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inStem develops novel drug delivery device to avert graft rejection in organ transplant

Our Bureau, Bengaluru

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Institute for Stem Cell Biology and Regenerative Medicine (inStem) in association with University Hospital of Bern, Switzerland and Brigham and Women's Hospital (BWH), USA has developed a hydrogel-based drug delivery system to mitigate graft rejection in organ transplant. The device when prompted helps to target controlled release of medication to where it is needed and when it is needed. The research carried out on rat model has proven successful but would take some time to be tested on humans.

inStem is located within the campus of National Centre for Biological Sciences (NCBS), Bengaluru. The researchers indicated that following a tissue graft transplant of the hand, arm or leg, administering an immunosuppressant drug is to prevent the recipient's body's immune system from rejecting and attacking the new organ part. However, there are toxicities associated with delivering these drugs systemically and side effects since suppressing the immune system can make a patient vulnerable to infection.

But now using a biomaterial 'hydrogel', is seen to be answer to diminish the drug reactions during a transplanted graft survival. The study is published August 13, 2014 in Science Translational Medicine.

"Until now, drug delivery to treat autoimmune and inflammatory diseases have been extremely challenging due to unpredictable disease severity and the failure of traditional drug delivery systems. Hence, developing a novel approach to deliver the immunosuppressant drugs has been our vision," said Dr. Praveen Kumar Vemula, Principal Investigator, inStem and Ramalingaswami Fellow and co-corresponding study author.

The researchers developed a hydrogel loaded with the immunosuppressant drug tacrolimus. It was injected under the skin after transplant surgery in a rat. The hydrogel remained inactive until it detected an inflammation or immune response from the transplant site, at which point it delivers the immunosuppressant drug for months locally within the transplanted graft.

In pre-clinical studies, a one-time, local injection of the hydrogel-drug combo prevented graft rejection for more than 100 days compared to 33.5 days for recipients receiving only tacrolimus and 11 days for recipients without treatment or only receiving hydrogel.

"This new approach to deliver immunosuppressant therapy suggests the benefits to reduce toxicity and marked improvement in the therapeutic outcomes which may lead to a paradigm shift in clinical immunosuppressive therapy in transplant surgery," said Dr. Jeff Karp, Division of Biomedical Engineering, BWH Department of Medicine and co-corresponding study author.

"Continuous release of the drugs irrespective of disease severity is a hallmark of existing drug delivery vehicles could be a thing of the past. Inflammation associated enzymes-directed drug release for months eliminates systemic toxicity," noted Dr. Robert Rieben, Head of Research, Reconstructive and Hand Surgery, Bern University Hospital and co-corresponding study author.

Dr. Narinder Mehra, professor and head, department of transplant immunology and immunogenetics, All India Institute of Medical Sciences, New Delhi, who was not involved in the study, views it as a good strategy to counter infections resulting from immunosuppression in limb transplants. In times to come it could also be used for face or hand transplants".

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