Isolation and identification of a new source of human stem cells expanded from pediatric congenital heart disease

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Purpose: During congenital heart surgery, surgeons often need to perform a cardiac incision to repair the defect. When the heart is injured (incision), the healing mechanism of regeneration begins. Therefore, recent evidences had shown that stem cell mobilization is the naturally process after the heart surgery. Current studies also reported the regenerative capacity of human cardiac progenitor cells in young patients with nonischemic congenital heart defects for potential use in congenital heart defect repair. Drainage of blood and tissue fluid from mediastinum and pleural space is a routine practice to establish adequate evacuation of blood after cardiac surgery. Is that possible that we can isolation, identification, and expansion stem cells from the drainage fluid of open heart surgery in children with congenital heart disease?

Methods: We collected the drain fluid in the congenital heart disease patients after surgery. Drain fluids were collected 24 hour and 48 hour after operation in an aseptic container which contained 300 ml of iced saline and was kept at 4°C. We completed the isolation and expansion of stem cells from open heart surgery drain fluids by using the flow cytometry. We also performed the immunocytochemistry study to stem cell markers on drainage fluid-derived stem cells (DDSCs).

Results: We had collected the drain fluid in 37 congenital heart disease patients after surgery were. Patients’ age ranged from 3 days to 43 months. The isolation and expansion of stem cells from open heart surgery drain fluids by using the flow cytometry were done. The average cells yield of the first 24-hour drainage fluid was 6.3 ± 3.0 x 10^6, and 2.2 ± 1.4 x 10^6 for the second 24-hour. DDSCs expressed similar stem-associated cell markers including CD31, CD34, CD45, CD90, CD105, CD117, and CD133. Spindle-like cells spread out on the culture dish On 6-7 days-in-vitro (DIV). Spindle-like cells became confluent with cardiospheres grew on top on 14 DIV. Immunofluorescence staining of CD117 (c-kit) also revealed positive in the cardiospheres (CS), indicating the presence of cardiac stem cells.

Conclusions: The present study has provided a practical method for obtaining autologous human stem cells. Further animal study is important for more clinical cell-based applications.