocedural risk but that is balanced by a satisfactory late survival. A more precise patient's risk assessment at admission, improvement of surgical and myocardial protection techniques, extensive use of intra-aortic counterpulsation, and new circulatory support when needed, can improve outcomes and late survival.**

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Introduction

Notwithstanding the notable progress made in the therapeutic field in the last few years, the mortality rate for subjects with acute myocardial infarction (AMI) and subsequently hospitalized is, according to recent large-scale trials, between 6 and 9%[1,2]. The results of these studies have confirmed epidemiological observations and studies carried out on smaller populations that the early phase of AMI is crucial in determining prognosis. In the GUSTO (Global Utilization of Streptokinase and Tissue-plasminogen activator for Occluded coronary arteries) study mortality at 30 days was 7%: 39% of these deaths were concentrated in the first day and 55% occurred within the first 48 hours[2]. The possibility of identifying from the very first contact those patients at the highest risk should suggest the adoption of more aggressive therapeutic strategies for these patients whilst allowing the lower risk patients to be discharged earlier. This would, moreover, allow a more rational use of health service resources. This kind of approach for the heart attack patient would also be determinant in reducing the delay in applying the most appropriate treatment for the specific case and in optimizing the organization of the referral third level hospitals as well as the peripheral centers. An early prospective prognostic picture may become a formidable instrument to tailor therapy which is now indispensable, due to international recognized utility of invasive and non-invasive therapeutic interventions (Fig. 1)[3].

The delay in treating AMI has become of great interest since the arrival of thrombolytic therapy. The assumption is that a rapid reperfusion of the infarct risk area minimizes the dimensions of AMI, reduces the degree of left ventricular dysfunction,

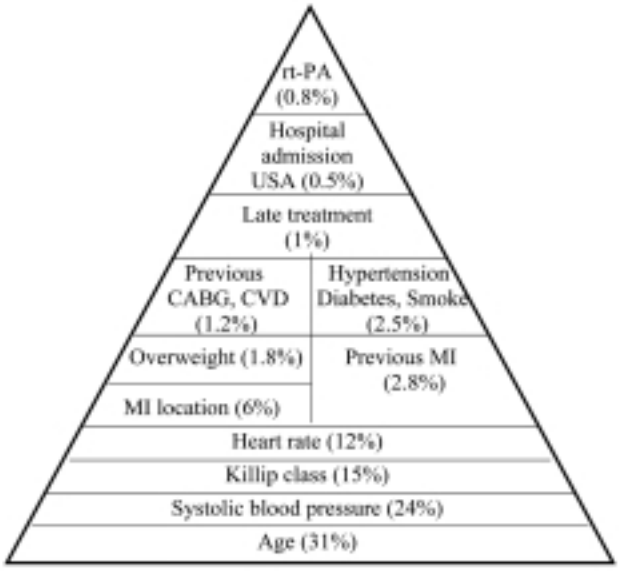

Figure 1. *Prognostic factors observed in the GUSTO I study, in a hierarchic order. The number in brackets indicates the percentage increasing or decreasing the rate given to any variable listed. CABG = coronary artery bypass graft; CVD = cardiovascular disease; MI = myocardial infarction; rt-PA = recombinant tissue-type plasminogen activator.*

and improves survival rates. Since early patency of the coronary artery has been shown to be the primary objective of the treatment (mortality in patients with TIMI 3 flow at 90 min 3.6 vs 9.5% in patients with TIMI 0/1 flow)[4], it is fundamental to review the procedure for an "as soon as possible" thrombolytic therapy or for an early approach with mechanical revascularization[5]. Moreover, the limits of thrombolytic therapy are well-known, in particular the inability to obtain an efficacious and lasting recanalization in a large percentage of the treated patients who thus risk an incomplete restoration of the left ventricular function and recurrent infarction[6].

