The Effect of Local Anesthetics Administered via Pain Pump on Chondrocyte Viability

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Introduction: Chondrolysis initiated by post-operative, intra-articular pain pumps has recently been described by multiple institutions. This study evaluates the chondrotoxicity of anesthetic formulations commonly used in pain pumps using a physiologically relevant culture system.

Materials and Methods: Freshly isolated human articular chondrocytes were cultured in a custom bioreactor, which mimics metabolism of synovial fluid and medication, for 24, 48, and 72 hour trials. Chondrocytes were perfused in DMEM-10% FBS and one of the following medications: 1% Lidocaine, 1% Lidocaine with epinephrine, Bupivacaine 0.25%, Bupivacaine 0.25% with epinephrine, Bupivacaine 0.5%, Bupivacaine 0.5% with epinephrine. Static and perfusion cultures with growth media were used as controls. All experiments were run in duplicate. Live/Dead staining was performed and the ratio of dead:live cells were assessed by fluorescent microscopy and histomorphometry.

Results: Significantly more chondrocyte necrosis was found in all cultures with medications containing epinephrine (p<0.05) at all time points. 0.25% Bupivacaine along with 1% Lidocaine exhibited similar necrosis rates compared to controls at 24 and 48 hours. However, 0.25% and 0.05% Bupivacaine produced significantly more cell death at 72 hours.

Discussion: 1% Lidocaine, 0.25% Bupivacaine cause minimal chondrocyte necrosis and are likely to be safe when used in pain pumps for a maximum of 48 hours. All anesthetics containing epinephrine (pH≤4), as well as infusion of 0.25% and 0.5% Bupivacaine for 72 hours, were chondrotoxic and cannot be advocated for pain pump use.