

Paper #10

Effect of Lidocaine on Torn Rotator Cuff Tendon

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Summary:

The present study investigated the influence of lidocaine (LD) on rotator cuff tear, and demonstrated that LD decreased cell proliferation and viability in vitro, inducing a delay of the collagen organization and decreased of biomechanical strength in vivo. Thus, physician should recognize these effects of LD when used in the clinical settings.

Abstract:

Introduction

Rotator cuff tear (RCT) is a common disease in the middle and elderly person. Local anesthetics and anti-inflammatory agents are frequently injected into the subacromial bursa or glenohumeral joint in patients with RCT. Although local anesthetics including lidocaine (LD) can be toxic to tendon fibroblasts, its effect on RCT remains unclear. Therefore, the purpose of the present study was to determine the effects of LD on tendon fibroblasts in RCT in vitro and in vivo.

Methods

In vitro analysis: Human rotator cuff tissues were obtained from 13 patients (mean age 64.3 ± 8.2 years) during surgery, subjected to culture and cell proliferation and cell viability assays.

In vivo analysis: Bilateral partial cuff tear was made on the supraspinatus tendon in Sprague-Dawley rats (N=30: 60 specimens). Then, lidocaine (1.0%) was injected onto the torn tendon and PBS in the opposite side (control). The animals were sacrificed at 2, 4 and 8 weeks after the surgery: 36 specimens were used for biomechanical testing and 18 specimens for histologic analysis. Six specimens 24 h after the surgery were used for electron microscopy.

Results

Cell proliferation: Compared with control, LD significantly decreased cell proliferation in a dose-dependent manner ($p < 0.01$).

Cell viability: LD significantly decreased cell-viability (% Live cells: 75.0 ± 7.0), compared with the control (%Live cells: 86.9 ± 8.0).

Biomechanical strength: All specimen tested failed at the tendon-bone interface. At 2 and 4 weeks after surgery, the ultimate load to failure in the LD group was significantly decreased than in the control group ($p < 0.05$). At 8 weeks after the surgery, there was no significant difference between 2 groups ($p = 0.109$). At 2 weeks after the surgery, the stiffness in the LD group was significantly decreased than in the control group ($p < 0.01$). At 4 and 8 weeks after the surgery there was no significant difference on the stiffness between 2 groups.

Histological evaluation: Two and 4 weeks after the surgery, the collagen bundles in the control group became more organized than in the LD group. Eight weeks after the surgery, the fibro-vascular tissue was matured in both groups,

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with a normal arrangement of the collagen bundles.

Ultrastructural evaluation: Twenty-four hours after surgery, collagen necrosis and injured tendon fibroblasts were observed at the edge of the torn tendon where LD was directly injected. These changes were not detected in control group.

Discussion & Conclusion

Numerous in vitro studies demonstrate cytotoxic effects of local anesthetics on various cells. However, there have been no studies on the effect of LD on torn rotator cuff tendon; therefore, we evaluated the effects of this agent on the torn tendon, using human- derived tendon fibroblasts and rotator cuff tear model in rat.

As a result, LD significantly decreased cell proliferation and viability in the cultured tendon fibroblasts, inducing a delay of the collagen organization and decrease of biomechanical strength in the animal model. Thus, we conclude that physician should recognize these effects of LD on torn rotator cuff tendon when used in the clinical settings.