Stem cell therapy for kidney repair

Regenerative therapies are gaining momentum for the replenishment of injured tissues. A specific subpopulation of cells known as stem cells show great promise with their ability to differentiate into desired cell types and ability for self-renewal.

Chronic kidney disease (CKD) is a primary candidate for stem cell therapy. It is a leading cause of mortality and morbidity affecting 11% of the adult population in western countries. It can progress towards end stage renal disease, which has no cure and requires renal replacement therapy such as dialysis or renal transplantation.

The EU-funded STAR-T REK (Set up and comparison of multiple stem cell approaches for kidney repair) project investigated the potential of stem cell therapy as an alternative approach to organ transplantation for patients suffering from kidney failure. During the project, researchers assessed the regenerative potential of stem
cells derived from different sources, their clinical utilisation and the impact at the disease level.

Special focus was given to stem cells isolated from the bone marrow and particularly mesenchymal stem cells, given their regenerating activity observed in several preclinical models of acute and chronic kidney injury. In addition, resident renal stem cells were exploited as a therapeutic tool for acute or chronic kidney disorders. Their isolation was based on the expression of CD133 and CD24 surface antigens. Upon transplantation into mice affected by acute tubular injury, these cells displayed the unique capacity to engraft within the kidney and significantly improve renal function. Similarly, renal stem cells demonstrated for the first time the ability to repair glomerular injury.

In another part of the project, the consortium developed techniques of de novo kidney organogenesis. The aim was to study the mechanisms of kidney development and screen the ability of different stem cell types to make renal tissue. The tissue engineered kidney demonstrated the ability to connect properly to a pumped blood system, supporting the idea of artificial transplants.

Collectively, the findings of the STAR-T REK study indicate that treatment of acute kidney injury with stem cells is possible, while for CKD, pharmacological modulation of renal stem cell function seems to be the best option.

**Keywords**

Regenerative therapies, chronic kidney disease, STAR-T REK, mesenchymal stem cells, renal stem cells

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