To overcome these limits, it has been proposed for some time an early invasive treatment for patients with AMI. Percutaneous transluminal coronary angioplasty (PTCA), which may be proposed for 90% of patients hospitalized with AMI, may not present the limits evidenced by thrombolytic therapy in terms of percentages of efficacious reperfusion of the infarct-related vessel, early reocclusion, and intracranial hemorrhagic events. In an era of great scientific rigor and constant reference to an evidence-based medicine, primary PTCA is indicated as a class I treatment in the American College of Cardiology/American Heart Association (ACC/AHA) guidelines[7], but only when performed by a very expert personnel in centers with a high number of procedures able to guarantee treatment in a very short time (door-to-balloon time < 90 min).

Surgical revascularization

The role or surgical revascularization in the treatment of AMI has changed considerably over the last 30 years as along with the improvement in intraoperative management and in the techniques of myocardial protection. In the mid '80s the experiences of DeWood et al.[8] and Phillips et al.[9] pointed toward the possibility of obtaining potential advantages over other methods of recanalization; however these studies, which were not randomized and without an adequate pre- and postoperative clinical and anatomical stratification of patients, were very particular and probably unrepeatable. Moreover, the clinical affirmation of thrombolysis and PTCA in the same period also had the effect of progressively relegating surgical revascularization, for practical, logistic, and economic reasons, to a role of a therapeutic option of third choice. Indeed, notwithstanding the excellent results in terms of mortality reported in the literature, there are few studies with patients who underwent first-choice surgical treatment for AMI[10-12], whilst there are many studies regarding surgical treatment in patients with a failure of vessel recanalization by thrombolysis or primary PTCA. On the contrary, numerous pathophysiological findings, such as a more complete and definitive revascularization with effective protection of all the myocardium at risk and a controlled reperfusion with prevention of reperfusion injury, would indicate that in selected patients a primary coronary bypass intervention, apart from logistic and organizational considerations, could be one of the first options for the treatment of AMI. The fundamental indications for surgical revascularization, as emerged in the studies of Allen et al.[12,13], are based on the possibility of a controlled use of the myocardial protection and reperfusion with the objective of not only limiting the extension of the necrosis, but also to protect the ischemic and non-ischemic remote myocardium in order to carry out a real prophylaxis of left ventricular dysfunction subsequent to an acute ischemic event. Once a precise prognostic stratification has been carried out it can be argued, in accordance with comments expressed in the guidelines and indications for coronary artery bypass graft surgery[7] and the guidelines for management of patients with AMI[14], that the surgical solution, even if not confirmed by randomized studies, is the best therapy for patients with extensive AMI and/or cardiogenic shock with multivessel disease or left main coronary stenosis. Unfortunately the same guidelines, inevitably reflecting epidemiological, logistic-organizational, and economic pressures, when having to translate indications into precise classes of therapy, end up placing the surgical option in class I only in failed cases of PTCA with hemodynamic instability and persistent ischemia refractory to medical therapy and the surgical option only in class IIa for cardiogenic shock with an anatomy favorable to surgery.

The "A. De Gasperis" Cardiac Surgery experience

The total case history of the "A. De Gasperis" Center includes 237 myocardial revascularizations performed from January 1986 to October 2003 in patients

with extensive AMI (≥ 5 ECG leads) and/or with a pump deficit, all responding to the following characteristics: 1) emergency operation; 2) persistent angor untreatable with medical therapy; 3) persistent ST-segment elevation up to the surgical procedure, independent of entity of the enzyme increase.

Patients who underwent emergency myocardial revascularization for complications during elective PTCA or for acute coronary occlusion in the postoperative period of revascularization, and patients operated on for acute mechanical complications during AMI were excluded from the study.

The patients, apart from those with specific contraindications, underwent surgical therapy after the failure of the other methods of revascularization (thrombolysis and/or PTCA).

The clinical characteristics and postoperative data of the 237 patients undergoing surgery are reported in tables I and II.

