Coronary artery surgery in the first 24 hours after myocardial infarction

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Background. Thrombolysis and angioplasty in the first hours after myocardial infarction minimize necrosis, leading to better early and late survival, but these therapies have limited effect in patients with three-vessel disease and cardiogenic shock. Emergency coronary surgery is an alternative treatment in some cases.

Aim. To assess perioperative complications, mortality and long-term survival in patients undergoing coronary surgery within 24 h of myocardial infarction.

Patients and methods. We retrospectively studied 57 patients undergoing surgery within 24 h of the onset of symptoms of myocardial infarction between 1982 and 1998. Multiple vessel disease was present in 31 patients (54%), shock or cardiac arrest in 19 (33%) and coronary angiography complications in 7 (12%). The mean time between onset of symptoms and surgery was 6.32 h. At the beginning of surgery 32 patients (56%) were hemodynamically stable, 15 (26%) were in shock and 10 (17%) were in cardiac arrest.

Results. The operative mortality was 0% for those who were hemodynamically stable at the start of surgery and 44% (11 of 25 patients) for those in shock or cardiac arrest.

Shock or prior cardiac arrest were associated with higher rates of sternal infection and heart failure and longer hospital stays.

Follow-up (mean 67 months) was possible for all remaining patients. The 5- and 10-year survival rates were 89 and 82%, respectively, for patients who were hemodynamically stable at the time of surgery. Five-year survival was 55%, however, for those who underwent surgery in shock or cardiac arrest. The overall rate of freedom from myocardial infarction, angioplasty or reoperation was over 95% at 5 years and over 85% at 10 years of follow-up. Age and shock or cardiac arrest were risk factors for a poor long-term outcome.

Conclusion. The early and long-term outcome of coronary surgery within 24 h of myocardial infarction is good for patients who are hemodynamically stable when surgery begins. Shock and cardiac arrest are important risk factors for complication and death. Coronary artery bypass grafting is a good treatment option in the first hours after myocardial infarction.

Key words: *Coronary artery bypass grafting. Acute myocardial infarction. Surgery.*

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Cirugía coronaria en el infarto de miocardio de menos de 24 horas de evolución

Antecedentes. La trombólisis y la angioplastia efectuadas en las primeras horas de un infarto de miocardio minimizan la necrosis, lo que da lugar a una mejor supervivencia precoz y tardía. Estas terapias son de efectos limitados en pacientes con enfermedad de múltiples vasos y especialmente en shock cardiogénico. La cirugía coronaria de urgencia es una alternativa terapéutica en casos seleccionados.

Objetivo. Evaluar la mortalidad perioperatoria y la supervivencia a largo plazo en pacientes sometidos a cirugía coronaria en las primeras 24 h de constituido el infarto de miocardio.

Pacientes y métodos. Se estudiaron retrospectivamente 57 pacientes operados entre 1982 y 1998 dentro de las primeras 24 h de los síntomas de inicio del infarto de miocardio. La indicación quirúrgica fue enfermedad de múltiples vasos en 31 pacientes (54%), shock o paro cardiocirculatorio en 19 (33%) y complicación de la coronariografía en 7 (12%). El tiempo promedio entre el inicio de los síntomas y la cirugía fue 6,32 h. El estado hemodinámico al inicio de la cirugía fue estable en 32 pacientes (56%), shock cardiogénico en 15 (26%) y paro cardiocirculatorio en 10 (17%).

Resultados. La mortalidad perioperatoria fue del 0% en aquellos pacientes operados en condiciones hemodinámicas estables y del 44% (11 de 25 casos) en los operados en shock cardiogénico o paro cardiocirculatorio. Adicionalmente el shock cardiogénico y el paro cardiocirculatorio previo se asociaron a mayor incidencia de infecciones esternales, insuficiencia cardíaca y estancia intrahospitalaria prolongada.

Se obtuvo un 100% de seguimiento en los supervivientes, con un tiempo promedio de 67 meses. La supervivencia a los 5 y 10 años en los pacientes operados en condiciones hemodinámicas estables fue del 89 y el 82%, respectivamente. En contraste, en los operados en shock cardiogénico o paro cardiocirculatorio la supervivencia a los 5 años fue de un 55%. Para el grupo total, la probabilidad de estar libre de infarto, angioplastia y reoperación fue de más de un 95% a los 5 años y superior a un 85% a los 10 años. La edad y el shock cardiogénico o paro cardiocirculatorio fueron factores de riesgo de mal pronóstico a largo plazo.

