외국 연수회원 연구 발표

신부전증 치료에서의 생체인공신장 치료의 응용

The Bioartificial Kidney in the Treatment of Acute Kidney Injury

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Acute kidney injury (AKI) continues to have an exceedingly high mortality rate, despite advances in dialysis technology. Current dialysis therapies replace only the filtration function of the kidney, not the critical transport, metabolic, and endocrine functions of renal tubule cells. In addition to their metabolic and endocrine functions, renal tubule cells presumably play an important role in the systemic inflammatory balance by participating in the complex and dynamic network of leukocyte action and pro- and anti-inflammatory cytokines. Loss of this function may result in a propensity to develop systemic inflammatory response syndrome, multiorgan dysfunction, and a high risk of death in AKI, and may relate to chronic inflammatory state in end-stage renal disease (ESRD). Recently, a renal tubule assist device (RAD) containing living renal proximal tubule cells has been successfully engineered. It has demonstrated differentiated absorptive, metabolic, and endocrine functions of normal kidney in vitro and ex vivo experiments. RAD containing human cells to conventional continuous renal replacement therapy has been shown in clinical studies to have the potential to advance AKI treatment, from enhancing renal clearance to providing more complete renal replacement therapy. This "bioartificial kidney" demonstrates metabolic activity and immunomodulatory function with improvement of survival in patients with AKI and multiorgan failure. The device also tested in continuous flow peritoneal dialysis (CFPD)-based extracorporeal circuit since a wearable dialysis system employing CFPD would be advantageous in requiring no extracorporeal blood circulation. RAD has been modified into a carbon disk-based compact, cryopreservable bioartificial renal epithelial cell system (BRECS) and a large- animal model of CFPD-based extracorporeal circuit was developed for both uremic control and keeping viability of the BRECS. This 24-hr CFPD model provided acceptable uremic control while maintaining cell viability and functionality in the BRECS device. The present model can be applied as a novel platform for various types of cell therapy and to PD-based wearable bioartificial kidney in the future. Innovative approaches to replace full renal functions such as the RAD may break the mold of current institutional dialysis therapies and provide numerous opportunities to develop lifesaving technologies.