Prenatal xenotransplantation of human amniotic fluid stem cells could improve the clinical outcome of type III spinal muscular atrophy

Shaw S, Tsai LK, Cheng PJ, De Coppi P
Chang Gung Memorial Hospital, Taiwan; and Institute for Women's Health, UCL, UK, Taipei, Taiwan

Objective

Human amniotic fluid is a promising resource of pluripotent stem cells and it makes fetal therapy using autologous transplantation possible. Human amniotic fluid stem (AFS) cells are a unique subgroup of human AF-derived stem cells that are isolated by C-Kit immunoselection, and which possess amazing capability of self-renewal and potential to differentiate.

Methods

We designed in-utero transplantation (IUT) into spinal muscular atrophy (SMA) mice using human AFS cells. Adult SMA mice had been proved that could be treated with human AFS by other research group. We transplanted 100, 000 human AFS cells per pup into the type III fetal mice intraperitoneally at E13.

Results

There were 89 fetuses from 9 dams received prenatal cell therapy with 62% survival rate. The results showed the engraft evidence in the PCR, flowcytomery, RNAscopy and immunohistochemistry among multiple fetal organs especially in the skeletal muscles. We showed the better survival after in utero human AFS cells transplantation. The functional tests including rotarod maintenance, tilting degree, grasping force in prenatal treated type III SMA showed significant improvement compared to untreated group.

Conclusion

This is the first study using human amniotic fluid stem cells as cell therapy source for prenatal transplantation into mice SMA model. For the clinical purpose, these cells either with mesenchymal or hematopoietic potential could be obtained prenatally for autologous cell fetal therapy, or storage the cells for postnatally tissue engendering in the future.