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HUMAN AMNIOTIC TISSUE AS AN ANTI-ADHESION, ANTI-FIBROTIC BARRIER IN AN OVINE SPINAL LAMINECTOMY MODEL

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ABSTRACT

Background

One of the first reported uses for human amnion tissue was reported in 1910 for a skin transplant.[1,2] Since then, this unique biomaterial has been used in a variety of ophthalmic, burn and general surgical procedures to prevent adhesions, minimize inflammation and as a temporary covering that facilitates the natural reconstruction and repair of the underlying injured tissue.[3,4,5] One clinical application that has been underappreciated is the capacity of human amnion to prevent adhesions and inflammation in spine surgery. Spinal revisions are often complicated due to the formation of adhesions causing unnecessary dural tears that are costly and time consuming for the surgeon and cause significant patient morbidity. The objective of this investigation was to evaluate whether human amnion tissue prevents adhesions and fibrosis in an ovine spinal laminectomy model.

Material and Methods

Human amniotic membrane (Figure 1) was obtained from consenting scheduled cesarean sections and processed according to proprietary methods. Seven (7) skeletally mature female sheep had a two-level (L2/L3 and L4/L5) dorsal laminectomy procedure performed (n=14). Test article amnion membrane tissues were placed over the laminectomy site with even distribution of membrane orientation (stromal surface toward or away from the spinal cord). A control laminectomy procedure without any membrane placement served as a control group. Animals were followed for eight weeks after surgery and then euthanized. The laminectomy sites were harvested and prepared for histopathological evaluation which included assessments of fibrosis, inflammation (granulomatous and lymphocytic), presence/absence of the membrane and presence of adhesion between the membrane and the dura, and membrane and the defect. The study was performed at Colorado State University.

Results

Histologic evaluation of the control group (Figure 2) sites showed continual fibrosis causing adhesion to the dura. There was minor granulomatous and lymphocytic inflammation within the defect itself. All processed amnion treated sites had fully intact membranes and a lack of adhesions to the epithelial side of the membrane (Figure 3). There was minor-moderate lymphocytic and granulomatous inflammation. There was a trend for less fibrosis when the epithelial was away from the dura as compared to the control or the treated amnion in the opposite orientation. The adhesions between the stromal surface and either the spinal cord dura or the musculature at the laminectomy site was greater compared to sites in which the epithelial surface was adjacent to these tissues.

Conclusion

The results from this study demonstrate that specifically processed human amnion tissue prevented the formation of adhesions, which greatly decreases the probability of a revision procedure due to fibrosis.

Figure 1. Microscopic Anatomy of Human Amnion Tissue[6]