At the time of surgery, 124 patients (52.3%) presented with one or more major preoperative complications; 82 cases (34.6%) presented with cardiogenic shock. One or more of the following serious clinical conditions were defined as major preoperative complications: cardiogenic shock (characterized by arterial pressure < 90 mmHg, signs of peripheral hypoperfusion, oligoanuria), acute pulmonary edema (characterized by worsening dyspnea, pulmonary rales, radiological signs of pulmonary congestion), threatening ventricular arrhythmia, cardiocirculatory arrest, the need for preoperative mechanically assisted ventilation and/or mechanical circulatory support (intra-aortic counterpulsation, percutaneous extracorporeal circulation). In accordance with the methodology previously described[10], in emergency operations a totally venous revascularization was preferred. The use of the internal mammary artery was judged unsuitable in this situation given the impossibility of administering the cardioplegic solution in the revascularized region of the internal mammary artery and thus impeding a controlled reperfusion. The internal mammary artery was anastomized on the anterior interventricular vessel in 2% of the cases, and only when AMI did not involve the anterior wall. In the years 2001-2003, however, the internal mammary artery was used in 78% of the patients, also in the presence of anterior AMI after reopening the necrotic vessel with primary PTCA without stenting.

Table I. Demographic characteristics.

Males	201 (85.3%)
Females	36 (14.6%)
Age (years)	59.6 ± 9.6
Previous AMI	62 (26.3%)
Two previous AMI	15 (6.4%)
Recent AMI (< 30 days)	32 (13.4%)
Previous CABG	14 (5.8%)
Anterior AMI	156 (66.1%)
Anterolateral AMI	40 (16.9%)
Inferior AMI	23 (10.5%)
Inferolateral AMI	18 (6.4%)
Non-surgical treatment of AMI	
Thrombolysis	118 (49.7%)
PTCA	52 (22.2%)
Angiographic data	
Left main coronary stenosis	31 (12.9%)
Three-vessel disease	107 (45.0%)
Two-vessel disease	72 (30.4%)
One-vessel disease	27 (11.7%)

AMI = acute myocardial infarction; CABG = coronary artery bypass graft; PTCA = percutaneous transluminal coronary angioplasty.

Table II. Clinical characteristics.

Ejection fraction (%)	37.2
Major preoperative complications	124 (52.3%)
Acute pulmonary edema	55 (23.4%)
Shock	82 (34.6%)
Complex arrhythmias	36 (15.2%)
Cardiovascular arrest	29 (12.3%)
Mechanical ventilation	21 (8.8%)
Aortic counterpulsation	125 (52.7%)
AMI-surgery interval (hours)	9.4
Intraoperative data	
No. anastomoses	639
LIMA usage	29 (12.2%)
Extracorporeal circulation (min)	101.3
Aortic cross-clamping (min)	53.3
Cardioplegia according to Buckberg	218 (92%)
Crystalloid cardioplegia	19 (8%)

AMI = acute myocardial infarction; LIMA = left internal mammary artery.

Immediate results. There were 50 hospital deaths which amounted to 21.1% of the patients. In relation to the seriousness of the preoperative clinical status, the operative mortality rate was 36.2% (45 cases out of 124) amongst patients with greater preoperative complications and 4.5% (5 out of 113) amongst those patients with AMI undergoing an operation for the severity and extension of the myocardial ischemic status without immediately life-threatening clinical-hemodynamic conditions (p = 0.0001). Amongst patients operated in the condition of cardiogenic shock, the mortality rate was 40.2% (33 out of 82).

Long-term results. A significant restoration of the left ventricular ejection fraction was evidenced in 102 echocardiographically controlled patients. The ejection fraction passed from 37.2 ± 8.5% preoperatively to 44.0 ± 10.1% at pre-discharge (p = 0.0001). A progressive decrease in the statistical significance in the difference between the pre- and postoperative ejection fraction was evidenced amongst those patients operated within 6 hours, between 6 and 12 hours, and > 12 hours from the onset of AMI. The survival rate of the first 140 patients undergoing operation and then discharged was 97.8% at 1 year and 79.6% at 5 years (Fig. 2).

