Light at the end of the tunnel: Stem Cells for the Treatment of Diabetic Vasculopathy

Background

Diabetes mellitus in elderly represents an exceptional subset in the population vulnerable to cardiovascular events. As aging, diabetes mellitus and hypertension share common pathways, an ideal treatment should possess the ability to counter more than one of, if not all, the underlying mechanisms. Stem cells emerged as a potential approach for complicated medical problems. We tested here the possible role of trans-differentiated endothelial cells (ECs) in the treatment of diabetes mellitus in old rats.

Methods

Mesenchymal stem cells where isolated from umbilical cord Wharton's Jelly and induced to differentiate into endothelial like-cells using vascular endothelial growth factor-enriched media. Thirty aged male Wistar albino rats were used in the present study. Rats were divided (10/group) into: control group (18–20 months old, weighing 350–400 g, received single intraperitoneal injection as well as single intravenous injection via tail vein of the vehicles), aged diabetic group (18–20 months old, weighing 350–400 g, received single intraperitoneal injection of 50 mg/kg streptozotocin, and also received single intravenous injection of saline via tail vein), and aged diabetic + ECs group (18–20 months old, weighing 350–400 g, received single intraperitoneal injection of 50 mg/kg streptozotocin, and also received single intravenous injection of $2*10^6$ MSC-derived ECs in 0.5 ml saline via tail vein) groups. Assessment of SBP, aortic PWV, and renal artery resistance was performed. Serum levels of ET1, ANG II, IL-6, TNF-α, MDA, ROS, and VEGF were evaluated, as well as the aortic NO tissue level and eNOS gene expression. Histopathological and immunostaining assessments of small and large vessels were also performed.

Results

Induction of diabetes in old rats resulted in significant increase in SBP, aortic PWV, renal artery resistance, and serum levels of ET1, ANG II, IL-6, TNF-α, MDA, ROS, and VEGF. While there was significant decrease in aortic NO tissue level and eNOS gene expression in the aged diabetic group when compared to aged control group. ECs treatment resulted in significant improvement of endothelial dysfunction, inflammation and oxidative stress.

Conclusion

We report here the potential therapeutic role of trans-differentiated ECs in aged diabetics. ECs demonstrated anti-inflammatory, antioxidant, gene modifying properties, significantly countered endothelial dysfunction, and improved vascular insult.