



Drug Capture System Developed to treat Limb Ischemia

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Dr. Patrick Ching-Ho Hsieh, Dr. Steve Roffler and colleagues at the Institute of Biomedical Sciences (IBMS) have announced a new treatment for limb ischemia that may solve many of the traditional problems associated with treating the disease. The new system is able to reduce the extent of tissue injury soon after blood flow reduction occurs, and speed up tissue regeneration over the subsequent weeks. The study, which uses a specially-designed “drug capture system” to improve the targeting of growth factors (proteins stimulating cell growth and healing) to the diseased leg tissue was published in the academic journal *Science Translational Medicine* on 16 November 2016.

Limb ischemia is a disease where the flow of oxygenated blood to the legs and feet is reduced. It is particularly common in patients with diabetes, high blood pressure or high cholesterol levels. It results in pain, difficulty walking, and sometimes requires amputation of the leg.

IBMS Research Fellow Dr. Hsieh, also a cardiac surgeon and co-corresponding author of the article said: “Regeneration of blood vessels is not easy, even with the use of drugs or cell therapy it is not possible to continuously deliver the therapy precisely to injured tissues. The tissue regeneration process is already complicated, and the regeneration needs several kinds of growth factors that function in different processes. One possible approach is to stimulate the natural growth process of regeneration of blood vessels by building a drug capture system that navigates drugs, growth factors, stem cell to injured tissues directly.”

The new capture system works by using two complimentary pieces of a biological jigsaw puzzle. First an antibody/hydrogel combination is injected into the injured muscle tissue, and later growth factors are delivered. When the growth factors arrive at the muscle tissue through the blood, they bind to antibodies, becoming trapped and building up to achieve a therapeutic effect. The team tested the system in mice and pigs with hind limb ischemia and found significant improvements in the recovery from injury.

Dr. Roffler, the other co-corresponding author also a Research Fellow at IBMS said: “Typically, less than 1% of the medication given to a patient will actually reach the damaged leg tissue, and even then, it doesn’t stay there for very long. Using this new system, we were able to improve the retention of drugs at the correct site by up to ten times, thus improving the treatment,”

First author Ms. Jasmine Wu said that “after injecting the drug capture system, we used two growth factors to treat the limb ischemia in mice. The first one is given soon after injury to protect the tissues from damage, and the second one encourages new blood vessels to form. In combination, this saved the limbs of the mice and increased the blood flow by more than 40%.”

“We are hoping that this research result will lead to advances in the treatment of cardiovascular disease in humans in the future. Cardiovascular disease is the leading cause of death in the world. In myocardial infarction, within a few hours of ischemia a large number of cardiac muscle cells die. Thrombolytic drugs or cardiac catheterization therapy cannot recover the normal function. It is hoped that a human clinical trials on the new system can begin soon, which could eventually lead to this treatment being used to treat human patients in the clinic,” Dr. Hsieh added. The system is also expected to have application as a cancer treatment.



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The full article entitled “Reloadable Multi-Drug Capturing Delivery System for Targeted Ischemic Disease Treatment” can be found at the *Science Translational Medicine* website at:
<http://stm.sciencemag.org/content/8/365/365ra160>

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