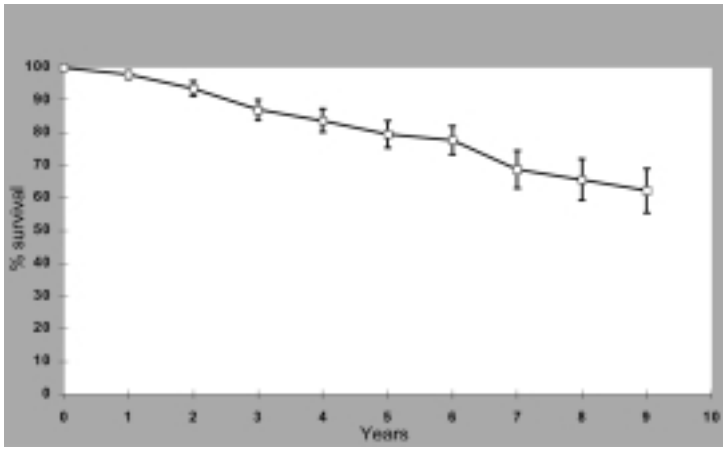

Figure 2. *Actuarial survival curve calculated on the global population of patients consecutively operated on and discharged (140 patients).*

Cardiogenic shock

Cardiogenic shock, especially after the progress made in the treatment of arrhythmic complications, has become the first cause of death amongst patients hospitalized for AMI. Cardiogenic shock is present in 10-15% of patients after AMI and is more frequent in patients with a previous infarction, especially if the anterior-lateral wall of the left ventricle was involved[15].

The autoptic examinations carried out on the hearts of the patients having died due to cardiogenic shock have shown that to develop left ventricular failure it is necessary that an infarct involves at least 30% of the muscle. This condition of pump deficit clinically presents itself from 12 to 24 hours after the initial infarction due to the extension of the infarction process or to the ischemic involvement of non-infarcted segments. Indeed, the acute infarction determines an immediate dyskinesia of the affected myocardial segments; to maintain the cardiac output, the non-infarcted segments ("remote myocardium") must develop a compensatory hypercontractility, increasing their oxygen demand. In the presence of a multivessel coronary artery disease, the remote myocardium cannot receive a sufficient coronary flow to satisfy the increased demand for oxygen brought on by the hypercontractility, and may therefore go up against a progressive ischemia with consequent dysfunction and incapacity of maintaining the compensatory hypercontractility. This manifests itself clinically in post-infarct angina with extension of the infarction and progressive development of left ventricular failure. Therefore the condition of hemodynamic decompensation rapidly worsens, with hypotension, vasoconstriction and multiorgan failure associated with the evident cardiogenic shock syndrome.

The patients with cardiogenic shock were initially considered inoperable, and so they were treated conservatively with expansion of blood volume and pharmacological support, with an awful prognosis (mortality very close to 100%). The discouraging results, in terms of both short- and long-term mortality, of medical therapy in cardiogenic shock have stimulated several groups to evaluate the role of early mechanical revascularization in patients stabilized with pharmacological therapy and intra-aortic counterpulsation.

The SHOCK Trial (Should We Emergently Revascularize Occluded Coronaries for Cardiogenic Shock?)[16] is the main randomized international study aimed at verifying if the use of emergency revascularization in patients with AMI complicated by cardiogenic shock is able to reduce the 30-day mortality compared to patients initially treated with medical therapy (including thrombolysis, unless contraindicated) and intra-aortic counterpulsation, and eventually revascularize after clinical stabilization (primary endpoint). The study foresees, amongst the secondary endpoints, the analysis of mortality at 6 months and at the end of the trial. Between April 1993 and November 1998, 302 patients were enrolled in 30 centers: 152 were treated with early revascularization (within 6 hours of the randomization) with PTCA or bypass surgery, 150 with medical therapy and eventual revascularization, if indicated, after clinical stabilization and anyway after 54 hours. Amongst the patients indicated for revascularization, those treated surgically presented more serious pathologies (stenosis of the left main coronary artery, severe three-vessel disease) or arrived at the operation after failed PTCA.

