A comparative study of primary coronary stenting and intravenous thrombolysis for acute myocardial infarction using ^{99m}Tc-MIBI SPECT imaging

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Abstract The theraputic effectiveness of primary coronary stenting was evaluated and compared with that of intravenous thrombolysis for acute myocardial infarction (AMI) using ^{99m}Tc-MIBI myocardial SPECT imaging. 42 patients with AMI were undergone primary coronary stenting (stenting group, 23 patients) or intravenous thrombolysis therapy (thrombolysis group, 19 patients). ^{99m}Tc-MIBI myocardium SPECT imaging was performed before and 1 week after stenting or thrombolysis therapy. The left ventricular myocardium of each patient was divided into 20 segments. The semiquantitative score of myocardial ^{99m}Tc-MIBI uptake was expressed with a five-point scoring system: 0 = normal; 1 = equivocal; 2 = mild defect: 3 = severe defect; 4 = absence of activity. The scores of scanning before stenting or intravenous thrombolysis was *SBS*. The scores of scaning after stenting or intravenous thrombolysis was *SAS*. Deducting *SAS* from *SBS* was *SDS*. A comparison was made between the stenting group and thrombolysis group: *SBS* was 41.3±9.8 and 39.4±7.9 (t=1.2, p <0.05); *SAS* was 17.8±6.4 and 27.3±6.7 (t=5.8, p <0.01); *SDS* was 24.5±4.2 and 12.2±2.3 (t = 7.3, p <0.01). In the 193 defect segments before stenting, 106 segments (54.9%) restored to normal after stenting. In the 149 defect segments before intravenous thrombolysis, 61 segments (40.9%) restored to normal after thrombolysis therapy. Comparing between stenting group and thrombolysis group in the improved rate of myocardial perfusion defect scores there was a significant difference (p <0.01). ^{99m}Tc-MIBI myocardial SPECT imaging has been proved to be an objective parameter for evaluating the therapeutic effectiveness of the stenting and the intravenous thrombolysis in the treatment of AMI. The results indicated that primary coronary stenting seems to be more effective than intravenous thrombolysis.

Keywords Myocardial infarction, Coronary stenting, Thrombolytic therapy, ^{99m}Tc-MIBI myocardium SPECT imaging

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1 INTRODUCTION

Re-perfusion therapy is one of the important progresses of acute myocardial infarction (AMI) therapy. It is established that early intravenous thrombolysis is effective and convenient for patency-related artery (IRA)[1]. But obvious limitation exists for thrombolysis application such as low IRA patency rate, recurrent ischemic events,

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high re-infarction rate, hemorrhage complication and so many contraindications. Recent years, primary coronary stenting has been developed as an important means for AMI treatment[2]. To evaluate and compare the therapeutic efficacy, we studied 23 patients of AMI treated by primary coronary stenting and 19 patients by intravenous thrombolysis using ^{99m}Tc-MIBI myocardial SPECT imaging in the period between Feb 1998 and Feb 1999 .

2 SUBJECTS AND METHODS

2.1 Subjects

Primary coronary stenting group (stenting group) consisted of 23 cases (Male 19, Female 4, mean age 58.7±10.3 years). All were hospitalized for AMI and given direct percutaneous transluminal coronary angioplasty (PTCA) treatment within 12 hours of onset. Inclusion criteria were as follows: (1) persistent chest pain over 30 minutes; (2) within 12 hours after the onset of the symptoms; (3) ST segment elevation over 1mm in at least 2 continuous ECG leads; (4) no intravenous thrombolysis; (5) for IRA, TIMI I-II or TIMI III antegrade flow, but residual stenosis over 90%; (6) first myocardial infarction.

Intravenous thrombolysis group (thrombolysis group) consisted of 19 cases (Male16, Female 3, mean age 60.3±9.6 years). All were AMI patients from the emergency room of our hospital. Inclusion criteria included: (1) persistent chest pain over 30 minutes; (2) within 12 hours after the onset of the symptoms; (3) ST segment elevation over 1 mm in at least 2 continuous ECG leads; (4) first myocardial infarction.

2.2 Intervention

Once the diagnosis of AMI was confirmed, the patient in the emergency room was sent to the cathetenization laboratory for selective coronary arteriography. If the result of arteriogram was eligible for the inclusion criteria of stenting group. PTCA and coronary artery stenting was administered to achieve TIMI III antegrade flow.

2.3 ^{99m}Tc-MIBI myocardial SPECT imaging

Single Photon Emission Computed Tomography(SPECT) was performed with a single head rotating scintillation camera(Sopha Medical Gammtomo II ECT). The camera is equipped with low energy high resolution collimator(LEHR).

