Lack of correlation after reperfusion between ventricular function and infarct size estimated by thallium single-photon emission computed tomography

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Abstract

In 32 patients with acute myocardial infarction, who had undergone successful intracoronary thrombolysis, the results of regional wall motion measured from contrast cineangiograms 10 to 21 days after thrombolysis were related to the results of thallium single-photon emission computed tomography (SPECT) after intravenous dipyridamole. Wall motion was measured by means of the centerline method, and thallium defect size was estimated by comparing the patient's circumferential profile with that of 20 normals. No correlation was found between ejection fraction or regional wall motion and thallium defect size. The time from symptom onset to thrombolysis was inversely correlated with the degree of hypokinesis (r = -0.51) but not with thallium defect size. In patients treated within 3 hours, hypokinesis was significantly less than in patients treated later (-1.1 ± 0.6 SD vs -2.2 ± 0.8 SD, p<0.01) whereas thallium defect size was not significantly different in both groups. It is concluded that, in patients after thrombolysis, thallium defect size determined by SPECT does not reflect the degree of left ventricular dysfunction.

Introduction

One of the purposes of thrombolytic therapy in acute myocardial infarction is the limitation of infarct size. In experimental animals, infarct size can be measured directly as the mass of infarcted tissue, but in man measurements of infarct size are less precise. The degree and extent of left ventricular wall motion abnormality 10 to 14 days after thrombolysis are considered to reflect infarct size [1]. This was confirmed by Sheehan et al. who found a correlation between regional wall motion in the infarct area 2 to 3 weeks after thrombolysis and CK release [2]. Also, the results of the Dutch interuniversity thrombolysis study point to the relation between left ventricular function and infarct size [3]. Recovery of left ventricular function was associated with a decrease in mortality rate which is known to be dependent on infarct size.

As opposed to the analysis of ventricular function, the extent of infarcted myocardium can be directly assessed by thallium scintigraphy. This technique is suboptimal for the quantitation of infarct size with planar imaging because of the overlap of normal and abnormal regions [4, 5, 6]. However, single-photon emission computed tomography (SPECT) has an advantage over planar imaging for the accurate assessment of infarct size, because the 180 or 360 degree angular sampling results in reduced overlap and improved contrast of the images. In previous studies, infarct size determined by thallium SPECT has been shown to cor-
relate with the anatomical infarct size in dogs [7] as well as with the creatine kinase-MB release after myocardial infarction in man [8]. Thallium SPECT studies following thrombolysis in patients with acute myocardial infarction are rare: Tamaki et al. [9] found that the correlation between the SPECT estimated infarct size and the creatine kinase-MB release weakened in comparison to untreated patients when patients had undergone thrombolysis. To our knowledge, the relationship between ventricular function and thallium defect size determined by SPECT has not yet been studied in patients with acute myocardial infarction undergoing thrombolytic therapy.

Methods

Patients. Thirty-two patients (30 men, 2 women; mean age 54 years, range 40 to 78 years) with acute transmural myocardial infarction who underwent intracoronary thrombolysis within 3 hours of symptom onset were included in this study. All patients had >2 mm ST segment elevation in at least 2 leads, with no abnormal Q-waves in the leads of ST elevation and no old transmural infarction. Patients with recent gastrointestinal hemorrhage, peptic ulcer, trauma, stroke or malignant neoplasm were excluded. The nature, possible benefit, and possible risks of the study were explained to the patients who gave their written informed consent.

Intracoronary thrombolysis. Intracoronary thrombolysis was performed as previously described [6]. The infarct vessel was the left anterior descending coronary artery in 13 patients, the circumflex coronary artery in 7 and the right coronary artery in 12 patients. In all patients the infarct vessel could be re-opened by thrombolytic therapy. After thrombolysis, 16 patients underwent coronary bypass surgery. Cineangiography was performed before discharge in all 32 patients.

Analysis of coronary angiograms and left ventricular function. Coronary reperfusion was defined, by the consensus of two observers, as prompt and complete filling of the infarct artery with a good run-off of the contrast medium. Regional wall motion in the infarct area was determined from cineangiograms obtained 10 to 21 days after thrombolysis. The centerline method was used for wall motion analysis [2]. Measurements were performed along 100 chords constructed perpendicular to a centerline drawn midway between the enddiastolic and endystolic contours and normalised by the enddiastolic perimeter. Abnormality in wall motion at the infarct site was expressed in units of standard deviations (SD) from the mean wall motion of 52 normal patients and was computed by averaging the motion of chords lying in the most abnormally contracting 50% of the territory. Hypokinesis is indicated by negative values and hyperkinesis by positive values.

Left ventricular chamber volume was calculated using the area length method [10].

Thallium SPECT. Thallium SPECT was performed 12 to 48 months after thrombolytic therapy. Only those patients were included in whom no new myocardial infarction, no new angina pectoris and no new Q-waves had occurred.

Dipyridamole (0.6 mg/kg body weight) was injected intravenously over 3 minutes under control of blood pressure and ECG. Five to 10 minutes later 2 mCi of thallium-201 were injected intravenously, followed by SPECT which was also repeated 3 hours later.

Imaging was performed by means of a rotating camera tomographic unit (Gamma Diagnost, Philips, Hamburg, FRG). Thirty-two views were obtained for 40 sec each in a 180 degree arc extending from the 30 degree right anterior oblique position. The large-field-of-view camera was equipped with a low-energy all-purpose parallel-hole collimator. Twenty percent energy windows were centered on the 72 kev and 169 kev peaks. The projection images were collected into a 64 × 64 matrix by means of a 1.4 hardware zoom. Transverse axial tomograms were reconstructed by filtered back projection and re-organised into sagittal and oblique sections parallel to the long and short axes of the left ventricle. For quantitative evaluation of the defect size maximal-count circumferential profiles for each of the slices were generated. In the basal short axis view