The results of the SHOCK Trial Registry[17] and of the SHOCK Trial[16] are highly concordant in confirming an improved survival in patients in cardiogenic shock undergoing early revascularization. Though not significantly, patients in both the SHOCK Trial Registry and in the SHOCK Trial treated with surgical revascularization, even with a worse angiographic picture and longer time to treatment than the PTCA-treated patients, showed a better prognosis. This observa-

tion is confirmed in a pilot study carried out at our center. Indeed, between November 1998 and June 2001, 56 consecutive patients with cardiogenic shock due to left ventricular failure during a myocardial infarction underwent emergency revascularization. Of these, 30 underwent bypass surgery (57%) and 26 (43%) PTCA with stent application in 96% of the patients. The two groups were homogeneous as regards the epidemiological characteristics and cardiovascular risk factors. The difference between the average times of onset of symptoms and the beginning of the procedure (chest pain onset to percutaneous coronary intervention procedure for the angioplasty group and chest pain onset to surgery for the bypass group) was, respectively 5.8 and 9.2 hours. Considering, however, the chest pain onset to reopening of the vessel in the hemodynamic lab interval, the interval rose to 6.7 hours. The patients undergoing surgery had prevalently three-vessel disease (70%) and with involvement of the left main coronary artery (16%) whilst the patients undergoing angioplasty had monovascular lesions or two-vessel disease (58 and 35%, respectively). Revascularization was complete in 86% of the patients undergoing surgery and 50% of those undergoing percutaneous coronary intervention. The in-hospital mortality was 30% (bypass surgery) vs 39% (PTCA).

Based on the results of the SHOCK Trial, the ACC and the AHA, in the recently revised guidelines for the treatment of patients with AMI, recommend early revascularization in cardiogenic shock patients, and place surgical revascularization for cardiogenic shock, in patients with a coronary anatomy favorable for surgery, in class IIa. According to the above-mentioned protocol of our Department, bypass surgery is considered an option of first choice for cases of AMI with cardiogenic shock and three-vessel disease or left main coronary disease. Present survival rates based on the first 60 patients in shock who were operated on and then discharged is 98.8% at 1 year and 81.2% at 5 years (Fig. 3).

Present epidemiology of acute myocardial infarction surgery

The reperfusion strategy of AMI has profoundly changed over the last few years, especially due to a greater use of percutaneous mechanical revascularization. Indeed, in Italy, the use of this method is ever increasing; from 3584 primary PTCA in 1999 to 6871 in 2001 and 9010 in 2002 (data from the Italian Society of Invasive Cardiology). There is no doubt that primary PTCA, when carried out in a short time and preferably by expert operators, especially if associated with stenting and the use of glycoprotein IIb/IIIa antagonists, is able to recanalize the infarct-related artery in more than 90% of the cases. The ever more frequent use of primary PTCA has led, in the last few years, to a continuous increase in the number or patients transferred from hospitals that are not able to perform interventional procedures to those that are able to perform them 24 hours a day and to the increase in the number of patients with AMI transported directly to hospitals with hemodynamic facilities: these new logistics have brought about the problem of how to treat these hyperacute patients in the minutes (often > 60 min) that precede mechanical revascularization.

The administration, prior to the percutaneous procedure, of the glycoprotein IIb/IIIa inhibitors and of low-dose thrombolysis, led to the concept of "facilitated PTCA". The rationale of this therapy is that of trying to pharmacologically recanalize the infarct-related artery before mechanical recanalization, reducing time of ischemia and saving viable myocardium[18]. This consequently led to a change in the acute infarct population undergoing emergency surgical revascularization. Thanks to the increasing cardiology experience and the more aggressive extension of indications for PTCA, the number of surgical procedures has decreased progressively over the last few years. In the choice of patients for surgery there has been a progressive selection of the "more unfavorable" cases.

