Unstable angina—experience with surgical therapy in the subset of patients having preinfarction angina

Jack M. Matloff, M.D.
Aurelio Chaux, M.D.
Hector Sustaita, M.D.

Los Angeles, California

During the first 10 years of direct cardiac revascularization by coronary bypass surgery a number of indications for such therapy have been presented for consideration to the medical community; and after an appropriate clinical experience has evolved, they generally have been accepted or discarded. Thus a number of urgent or emergent indications for surgery have been defined, primarily in relation to or associated with mechanical complications occurring after a myocardial infarction.

This sequence has not pertained in regard to the role of revascularization in patients experiencing acute ischemic manifestations of coronary artery disease. Much of the debate that has evolved has been semantic, but much of it has been due initially to disparate surgical experience and later to continually improving medical management. This presentation will be confined to that subgroup of patients with emergent indications for surgery that we feel can appropriately be termed "preinfarction angina."

Definition

The hallmark of these cases has been a short history of crescendo angina with episodes lasting 15 minutes or more of either recent onset or

representing an exacerbation of a previously stable anginal pattern associated with evanescent S-T segment or T-wave changes of ischemia, and continuing to occur at rest under medical therapy in the hospital. Initially no Q-waves are present in the electrocardiogram and enzymes are within 10% of normal. Medical therapy has included the use of nitrates, sedatives, tranquilizers, and propranolol in doses up to 120 mg a day when appropriate; in some cases after-load reduction with frequent sublingual isosorbide dinitrate, Nitrol paste or intravenous nitroprusside was pursued. We have not used mechanical assist devices in this setting. The fact that these patients continue to experience angina indicates that they are progressing from an unstable to true preinfarction state. Continuing experience during the last 7 years has only tended to support our early impression that the subgroup of patients with unstable angina that is unresponsive to a trial of medical therapy in the hospital can be prospectively defined as being at extreme risk for progression to a myocardial infarction.

Clinical material

As of February 1977, our experience with surgical therapy in this subset numbered 203 patients. One hundred thirty-two of these patients were admitted, the diagnosis made, catheterization and angiography carried out, and bypass surgery performed *without untoward complications prior to surgery*. The remaining 71 experienced a major ischemic complication of their coronary atherosclerosis prior to surgery. Sixty-one of these patients had an acute myocardial infarction as their complication. They were not dropped from our series after they had their complications, because we had decided at the onset that no patient would be excluded once the diagnosis was confirmed, in order to have a complete picture of what happens when this diagnosis pertains. Much of our experience with the complicated group occurred early in the series.

In order to define possible significant factors that might predispose to the occurrence of an ischemic complication, a number of variables have been examined. Age and sex were not statistically significant factors. The occurrence of remote myocardial infarctions was examined and the higher incidence of these in the uncomplicated group ($p = 0.05$) suggested that they might have a higher mortality. The opposite was true. Another way of looking at this fact is to realize that since the present occurrence was more often the first coronary event in the complicated group, there was more of a tendency to wait and watch in these patients.

Similarly, the incidence of single-, double-, triple-, and quadruple-vessel disease has been examined. Overall, both groups averaged 3.0 diseased vessels per patient, but the incidence of single-vessel disease was significantly greater in the complicated subgroup ($p = 0.04$). This fact also led to a delay in the pursuit of surgical therapy early in our experience, and often was associated with a significant complication before surgery was undertaken.

With regard to the degree of occlusiveness of involved vessels, total occlusions were more frequent in the complicated subgroup ($p < 0.01$), and subtotal occlusions more frequent in the uncomplicated subgroup ($p =$

0.03). But more importantly, 95% of all the involved vessels were subtotally to totally occluded.

With regard to the distribution or location of involved vessels (*Table*), there were no significant differences between the complicated and uncomplicated patients. More noteworthy is the fact that 98% of these patients had significant anterior descending disease and 13% had left main coronary artery disease of 50% or more. Given this coronary anatomy, it is not surprising that only 15% of the uncomplicated and 9% of the complicated patients had normal right anterior oblique ventriculograms. Furthermore, anterior segmental dysfunction was present in 67% of all patients.

Left ventricular end-diastolic pressure was, overall, higher in the complicated group (14.0 [5–33] vs 11.3 [2–34] mm Hg) p = 0.005; these figures are at the upper limits of or slightly elevated beyond normal in our catheterization laboratory. Conversely, ejection fraction was less than the 60% normal of our laboratory in both groups, but was significantly lower (p = 0.003) in the uncomplicated group (43.6% [18–87] vs 54.0% [17–77]) than in the complicated group. The upper limit for end-diastolic pressure was 33–34 mm Hg in both groups, and ejection fraction in some patients was as low as 17% to 18%.

With regard to the surgical therapy carried out (*Figure*), there was no significant difference between the groups. In both groups, fewer vessels were bypassed earlier than in the later experience. The distribution of vessels bypassed was very similar. Perhaps the most important feature was that 90% of involved left-sided vessels had been bypassed.