Conclusión. La cirugía coronaria efectuada dentro de las primeras 24 h de constituido el infarto de miocardio tiene buenos resultados precoces y tardíos en aquellos pacientes operados en condiciones estables. El shock cardiogénico y el paro cardiocirculatorio son importantes factores predictores de morbimortalidad. La cirugía de revascularización miocárdica es una buena estrategia alternativa en la terapia de las primeras horas del infarto de miocardio.

Palabras clave: *Cirugía de revascularización miocárdica. Infarto agudo de miocardio. Cirugía.*

INTRODUCTION

Cardiovascular diseases are the first cause of death in Chile, being responsible for 27.13% of all deaths. Myocardial infarction (MI) is the most frequent cardiovascular cause (7.3%), which is why its treatment is especially important in public health.

Revascularization therapy in the infarcted area decreases the lethality of this pathology because it limits the area of initial necrosis and its possible extension, which in the long term reduces ventricular dysfunction and improves the initial and long-term survival. These pathophysiological and clinical considerations are confirmed by large series in which thrombolytic drugs and primary angioplasty have demonstrated their effectiveness.

Nevertheless, there is a group of patients in which angioplasty has failed or the coronary anatomy is complex, which would benefit from coronary surgery as the initial method of revascularization. Various series have demonstrated the low morbidity and mortality of surgery in the 30 first days after MI;[5-8] however, only a few publications have evaluated surgery in the first 24 h, but report excellent results in hemodynamically stable patients and promising results in the rescue of patients in shock or cardiorespiratory arrest (CRA).

Therefore, the aim of this study was a retrospective analysis of the experience of the Cardiac Surgery Department of the Hospital Clínico, Pontificia Universidad Católica, Chile in relation to perioperative morbidity and mortality and long-term results of emergency coronary surgery in the first 24 h of IM.

PATIENTS AND METHODS

Between December 1982 and June 1998, 4788 patients underwent myocardial revascularization surgery (MRS) at the Hospital of the Universidad Católica in Santiago de Chile. Of these patients, 57 underwent aortocoronary bypass in the first 24 h after MI diagnosed using classic criteria: compatible clinical condition, signs of lesion (ST elevation) followed by necrosis waves (pathological Q) in the electrocardiogram, and enzyme elevation (MB fraction of creatine phosphokinase) by more than 10% of the total. Sixty-eight percent of the patients (n=39) had an anterior infarction, 18% (n=10) lateral, and 14% (n=8) inferior.

The analysis was retrospective and made through the computerized files of the Servicio de Cirugía Cardíaca, clinical records, and operating protocols. The follow-up took place between October and November of 1998 by control of treating cardiologists and telephone contact.

Data were stored in Microsoft Excel 97 and statistically processed in SPSS (Statistical Package for Social Systems) 5.0.3 for Windows. The continuous variables were compared with the Student t test and the categorical ones with the chi-square test or Fischer test when the expected values were small.

Survival was evaluated with the Kaplan-Meier method and curves were compared with the test of logarithmic ranges.

The valor of $P<.05$ was considered significant in all cases and the confidence intervals were 95%.

Of the 57 patients, 44 (77%) were men and the average age was 63.7 years. The most frequent risk factors were hypercholesterolemia, hypertension, and smoking habit, with percentages near 45%. Diabetes was present in 17.5%. More than half did not have a history of angina at the time of infarction (31 patients, 54.3%). Of those who had a history of angina, 21 patients (36.8%) had stable angina and 5 (8.8%) had unstable angina. With respect to previous events, 18 patients (31%) had a history of old infarction, 8 (14%) coronary angioplasty (PTCA), and 2 (3.5%) coronary surgery (MRS). The vessels involved were 2.49 per patient; ventricular dysfunction before MI was moderate to severe in 21 patients (37%), and 8 (14%) required preoperative intra-aortic balloon counterpulsation. The other demographic characteristics are detailed in Table 1.

