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Optimal delivery route of mesoangioblasts for stem cell therapy in rat model for simulated vaginal birth injury

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Introduction and aim of the study: Stem cell therapy could be used in the treatment for pelvic floor dysfunction, either for treatment or in prevention. For both there is an experimental basis [1,2], yet the mechanism of action, optimal administration route, dose and cell type need to be determined. We aimed to investigate the fate of mesoangioblasts (MABs) when administered via local, intravenous (IV) or intra-arterial (IA) injections, using vaginal birth injury model.

Materials and methods: 30 virgin Sprague-Dawley female rats underwent simulated vaginal birth injury [3]. One hour after the injury, rats ($n = 10$) were randomly assigned to receive 2×106 MABs-eGFP-fLuc either local (perivaginal), IV (tail vein) or IA (bilateral at common iliac arteries). Viable MABs were tracked in vivo in the pelvic area by bioluminescence imaging (BLI) at 0d, 1d and 3 d, and ex vivo in pelvic floor organs and lungs at 3d. Further, in situ tracking of MABs was determined at 3d and 7d by RT-PCR.

Results: Following IV injection, most of the MABs were found in the lungs and tail at all time points. Local injection was associated with the highest amount of MABs at 0d. However in the IA group, the amount of MABs increased significantly at 1d. All groups showed a significant decrease of MABs at 3d, yet with the highest remaining cell number in the IA group.

Interpretation of results: IV injection is the least invasive route, yet the majority of cells can be found in the lungs. IA injection is an interesting route since MABs were found more locally and persisting longer, increasing the likelihood of engraftment. Following local injection there was a quick drop in MABs, yet for unknown reasons.

Conclusions: Intra-arterial injections of MABs resulted in a more efficient homing and distribution of mesoangioblasts in the target organs.

Reference

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Ureidopyrimidinone-polycaprolactone electrospun MESH reinforce rabbit abdominal wall incisional hernia maintains physiological compliance

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Introduction and aim of the study: Electrospun hybrid meshes as the one investigated polycaprolactone (PCL) modified with ureidopyrimidinone (UPy) provide mechanical properties that may be better than standard synthetic materials. We aimed to investigate the medium term biocompatibility and biomechanical effects of rabbit abdominal wall reconstruction using UPy-PCL mesh.

Materials and methods: Twelve New-Zealand rabbits were implanted with electrospun (UPy-PCL; n = 12) or textile light weight polypropylene (PP; n = 12) Two full-thickness abdominal wall defects (30×5) were created, primarily repaired and reinforced with the mesh (40×25 mm). Rabbits were clinically evaluated and harvested at 30 and 90 days (n = 6 implants/group). Gross anatomy was noted (mesh size, adhesions, local complications). Explants were divided for uniaxial biomechanical testing and histology. Slides were semi-quantitatively investigated for fibrosis (Masson's Trichrome), foreign body giant cells (FBGC; H&E), myofibroblasts and vessels (α-SMA).

Results: We did not observe any clinical complications. Both implants were well incorporated, without herniation or infection, although with signs of UPy-PCL degradation (30d: 66%, 90d: 83%). There was an increase in mesh size (PP: 19%, UPy-PCL: 30%) and no adhesions. UPy-PCL had a stiffness closer to native muscle yet lower disruption force. There was more collagen deposition around PP and myofibroblasts and equal amount of vessels at 30days. UPy-PCL induced a vigorous FBGC reaction at 30 days decreasing by 90 days.

Interpretation of results: UPy-PCL electrospun mesh had a stiffness closer to native tissue, however lower disruption force compared to PP. It degrades from 30 days in rabbits.

Conclusions: UPy-PCL electrospun mesh seems biocompatible and has biomechanical properties closer to native tissue than PP. Its macroscopical degradation starts already at 30 days. This suggests that a longer degradation time may be useful.

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