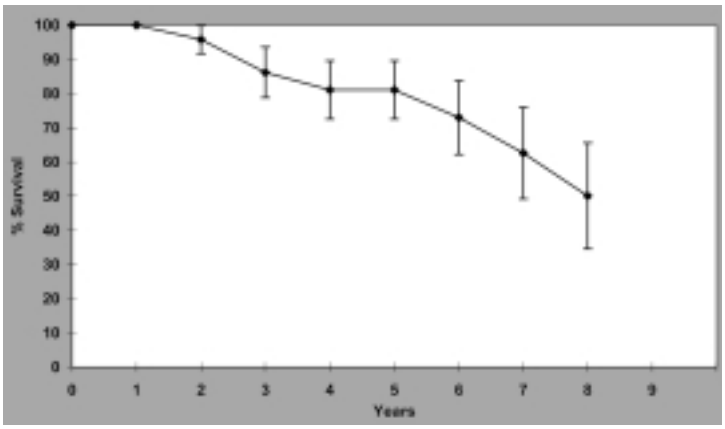

Figure 3. *Actuarial survival curve calculated on the population of patients with cardiogenic shock, consecutively operated on and discharged (60 patients).*

Patients who undergo myocardial revascularization are those particularly critical as regards clinical characteristics (overt and prolonged cardiogenic shock), with an unfavorable anatomy and extension of the heart disease, as well as incidence of associated pathologies. We may say that in our experience, three-vessel disease regards 92% of our patients whilst left main coronary stenosis regards 48% of our cases. Moreover, given the ever increasing prognostic value of early infarct-related artery reperfusion, most of our patients, in the last 2 years, have undergone surgery after undergoing recanalization of the necrotic vessel with thrombolysis or primary PTCA. This fact has two important consequences: first a lengthening of the time to surgical treatment; second it has allowed cardiac surgeons to reduce the importance of the concept of controlled reperfusion of the infarcted region. In our more recent experience, it has, in fact, emerged how, also in cases of three-vessel disease, the treatment of the culprit lesion as a bridge to surgery, via PTCA without stenting and eventually with suboptimal final flow, nevertheless allows hemodynamic stabilization sufficient to allow the completion of emergency surgical revascularization in conditions of "less ischemia" and with the temporal possibility of using the internal mammary artery. Indeed, in the last few years, in a high number of cases (78%) treated with partial pharmacological or pre-surgery mechanical reperfusion, we have successfully extended the use of the internal mammary artery for the revascularization of the left anterior descending coronary artery, overturning, in a certain way, the previous concepts espoused by Buckberg's studies[12,13]. At the beginning of our studies, the use of the internal mammary artery in acute patients was not, in fact, considered since it was impossible to control the reperfusion of the anterior left ventricular wall. We now prefer to privilege the shortening of the time of reperfusion, with PTCA bridge, over its control and so favoring the capacity of the arterial channel of maintaining an efficacious revascularization and be able to adapt itself, progressively, to the coronary flow necessary in the different moments of ischemic stunning, similarly to the no-flow phenomenon of primary PTCA. The value of the surgical option, in our experience, remains instead unchanged for what concerns the other two factors: the fundamental role of the extracorporeal circulation in unloading the heart and decreasing oxygen consumption in a moment of great global ischemic suffering (multivessel disease), and the possibility of a complete revascularization, with protection of the remote myocardium. The undeniable pathophysiological value of these two concepts is amplified above all in cases of large AMI and/or in shock, where we believe the best myocardial protection is the most extensive revascularization which leads to a better prevention of the post-infarct ischemic cardiomyopathy.

