A Comparative Study of 4 Biomaterials for Improving Cell Engraftment in the Infarcted Myocardium

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Background and Objective: A promising new area of research, cell injection into the heart, has demonstrated modest improvements in cardiac function and repair. A significant problem with injection of cells into the infarcted heart is the low cell engraftment. Thus, we aimed to test the hypothesis that co-injection of cells together with biomaterials into the infarcted myocardium will enhance their retention and survival in the infarct area.

Methods and Results: SD female rats were subjected to MI (n=36). After 7 days, male bone marrow mononuclear cells (2x106) or saline were injected into the scar border zone with 4 injectable biomaterials: affinity-binding alginate+ HGF, collagen, matrigel and hyaluronic acid. Cell retention and survival were assessed in the scar, border zone and remote myocardium (RM), 4 weeks after injection.

The number of donor cells was determined by quantitative real-time PCR of Y chromosome-specific primers. In our hands all rats which received injection of hyaluronic acid, died within 24h from the injection. Co-injection with biomaterials increased cell engraftment. When comparing cell number survived in scar with cells survived in the RM, our results showed that it feasible to find the injected cells in both areas, which indicates the injected cell migrate from the scar to the RM. The results were analyzed as total cell numbers survived in the myocardium (RM+scar) We have found that combination of cells with injectable matrigel or affinity-binding alginate + HGF have enhanced cell retention in the entire myocardium and improved cell survival compared to cells only (p=0.022; one way ANOVA).

Conclusions: Injectable biomaterials seem to improve retention of transplanted bone marrow cells at injection sites. The best improvement in cell retention was at the combination of matrigel with affinity-binding alginate containing HGF.