The surgical indication was MI with multiple vessel disease in 31 patients (54%), shock or cardiorespiratory arrest (CRA) in 19 (33.3%), and complication of the hemodynamics laboratory in 7

TABLE 1. **Preoperative demographic characteristics**

	Number	Percentage
Overall patient group	57	100
Sex		
Male	44	77.2
Female	13	22.8
Age (years)	63.7±11	
Preinfarction clinical manifestations		
Asymptomatic	31	54.3
Stable angina	21	36.8
Unstable angina	5	8.8
Previous MI	18	31.6
Previous PTCA	8	14
revious MRS	2	3.5
Arterial hipertensión	26	45.6
Diabetes mellitus	10	17.5
Dyslipidemia	30	52.6
Peripheral vascular disease	10	17.5
Smoking	23	40.4
Kidney failure	1	1.8
Vessels with significant stenosis	2.49±0.75	
Ventricular function		
Normal or mild dysfunction	36	63.1
Moderate to severe dysfunction	21	36.8
Previous balloon counterpulsation	8	14

MI indicates myocardial infarction; PTCA, percutaneous transluminal coronary angioplasty; MRS, myocardial revascularization surgery.

TABLE 2. **Surgical indication**

Surgical indication	Number	Percentage
MI+multiple vessel disease	31	54
MI+shock	19	33
MI+hemodynamics laboratory complication	7	12

MI indicates myocardial infarction.

cases (12.3%) (Table 2). The hemodynamic state at the onset of surgery was stable in 32 patients (56%), CRA in 15 (26.3%), and shock in 10 (17.5%). Unstable hemodynamics was defined as CRA or shock (use of two or more vasoactive drugs or counterpulsation balloon to maintain blood pressure above 90/60 mm Hg). Only one patient treated as a complication of the hemodynamics laboratory was not in shock or CRA

The average time from the onset of MI symptoms to surgery (beginning of extracorporeal circulation) was designated time of ischemia and reached 6.32 h. The number of patients who were at home when symptoms of MI began and were transferred urgently to the hemodynamics laboratory and then to surgery was 28 (49.1%). In these patients, percutaneous transluminal coronary angioplasty (PTCA) was attempted in only 2 and was unsuccessful; in the others, the coronary anatomy was considered unfavorable and the procedure was not attempted. There were 22 patients (38.5%) who underwent coronariography and suffered infarction while surgery was being considered; these patients were taken to the operating room immediately. Finally, 7 patients (12.3%) had infarction as a complication in the hemodynamics laboratory; of them, 4 had a lesion of the trunk of the left coronary artery that became occluded when the catheter was in the ostium and 3 patients had arterial dissection when PTCA was attempted for a stenosis. The interval between coronariography and MRS was less than 24 h in 44 cases (76%) (Table 3).

TABLE 3. **Coronariography-surgery, symptom-surgery interval**

	No. of patients	Percentage
Coronariography-surgery interval		
0-8 h	35	61
9-24 h	9	16
24-72 h	5	9
>72 h	8	14
Time of ischemia (onset of symptoms to surgery)		
<6 h	40	70
6 to 24 h	17	30
Average	6.32±6.15	

TABLE 4. **Surgical technical data**

	Average	Minimum	Maximum
Time of extracorporeal circulation (min)	115,07 ± 59,4	20	310
Clamping time (min)	52,56 ± 27,2	11	133
Distal bypasses	3,04 ± 1,12	1	5
Proximal bypasses	2,58 ± 1,07	0	5
Mammary bypasses	0,23 ± 0,46	0	2

One or more venous grafts were made in all patients, with or without associated internal mammary artery revascularization. Extracorporeal circulation was used with routine cannulation, aortic clamping, and St. Thomas anterograde cardioplegy. No other cardiac or extracardiac operations were associated.

The internal mammary artery was used in 13 patients (22%). The other surgical details are shown in Table 4.

RESULTS

The total operative mortality was 11 patients (19.3%). In 32 patients with a stable hemodynamic status at the onset of surgery, there was no mortality; of 15 patients operated in shock, 6 (40%) died; and of the 10 patients operated in CRA, 5 (50%) died.

