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Human umbilical cord mesenchymal stem cell treatment for severe pulmonary arterial hypertension

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Objective

To report the first in human application of human umbilical cord mesenchymal stem cell (HUCMSC)-derived therapy for pulmonary arterial hypertension (PAH).

Methods

A 3-year-old female presented with heritable PAH associated with hereditary hemorrhagic telangiectasia and was treated for 6 months with serial intravascular infusions of conditioned media (CM) from allogenic HUCMSCs. The properties of HUCMSCs were validated by untargeted label-free quantitation of the cell and CM proteome, suggesting increased activity of regeneration, autophagy and anti-inflammation pathways and mitochondrial function. Prostaglandin analysis demonstrated increased HUCMSC secretion of prostaglandin E2, known for its regenerative capacity.

Results

The treatment markedly improved clinical and hemodynamic parameters and decreased blood plasma markers of vascular fibrosis, injury and inflammation. A comparative analysis of single-cell RNA sequencing data collected from three HUCMSCs and two human umbilical vein endothelial cell (HUVEC) controls identified eight common cell clusters, all of which indicated regenerative potential specific for HUCMSCs.

Conclusion

Human umbilical cord mesenchymal stem cell-derived treatment of severe pulmonary arterial hypertension is a promising novel therapy concept. Additional prospective clinical studies are warranted to confirm and further explore the benefits of HUCMSC-derived therapy for PAH.