Summary of conference

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It will be difficult for me to close this Symposium analyzing in such a short period the basic material presented during the 3 days. I think that the subject of myocardial revascularization has been discussed in depth, a noteworthy amount of data have been accumulated, and several conclusions have been reached. I will only present some ideas which I think are important for the future.

Diagnostic procedures

The diagnosis of coronary insufficiency or ischemic myocardiopathy is based on a carefully elicited clinical history. Other noninvasive techniques constitute a tremendous advance in the diagnosis and prognosis of patients with coronary arteriosclerosis. Ergometric tests are a clear example; not only do they confirm or exclude a diagnosis, but help categorize patients as regards their physical capacity, mainly patients with stable angina. By means of ergometric tests high risk patients in need of further investigation are properly identified.

Cross sectional echocardiography and radioisotopes (technetium 99m stannous pyrophosphate and thallium 201) are precise tools to analyze and tabulate the implications of dimin-

ished coronary flow at the muscular level. I believe that the use of echocardiography and radioisotopes will be justified in patients with acute coronary insufficiency, impending infarction, and acute myocardial infarction to differentiate contraction abnormalities due to anoxia or necrosis. These two methods will enable us to extend our present surgical indications.

Notwithstanding these late advances, selective cine coronary angiography remains the cornerstone as far as diagnostic procedures are concerned. It has helped us to visualize more precisely the anatomy of the coronary circulation, understand the natural history of coronary arteriosclerosis, obtain a good preoperative evaluation and selection of surgical candidates, and compare longevity with medical and surgical treatment. Presentations during this meeting have emphasized once more the different prognoses of patients with single-, double-, or triple-vessel disease. The general conclusion is that the severity and number of coronary occlusions are directly related to the late prognosis of the patient, and that the status of the left ventricle also plays a significant role in the survival of patients with coronary arteriosclerosis.

Even though this has been the base line for our work performed in these 10 years, I think that we must analyze the studies with much more accuracy if we want to clarify indications and compare medical and surgical treatments. It is not enough to talk about patients with left main coronary artery obstruction or single-, double-, and triple-vessel disease. There are countless publications which are controversial as regards final results when apparently similar anatomic lesions are compared; e.g., obstruction of the left main coronary artery, obstruction of the anterior descending coronary artery (before and after the first perforator), and obstruction of the right coronary artery.

As an example, obstructions at the left main coronary artery may have different prognoses. It would be difficult to place on the same level a patient with left main coronary obstruction, no obstruction at the distal distribution of the left coronary artery, excellent distal runoff at the anterior descending and circumflex coronary branches, and a dominant right coronary artery that provides some collaterals to the left coronary artery and a patient with a similar, severe obstruction at the left main coronary artery, obstruction at the main anterior descending with poor distal runoff, total occlusion of the circumflex coronary artery, and a nondominant right coronary artery totally occluded. Between these two cases there are variations that pose different problems. By now, we should be able to give a more precise evaluation after reading the cine coronary angiogram in order to select patients properly and to compare medical and surgical series.

In Buenos Aires we tabulate patients with coronary artery disease according to parameters seen in *Table 1*. This classification should enable us to assess precisely the amount of ischemia in each patient; besides the different degrees of stenoses, the different variations of each branch of the coronary arteries and the status of the left ventricle, it is important to consider as well the severity of the

Table 1. Coronary tabulation

	Number
Circumflex coronary artery	
Nondominant	
Atrioventricular	
Proximal	3
Distal	1
Lateral	1
Dominant	
Atrioventricular	
Proximal	5
Distal	3
Lateral	2
Left main coronary artery	10
Anterior descending coronary artery	
Short	
Proximal	3
Medial	1
Medium	
Proximal	5
Medial	2
Distal	1
Long	
Proximal	7
Medial	3
Distal	2
Right coronary artery	
Nondominant	2
Dominant	
Before bifurcation	5
After bifurcation	2
Useful collateral circulation*	
Compromised	
Good circulation	4
Poor circulation	2
Noncompromised	
Good circulation	−4
Poor circulation	−2
Left ventricle	
Good	0
Moderate	6
Severe	10
Occlusive corrective factors	
1.2 − 50% < to < 75%	
1.5 − 75% < to < 100%	
1 − 100%	
Distal vascular bed corrective factors	
Good 0	
Moderate 2.5	
Bad 5	

* When useful collateral circulation originates in an artery free of obstructions, collateral circulation is not compromised and consequently instead of adding it is mandatory to subtract for the final tabulation.

obstructions (occlusive corrective factors), the distal vascular bed, and the collateral circulation.