The causes of death were cardiogenic shock in 9 patients, sepsis with multiorgan failure in 1, and stroke in

TABLE 5. **Perioperative results**

	Number	Percentage
Mortality		
Overall operative mortality	11	19.3
Hemodynamic		
Stable	0	0
Shock or CRA	11	44
Cause		
Cardiac	9	15.8
Noncardiac	2	3.5
Morbidity		
Stroke	2	3.8
Kidney failure	5	9.4
Dialysis	2	3.8
Lung disease	6	11.3
Heart failure	9	17
Respiratory failure	6	11.3
Surgical wound infection	4	7.5
Sternal dehiscence	4	7.5
Reoperation for hemorrhage	0	0
Postoperative MI	0	0
CRA	1	1.9
Time	**Average (days)**	**Interval**
Aortic balloon counterpulsation	0,59±1,54	0 to 9
Mechanical ventilation	3,17±5,49	1 to 30
Intensive care unit	6,45±8,28	1 to 45
Hospitalization	13,57±9,67	1 to 62

CRA indicates cardiorespiratory arrest; MI, myocardial infarction

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There were no reoperations for hemorrhage. Six patients (11%) had pulmonary disease with a variable degree of hemodynamic impairment; 1 of them developed multiorgan failure and died; the others recovered. Four patients presented surgical wound infection with sternal dehiscence (7.5%) that evolved satisfactorily without reintervention. The average hospitalization time was 13.5±9.6 days and the stay in the intensive care unit was 6.4±8.2 days (Table 5).

In univariate analysis, evaluation of the influence of age, hemodynamic status, surgical indication, and ischemia time on morbidity and mortality demonstrated that only the state of shock or CRA was associated significantly with greater mortality and a longer hospital stay. The mortality in patients with an unstable hemodynamic status was 44% versus 0% in hemodynamically stable patients, and the hospital stay was 19 versus 12 days, respectively (Table 6).

As far as risk factors of postoperative complications were concerned, age over 75 years increased the probability of respiratory failure to 37% versus 6% in patients under 75. A state of shock or CRA was associated with infection (40%) and heart failure (27%), while time of ischemia and surgical indication did not influence morbidity (Table 7).

All patients were followed-up, the average follow-up being 67.2 months and the range being 4 months to 167 months. Survival, including hospital mortality, was 74% and 59% at 5 and 10 years, respectively. After the exclusion of hospital deaths, the survival was 91% and 74%, respectively, at 5 and 10 years. The survival free of cardiac death was 83% at 5 years and 75% at 10 years, including hospital mortality (Figure 1). The 5-year and 10-year probabilities of remaining free of MI, PTCA, and a new MRS were 96% and 86% or more, respectively (Figure 2). The presence of angina at the time of follow-up was 25% (12 of 46 patients); nevertheless, all were in functional capacity.

Patients over 75 years had 5-year survival of 25%, much lower than patients under 75, for which it was 79% in the same term.

All these differences were significant (Table 8, Figure 3). Shock or CRA was associated with worse survival in univariate analysis, with 5-year survival rates of 60% and 50% versus hemodynamically stable patients, who had a 5-year survival rate of 88% (Figure 4).

TABLE 6. **Univariate analysis of operative mortality, total hospital stay, and UCI stay**

	Mortality	P	Days in UCI	P	Hospital stay	P
Age						
<75 years	18%	.66	5.7	.29	14.1	.58
>75 years	25%		9.6		16.5	
Hemodynamic status						
Stable	0%	.00003	4.5	.04	12.4	.03
Shock or CRA	44%		10		19	
Surgical indication						
MI+shock	42.1%	.73	10.1	.95	19.1	.93
MI+shock+complication	50%		9.6		18.3	
Coronariography						
Time of ischemia						
<6 h	22%	.35	6.9	.45	14.5	.89
6-24 h	11%		4.8		14.1	

CRA indicates cardiorespiratory arrest; MI, myocardial infarction.

TABLE 7. **Univariate analysis of perioperative morbidity**

	Age			Hemodynamic status		
	<75 years	>75 years		Stable		Shock or CRA
	N	N	P	N	N	P
Kidney failure			NS			NS
Dialysis			NS			NS
Heart failure			NS	0	9 (40%)	.00007
Respiratory failure	3 (6.5%)	3 (37.5%)	.01			NS
Stroke			NS			NS
Sepsis			NS	1 (3.1%)	6 (27%)	.009
Surgical wound infection			NS			NS
Sternal dehiscence			NS			NS
Reoperation for hemorrhage			NS			NS
	Surgical indication			**Time of ischemia**		
	MI+shock	MI+shock+coronariography complication		<6 h		6-24 h
	N	N	p	N	N	P
Kidney failure			NS			NS
Dialysis			NS			NS
Heart failure			NS			NS
Respiratory failure			NS			NS
Stroke			NS			NS
Sepsis			NS			NS
Surgical wound infection			NS			NS
Sternal dehiscence	1 (5.9%)	2 (40%)	.05			NS
Reoperation for hemorrhage			NS			NS

Values between parenthesis correspond to percentages. Only data with significant differences are included.
CRA indicates cardiorespiratory arrest.

