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TOXIC EFFECTS OF LOCAL ANESTHETICS ON RAT FIBROBLASTS: AN IN-VITRO STUDY

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Background: Infusion catheters are often utilized to control pain after arthroscopic shoulder surgery, facilitating a controlled infusion of local anesthetic into the subacromial space. Although infusion of anesthetic can provide efficacious pain control, the potential effects on fibroblasts, which promote tendon healing, are unknown. This experiment sought to assess the toxicity of varying local anesthetics to fibroblasts and the potential impact on tendon repair.

Methods: Rat synovial fibroblasts were cultured in 12-well plates. Dilutions of the appropriate drug were prepared in a solution containing reduced-serum media and 0.9% sodium chloride in 1:1 concentration. Each well was treated with 500µl of the appropriate anesthetic dilution or normal saline control for 15 or 30 minutes. Anesthetic dilutions included: 0.5% ropivacaine HCl, 0.2% ropivacaine HCl, 1% lidocaine HCl and epinephrine 1:100,000, 1% lidocaine HCl, 0.5% bupivacaine HCl and epinephrine 1:200,000, and 0.5% bupivacaine HCl. This was replicated three times. Cell viability was determined using propidium iodide, and viable cells were counted with flow cytometry. Dilution of each local anesthetic whereby 50% of the cells were unviable (Lethal dose 50 [LD50]) was analyzed.

Results: LD50 was reached for most local anesthetics, with toxicity increasing in the following order: ropivacaine 0.5% (toxic at 30 minutes), lidocaine 1% with epinephrine (toxic at 30 minutes), lidocaine 1% (toxic at 15 and 30 minutes), bupivacaine 0.5% (toxic at 15 and 30 minutes), and bupivacaine 0.5% with epinephrine (toxic at 15 and 30 minutes). Cells treated with ropivacaine 0.2% did not reach LD50, remaining viable at 15 and 30 minutes of treatment. Overall, increased duration of exposure to each anesthetic resulted in an increased deleterious impact on cell viability.

Conclusions: Pain pumps have become popular given their efficacy and ease of placement, which are key in when performing outpatient shoulder surgery. However, our findings suggest that local anesthetics are toxic to rat fibroblasts in-vitro, thus may prohibit fibroblast promotion of healing such as in the setting of rotator cuff repair. Should a continuous infusion of local anesthetic be used, our data supports ropivacaine 0.2%.