Clinical Research

Effect of puerarin on myocardial perfusion and ventricular wall motion in patients with acute coronary syndrome

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Objective  To investigate the effects of puerarin (Pur) on myocardial perfusion and ventricular wall motion in patients with acute coronary syndrome (ACS).

Methods  Thirty-seven patients with ACS were randomly divided into two groups: conventional treatment group (n=17, 11 males, range of age: 32-80 years, average age: 60.9±4.9 years) and Pur treatment group (n=20, 12 males, range of age: 40-76 years, average age: 62.7±3.5 years). Patients in the conventional treatment group received standard treatment according to the current guidelines, while patients in the Pur treatment group received intravenous administration of Pur (500 mg/day) for 10 days plus conventional treatment. Real-time myocardial contrast echocardiography (RT-MCE) was performed to evaluate the change in myocardial perfusion index (MPI) and ventricular wall motion index (VWMI) at admission and 10 days after treatment.

Results  At 10 days after treatment, MPI was significantly higher (P<0.01) and VWMI significantly lower (P<0.01) in the Pur group comparing with those in the conventional group.

Conclusions  Puerarin might improve myocardial microcirculation perfusion and ventricular wall motion in patients with ACS. (J Geriatr Cardiol 2008; 5:155-158)

Key words  acute coronary syndrome; myocardial perfusion index; ventricular wall motion index; puerarin

Patients and methods

Patients  The subjects for this study were 37 patients with ACS including, unstable angina pectoris (UAP) and acute myocardial infarction (AMI), hospitalized in Department of Cardiology, The Affiliated Hospital, Xuzhou Medical College from October 2006 to March 2007. On admission, patients received random assignment to one of two groups: conventional treatment group (n = 17; 11 males; age range 32-80 years, average age 60.9±4.9 years; major medications: enteric-coated aspirin, low molecular weight heparin, statins, α-blockers, angiotensin-converting enzyme inhibitors) and Pur treatment group (n = 20; 12 males; age range 40-76 years, average age 62.7±3.5 years; major medication: conventional treatment plus 500 mg per day of Pur [Zhenda-Tianqin Corp., Nanjing, China] administered intravenously). The course of treatment for all patients was 10 days. Inclusion criteria included diagnosis of AMI was according to 1979 diagnostic criteria coming from World Health Organization (WHO) or diagnosis of UAP by the 2002 diagnostic criteria from American College of Cardiology/American Heart Association (AHA/ACC). Exclusion criteria were serious hepatic or renal disease, serious heart failure, malignant tumor, recent trauma or operation; hyperthermia; pregnancy; and acute infection. Patient data are shown in Table 1.
No significant difference between age, sex, smoking, hypertension, et al between two groups.

**RT-MCE study**

RT-MCE was performed in all patients by using the Sonos 5500 cardiovascular ultrasound system (Hewlett-Packard, USA). The frequency of the transducer (S3) was 1.0-3.0 MHz. The mechanical index was 0.1. Transmitting and receiving frequencies were 1.8 and 3.6 MHz; real-time opacification and Angio modes were used. The frame frequency was 14/s, and the chroma gain was adjusted to 50%. The rest of machine settings were default values of the machine. The machine settings were kept constant throughout the study.

The contrast agent SonoVue (Bracco, Milan, Italy) was used. After mixing with saline, 5 mL was given intravenously at 1 mL/min, and the line was then flushed with saline. When sufficient contrast medium was given, flash echocardiography at a high mechanical index (1.6) was performed to destroy microbubbles in the myocardium and to observe replenishment. End-systolic frames up to 15 cardiac cycles after microbubble destruction were digitally captured in 3 apical views (apical 4-, 2-, and 3-chamber views). All captured images were collected and stored on a magnetic optic disc for off-line analysis.

**Image analysis**

A semiquantitative scoring system and the American Society of Echocardiography 16-segment LV model were used to analyze images. 2 Contrast was scored as 0 (minimal or absent opacification); 0.5 (reduced or heterogeneous opacification); or 1 (homogeneous opacification). The ventricular wall motion score (VWMS) was used (1 = normal, 2 = reduced, 3 = absent, 4 = dyskinesia or ventricular aneurysm). The myocardial perfusion index (MPI) and ventricular wall motion index (VWMI) were obtained from the proportionality score for all segments/number of segments. Higher MPI and lower VWMI indicated better myocardial perfusion and ventricular wall motion. Wall motion and MCE images were analyzed separately by two independent doctors in the department of echocardiography who were blinded to clinical, angiographic, and other imaging data.

