Translational medical research of cardiovascular disease

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NONINVASIVE ESTIMATION OF INFARCT SIZE BY ECHOCARDIOGRAPHIC CORONARY FLOW IN A MOUSE MODEL OF MYOCARDIAL INFARCTION

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Objectives Animal model of myocardial infarction (MI) is widely used not only in analyses for the mechanisms but also in testing the efficacy of therapeutic strategies for the disease. It is therefore critically important, but almost impossible to exactly evaluate the validity of coronary artery ligation in a mouse model of MI except analysis by anatomy and histology. We here explore a noninvasive method to estimate MI through analyses for coronary flow by transthoracic echocardiography (TTE) in mice before and 1 day after ligation of left anterior descending (LAD) coronary artery.

Methods TTE-based cardiac function, geometry and coronary perfusion, electrocardiogram (ECG), and serum troponin I (TnI) level were examined in C57BL6/J mice subjected to LAD ligation. Histological infarct size (IS) was confirmed by staining the heart with 2,3,5-triphenyltetrazolium chloride.

Results Among all parameters, postoperative hyperaemic peak diastolic velocity (PDV) and coronary flow reserve (CFR) were most correlated with IS (R^2=0.8028 and 0.5825, respectively; both p<0.0001). With IS≥30% as successful LAD ligation (MI+) and <30% unsuccessful one (MI-), receiver operating characteristic (ROC) curve analysis demonstrated that postoperative hyperaemic PDV and CFR most effectively indicated the IS level with the

optimal cut-off value 480.16 mm/s and 1.89, respectively. Furthermore, impaired cardiac function, eccentrically expanded left ventricular, typical pathological ECG and elevated TnI levels were observed most often in the mice with impaired hyperaemic PDV and CFR.

Conclusions Echocardiographic hyperaemic PDV and CFR can estimate histological IS in mice with coronary occlusion.