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Protective effect of adipose-derived mesenchymal stem cell on acute kidney injury induced by ischemia/ reperfusion in Sprague-Dawley rats

Hussein Sheashaa¹, Ahmed Lotfy¹, Fatma Elhusseini¹, Azza Abdel Aziz¹, Azza Baiomy¹, Faten Zahran², Samah Awad¹, Aziza Alsayed¹, Abdel-Hady El-Gilany¹, Mohamed-Ahdy A A Saad¹, Khaled Mahmoud¹, Dalia A Salem¹, Ahmed Sarhan¹, Hassan Abdel Ghaffar¹ and Mohamed Sobh¹

¹Mansoura University, Egypt

²Zagazig University, Egypt

Aim: Acute kidney injury is a complex clinical problem associated with significant morbidity and mortality and lacking effective management. Ischemia-reperfusion injury (IRI) remains one of the leading causes of AKI in both native and transplanted kidneys. We aimed to evaluate the efficacy of adipose derived mesenchymal stem cells (ADSCs) to prevent renal IRI in rats.

Methods: This study was conducted on male Sprague-Dawley rats weighing 250-300 g (n=72). Rats were randomly assigned to three main groups: (1) sham-operated control group (n=24); (2) IRI + culture media group, in which rats were subjected to IRI and were administered culture media after 4 hr of IRI (n=24); and (3) IRI +ADSCs treated group (n=24), in which rats were administered 1×10⁶ ADSCs after 4 hr of IRI via the tail vein. Each main group was further divided according to the timing of scarification into four equal subgroups. Renal function (serum creatinine and creatinine clearance) was tested and moreover, kidney homogenate antioxidant enzymatic activity was assayed where malondialdehyde (MDA) was determined in serum and renal tissue. Histopathological changes were analyzed in the different regions of the kidney (cortex, outer stripe of the outer medulla (OSOM), inner stripe of the outer medulla (ISOM) and inner medulla). In each layer, the scoring system considered active injury changes, regenerative changes and chronic changes.

Results: The ADSCs were defined and their capability of differentiation was proved. When compared to sham-operated rats, IRI resulted in a significant increase in plasma creatinine, serum and tissue MDA and a significant decrease in creatinine clearance. These changes were attenuated by the use of ADSCs. The prominent histopathological changes in the cortex, ISOM and OSOM were the prominent injury score which was significantly evident in the positive control group. The use of ADSCs was associated with significantly lowered injury score at day 1 and 3. It lost its significance at day 7.

Conclusion: The use of ADSCs ameliorates renal injury and dysfunction associated with IRI in rats.