Comparison of Cryopreserved Amniotic Membrane and Umbilical Cord Tissues for use in Foot and Ankle Reconstructive Procedures

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Disclosure

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Background

• Fetal tissue derived products have demonstrated success when used clinically as adhesion barriers during foot and ankle reconstructive procedures.

• Many fetal tissue products consist of the amniotic membrane derived from the amniotic sac of the placenta proper, with some including the underlying chorion.

• Currently, only one fetal tissue product utilizes amniotic membrane derived from the umbilical cord.

• The purpose of this study was to characterize key structural, biochemical, and functional differences between cryopreserved amniotic membrane and cryopreserved umbilical cord tissues that are necessary for their therapeutic potential.
Materials & Methods

• **Materials:**
  • Cryopreserved amniotic membrane (AM; CLARIX™ 100) and cryopreserved umbilical cord (UC; CLARIX™ 1K, Amniox Medical Inc., Atlanta, GA)

• **Methods:**
  • **Histology:** Samples were stained for hematoxylin and eosin, Masson’s trichrome, and Safranin-O
  • **Histochemistry:** Tissue matrix hyaluronic acid (HA) content was measured using HA binding protein (HABP) fluorescent histochemistry
  • **Macrophage functional assessment:** RAW264.7 macrophage proliferation and cell death was assessed in cultures on cryopreserved AM and UC tissues
  • **Inflammatory cytokine levels:** Secreted levels of the pro-inflammatory cytokine, IL-12, and the anti-inflammatory cytokine, IL-10, were measured in RAW264.7 cells cultured on cryopreserved AM and UC tissues
Collagen, non-sulfated glycosaminoglycans, and HA content were similarly distributed across the AM matrix. However, the additional Wharton’s Jelly matrix **considerably increased the amount of all ECM components**
Cryopreserved umbilical cord contains approximately **10-fold higher levels of HA** compared to amniotic membrane.

*Results*
Results

- Cryopreserved AM and UC significantly reduced RAW264.7 macrophage cell proliferation compared to control.
- Cryopreserved UC significantly increased macrophage cell death compared to AM and control.
Results

- Secreted levels of the pro-inflammatory cytokine IL-12 were significantly **reduced in AM and tissues** compared to control. Cryopreserved UC **further decreased IL-12 levels** compared to AM.
- Secreted levels of IL-10, an anti-inflammatory cytokine were **increased in UC tissues** compared to both control and AM tissues.
Discussion

• Cryopreserved umbilical cord tissues contain significantly higher amounts of extracellular matrix components, including high molecular weight hyaluronic acid, that are attributed to the anti-inflammatory and anti-scarring properties of fetal tissues that aid in tissue healing.

• Cryopreserved umbilical cord outperformed amniotic membrane in anti-inflammatory functional assays using RAW264.7 macrophages by reducing macrophage proliferation and increasing macrophage cell death compared to amniotic membrane alone.

• Levels of pro-inflammatory cytokines are significantly decreased while levels of anti-inflammatory cytokines are increased in cryopreserved-UC compared to cryopreserved-AM.
Conclusions

• These results indicate that cryopreserved umbilical cord may offer physiological advantages within the wound environment, ultimately translating to greater clinical efficacy compared to amniotic membrane alone.
References