With the present highly efficient equipment and the utilization of different projections it is possible to interpret cine coronary angiograms properly. If we do not realize that evaluation of cine coronary angiograms is much more complex than just visualizing single-, double-, and triple-vessel disease, it will be impossible to compare medical and surgical series adequately. I would emphasize that our clinical work should be based on high quality cineangiography and accurate reading. This is the main reason why the present randomized study of the VA Cooperative Study[1] has so many pitfalls. We know that

> . . . after an initial study revealed considerable interobserver and intraobserver variability in interpretation, all coronary angiograms were reread by each observer, who used a standardized data sheet. Data presented in this report are based on the second-reading information.

This confusion was due to the poor quality of the cine coronary angiograms performed in a significant number of patients.

Gensini[2] has pointed out,

> As I have expressed to you on a number of occasions, I wish to now go on record that I have a great deal of reservations on the validity of the VA cooperative study on stable angina specifically on its goal to achieve a fair comparison of surgical vs medical therapy. I am sure you will agree that some of the early films hardly show the outline of the coronary arteries at all, thus the determination of the size, degree of stenosis and the surgical adequacy of the runoff is quite chancey at best. Under such circumstances I believe that a not insignificant number of patients were considered surgical and thus randomized to either medical or surgical therapy when they should not (or could not) have been selected for surgery in the first place. If you assume for a moment that a statistically significant number of patients had surgery when either the run-off was inadequate or the bypass was unnecessary, it would not be surprising to find no difference between medical and surgical therapy. In fact, these patients when randomized to surgery would tend to have poor results.

Angiographic criteria for that study was only 50% or less in lumen diameter; as we know, patients with less than 75% lumen diameter are rarely accepted for surgery.

The VA Cooperative Study referred to in every meeting in this country should be reanalyzed and reclassified to clarify the matter. With so many inaccuracies, I am firmly persuaded that it should no longer be taken into account when dealing with the comparison of medically and surgically treated patients.

Operative technique

With minor variations among the different cardiovascular centers, the operative technique is well standardized and myocardial revascularization is now a simple and safe procedure.

The introduction of cardioplegia has reduced mortality and morbidity in complicated procedures (reconstruction of the left ventricle + myocardial revascularization, valvular replacement + myocardial revascularization). I believe its utilization is a major contribution and we should extend its indications; it could even reduce the incidence of postoperative myocardial infarction.

Some speakers have emphasized that total revascularization is an absolute requirement, and that multiple bypasses are necessary in most patients. I think it is more appropriate to talk about satisfactory revascularization. In some patients it would be possible to obtain total and satisfactory revascularization, but in others only major branches could be reconnected; revascularization of small branches with poor distal runoff is not advisable. The final product would be satisfactory but partial revascularization. I believe that most patients benefit from two, three, or four bypasses at the most.

Selection of patients for myocardial revascularization

The selection of patients for myocardial revascularization is directly related to preoperative evaluation, operative mortality and morbidity, early and late results, and comparison with suitably matched groups treated medically.

I am firmly convinced that if we want to clarify this subject ischemic myocardiopathy must be properly classified. There is much confusion in modern cardiology, and it is mandatory to overcome this confusion if patients are to be selected properly. The classification we follow in Buenos Aires is shown in *Table 2*.

Symptomatic patients constitute the most important group. When angina is the predominant symptom seven different subgroups are individualized.

Stable angina. This category includes patients with angina pectoris which has not changed its characteristics during the past 3 months. The classification of the New York Heart Association is accepted for this group and used for a proper tabulation.

