The Negative Effect of Tumescent Lidocaine on Lipoaspirate Stem Cell Survival

Joshua J. Goldman, M. D., Wei Z. Wang, M.D., Xin-Hua Fang, M.T., Shelley J. Williams, M.S., Richard C. Baynosa, M.D. Department of Surgery, Division of Plastic Surgery, University of Nevada School of Medicine, Las Vegas, Nevada

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Introduction: Previous, *in vitro* study has shown that lidocaine at clinical concentrations has a significant impact on adipose-derived stem cell (ASC) survival.[1] For large-volume liposuction, patients are often sedated. Lidocaine subcutaneous anesthesia is then unnecessary, and local anesthetic can be administered after performing liposuction. We hypothesized that removing lidocaine from tumescent solution would improve *in vivo* ASC survival.

Materials and Methods: Adults undergoing liposuction on bilateral body areas were included (n=12). Under sedation, liposuction on one side was conducted with standard tumescent (1L of LR with 30ml of 1% lidocaine and 1 mcg/ml epinephrine). Tumescent without lidocaine was infiltrated on the contralateral side. Five milliliter lipoaspirate samples were processed for isolation of the stromal vascular fraction (SVF). Apoptosis and necrosis of SVF were examined by Annexin V-FITC/PI staining and analyzed by flow cytometry. ASC's were also cultured and, after 24h, adherent, viable ASC's were counted. The effect of ropivacaine on ASC survival was compared to PBS control and lidocaine in a cell culture, dose-response model.

Results: From Annexin V-FITC/PI flow cytometry, the lidocaine group showed an average percentage of live ASC's of 68.0±4.0% (28.5±3.8% of apoptosis and 3.4±1.0% of necrosis) as compared to 86.7±3.7% (11.5±3.1% of apoptosis and 1.8±0.7% of necrosis) in the no-lidocaine group ($p = 0.002$). In cell culture, the average number of viable ASC's was also lower in the lidocaine group (367,000±107) as compared to the no-lidocaine group (500,000±152), a 26.6% decrease ($p = 0.04$).

In our dose-response study, ASC survival was significantly lower ($p<0.01$), in a dose-dependent manner, when treated by lidocaine and ropivacaine as compared to the correspondent PBS control. No significant difference was found between lidocaine and ropivacaine.

Conclusions: Excluding lidocaine from tumescent solution significantly improves ASC survival and decreases the apoptotic response. This increased survival may affect fat graft take by increasing angiogensis and enhancing the healing cytokine milieu,[2,3] and it will affect expansion and differentiation of cells for use in research or regenerative medicine by optimizing stem cell harvest.[4]

Ropivacaine, despite having a decreased side effect profile, does not represent an alternative to lidocaine in terms of ASC survival.

References:

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