DISCUSSION

Reperfusion therapy in MI using thrombolytic drugs or primary angioplasty is very useful in reducing the area of necrosis of the ischemic myocardium, which in the long term improves ventricular function and survival.

In Chile and Spain, thrombolysis is the most frequent reperfusion treatment. It is used in 40% of MI, versus only 4.5% for angioplasty and 1.2% for surgery.

The review of Lieu et al. demonstrates that thrombolysis rescues an average of 38 patients per 1000 who suffer MI compared with a control group. The results not only are the consequence of repermeabilization of the artery related to infarction (RAI), but are also explained by the decrease in necrosis in the rest of the territories, better ventricular remodeling, and prevention of the subsequent cardiac dilation. Nevertheless, mortality depends strictly on the capacity to restore TIMI 3 type flow in RAI, which is achieved with the most effective regimes in only 50-75% of cases at 90 min. Added to reocclusion of 25% to 30% in one year, this is a limitation to this form of revascularization. If we also consider that its benefit in cardiogenic shock is doubtful and the various contraindications to its use, other therapies must be sought in a large subgroup of patients.

Primary angioplasty demonstrates patency rates from 80 to 98%. In randomized studies, although there is improvement with respect to thrombolysis, the final

TABLE 8. **Univariate analysis of survival**

	5 years	10 years	P
Age			
<75 years	79.3%	66.9%	.0056
>75 years	25.0%		
Hemodynamic status			
Stable	88.6%	81.8%	.0080
Shock	60.0%	*	
CRA	50.0%	*	
Surgical indication			
MI+shock	57.8%	*	.9700
MI+shock+complication Coronariography	50.0%	*	
Time of ischemia			
<6 h	88.2%	77.2%	.1320
6 to 24 h	67.7%	50.6%	

*No 10-year survival figures are presented because the patients in these groups did not have a 10-year follow-up. CRA: cardiorespiratory arrest.

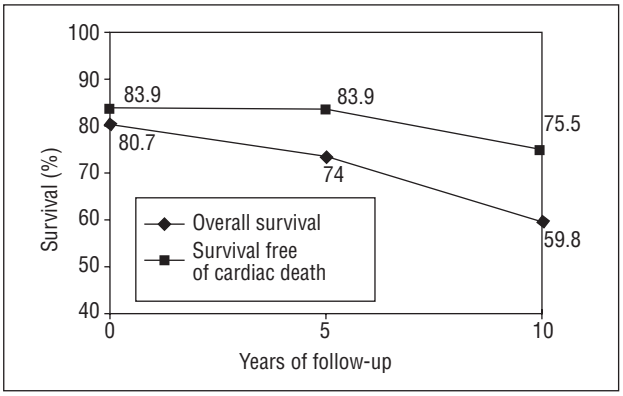

Fig. 1. Overall survival and survival free of cardiac death.

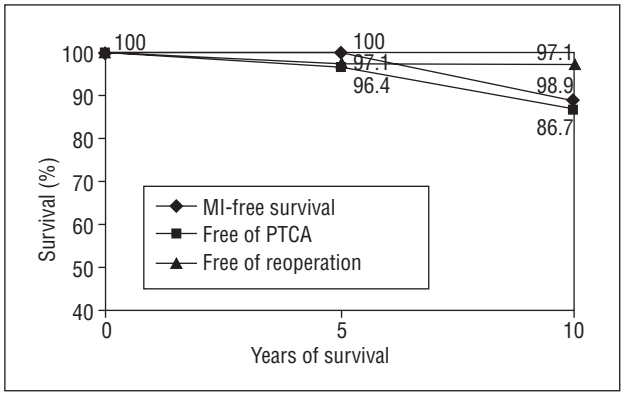

Fig. 2. Survival free of myocardial infarction (MI), percutaneous transluminal coronary angioplasty (PTCA), and reoperation.

results do not differ substantially with respect to ventricular function and survival. This is probably because the number of patients is insufficient, which is why the definitive response will be resolved with new studies. In addition to better initial permeability, PTCA has less early reocclusion (9%) than thrombolysis (up to 25%), which is why we expect better results with PTCA.

