ANATOMICAL STUDY OF THE CHONDROCOSTAL GRAFT VASCULARIZATION

Chrosciany Sacha, Hardy Jeremy, Bernard Jean-Philippe, Mathieu Pierre-Alain, Marcheix Pierre-Sylvain, Mabit Christian

Laboratory of Anatomy, Faculty of Medicine, Limoges Dupuytren University Hospital, Limoges, France.
Introduction:

Hyaline Cartilage: avascular, non-innervated -> Poor intrinsic regeneration
Cartilaginous defects (traumatic/degenerative) = therapeutic challenge (young patients++)

Some Teams: works on autografts with non-vascularized osteochondral cartilage grafts:
- Rhizarthrosis
- Kienböck disease
- Articular distal radius vicious callus

Problem: bony metaplasia at mid-term

Vascularized osteochondral graft:
- Long-term viability?
- Histologic stability?
- Better integration?
METHODS:

-> Dissection of 6 chondrocostal grafts, pedicled on the internal thoracic artery, on 4 fresh anatomical subjects

-> Injection of the grafts with:
   - Mix of food gelatin + red pigment + BaSO4 solution (1 injection)
   - Mix of Epoxy resin (R123+R614) + red pigment + BaSO4 solution (5 injections)

-> Drying and fresh storage (48h)

-> Decalcifying of the grafts (bone artifacts on the x-rays tests) with RDO (Rapid Bone Decalcifying)

-> Face + Profile X-rays with suppression of background noise

-> Tomodensitometry (Imation Phillips 64-bar CT-scan, 1/1,3 millimeters sections) + 3D modelling (PACS Telemis software)
DISSECTION (1):

- Incision centered on the 5th rib
- Medioclavicular line
- Cutaneous approach

- Pectoralis major muscle
- Muscle approach

- Exposure of the 5th rib

- Internal Thoracic Artery
- Conservation of an Intercostal muscle « cuff »
- Exposure of the Intercostal space

Prox.  
Lat.
DISSECTION (2):

- Osteotomy of the cartilage part
- Intercostal pedicle ligation
- Internal Thoracic Artery ligation
- Internal Thoracic artery and vein
- Finger dissection of the posterior layer
- The graft is harvested with its proximal pedicle
- Pedicle lengthening by elevation of the adjacent rib
DISSECTION (3)
CHONDROCOSTAL GRAFT VASCULARIZATION: injection 3/4

Visible perichondral vascularization

Anatomical piece

X-Ray analysis

Anastomotic branch

Intercostal artery

Anterior perichondral branch

Profile

Rich anastomotic intercostal network

Superior

Medial

Inferior

Lateral

Rich dorsal and anterior perichondral vascularization
CHONDROCOSTAL GRAFT VASCULARIZATION: the other injections...

Failure of an injection:

- Injection with food gelatin + BaSO4:

- Lack of radiotracer on x-rays and on CT Scan (not concentrated enough):
- No conclusion was possible about perichondral vascularization

Leak of solution on an injection:

- Injection with resin + red carmin + BaSO4:

- Leak due to a failure of an intercostal ligation:

- However, confirmation of an ant. and post. perichondral vascularization
➢ Injections demonstrate **constant vascularization** of the perichondrium by the **internal thoracic artery**

➢ This vascularization is distributed through the **superior and inferior intercostal arteries** (5 out of 5 injections)

➢ Rarely (1 injection out of 5), the posterior perichondrium vascularization comes directly from the internal thoracic artery

➢ Vascularization is **constantly** running on **anterior perichondrium** (5 out of 5 injections)

➢ Vascularization is present on posterior perichondrium on 4 out of 5 injections

➢ The internal thoracic artery caliber is about 2mm: **easy to use as a free flap**

➢ Dissection of the pedicle on an adjacent intercostal space allows to obtain a 7cm-long pedicle: **easy for anastomosis**
**IMPLICATIONS:**

- Anastomosis between superior and inferior intercostal network through ITA
  - \( \rightarrow \) Vertical split

- Anastomosis between anterior and posterior intercostal arteries
  - \( \rightarrow \) Horizontal split

- Resurfacing of small unipolar articular surfaces
- Resurfacing of small bipolar articular surfaces

« Modular flap »
CONCLUSION

- Interesting support in the treatment of cartilaginous substance loss, especially in young patients

- Simple and reproducible harvesting

- Low morbidity on the donnor site

- Many remodelling possibilities, with a « modular vascular flap »

But...

- Voluminous graft

- Long-term viability ? (mechanical stress)
Thank you for your attention