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Stem Cells as Therapy in AKI

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Acute kidney injury (AKI) is defined by a rapid loss of kidney function. AKI occurs in 10%-15% of hospitalized patients and in >50% of ICU patients. To date, specific treatments to effectively reduce AKI or improve kidney recovery from AKI are not available. The delayed diagnosis and treatment of AKI may result in irreversible loss of kidney cells and nephrons, which leads to persistent kidney dysfunction and the development of chronic kidney disease (CKD). A growing body of evidence has demonstrated the potential of stem cell-based cellular therapy for the management of AKI. The therapeutic efficacy of stem cells in attenuating AKI in various animal models have been well reported. Reports have demonstrated stem cells as a safe and effective therapeutic strategy for treating AKI in preclinical and clinical trials. Stem cells functionally attenuate AKI progression through regulating the immune response, renal tubular cell apoptosis, tubular EMT, oxidative stress, etc. However, the low survival rates and short survival period of stem cells in vivo limit their therapeutical value. Numerous in vivo studies have demonstrated that the therapeutic benefit of stem cells is principally orchestrated by the paracrine secretion of a broad repertoire of growth factors, chemokines, and cytokines. The stem cells may interact with target cells through released extracellular vesicles exosomes and/or tunnelling nanotubes. Preclinical studies have shown that stem cells derived exosomes protected tubular cells, decreased apoptosis, and maintained mitochondrial function in AKI. Our pilot study has shown MSC-derived exosomes remained in mouse kidney up to 72 hours after one single injection in vivo and protected against folic acid-induced impairment of renal function in mice. Clinical trials have demonstrated improved renal function in patients with AKI through stem cells-based treatments. However, longer-term therapeutic effects and potential side-effects need to be established. Thus large scale clinical trials are warranted.

Keywords: acute kidney injury, stem cell, stem cell-derived exosomes