The multivariate analysis by Brodie showed a subgroup of patients with worse results of PTCA: cardiogenic shock, unsuccessful reperfusion, diabetics, and three-vessel disease. Again, surgery appears to be the best option, as in patients in which MI occurs as a complication of PTCA. Even so, Garot et al. in France demonstrated that cardiogenic shock is an independent variable for predicting reocclusion of a successful angioplasty, which is why surgery is even more attractive in this population of severely ill patients.

The good results of surgery in coronary disease have been extensively confirmed since Favaloro described the technique in 1968. Its benefits are clear in patients with three-vessel disease, poor ventricular function, and involvement of the trunk of the left and/or anterior descending coronary artery. The survival and the time free of cardiac events are greater compared with standard medical therapy.

Nevertheless, its use in MI was questioned in the 1970s because of the poor results obtained in the early stages of surgery. This has changed radically thanks to improved methods for protecting the ischemic myocardium, surgical technique, and intensive care. At least 8 studies published since 1989 demonstrate the low mortality of surgery in the first 30 days of MI, ranging from 1.4% to 5.9%. This has been confirmed in our department, where the mortality rate is 4.3% in the first 15 days of MI (most undergoing surgery in stable conditions). In these studies we found that mortality was associated consistently with age, post-IM cardiogenic shock, previous poor ventricular function, and emergency surgery. In contrast, surgery in the first month was never associated with a more

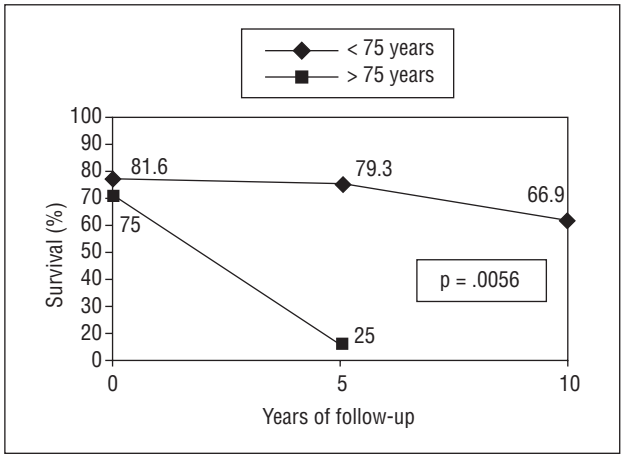

Fig. 3. Survival in relation to age.

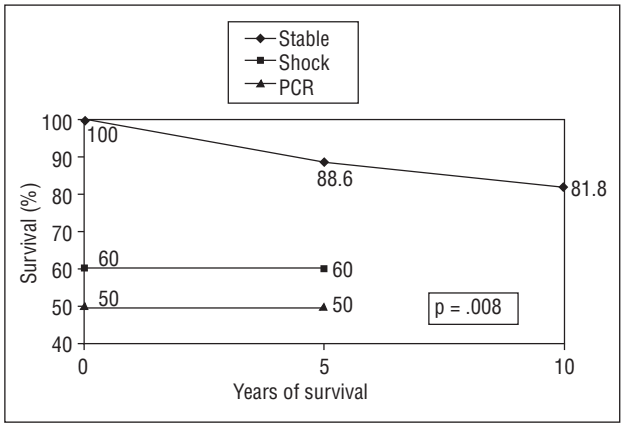

Fig. 4. Survival according to preoperative hemodynamic status. CRA: cardiorespiratory arrest.

unfavorable prognosis. Therefore, the idea of operating on a patient before myocardial necrosis becomes consolidated is increasingly interesting. Currently, Sergeant et al. and Donatelli et al. have specifically evaluated the impact of surgery in the first 15 h. The results are excellent in hemodynamically

stable, patients with a mortality between 1.9% and 6%, and promising with regard to the rescue of patients in shock or CRA, whose mortality ranges from 21% to 50%.