The operative mortality was 1.5% in the uncomplicated patients and 7% in the complicated ones. This is a significant difference in 30-day mortality (p = 0.04). Overall operative mortality was 3.4%. Four fifths of the complicated group occurred in patients who experienced an acute myocardial infarction either during or after catheterization, but before their surgery. When this fact became evident, our protocol was modified so that catheterization and surgery were planned as a single entity, without

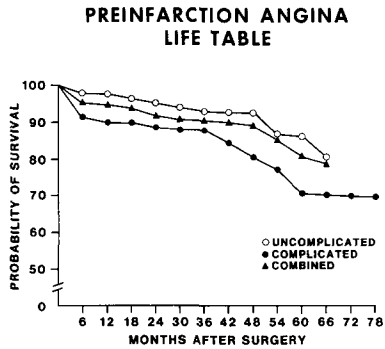

Figure. Preinfarction angina.

Table. Preinfarction angina; surgical therapy—vessels bypassed

Artery	Uncomplicated	Complicated	Total
Left anterior descending	125 (130) 96.2%	65 (70) 92.2%	190 (200)
Diagonal	45 (46) 97.8%	19 (28) 67.9%	64 (74)
Circumflex marginal	115 (130) 88.5%	56 (63) 88.9%	171 (193)
Right coronary	64 (102) 62.7%	30 (53) 56.6%	94 (155)
	349 (408) 85.5%	170 (214) 79.4%	

( ) Number vessels involved.

Uncomplicated, 2.6 vessels/pt; complicated, 2.4 vessels/pt; 90% of involved left-sided vessels bypassed; 60% of involved right coronary arteries bypassed; 83% of all involved vessels bypassed.

intervening delay beyond 1 to 2 hours. One of the uncomplicated operative deaths occurred in a 76-year-old man who experienced superior mesenteric artery occlusion late in his hospital course, and the second occurred in a 67-year-old man who was a borderline candidate because of diffuse distal disease. His postmortem examination showed acute necrotizing phlebitis of the vein grafts.

Postoperative morbidity was significant. More perioperative infarctions, 10%, occurred in the uncomplicated group, but there was a significantly higher incidence of low cardiac output syndromes in the complicated group, necessitating the use of intra-aortic balloon counterpulsation in 7% of the complicated group. One percent of the complicated patients experienced a perioperative infarction. Obviously the number of these was decreased because so many had documented preoperative infarctions. These have to be clearly sought out and defined. If they are not fully appreciated, an evaluation of the results of surgery will be grossly distorted. It has probably been a lack of recognition of this fact that accounts for the early disparate results from a number of centers.

Arrhythmias were the most frequent postoperative complication. It is surprising that postoperative mortality was not related more to the occurrence of these; this can be attributed to the efficacy of present day antiarrhythmic drug therapy. The long-term occurrence of arrhythmias has been small in relation to the frequency of postoperative arrhythmias.

Of the long-term survivors, 6% have had residual angina, and 2% have had reoperations for closed grafts or progressive disease in other nongrafted vessels. There have been three nonfatal late infarctions; but there have also been eight other late fatal infarctions. Thus, in 196 survivors, there have been 11 total myocardial infarctions, an overall incidence of 5.6%. These numbers, although small, suggest that a later postoperative infarction may carry a high risk of mortality. Seven patients with late congestive failure have either had severely restricted ventricular function preoperatively or have sustained a perioperative infarction.

Two-thirds of survivors have returned to work. Of those retired or unemployed, it has not always been possible to determine whether this inactivity has been enforced or of choice.

Total late mortality has been 7% and 10% respectively in the uncomplicated and complicated groups. A disquieting fact has been that five of the nine late mortalities in the uncomplicated group have occurred in the last 6 months; and all have been cardiac-related. What the relative roles of initial incomplete revascularization, late graft failure and/or progression of intrinsic disease have been is not yet clear. Noncardiac mortalities have occurred in 3/9 uncomplicated and 1/7 complicated late deaths. Thus while the incidence of late cardiac-related mortality is approximately twice as high in the complicated group (8.5% vs 4.5%), there is not a significant difference between the two groups in total late mortality.

Discussion

Obviously this is a dynamic experience and underscores the need for continuing follow-up of this series.

This fact can best be appreciated by examination of the life table expression of this experience (*Figure*). At 48 months there was a 95% probability of the uncomplicated patient being alive. Similarly, there was an 82% probability of the complicated patient being alive. Through the ensuing 18 months there has been a further drop-off so that at 66 months these figures are 82% and 72% respectively. Overall probability of survival is 80% at 5½ years. Since our experience began with the complicated group there are insignificant numbers at risk in the uncomplicated group to draw further comparisons.

In the uncomplicated group annual attrition, including operative mortality, has averaged 1.5%/year through 5½ years for a total mortality of 8.3%. In the complicated group the annual attrition rate has been 1.7%/year through 6½ years. Overall attrition rate of the entire series of 203 patients has averaged 1.8%/year through 6 years. Clearly this life table demonstrates that significant palliation can be achieved in a group of patients with predominately subtotal to total obstruction and multivessel disease.

Furthermore, these results can be improved upon. With the use of hypothermia (22–24 C), operative morbidity and mortality have been reduced further. And with the use of multiple grafts averaging 4.2/patient, better long-term results are to be anticipated.

It is this experience that underscores our belief that a subset of patients can be defined who are at high risk to progress to a myocardial infarction and can therefore appropriately be labelled as having *preinfarction angina*. Furthermore, prompt identification of this patient followed by expeditious definition of anatomy, anesthetic induction, and emergent surgery appears to offer an excellent level of palliation through 5½ years of follow-up.