Transplantation of an allogeneic vein bioengineered with autologous stem cells: a proof-of-concept study
Extrahepatic portal vein obstruction (EPVO)

Impaired hepatopedal blood flow from the superior mesenteric vein, splenic vein, and coronary veins through the portal vein.

SMV...Superior mesenteric vein
RPV...Right portal vein
LPV...Left portal vein
Extrahepatic portal vein obstruction (EPVO)

- Not associated with intrinsic liver disease
- Congenital or acquired
- Predisposition criteria in children
  - Hereditary thrombophilias
  - Neonatal abdominal surgery
  - Sepsis
  - Umbilical vein catheterisation
  - Dehydration

- Clinical manifestation
  - Episodes of upper GI bleeding
  - Splenomegaly

- Complications
  - Variceal haemorrhage
  - Enlarged spleen
  - Biliopathy
  - Developmental retardation
  - Neurocognitive disability
**Diagnosis**
- Abdominal Doppler ultrasonography
- CT angiography

**Surgical restoration**
- Meso Rex bypass using autologous veins

Umbilical veins, **internal jugular veins**, internal iliac, splenic, inferior mesenteric or saphenous veins

Artificial grafts and cryopreserved veins → shortcomings and little success.
Patient

- 1-year-old girl
  - Developed thrombocytopenia and splenomegaly
  - Diagnosis: idiopathic thrombocytopenic purpura

- At 9 years
  - International normalized ratio (INR): 1.4
  - Protein C & Protein S: normal
  - Activated protein C resistance: none
  - Elastography
  - CT angiography:
    - Portal vein thrombosis
    - Open superior mesenteric vein

Enlarged spleen and collaterals
Collaterals feeding the portal vein
Intrahepatic portal flow
72h rinsing of tissue

Vessel decellularization

- 3h incubation with triton X
- 3h incubation tri-n-butyl phosphate
- 3h incubation in deoxyribonuclease I

Lumen decellularization

- Lumen filled with Triton X
- 3h agitation at 37°C
- Washing with PBS
- 3h incubation with tri-n-butyl phosphate
- 3h incubation with DNAse
- Washing with distilled water overnight to remove cell debris.
Gross morphology and histology of the iliac vein

Before
decellularization

After
decellularization
Histogram: absence of binding of anti-endothelial cell antibodies in serum
Immunofluorescence staining

Endothelial cells

Smooth muscle cells
Seeding of allogeneic vein
Recellularization of first vein graft
1st surgical procedure
9 month follow-up: vein lumen decreased
Recellularization of second vein graft
2nd surgical procedure
Follow-up – 1 year

- Patient’s height and weight increased.
- No neurocognitive tests done
- Physical activity enhanced
- Articulated speech improved
- Concentration power in school activities developed

Risk of postoperative thrombosis

- Monitoring the graft → ultrasounds daily postoperatively & heparin

Change in graft:
- Lumen was adjusted to the lumen on the portal side of the anastomosis.
- The flow velocity did not change during this period.
- Initial circulation to the right lobe was improved after about 2 weeks
Thank you for your attention!