Mechanical revascularization and mechanical support of the circulation

Notwithstanding the progress made in mechanical reperfusion therapy, the results of extensive AMI complicated by serious hemodynamic instability and/or cardiogenic shock are still discouraging. In some recent studies of patients treated with primary PTCA the in-hospital mortality was between 40.2 and 46%[19,20]. The mortality in patients undergoing surgical revascularization for AMI in shock is slightly better but still between 30 and 38%[21]. The prognosis of these patients is influenced by a number of factors, yet certainly one of the most determining factors is the length of the pre-surgery "low cardiac output", which translates into a reduced perfusion both of the peripheral organs, and of the myocardium. This general ischemia leads to complex systemic inflammatory reactions, leading to multiorgan failure, also when the general circulation is restored.

Several studies have shown how devices for circulatory mechanical support are able to reduce the oxygen consumption and the infarct size and so improve recovery of the "stunned" myocardium[22]. However, the implantation of a left ventricular assist device is still an extremely invasive surgical procedure, with high biological costs in terms of bleeding, hemorrhage and infections, that makes it an option only for extremely selected cases, for example ischemic cardiomyopathy with a high probability of heart transplant[23]. In some studies, the percutaneous cardiopulmonary bypass or extracorporeal membrane oxygenation did not prove satisfactory in the treatment of AMI complicated by shock, given the inability of such devices to unload the left ventricle[24,25]. The technological evolution has permitted the development of the continuous flow devices relatively compact and easy to implant. Some studies in the 1990s with the intraventricular transthoracic Hemopump device in post-cardiotomic shock[26] showed that the microaxial pumps are efficacious and have a lower biological cost and surgical trauma than conventional ventricular assist devices. However, the femoral approach for the insertion of the Hemopump resulted affected by a series of side effects, such as arterial dissection, mechanical failure, and serious hemolysis[27]. The new microaxial pump Impella Recover 100 is the natural evolution of the Hemopump for which it seems to have corrected some principal defects. Our experience with this device, for cardiogenic shock of various etiology, appears greatly satisfactory[28,29]. In the literature there is already evidence of the use of the peripheral version of the Impella to support the AMI complicated by shock; Meyns et al.[30], in a population of 16 patients in cardiogenic shock, supported by this device and undergoing emergency revascularization, showed a weaning of 68% and a survival of 37%. Also in our center, a protocol for treatment of AMI with this device is in the making.

Conclusions

The lack of scientifically accurate, prospective studies, with randomization of patients among the various techniques has prevented, till now, the identification of adequate clinical protocols for the treatment of choice for each individual patient with extensive AMI with and without cardiogenic shock. Only the start of such studies would allow the acquisition of a high level of knowledge and experience for all the equipes involved with the objective of dealing with the whole spectrum of possible technical solutions linked to the fundamental presuppositions of early reperfusion and controlled reperfusion.

The introduction of a protocol for the treatment of high-risk AMI patients must be seen as a unique clinical-scientific opportunity for a further evolution of our capacity of a global treatment of this pathology. A referral hospital as is the Niguarda Ca' Granda Hospital must be able to overcome the organizational problems already mentioned and actuate preferential lines that permit an early and efficacious treatment of devastating AMI with all the mechanical procedures for revascularization available using, when possible, a support to the circulation through the extensive use of intra-aortic counterpulsation and, in selected cases, of new mechanical support devices.

