

Development of Extracorporeal Shock Wave Therapy for the Treatment for Ischemic Cardiovascular Diseases

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Abstract. Cardiovascular diseases, such as coronary artery disease and peripheral artery disease, are the major causes of death in developed countries, and the number of elderly patients has been rapidly increasing worldwide. Thus, it is crucial to develop new non-invasive therapeutic strategies for these patients. We found that a low-energy shock wave (SW) (about 10% of the energy density that is used for urolithiasis) effectively increases the expression of vascular endothelial growth factor (VEGF) in cultured endothelial cells. Subsequently, we demonstrated that extracorporeal cardiac SW therapy with low-energy SW up-regulates the expression of VEGF, enhances angiogenesis, and improves myocardial ischemia in a pig model of chronic myocardial ischemia without any adverse effects *in vivo*. Based on these promising results in animal studies, we have subsequently developed a new, non-invasive angiogenic therapy with low-energy SW for cardiovascular diseases. Our extracorporeal cardiac SW therapy improved symptoms and myocardial perfusion evaluated with stress-scintigraphy in patients with severe coronary artery disease without indication of percutaneous coronary intervention or coronary artery bypass surgery. Importantly, no procedural complications or adverse effects were noted. The SW therapy was also effective in ameliorating left ventricular remodeling after acute myocardial infarction in pigs and in enhancing angiogenesis in hindlimb ischemia in animals and patients with coronary artery disease. Furthermore, our recent experimental studies suggest that the SW therapy is also effective for indications other than cardiovascular diseases. Thus, our extracorporeal cardiac SW therapy is an effective, safe, and non-invasive angiogenic strategy for cardiovascular medicine.

Keywords: Shock wave therapy, Angiogenesis, Ischemic heart disease, Growth factors.

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