Angina of recent onset. This category includes patients with angina pectoris of less than 3 months' duration. It is important to differentiate

Table 2. Classification of ischemic myocardiopathy

Symptomatic	With angina	Stable angina	With or without previous myocardial infarction	Sudden death
		Angina of recent onset		
		Intermediate		
		Progressive angina		
		Prinzmetal's angina		
		Acute persistent ischemia		
		Acute myocardial infarction		
	Without angina	Congestive heart failure		
		Arrhythmias		
		Valvular insufficiency		
		Embolism		
		Dyspnea		
		Fatigue		
Asymptomatic		Following an acute myocardial infarction		
		Ergometric test		
		Arteriosclerosis in other vascular territories		
		Valvular diseases		
		Family history and/or risk factors		
		Abnormal electrocardiogram		

patients with preserved physical capacity from those with diminished physical capacity because their prognoses are different.

Intermediate syndrome. This group comprises patients with the following characteristics: recurring, prolonged and intense angina at rest; normal serum enzyme levels or 50% above basal levels, and absence of severe pump failure or severe arrhythmias; little or no response to nitrites; less than a month between anginal onset on admission to the coronary care unit; transitory electrocardiographic changes of ventricular repolarization and transitory arrhythmias.

Progressive angina. Patients are included in this group when angina pectoris has increased in intensity and frequency related to effort in the past 3 months.

Prinzmetal's angina. This is a rare entity characterized by severe episodes of decubitus angina with transient elevation of the S-T segment hourly related. Some have normal coronary arteries and others definite coronary arteriosclerosis. Spasm plays a significant role in this entity.

Acute persistent ischemia. This group comprises patients with one or two episodes of intense and prolonged angina pectoris lasting more than 10 minutes in 24 hours and thereafter continues asymptomatic; in general they have one episode of severe chest pain. They show persistent electrocardiographic changes of ventricular repolarization and normal serum enzyme levels or elevation to 50% above basal levels. Their clinical picture is that of a myocardial infarction, but neither the electrocardiogram nor enzymes show patterns of myocardial necrosis.

These three categories of unstable angina, i.e., intermediate syndrome, progressive angina, and acute persistent ischemia are worth differentiating because their prognoses are quite different. Prospective studies show that within 4 months intermediate syndrome has a 29.1% mortality rate, progressive angina 3.7%, and acute persistent ischemia 2.5%; within 24 months it is 41.6%, 7.4%, and 2.4% respectively. The rate of acute myocardial infarction within 4 months is 25% in patients with intermediate syndrome, 3.7% in patients with progressive angina, and 15% in patients with acute persistent ischemia; within 24 months it is 37.5%, 7.4%, and 20% respectively. After these carefully analyzed data, there is no question that intermediate syn-

Table 3. Classification of patients with unstable angina; comparison between the Myocardial Infarction Research Unit tabulation and our own classification

A. Angina pectoris of new onset	A. Angina of recent onset
1. On effort	Preservation of physical capacity
2. At rest	Loss of physical capacity
B. Changing pattern of angina pectoris	
1. On effort	1. Progressive angina
2. At rest	2. Intermediate syndrome
For both major groups, pain might occur as	
1. Single episodes	1. Acute persistent ischemia
2. Discrete episodes	
3. Multiple episodes throughout day or night	

drome and progressive angina have different prognoses with the present medical treatment.

If we want to exemplify the importance of classifying patients properly to compare medical and surgical treatment, the Myocardial Infarction Research Unit Study[3] on unstable angina is an example. When comparing it with our classification (*Table 3*), we realize that patients with different prognoses have been grouped together and the final result depends on the percentage of patients with intermediate syndrome, progressive angina, acute persistent ischemia, and angina of recent onset included in the medical and surgical series.

If, on the other hand, we bear in mind that 33% of patients in the medically treated group have already been operated on, my conclusion is that the National Cooperative Study on Unstable Angina no longer is a randomized study and cannot be referred to with the purpose of clarifying unstable angina.

If we do not classify once for all our patients properly, and read the cine coronary angiograms with exactness we will be trapped in a labyrinth, and it will be difficult to find an open door leading to an honest and scientific knowledge of coronary arteriosclerosis.

