The ECG in Acute Myocardial Infarction

The aggressive management of coronary occlusion in acute myocardial infarction has altered the usual progression of this disease. Many aspects of the diagnosis, management, and prognosis of myocardial infarction have been impacted, ranging from the pattern of cardiac enzyme release to the use of exercise testing to define patients at high risk of a subsequent cardiac event. The new treatment strategies have also raised some clinical challenges. For example, it would be very valuable to be able to identify satisfactory blood flow in the infarct-related artery following thrombolysis. Lack of such a satisfactory flow might dictate a different type of intervention. In addition, a noninvasive estimation of the extent of myocardial infarction or the area of myocardium at risk for infarction would be exceedingly valuable in studying the effects of intervention in acute infarction.

Thus, in the thrombolytic era, the ECG is undergoing reevaluation, and a careful reassessment of the ECG patterns in evolving myocardial infarction may provide valuable, clinically relevant information. The use of the ECG for the foregoing purposes has certain benefits. The ECG is considerably less expensive than other investigative procedures and is easy to obtain. Also, the ECG in its various forms has been well characterized in many clinical settings. With regard to the quantification of infarction and the extent of ischemia, many studies in the 1970s correlated epicardial ECG changes with area of myocardium at risk, but application of these measurements to the clinical setting was difficult. Many theoretical constraints limit the determination of infarct size and myocardium at risk from the ECG. However, by combining information on infarct artery patency and independent assessment of myocardium at risk, it may be possible to identify features on standard ECGs or develop ECG methods that could be used to determine myocardium at risk and patency of the infarct-related artery.

The ECG criteria for the diagnosis of acute myocardial infarction are integral to initiation of thrombolysis. The Thrombolysis in Myocardial Infarction (TIMI) Study Group found that ST-segment elevation by more than 1 mm in 2 or more limb or chest leads coupled with characteristic chest pain identified the likelihood of an eventual myocardial infarction in a patient with 95 percent accuracy. However, too strict adherence to this ECG marker for infarction will exclude many patients with evolving infarction from receiving thrombolytic therapy (eg, patients with left bundle branch block or left ventricular hypertrophy and evolving infarction). Also, it is evident that a certain proportion of patients with evolving infarction do not have ST elevation on their ECGs. These infarctions may be quite extensive. Unfortunately, it may not always be prudent to rely on the features of chest pain in patients as a guide to initiation of therapy. It is for these reasons that ECG diagnosis of acute infarction requires reassessment. Other features of the ECG, including the R and T waves, undergo alterations early after infarction. Perhaps these aspects should be explored for their diagnostic ability when ST elevation is not present. Of course, it is well known that exploring the chest with nonstandard leads looking for ST elevation may be valuable in detecting acute infarction, such as right precordial ST elevation in right ventricular infarction.

The study of Birnbaum et al in the June, 1993 issue of Chest (103: 1681) attempts to use the acute ECG to define prognosis after myocardial infarction. These authors identify a particular pattern of early repolarization abnormality (type C) that is associated with a 29 percent in-hospital mortality. This pattern involves loss of the S wave and a high takeoff of the elevated ST segment in patients with a first infarction that is anterior in site. Similar patients without such a pattern have a 10 percent mortality.

It is of note that this finding occurs in 50 percent of the patients and that these patients continue to have a high mortality despite early thrombolysis. Stimulated by this article, I sat down to characterize a number of ECGs that had been obtained in the early hours after acute myocardial infarction onset. The patients were consecutive and had TIMI criteria for acute myocardial infarction. It soon became clear that the majority of these ECGs showed the type C pattern. In addition, this population of patients treated with angioplasty had a low mortality. This raises several questions.

As indicated above, it is likely that TIMI ECG criteria do indeed select a subset, albeit a large subset, of patients with evolving infarction and exclude a significant group of other patients. It is concerning that Birnbaum et al found such a high mortality in type C patients. Again, this may be a question of patient selection. In the group of patients I reviewed, perhaps the most ill patients were excluded. Alternatively, perhaps treatment differences account for the mortality disparities. Before the findings of Birnbaum et al can be extrapolated widely, these ECG observations must be assessed in a prospective study of mortality in acute myocardial infarction. Clearly, if the observations are confirmed, aggressive treatment of these patients will be indicated since the majority die of cardiogenic shock.

The Selvester score is a method of relating standard ECG findings to infarct size. This has been validated in postmortem studies but has only a modest correlation with infarct size in the clinical setting.
changes in acute infarction also bear only a modest correlation with extent of myocardium at risk of infarction. These studies have used the standard ECG, and it is unclear whether different lead systems or more extensive ECG mapping can better predict infarct size or area at risk of infarction.

The ST changes observed on standard ECGs proved unsatisfactory in some studies12 for the prediction of infarct-related artery patency after thrombolysis, yet prompt resolution of ST elevation associated with an intervention often predicts a patent infarct-related artery. This discrepancy points out the value of continuous ECG observation for the detection of patency of the infarct-related artery.13 Continuous observation of the ST segment on the standard ECG or of the QRS and ST vector magnitude of vectorcardiograms has been suggested to be very valuable in prediction of infarct-related artery patency.13,14

The observations of Birnbaum et al are valuable for two reasons. First, they may identify a high-risk population of patients with acute myocardial infarction who warrant aggressive management. Second, their observations indicate that the ECG may contain more information than meets the eye and that the ECG should be reassessed in light of the information obtained during the thrombotic era.

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REFERENCES

High-Technology Home Care

The Need for a Creative Management Approach

Critical care units with finite capacity have been constrained by excessive length of stay of patients who failed withdrawal from life-sustaining technology and achieved medical stability on prolonged support. Centers experienced with long-term mechanical ventilation have developed programs to select home-care candidates according to strict criteria, to prepare them and their families with essential education and training, and to discharge them home safely from expensive acute-care settings. As DeWitt et al outline in their article in the May, 1993 issue of Chest (103:1560), despite years of experience, current resource management results in enormous waste due to misapplication, creating obstacles to discharge from hospital to home.

High-technology home care (HTHC) has been the subject of much study and public debate. Public policy in the United States has struggled with financial concerns since President Reagan highlighted the plight of Katie Beckett, a ventilator-assisted child denied home care by bureaucratic red tape (New York Times, Nov 11, 1981). For the past decade, public funders have preferred to limit financial risk for HTHC by strict waivers from Medicaid regulations. Sources of private funding have limited reimbursement for HTHC by applying rigid cost-control strategies or by denying approval of needed benefits. Public regulatory policies and private reimbursement have limited access according to entry criteria and reduced flexibility, which individual complex home-care cases require.