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Aqueous humor fluid dynamics can be better understood by a real time perfusion system at constant pressure

For over half a century, glaucoma research has made little progress towards understanding the regulation of aqueous humor outflow resistance and fluid dynamics. Nevertheless, an understanding of the fluid dynamics in the eye, being either pulsatory or continuous as demonstrated in an ex vivo environment, would provide the key information as to the mechanisms of glaucoma. Without this understanding, it is difficult to predict definitively the role of outflow pathway cells in aqueous humor outflow resistance at the molecular level. Several designs of the perfusion systems have been proposed as measurements of the aqueous humor outflow facility in enucleated eyes either at constant pressure or at constant flow. The major problem of perfusion systems measurement is that the equipment is not available commercially, so the perfusion equipment is self-assembled in laboratories after procuring the parts from different resources. Above all, the Grant perfusion system holds unique features that measure the outflow facility at constant pressure while two pairs of enucleated whole eyes are evaluated, simultaneously. Based on the same principle, the newly engineered real time perfusion system equipped with modern tools and technology using Balance Talk XL program 5.1 (Labtronics Inc., Canada) measures the outflow facility at constant pressure and was presented at ARVO 2006 by J Kumar. Clearly, the perfusion of H-7 in porcine eyes using the newly designed real time perfusion system model demonstrated that the perfusion of Optimedia, the composition similar to aqueous humor is a far superior physiological media than the traditionally used PBS plus glucose for the analysis of outflow facility. Our preliminary data analysis of outflow suggested that the aqueous outflow is discontinuous and exhibits a pulsatory motion. We anticipate that the newly designed real time perfusion system will be a valuable research tool for studies aimed at characterizing fluid dynamics as well as being easy to assemble and commercially available. If so, this will raise awareness for glaucoma research among basic scientists worldwide and contribute to a better understanding of aqueous flow and the mechanism of glaucoma leading to new treatment options.

Biography

Janardan Kumar is the Professor and Former Chair of Natural Sciences. He has earned MS in biochemistry from University of Allahabad and received PhD in chemistry at CDRI, Lucknow affiliated to Kanpur University in India. Being research Assistant Professor in the department of Cell Biology at Duke University in 1998, he developed his research interest to the field of glaucoma and joined the internationally renowned laboratory of Prof. David L Epstein at Duke Eye Center, Duke University, Durham, NC (USA). His work at Duke Eye Center provided opportunity to file two patents, one for glaucoma therapy and the other for vitrectomy. At TEI biosciences in 2002, he gained a unique experience on stem cell research. His strategies made him capable of inducing differentiation of insulin producing cells from adult human skin fibroblast stem cells using specific signaling complexes, and successful transplantation of these cells into three diabetic nude mice resulted of maintaining the normal glucose level for approximately a month.

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