Another group of patients is symptomatic because of congestive heart failure, severe arrhythmias, mitral insufficiency, systemic emboli, dyspnea or fatigue. They have definite hallmarks; as an example, for patients with dyspnea—without pain—appearing suddenly as a consequence of left ventricular failure, the prognosis is poor; after admission to the coronary care unit their mortality rate is 46%. They should be studied by cine coronary angiography and operated on if they are found to be suitable candidates after reading the cine study. The last category, that of asymptomatic patients, is a difficult one, and I am sure it will pose signif-

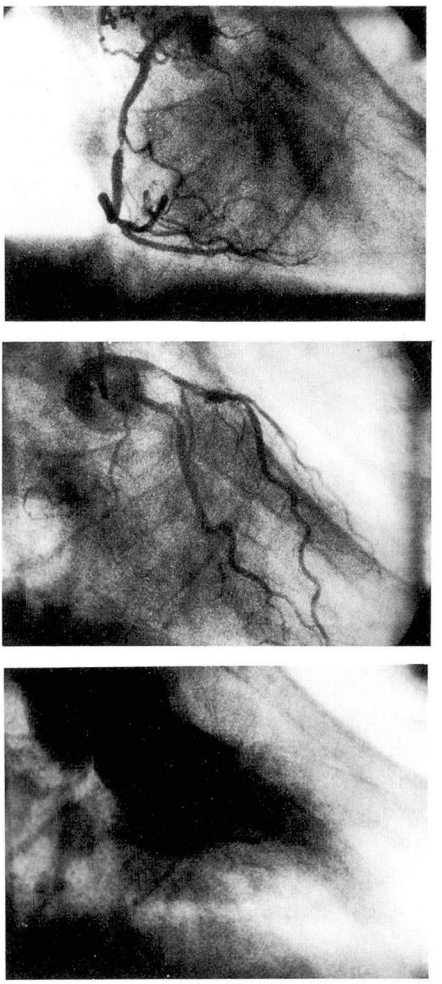

Fig. 1. Severe triple-vessel disease in an asymptomatic patient. A 61-year-old man had two fainting episodes when playing golf. The clinical examination was negative; the ergometric study showed significant S-T segment depression at 3′-5 metz. The cine coronary angiogram demonstrated **A**, severe total obstruction in the middle third segment of the right coronary artery; **B**, severe obstructions in the proximal portion of the main anterior descending and circumflex branches of the left coronary artery. **C**, The left ventriculogram showed normal contraction.

icant problems to cardiologists and cardiovascular surgeons.

Patients come to our consultation even if they are asymptomatic after an acute myocardial infarction, a positive ergometric test, when arteriosclerotic manifestations are found in other locations (carotid plaques, abdominal aneurysm, peripheral vascular disease), when severe obstructive lesions are encountered at the coronary level through routine cine coronary angiography (valvular patients in the mitral and aortic position may have significant obstructive lesions at the coronary region), because of an unfavorable family history or risk factors, or because of an abnormal electrocardiogram. An example of asymptomatic patients is shown in *Figure 1 A–C*.

The important question to be answered is whether the operation is indicated. Clinical applications and carefully analyzed data on patients followed under medical and surgical treatment will give some valid appraisal on how to manage these patients.

Perhaps we should remember that sudden death is a permanent hazard to patients with coronary arteriosclerosis. Certain studies[4] and our own data suggest that the incidence of sudden death is extremely low in revascularized patients. Prospective studies might be necessary in the future among subgroups of asymptomatic patients to determine the most feasible course to follow.

Long-term follow-up

The participants in this symposium have emphasized that myocardial revascularization has a definite place in the treatment of coronary arteriosclerosis.

It would be difficult to deny all the major steps accomplished in the past 10 years. I think we can conclude that patients with left main coronary artery disease, triple-vessel disease, selected patients with double-vessel disease, patients with intermediate syndrome, ventricular aneurysm, and angina benefit from surgical treatment. The comparison with similar groups of patients treated medically has shown that prolongation of life is now possible with direct myocardial revascularizaton.

I am firmly convinced that the combined effort of medical and surgical treatments together with thorough rehabilitation can change the pattern of coronary arteriosclerosis.

References

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