What advantage does MRS have over the other methods? In the first place, it allows complete revascularization of coronary arteries that vary widely in anatomy. In addition, it minimizes reperfusion damage. In thrombolysis and angioplasty there are arrhythmias, dysfunction, and secondary pump failure, to a large extent due to the production of free oxygen radicals and other mediators in the revascularized tissue. Cardioplegia attenuates the effects of ischemia and the fact that the patient continues extracorporeal circulation for a short time after the aortic clamp is released provides a period of controlled reperfusion with ventricular care and less risk of cardiogenic shock.

In the RITA-1 study,[19] MRS was found to decrease the need for reintervention and the incidence of angina with the same mortality and costs as angioplasty in patients with one or more vessels involved, which is why it seems logical to solve several problems at one time in patients who are candidates for surgery because of their age and associated disease. Let us remember that the 5-year rate of MRS after PTCA is 26% and that the rate of repeat angioplasty is 19%, compared with only 2% per year for MRS. In addition, in another randomized study (BARI) the cumulative cardiac mortality was greater in PTCA with two-vessel and three-vessel disease, which is even more evident in diabetic patients, all of which indicates that MRS could be used with good immediate and long-term results in MI.

It has been discussed if it is technically feasible to perform MRS quickly enough to avoid the consolidation of MI, which does not concur with our average time from the onset of symptoms to surgery of 6.32 h. If a patient is awaiting surgery and has previous coronariography, the surgical indication seems obvious to us.

Our overall operative mortality was 19.3%, 0% in hemodynamically stable patients, which is similar to figures reported by Sergeant et al. Nevertheless, in patients in shock or CRA, mortality was greater in our series (44%). The difference between the two groups in the ischemia time should be noted, since the ischemia time in the Belgian group was 2 h 25 min. The patients analyzed by them were on a waiting list for coronary surgery, and suffered infarction in the hemodynamics laboratory or had recent MRS, which explains why their ischemia times were shorter than in our patients. Seventy-two percent of out patients had infarction outside the hospital without previous studies. Donatelli et al,[18] in Milan, obtained results similar to ours with a prospective protocol for patients in shock or CRA. The mortality was 50%, which we consider good for patients whose serious disease would have lead to worse results without surgery. The hemodynamic state of the patient at the beginning of the procedure was the only determinant factor of prolonged hospitalization, perioperative stay in UCI, and death. As could be expected, it was associated with a greater incidence of heart failure and sepsis, principally in patients with prolonged mechanical ventilation.

In patients in shock, we found no differences between patients whose surgical indication was the presence of angioplasty complications and other patients. The study of Naunheim et al. showed worse results of post-PTCA MRS (11% versus 1% mortality), but their patients were an elective group in which angioplasty failed without producing an emergency situation, in contrast with our patients, who presented infarction in the hemodynamics laboratory and entered surgery in shock, CRA, or unstable condition with no other alternative for treatment.

The rate of surgical wound infection and sternal dehiscence is a concern, although is difficult to avoid, because several patient in CRA required cannulation for emergency extracorporeal circulation. Nevertheless, there was no mediastinitis. These rates are higher than the surgical wound complications found in our department with coronary patients.

The long-term survival was similar to that recorded in the 20-year follow-up of MRS in the Hospital of the Universidad Católica, and the probability of new episodes was low. This is one of the main advantages of surgical revascularization. It allows patients long periods of active life without requiring reoperation. Again, the results were similar to those of Sergeant et al., with survivals of 79% and 66% at 5 and 10 years, respectively.

At present, an aggressive and invasive approach is indicated for the treatment of MI to rescue patients and improve their quality of life. Nevertheless, such interventions must be carried out at institutions staffed with experienced cardiological and surgical personnel 24 h a day, and endowed with the necessary infrastructure and equipment to operate quickly to prevent subsequent myocardial damage.

We conclude that surgery of MI of less than 24 h of evolution in patients without hemodynamic failure produces excellent initial results and has a mortality and morbidity similar to that of conventional coronary surgery. The 5-year and 10-year probability of new episodes in these patients is very low.

Instability at the onset of the operation (shock or CRA) is main determinant of perioperative mortality and morbidity. Nevertheless, the otherwise very poor prognosis of these patients makes this therapeutic option reasonable. Ideally, patients should undergo surgery before their clinical condition evolves to

shock.

These results should be confirmed by new studies with a larger number of patients who are randomized to compare surgical treatment, angioplasty and/or medical treatment in patients with similar clinical and anatomic conditions.

Surgery is a valid therapeutic option in the early constitutive stage of MI.

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