In Vitro Reconstitution of Human Kidney Structures for Renal Failure

Nadia Guimaraes-Souza, Tamer Aboushwareb, Kathryn A. Stern, Anthony Atala, James J. Yoo
Department of Urology and Wake Forest Institute of Regenerative Medicine, Wake Forest University Health Sciences, Winston-Salem, NC, USA

jyoo@wfu

Introduction and Objectives:
End stage renal disease is currently being treated effectively by transplantation. Recent advances in cell-based therapies have provided potential opportunities to alleviate the current challenges of donor shortage. We previously have demonstrated that single renal cells expanded in culture are able to form renal structures when implanted in vivo. In this study, we investigated whether human kidney structures could be pre-formed in vitro for subsequent implantation in vivo to maximize tissue forming efficiency.

Methods:
Primary human renal cells were isolated from unused donor kidneys using enzymatic digestion methods. Renal cells were grown, expanded and characterized. To form kidney structures, single renal cells were placed in a three-dimensional culture system, consisting of neutralized type I collagen. The three-dimensional matrix with cells was solidified and cultivated over a period of 10 days. Histomorphological and ultra structural analyses were performed using cell specific markers.

Results:
Human primary renal cells were isolated and expanded in culture. The cells retained their phenotypic and functional characteristics at multiple culture stages. Single renal cells placed in a three-dimensional culture environment formed structures that resemble renal tubules. Histologically, these structures showed phenotypic resemblance to native kidney structures. The reconstituted tubules stained positively for proximal and distal tubular markers.

Conclusions:
These findings show that single human renal cells grown in a three-dimensional culture system are able to generate kidney structures. This system may ultimately be developed into an efficient cell-based therapy for patients with end stage renal disease.

References:

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