The Changes of the Potassium Channels Expression and the Effect of Umbilical Cord Blood Derived Mesenchymal Stem Cells Treatment in Monocrotaline-induced Pulmonary Arterial Hypertensive Rats

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Introduction

- Pulmonary arterial hypertension (PAH) causes right ventricular failure and possibly even death due to progressive increase in pulmonary vascular resistance.
- With a progressive loss of pulmonary microvasculature, it later becomes refractory to traditional therapy.

K⁺ Channels

- The abnormality of PAH can be triggered by a defect in the function of K⁺ channels or by alveolar hypoxia.
- K⁺ channel dysfunction plays an important role in the development of pulmonary hypertension.

Human umbilical cord blood-derived mesenchymal stem cells (hUCB-MSCs)

- Alternative source of bone marrow-derived mesenchymal stem cells because collection of cord blood is less invasive than that of bone marrow.
- hUCB-MSCs have recently been studied for evaluation of their potential as a source of cell therapy in specific diseases.

Purpose

- To investigate the changes of the expression levels of several types of K⁺ channels by PCR and western blot analysis.
- To find the optimal index verifying the effect of treatment of UCB-MSCs on PAH associated with K⁺ channels.

Materials

- Control group
  - Normal saline S.O
- Monocrotaline group
  - MCT 60 mg/kg S.O
- Treatment group
  - Monocrotaline cell LV, transfusion 3X10⁶ cells

Methods

- Hemodynamic data
  - RV, AO pressure
- Organ weight measurement
  - RV, LV+septum, lungs, kidney, liver
- Two photon microscopy
- Immunohistochemical staining
  - Macrophages (ED-1)
- Histopathological changes
  - Medial wall thickness, Number of intra acinar arteries
- Westernblot & RT-PCR analysis
  - Kᵥ6.1, Kᵥ6.2, Kᵥ1.7, Kᵥ18.3

Characterization of hUCB-MSCs

- Two-photon microscopy

Immunohistochemical staining

- Macrophages (ED-1)
- Pathologic finding of pulmonary arteries

The number of intra acinar arteries

- Medial wall thickness

Kᵥ6.2 by PCR analysis

Kᵥ1.7 by PCR analysis

Summary

- The effect of MCT injection
  - RV weight ↑, RV/LV+S ↑, No. of intra acinar arteries↑,
  - RV weight ↑, RV/LV+S ↑, No. of intra acinar arteries↑,
  - RV weight ↑, RV/LV+S ↑, No. of intra acinar arteries↑,
  - RV weight ↑, RV/LV+S ↑, No. of intra acinar arteries↑,
  - RV weight ↑, RV/LV+S ↑, No. of intra acinar arteries↑,
  - RV weight ↑, RV/LV+S ↑, No. of intra acinar arteries↑,
  - RV weight ↑, RV/LV+S ↑, No. of intra acinar arteries↑,
  - RV weight ↑, RV/LV+S ↑, No. of intra acinar arteries↑,

- The effect of UCB-MSCs transfection
  - RV weight ↓, RV/LV+S ↓, No. of intra acinar arteries ↓,
  - RV weight ↓, RV/LV+S ↓, No. of intra acinar arteries ↓,
  - RV weight ↓, RV/LV+S ↓, No. of intra acinar arteries ↓,
  - RV weight ↓, RV/LV+S ↓, No. of intra acinar arteries ↓,
  - RV weight ↓, RV/LV+S ↓, No. of intra acinar arteries ↓,
  - RV weight ↓, RV/LV+S ↓, No. of intra acinar arteries ↓,
  - RV weight ↓, RV/LV+S ↓, No. of intra acinar arteries ↓,
  - RV weight ↓, RV/LV+S ↓, No. of intra acinar arteries ↓,

Conclusion

- There was improvements of RVH, mean RV pressure and changes of potassium channel expression levels such as Kᵥ18.3, Kᵥ6.2, Kᵥ1.7 after UCB-MSCs transfection.