**Statistical analysis**

Quantitative data were reported as mean ± SD. The paired t test was used to measure the difference before and after the procedure within the same group. Unpaired t tests were used for between-group comparisons. The numerical data were expressed with the rate. Group comparisons of rate were made with the χ2-test. Linear correlation analysis for the relation between two variances was used. A P value < 0.05 was considered statistically significant.

**Results**

RT-MCE was performed on 37 patients (conventional group 17, Pur group 20) before and after therapy. There were no significant differences between groups in age or sex. In each group, VWMI decreased significantly (P < 0.01) and MPI increased significantly (P < 0.05) after therapy. Compared with the conventional group, VWMI decreased and MPI increased in Pur group. The results of RT-MCE are shown in Table 2 and Figure.

**Discussion**

Pur is the main effective constituent of the isoflavone in Pueraria which belong to the kudzu group in the pulse family. The chemical name of Pur is 4,7-dihydroxide radical 8-β-d-glucosyl-isoflavone, molecular formula is C21H20O9, and the molecular weight is 416. In 1992, a Japanese researcher found that Pur could expand coronary arteries and produce anti-inflammatory effects. Since that time, many studies have suggested that Pur inhibit the oxyradical activity, protect the blood vessel endothelium, protect myocardial cells, dilate coronary arteries, relieve coronary artery spasm, and facilitate the formation of collateral circulation. It inhibits platelet aggregation induced by adenosine diphosphate (ADP) in human and animals. It can increase the levels of prostacyclin and high density lipoprotein decrease thromboxane A2, and inhibit the platelet aggregation by repairing endothelial cells, thus preventing the progression of disease in patients with ACS. From studies in vitro, Li et
confirmed that Pur could inhibit the expression and the activity of matrix metalloproteinase-9 (MMP-9) and TF secreted by monocyte-derived macrophages, stabilize the plaque, and decrease the vulnerability of blood to certain extent. Myocardial cells have autorhythmicity, conductivity, excitability and contractility, and maintaining the function of myocardial cells is essential to cardiac function. Guaranteeing the blood supply of myocardial cells is necessary to maintaining the function of myocardial cells. In the present study, we observed that the perfusion of myocardial microcirculation and the systolic wall function improved after the course of 10 days (Pur injection 500 mg per day). We presume that these improvements were the consequence of increased integrity of blood vessel endothelium, dilation of blood vessels, antioxidation, and protection of myocardial cells.

Studies of myocardial microcirculation are limited because of the complexity of microcirculation physiology and the limited methods of intervention. MCE is a new technology that can improve acoustic contrast and ultrasonic imaging accuracy, leading to improved sensitivity and the specificity in evaluation of the myocardial microcirculation. The application of RT-MCE has grown rapidly in recent years. The ventricular wall motion can be observed simultaneously when the myocardial perfusion is observed in RT-MCE. Janardhanan et al found that MCE was superior to coronary arteriography (CAG) in judging the stenosis of vessels and the size and range of collateral circulation. Chinese researchers have discovered that the speed and quantity of myocardial blood flow was lower in patients with syndrome X than the normal controls while using RT-MCE for evaluation. The use of MCE in estimating the viable myocardium and the endotheliocyte function of coronary arteries was generally too. At present, RT-MCE is considered an important potential implement in evaluating myocardial microcirculation perfusion without injury. In this study, we evaluated the effect of Pur on myocardial microcirculation perfusion and ventricular wall motion with RT-MCE by calculating MPI and VWMI. RT-MCE was completed in all patients in this study. There were no adverse effects associated with RT-MCE or the contrast material.

Preliminary findings in this study showed that the use of RT-MCE in evaluating the effect of Pur on the myocardial microcirculation, perfusion, and ventricular wall motion in ACS was simpler and more convenient than CAG. Patients had no adverse reaction to the use of RT-MCE. The find-
ings may provide the basis for the use of Pur as new therapeutic option for patients with ACS—an option that integrates traditional Chinet and Western medicine to treat patients with ACS. It should be noted, however, that, quantitative analysis was not used in this study, and semiquantitative analysis has some limitations. The relationship between MPI and VWMI and the prognosis of patients with ACS will require intensive investigation in the future.

References