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In vivo vasculogenic potential of human umbilical vein endothelial cell microtissues: A modular tissue engineering approach

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Developing a functional three-dimensional large sized vascularized tissue has been a longstanding objective in the field of tissue engineering. Although the current strategies employed to meet this challenge give stable vessels when grown with mural cells, however it takes weeks to months to get anastomosed and perfused vasculature. Micro fabrication techniques; despite showing great potential, are expensive, requires high expertise and have employed microfluidic chip to develop small dimension vasculature. Modular tissue engineering is an emerging field that generates tissue structures from the bottom-up that mimic the intricate architecture and complexity of native organs and tissues. Vascularization by this approach has been attempted by researchers; however, this approach is not well explored. Previously, we had optimized the *in vitro* parameters for vascularization via this approach and have shown that endothelialization using human umbilical vein endothelial cells (HUVEC) microtissues (MTs) grown in goat tendon collagen type I-fibrin hydrogel were interconnected, branched and were stable for at least 5 days without mural cells, however; it's *in vivo* validation was not performed. In the current study, an attempt was made to validate our *in vitro* developed 3D vasculature in an immunocompromised mouse in presence and absence of growth factors. Results showed that MTs underwent different stages of evolution and formed interconnected, anastomosed and perfused vasculature without any supporting cells within 12 days post implantation and eventually became more mature by 21 days. Immunohistochemical analysis showed that the neovessels were composed of human endothelial cells. H&E staining showed presence of mouse RBCs in the newly formed vessels, clearly indicating that anastomosis has occurred. These HUVEC MTs if grown with desired cell type may result in a functional engineered tissue construct of clinical relevance.

Biography

Rajan Narayan has completed his MSc in Biochemistry from Bangalore University in 2010. He has worked as a Scientist at Biocon Limited, in Bangalore, India for a year and then joined the Department of Biotechnology, Indian Institute of Technology Kharagpur in 2011 to pursue PhD in Vascular Tissue Engineering. He has published 4 papers in journals of international repute.

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