angina had a favorable effect on the incidence of ventricular arrhythmias and late-phase ventricular function. Because their patients with and without preinfarction angina were similar in treatment delay from onset of symptoms, revascularization therapies, angiographic success rate, collateral supply to the infarct region, severity and extent of coronary artery disease, they propose that ischemic preconditioning may be responsible for this protection.

Anzai et al. rightly point out that mechanisms other than acute collateralization could be responsible for protection seen in patients with preinfarction angina. They do not provide coronary recanalization times in the two groups. However, the duration of coronary occlusion is a major determinant of the extent of myocardial necrosis and infarct size. We previously showed (2) that 49% of patients presenting with myocardial infarction show spontaneous intermittent recanalization of the infarct-related coronary artery before administration of thrombolytic treatment (*intermittency*) and that this intermittency is associated with greater hemostatic activity. Furthermore, a large proportion of patients with intermittency have preinfarction angina. Intermittency and preinfarction angina appear to represent a slower mode of evolution of the process of coronary thrombosis and acute myocardial infarction (2). It is conceivable that the infarct-related arteries of such patients are more amenable to recanalization because fresh thrombi are lysed comparatively easily, both by intrinsic fibrinolysis, leading to intermittency, and by therapeutic measures, resulting in faster coronary recanalization. Thus, reperfusion associated with intermittency may protect myocardium by providing intermittent nutrient flow to the area at risk, by facilitating faster recanalization after thrombolytic therapy (3) or by preconditioning the myocardium.

Interestingly, intermittency can have a dual effect on the incidence of ventricular arrhythmia during acute myocardial infarction. We recently showed that intermittency is associated with a higher incidence of ventricular arrhythmia in the first 6 h of infarction but a lower incidence between 18 and 24 h (4). This delayed protection is independent of treatment delay, coronary recanalization time and 90-min patency of the infarct-related coronary artery and is consistent with the "second window of protection" seen in the experimental studies (5).

AGHA W. HAIDER, MBBS
Department of Medicine (Cardiology)
RSCH Brighton Healthcare NHS Trust
Brighton BN2 5BE, England, United Kingdom

GRAHAM J. DAVIES, MD, FRCP
Division of Clinical Cardiology
Royal Postgraduate Medical School
Hammersmith Hospital
London, England, United Kingdom

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Reply

Haider and Davies state that an unexpectedly large proportion of patients with acute myocardial infarction showed intermittent recanalization, as evidenced by transient regression of ST segment elevation on ambulatory electrocardiographic (ECG) monitoring, and that this phenomenon was related to protection of myocardial damage (1). There were diverse effects of spontaneous ST segment regression on ventricular arrhythmia (i.e., higher incidence of ventricular arrhythmia in the early phase but a lower incidence in the late phase) (2). They suggested that intermittent reperfusion had a protective role against myocardial damage through the preconditioning effect because there was no significant difference in recanalization time between the groups with and without intermittent ST segment regression, although it tended to be shorter in patients with than without ST regression. Recently, they also examined the effect of the presence of preinfarction angina on recanalization time in patients with acute myocardial infarction who received thrombolytic therapy and found that the recanalization time was earlier in patients with than without preinfarction angina, although the study cohort was limited (3).

We do not have any data on continuous monitoring of the ST segment, and therefore we cannot discuss this explanation with certainty. We also cannot exclude such a possibility in our study cohort. Our study was concerned with the effects of preinfarction angina on infarct expansion and ventricular remodeling and included patients with a first anterior or inferior Q wave infarction who did not undergo reperfusion therapy, as well as those who did (4). In contrast, their study cohort included patients who underwent thrombolytic therapy. Furthermore, their cohort included patients with a prior infarction, which potentially affected the results.

In our study, coronary revascularization therapy was attempted in patients <75 years old who arrived within 6 h after the onset of acute myocardial infarction. The percentage of patients who arrived within 6 h after the onset was similar in those with and without preinfarction angina, as we have shown (4,5). There was also no difference in the time that reperfusion therapy was initiated between the two groups. The angiographic success rate was not different between patients with and without preinfarction angina. Patients who underwent reperfusion therapy encompassed only 39% of the cohort, and angiographically documented reperfusion was confirmed in only some of the patients. Another 61% who did not undergo reperfusion therapy also showed a better clinical outcome in the presence of preinfarction angina (4). This finding suggests that some additional mechanisms played a role in the favorable clinical outcome. Although intermittent reperfusion may have played a protective role in patients with preinfarction angina, we have no clear evidence to support this phenomenon, at least in the study cited by Haider and Davies.

TOSHIHISA ANZAI, MD
Cardiology Section (9111A)
Department of Veterans Affairs
University of California–San Diego
3350 La Jolla Village Drive
San Diego, California 92161

TSUTOMU YOSHIKAWA, MD
Cardiopulmonary Division
Department of Medicine
Keio University School of Medicine
35 Shinanomachi, Shinjuku-ku, Tokyo 160, Japan

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