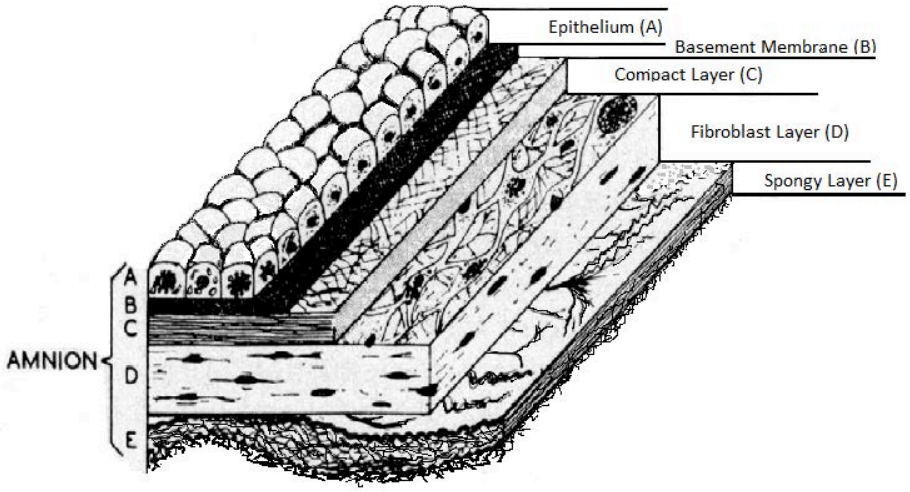
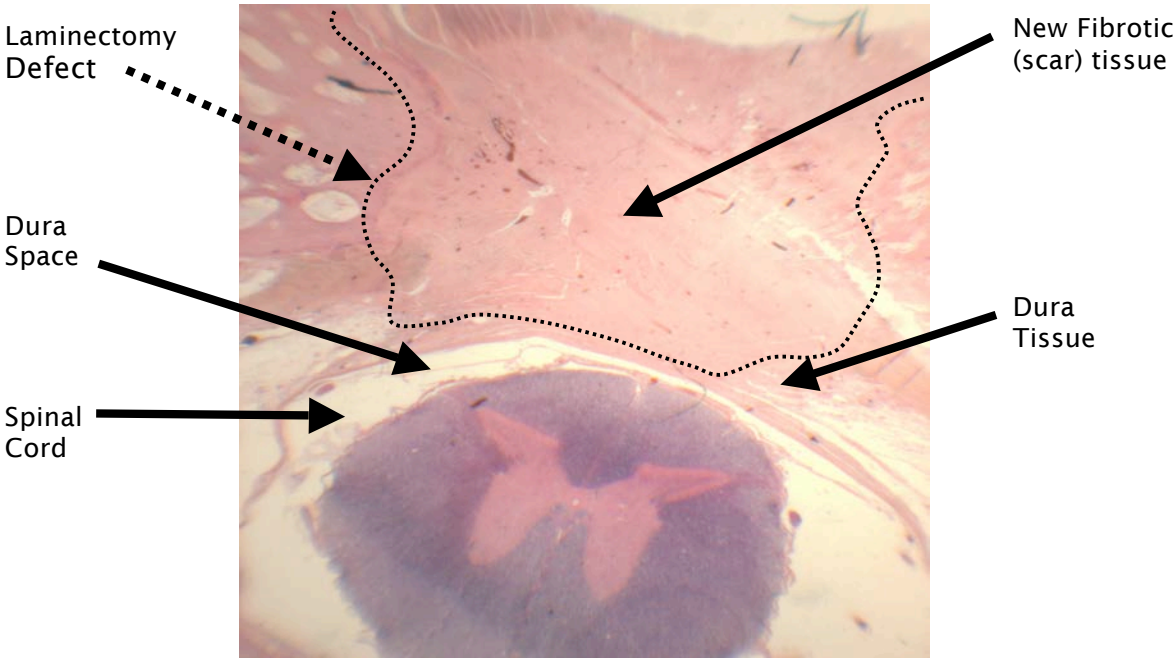
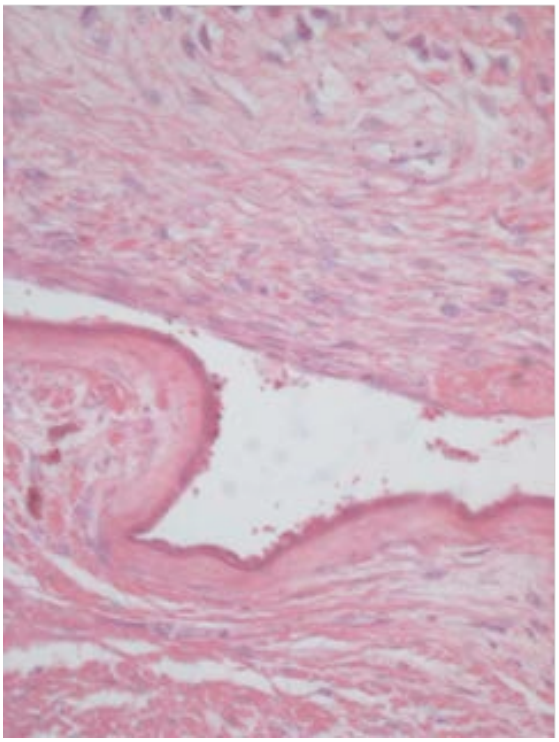


Figure 2. Control Group Histology



The control group shows extensive scar formation and adhesions to the dura.

Figure 3. Epithelial Side Up Away from the Dura



This histophotomicrograph of epithelial away from the dura shows a cleft and lack of adhesion to the fibrotic infill (top). There is tissue congruency between the stromal side of the amnion and the dura (bottom).

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