

The parkinsonism-inducing neurotoxin MPTP produces severe changes in the cervical spinal cord

Alessia Bartalucci¹, Larisa Ryskalin¹, Paola Parlanti¹, Cristina Demi¹, Giorgio Vivacqua² and Antonio Paparelli¹

¹ Department of Human Morphology and Applied Biology, University of Pisa, Pisa, Italy

² Department of Anatomic, Histologic, Forensic and Locomotor Apparatus, University of Rome "La Sapienza", Roma, Italy

The neurotoxin 1-methyl-4-phenyl-1,2,3,6-tetrahydropyridine (MPTP) is commonly used in experimental parkinsonism due to its capacity to induce degeneration of nigrostriatal dopaminergic neurons and locus coeruleus noradrenaline-containing neurons.

Recently it was demonstrated that administration of MPTP to mice induces spinal cord alterations consisting of changes in the alpha-synuclein immunostaining and loss of motor neurons. Interestingly, a relationship between motor neuron degeneration and motor symptoms has been reported also in Parkinson's disease (PD) patients. On the other hand, several non-motor sensory alterations commonly reported in PD, such as increased spinal nociception and pain sensitivity, numbness, paresthesia/dysesthesia, suggest the involvement of spinal cord pathology in PD.

In the present study we carried out an in-depth investigation of the spinal cord in a mouse model of PD, consisting of a chronic treatment with MPTP. At this purpose, C57Bl mice were treated with MPTP (5 mg/kg x 2 x die) for 21 days and the cervical spinal cord was dissected. Serial sections were collected in a strict anatomical order and analyzed at light microscopy following a stereological-like procedure. Smi-32 positive lamina IX motor neurons and gephyrin-positive lamina VII interneurons were counted throughout the whole cervical tract. Moreover, the immunopositivity for met-enkephalin, which is a marker of central fibers involved in pain transmission, was investigated.

Our results demonstrate that MPTP decrease specific neuronal populations in the spinal cord. Noteworthy, motor neurons were significantly decreased by MPTP administration. These data, joined with finding obtained in human patients suggest that a dysfunction in the spinal cord might play a role in Parkinsonism.

Keywords: Parkinson's disease, spinal cord, mice, stereological procedure.