

# **Combined Transplantation of Human Neuronal and Mesenchymal Stem Cells following Spinal Cord Injury**

Transplantation of human fetal neural stem cells (hNSCs) previously demonstrated significant functional recovery after spinal cord contusion in rats. Other studies indicated that human mesenchymal stem cells (hMSCs) can home to areas of damage and cross the blood-brain barrier. The purpose of this article is to determine if combined administration of mesenchymal stem cells and neuronal stem cells improves functional outcomes in rats. The study design was a randomized controlled animal trial. Female adult Long-Evans hooded rats underwent laminectomy at T10 level. Moderate spinal cord contusion at T10 level was induced by the MASCIS Impactor. Four groups were identified. The MSC + NSC group received hMSCs intravenously (IV) immediately after spinal cord injury (acute) and returned 1 week later (subacute) for injection of hNSC directly at site of injury. The MSC-only group received hMSC IV acutely and cell media subacutely. The NSC-only group received cell media IV acutely and hNSC subacutely. The control group received cell media IV acutely and subacutely. Subjects were assessed for 6 weeks using Basso, Beattie, Bresnahan Locomotor Rating Score. Twenty-four subjects were utilized, six subjects in each group. Statistically significant functional improvement was seen in the MSC + NSC group and the NSC-only group versus controls ( $p = 0.027, 0.042$ , respectively). The MSC-only group did not demonstrate a significant improvement over control ( $p = 0.145$ ). Comparing the MSC + NSC group and the NSC-only group, there was no significant difference ( $p = 0.357$ ). Subacute transplantation of hNSCs into contused spinal cord of rats led to significant functional recovery when injected either with or without acute IV administration of hMSCs. Neither hMSCs nor addition of hMSC to hNSC resulted in significant improvement.

## 脊髓損傷後人類神經和間葉幹細胞聯合移植

人類胎兒神經幹細胞移植 (hNSCs) 已經在脊髓挫傷的大鼠中表現出顯著的功能恢復。其他研究表明，人類間葉幹細胞 (hMSC) 能回到損壞的地區，並穿過血腦屏障。這篇文章的目的是確定聯合使用間葉幹細胞和神經幹細胞能否改善大鼠的功能結果。研究設計是一項隨機對照的動物實驗。成年女性 Long-Evans 大鼠在 T10 節段進行椎板切除術。並使用 MASCIS 脊椎衝擊損傷儀在 T10 節段促使中度脊髓挫傷。四組進行了鑑定。MSC+ NSC 組別在脊髓損傷 (急性) 後立即接受 hMSCs 的靜脈注射 (IV)，1 週後再 (亞急性) 在損傷部位直接注射 hNSCs。MSC-組別只在急性情況下接受 hMSC 靜脈注射和在亞急性情況下接受細胞介質。NSC-組別只在急性情況下接受細胞介質靜脈注射和在亞急性情況下接受 hNSC。對照組別則在急性和亞急性情況下接受細胞介質靜脈注射。研究對象在 6 週內利用 Basso, Beattie, Bresnahan Locomotor 計算結果。總共有二十四名研究對象，每 6 人一組。MSC+ NSC 組和 NSC-組與對照組相對 (分別為  $P=0.027$ ， $0.042$ )，在統計學上有顯著的功能改進。MSC-組別與對照組相對並沒有表現出顯著的功能改進 ( $P=0.145$ )。比較 MSC+ NSC 組和 NSC-組，沒有出現顯著性差異 ( $p=0.357$ )。無論有或沒有急性的 hMSCs 靜脈注射，在亞急性階段移植 hNSCs 到脊髓挫傷的大鼠注射時可導致明顯的功能恢復。hMSCs 或在 hNSC 外額外加入 hMSC 也不會導致顯著改善。