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Modulation of the Early Host Response to Electrospun Polylactic Acid Matrices by Mesenchymal Stem Cells from the Amniotic Fluid.

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Abstract

Purpose: The reconstruction of congenital diaphragmatic hernia or other congenital soft tissue defects often requires implants. These can be either degradable or permanent, each having their advantages. Whatever type is being used, the host response induced by implants plays a crucial role to determine the outcome. Macrophages are pivotal during implant remodeling; they are plastic and acquire in response to environmental stimuli either an inflammatory status and mediate subsequent fibrosis or a regulatory status and facilitate functional remodeling. Matrices engineered with mesenchymal stem cells (MSCs) have the capacity to modulate the host immune reaction. MSCs are believed to promote constructive remodeling of the implant through a regulatory macrophage response among others. Herein, we evaluate this potential of MSC derived from the amniotic fluid (AF-MSC), an interesting MSC type for neonatal reconstruction, on electrospun polylactic acid (PLA) scaffolds.

Methods: We seeded AF-MSC at a density of $1.10^5/cm^2$ on electrospun PLA matrices and determined cell viability. In vivo, we used cell-seeded or cell-free PLA matrices for subcutaneous implantation in immune competent rats. The host immune response was evaluated by histomorphometry at 14 days postoperatively.

Results: The PLA matrix supported adherence and proliferation of AF-MSC. Fourteen days after implantation, PLA matrices were well penetrated by inflammatory cells, new blood vessels, and collagen fibers. AF-MSC–seeded scaffolds were associated with a similar response yet with a decreased number of eosinophils, increased matrix degradation and collagen fiber deposition compared with controls. The amount of total macrophages and of M2-subtype was similar for all animals.

Conclusion: Electrospun PLA matrices are a suitable substrate for short-term culture of AF-MSC. In rats, addition of AF-MSC to PLA matrices modulates the host response after subcutaneous implantation, yet without a difference in macrophage profile compared with control.