

The Effects of Minocycline on Spinal Root Avulsion Injury in Rat Model

TAN Yew Chin^{1,3}, SIM Sze Kiat^{1,4}, Hizal Ghazali FAIZUL¹,
Wutian WU², JAFRI MALIN Abdullah^{1,3}

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¹ Department of Neurosciences School of Medical Sciences, Universiti Sains Malaysia, 16150 Kubang Kerian, Kelantan, Malaysia

² Department of Anatomy, Hong Kong University, 21 Sassoon Road, Hong Kong

³ Center for Neuroscience Services and Research, Universiti Sains Malaysia, 16150 Kubang Kerian, Kelantan, Malaysia

⁴ Department of Surgery, Faculty of Medicine and Health Sciences, Universiti Malaysia Sarawak, 94300 Kota Samarahan, Sarawak, Malaysia

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Abstract

Background: The neuroprotective role of minocycline in the treatment of brachial plexus injury is controversial.

Objective: To study the neuroprotective effect of minocycline via different routes in adult Sprague Dawley rats with brachial plexus injury.

Methods: The C7 nerve roots of the animals were avulsed via an anterior extravertebral approach. Traction force was used to transect the ventral motor nerve roots at the preganglionic level. Intraperitoneal and intrathecal minocycline (50 mg/kg for the first week and 25 mg/kg for the second week) were administered to promote motor healing. The spinal cord was harvested six weeks after the injury, and structural changes following the avulsion injury and pharmacological intervention were analysed.

Results: Motor neuron death and microglial proliferation were observed after the administration of minocycline via two different routes (intraperitoneal and intrathecal) following traumatic avulsion injury of the ventral nerve root. The administration of intraperitoneal minocycline reduced the microglia count but increased the motor neuron count. Intrathecal minocycline also reduced the microglial count, with a greater reduction than in the intraperitoneal group, but it decreased the motor neuron count.

Conclusions: Intraperitoneal minocycline increased motor neuron survival by inhibiting microglial proliferation following traumatic avulsion injury of the nerve root. The inhibitory effect was augmented by the use of intrathecal minocycline, in which the targeted drug delivery method increased the bioavailability of the therapeutic agent. However, motor neuron survival was impaired at a higher concentration of minocycline via the intrathecal route due to the more efficient method of drug delivery. Microglial suppression via minocycline can have both beneficial and damaging effects, with a moderate dose being beneficial as regards motor neuron survival but a higher dose proving neurotoxic due to impairment of the glial response and Wallerian degeneration, which is a pre-requisite for regeneration.

Keywords: minocycline, avulsion injury, histological study, microglia