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Metabolic Responses of Degenerative Intervertebral Discs from Patients Undergoing Cervical or Lumbar Spinal Fusions

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INTRODUCTION: Intervertebral disc degeneration encompasses a spectrum of biomechanical and cellular changes that are related to neck and back pain. This study was designed to clarify differences in tissue metabolism between cervical and lumbar IVD disc degeneration by examining basal and cytokine stimulated responses of IVD tissues. It was hypothesized that pro-inflammatory and pro-degradative biomarker production from degenerative lumbar discs would be significantly higher than degenerative cervical IVDs while pro-inflammatory and pro-degradative biomarker production would be further escalated by cytokine stimulation of degenerative IVDs from both sites.

METHODS: With IRB approval, IVD tissues were recovered from patients (n=145, mean age 57 years, 92 female) during surgical intervention. Excised tissues were used to make two explants of combined NP and AF per disc segment with a 6 mm diameter biopsy punch. Explants were cultured for 3 days, and media was collected for biomarker analysis. Mann-Whitney u-tests were used to determine differences between cervical and lumbar tissues.

RESULTS: Without IL-1β stimulation, lumbar explants produced higher concentrations of GRO-α, IL-6, IL-8, MIP-1α, MIP-1β, RANTES, MMP-8, MMP-9, MMP activity, PDGF-AB/BB, VEGF, and lower MMP-7 and PDGF-AA compared to cervical explants. With IL-1β stimulation, lumbar IVDs produced higher concentrations of RANTES, MMP activity, MMP-8, MMP-9, and PDGF-AB/BB compared to cervical IVDs.

CONCLUSION: This data expands on previous studies findings indicating degenerative lumbar IVDs have more pro-inflammatory and degradative basal metabolism compared to degenerative cervical IVDs, while degenerative cervical and lumbar IVDs showed similar metabolic responses to pro-inflammatory cytokine stimulation.