Riassunto

Il ruolo della rivascolarizzazione chirurgica nel trattamento dell'infarto miocardico acuto (IMA), pur se cambiato considerevolmente nel corso degli ultimi 30 anni, è stato progressivamente relegato, per ragioni pratiche, logistiche ed economiche, al ruolo di opzione terapeutica di terza scelta. Al contrario numerose evidenze fisiopatologiche, quali una rivascolarizzazione più completa e definitiva con protezione effettiva di tutto il miocardio a rischio e una prevenzione del danno da riperfusione, farebbero considerare in casi selezionati il bypass coronarico una delle opzioni primarie per il trattamento dell'IMA. Tuttavia, una volta effettuata una precisa stratificazione prognostica, si può affermare, in accordo con i commenti espressi a margine delle linee guida per l'intervento di bypass aortocoronarico e per la gestione dei pazienti con IMA, che la soluzione chirurgica, anche se non confermata da studi clinici randomizzati, sia la terapia migliore dei pazienti con IMA esteso e/o con shock cardiogeno portatori di coronaropatia multivasale o stenosi del tronco comune della coronaria sinistra. Purtroppo le stesse linee guida pongono l'opzione chirurgica in classe I solo nei casi di angioplastica coronarica fallita con instabilità emodinamica e di ischemia persistente refrattaria a terapia medica, e solo in classe IIa lo shock cardiogeno con anatomia favorevole alla chirurgia.

La casistica complessiva del Centro "A. De Gasperis" comprende 237 interventi di rivascolarizzazione miocardica in pazienti con IMA esteso (≥ 5 derivazioni ECG) e/o con deficit di pompa, tutti rispondenti alle seguenti caratteristiche: 1) intervento di emergenza; 2) angor persistente intrattabile con terapia medica; 3) sopraslivellamento persistente del tratto ST fino alla procedura chirurgica, indipendentemente dall'entità del movimento enzimatico.

I pazienti, tranne quelli con specifiche controindicazioni, sono stati avviati alla terapia chirurgica dopo fallimento delle altre metodiche di rivascolarizzazione (trombolisi e/o angioplastica coronarica).

Lo shock cardiogeno è diventato la prima causa di morte nei pazienti ricoverati per IMA e si presenta nel 10-15% dei pazienti dopo IMA. Tali pazienti, pur se inizialmente considerati inoperabili, sono stati recentemente oggetto di particolare studio. Lo SHOCK trial (Should We Emergently Revascularize Occluded Coronaries for Cardiogenic Shock?) e lo SHOCK Trial Registry hanno confermato i dati, già presenti in letteratura, di una migliore sopravvivenza nei pazienti in shock cardiogeno trattati con rivascolarizzazione precoce. Questa osservazione è risultata confermata anche in uno studio pilota eseguito presso il nostro centro.

L'American College of Cardiology e l'American Heart Association raccomandano la rivascolarizzazione precoce nei pazienti con shock cardiogeno, inserendo la rivascolarizzazione chirurgica per lo shock cardiogeno in classe IIa. Secondo il protocollo in attuazione presso il nostro Dipartimento, nei casi di IMA con shock cardiogeno e malattia trivasale o di stenosi del tronco comune della coronaria sinistra il bypass aortocoronarico è stato da noi ritenuto opzione di prima scelta. Nonostante i progressi della terapia riperfusiva meccanica, i risultati del trattamento degli IMA estesi complicati da grave instabilità emodinamica e/o da shock cardiogeno sono ancora scoraggianti. In alcune esperienze il bypass cardiopolmonare percutaneo o l'ossigenazione extracorporea a membrana non si sono rivelati soddisfacenti nel trattamento dell'IMA complicato da shock, data l'incapacità di tali supporti di decaricare il ventricolo sinistro. Alcune esperienze degli anni '90 con la turbina intraventricolare Hemopump transtoracica nello shock post-cardiotomico hanno dimostrato che le pompe microassiali sono efficaci e hanno un minor costo biologico e trauma chirurgico rispetto ai device di supporto ventricolare convenzionali. Meyns et al., in una popolazione di 16 pazienti in shock cardiogeno, supportati con l'Impella Recover 100, una pompa assiale intravascolare di recente introduzione, e avviati alla rivascolarizzazione di emergenza, hanno ottenuto una percentuale di "weaning" del 68% e una sopravvivenza del 37%. Anche il nostro centro si appresta ad iniziare un protocollo di trattamento dell'IMA con questo device.

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