COSTAL CARTILAGE AUTOGRFTS TO SIMULATED DEGENERATIVE INTERVERTEBRAL DISCS IN THE RAT

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Introduction: Although the exact pathogenesis of disc degeneration is controversial, intervertebral disc disease is thought to be a leading cause of back pain. The pathophysiology of disc degeneration remains unclear and controversial, but it involves the loss of matrix including type II collagen and proteoglycans. The decrease in proteoglycans ultimately results in a dehydrated disc and a subsequent loss of disc height [1,2,4]. Reversal of degenerative disc dehydration is an attractive treatment. We hypothesized that an autograft of costal cartilage to the intervertebral disc (IVD) would expand a previously degenerated IVD space. It seemed reasonable that costal cartilage, which has a matrix consisting of type II collagen and proteoglycans, and is populated with chondrocytes not dependent on a blood supply, might survive transplantation into the degenerated IVD and restore some predegenerative properties.

The purpose of this study was to evaluate costal cartilage transplantation into a degenerated disc as a possible therapy. An autograft of costal cartilage was transplanted into the intervertebral space following two weeks of simulated degeneration by Chondroitinase ABC.

Methods: The University of North Carolina at Chapel Hill Institutional Animal Care and Use Committee approved the following protocol.

The Norcross model of simulated disc degeneration was used for this study [3]. Lyophilized chondroitinase ABC (CABC 27038; Sigma-Aldrich Inc., Allentown, Pa, USA) was prepared as a 0.25 unit/ml study [3]. Chondroitinase ABC treatment had no surgery and served as a control for simulated degeneration.

A control group of 12 rats received chondroitinase ABC treatment with 3-O absorbable suture. Twenty-one days after their designated treatments all rats were sacrificed, and their tails were harvested. Radiographs were again made of the lumbar vertebrae on day 21 (post-sacrifice) radiographs of both the CABC only group and the sham group were not significantly different. A 64% increase in intervertebral disc height was observed in the implant group compared to a 4% increase in sham operated group and a 39% increase in the CABC only group. Histology demonstrated a viable implant in seven out of nine rats. Histologic images from representative implant, sham, and CABC only specimens are seen in Fig 1. The average histologic grading scores for each group are presented in Figure 2. The implant group showed significantly higher average grades than both the sham and CABC groups (P < 0.05).

Discussion: Much work remains to be done, but this study provides evidence that it is possible to successfully transplant costal cartilage to a degenerated IVD. The costal cartilage transplant may serve to rehydrate degenerated intervertebral discs and could possibly serve as an alternative to bone fusion or artificial disc implantation. We believe the response in this model should stimulate further work to investigate cartilage transplantation as a possible treatment for degenerative disc disease.

References:

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