NEONATAL PULMONARY RESEARCH

Serum- and xeno-free cryopreservation of human umbilical cord tissue as mesenchymal stromal cell source

Background

Mesenchymal stromal cells isolated from umbilical cord (UC-MSCs) have multi-potential mesenchymal stem cell characteristics and can differentiate into adipocytes, osteoblasts and chondrocytes. These cells are also considered to suppress inflammatory responses or accelerate the repair process in damaged tissues. Because UC-MSCs can be collected in a painless, safe and secure manner they have become one of the major MSC sources for autologous and allogeneic use.
To obtain MSCs, the whole UC is processed immediately after delivery. The authors compare different cryoprotectants to find a suitable cryopreservation method of umbilical cords for clinical use that would yield MSCs that are equivalent to those from fresh umbilical cords in growth and function.

Cryoprotectants:

1) 10% DMSO/1% dextran/ human CB-plasma
2) 10% DMSO/ 90% FBS
3) CELL BANKER 1 plus (ZENOAQ Resource Co, Ltd)
4) STEM-CELLBANKER (ZENOAQ Resource Co, Ltd) (serum- and xeno-free)

The authors compared MSCs of freeze-thawed UC- fragments with those of fresh UC-fragments originated from the same initial donor sample.

Summary of results

The highest yield of cells isolated from frozen-thawed UC was achieved after storage with the cryoprotectant STEM-CELLBANKER, although there were no significant differences among the frozen-thawed UC in different cryoprotectants. Additionally, immersing the UC in STEM-CELLBANKER for 0 to 18h at 4°C before freezing showed no significant differences in the number of cells derived from the thawed UC.
Further experiments were conducted with cells immersed for 3h in STEM-CELLBANKER before freezing in that solution. Both, fresh- and frozen-thawed UC-MSCs showed similar phenotypic characteristics and implemented the minimal criteria of MSCs defined by the International Society for Cell Therapy. The cells are able to differentiate in adipocytes and chondrocytes but not entirely in osteoblasts and are able to inhibit T-cell proliferation in allogeneic mixed lymphocyte reactions.

Strength

This is the first study showing a cryopreservation method of UC tissue in serum- and xeno-free cryoprotectant with cell yields and function equivalent to those from the fresh UC.

Limitations

The authors examined only four UCs in one serum- and xeno-free cryoprotectant. Additional UCs and functional assays for immunosuppressive property and differentiation potencies are required to evaluate possible influences of various pregnancy and delivery conditions together with cryopreservation on that tissue or on cell characteristics. In this study, the UC-fragments were stored at least 2 weeks. It would be interesting to evaluate the quality of the frozen tissue after long-time storage.

Practical conclusion

UC-MSCs may be a tool for treating several disorders. The cryopreservation of umbilical cord tissue would enable isolation of MSCs or cells with unknown potential at later time points for research or when needed in therapy. There will be also the possibility to first check a part

for quality of UC-MSCs before large-scale culturing, to check the original source of MSCs or to repeat MSC-isolations from the same donor-sample with other conditions. Derived from a donor with intractable disease, stored UC-tissue could be used for research or autologous therapy.

Shimazu et al., Serum- and xeno-free cryopreservation of human umbilical cord tissue as mesenchymal stromal cell source. Cytotherapy. 2015; 17: 593-600

Written by: Sarah Koss