740 MBq ^{99m}Tc-MIBI was injected before stenting or thrombolysis and scanned after IRA patency for all subjects. To assure the results of two groups comparably, coronary arteriography was performed 90 minutes after intravenous thrombolysis for thrombolysis group. Patients with IRA TIMI III antegrade flow reached grade were be enrolled.

^{99m}Tc-MIBI myocardium SPECT imaging was repeated 1~2 weeks after IRA pa-

tency treatment for all patients.

2.4 Imaging processing and analysis

The left ventricular myocardium was divided into 20 segments[3]. The semiquantitative score of myocardial ^{99m}Tc-MIBI uptake was expressed with a five-point scoring system: 0 = normal; 1 = equivocal; 2 = mild defect; 3 = severe defect; 4 = absence of activity. The scores of scanning before stenting or intravenous thrombolysis was *SBS*. The scores of scanning after stenting or intravenous thrombolysis was *SAS*. *SDS* = *SBS* -*SAS*.

3 RESULTS

3.1 Clinical features

There were no significant differences in age, sex, onset and coronary arteriography between two groups ($p > 0.05$).

3.2 Myocardial SPECT imaging

The semiquantitative scores of myocardial ^{99m}Tc-MIBI uptake were compared between stenting group and thrombolysis group: *SBS* was 41.3± 9.8 and 39.4±7.9 (t=1.2, $p > 0.05$) respectively; *SAS* was 17.8±6.4 and 27.3±6.7 (t=5.8, $p < 0.01$) respectively; *SDS* was 24.5±4.2 and 12.2±2.3 (t=7.3, $p < 0.01$) respectively.

3.4 Improvement rate of intervention treatment

106 out of the 193 defect segments (54.9%) before stenting restored to normal after stenting. 61 out of the 149 defect segments (40.9%) intravenous thrombolysis restored to normal after thrombolysis. There was a significant improvement in myocardial perfusion defect scores between stenting group and thrombolysis group ($p < 0.01$).

4 DISCUSSION

It has been confirmed that the key point for IRA re-patency is to rescue the dying myocardium, reduce infarct area and improve prognosis for AMI treatment. The IRA patency methods included two types: intravenous thrombolysis and primary angioplasty. Though the efficacy and convenience of intravenous thrombolysis have been confirmed, some limitation still existed: (1) IRA patency rate is relatively low (50%~70%) and 50% of the patency achieve TIMI II antegrade flow. (2) The residual stenosis after thrombolysis therapy is not satisfied. Recurrent ischemic events and re-infarction rate is high. (3) The clinical application range is restricted in terms of its contraindications. In our hospital, before we can perform PTCA, intravenous thrombolytic treatment can

only apply to 30% AMI patients. Majority of patients can't acquire effective treatment for varied contraindications.

In order to assure the comparability for our research result, we only select subjects whose IRA antegrade flow reached TIMI III confirmed by coronary arteriography. It is demonstrated from our study that ^{99m}Tc-MIBI myocardial uptake increased greatly after coronary artery reperfusion treatment. The improvement of myocardial perfusion is more evident in stenting group than thrombolysis group. Persistent and complete patency may be a important factor for patients after successful stenting. Re-infarction may happen after thrombolytic treatment in thrombolysis group.

In recent years, clinical studies abroad have confirmed that direct PTCA is more effective and has better long-term prognosis than intravenous thrombolytic treatment[4,5]. Direct PTCA result in less mortality, recurrent ischemic events, re-infarction rate and can improve left ventricle function. These research findings fit closely with ours. At present, direct PTCA applying to AMI emergence is at the very beginning in China. This technique was first applied in our hospital in 1996. 150 AMI patients have received direct PTCA since then. It is observed that direct PTCA is more effective than intravenous thrombolysis. Objective evaluation is relatively uncommon. ^{99m}Tc-MIBI myocardial perfusion tomography divided the left ventricular myocardium into 20 segments and the myocardial ^{99m}Tc-MIBI uptake for every segment were scored. The total score reflects the actual degree and areas of myocardial perfusion of each patient. Thus ^{99m}Tc-MIBI myocardial perfusion tomography and the scoring system have provided a evaluation standard for direct PTCA.

5 CONCLUSIONS

^{99m}Tc-MIBI myocardial SPECT imaging is an objective method for evaluating the therapeutic effectiveness of stenting and intravenous thrombolysis in the treatment of AMI. At the same time, our results indicate that primary coronary stenting seems to be more effective than intravenous thrombolytic therapy.

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