PENGARUH SEKRETOM SEL PUNCA MESENKIMAL INTRAVITREAL TERHADAP EKSPRESI TNF-α DAN DENSITAS SEL GANGLION RETINA PADA TIKUS MODEL NEUROPATI OPTIK TRAUMATIKA

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ABSTRAK

Latar Belakang: Neuropati optik traumatika (NOT) merupakan cedera nervus optikus yang menyebabkan kebutaan permanen akibat hilangnya sel ganglion retina. *Tumor Necrosis Factor-Alpha* (TNF-α) adalah sitokin proinflamasi yang memediasi apoptosis sel ganglion retina pasca cedera. Densitas sel ganglion retina merupakan indikator utama derajat kerusakan neuroretina akibat proses apoptosis tersebut. Bukti kuat mengenai pengobatan standar NOT belum ada hingga saat ini. Sekretom sel punca mesenkimal mengandung faktor neurotrofik dan imunomodulator yang berpotensi sebagai terapi NOT.

Tujuan: Menganalisis pengaruh sekretom sel punca mesenkimal intravitreal terhadap ekspresi TNF-α dan densitas sel ganglion retina pada tikus model NOT.

Metode: Studi *true-experimental*, *post-test only control group*. Empat belas tikus Wistar jantan model NOT (usia 8–10 minggu, berat 200–300 gram) diacak ke kelompok perlakuan (sekretom 5 µL intravitreal) dan kontrol (PBS 5 µL intravitreal), masing-masing n=7, tiga hari pasca induksi cedera. Ekspresi TNF-α dinilai dengan imunohistokimia dan densitas sel ganglion retina dengan pewarnaan hematoksilin-eosin. Data dianalisis dengan *independent sample t-test* dan korelasi *Pearson*.

Hasil: Ekspresi TNF-α signifikan lebih rendah pada kelompok perlakuan (5,743 ± 0,326) dibandingkan kontrol (6,557 ± 0,355) (p = 0,001). Densitas sel ganglion retina signifikan lebih tinggi pada kelompok perlakuan (454,86 ± 69,56) dibandingkan kontrol (311,615 ± 111,57) (p = 0,014). Terdapat hubungan negatif bermakna dengan kekuatan sedang antara ekspresi TNF-α dan densitas sel ganglion retina (r = -0,543; p = 0,045).

Simpulan: Ekspresi TNF-α lebih rendah dan densitas sel ganglion retina lebih tinggi pada kelompok yang mendapat sekretom sel punca mesenkimal intravitreal dibandingkan kontrol, sehingga berpotensi sebagai strategi terapi neuroprotektif pada NOT.

Kata kunci: neuropati optik traumatika, sekretom sel punca mesenkimal, intravitreal, TNF-α, sel ganglion retina

THE EFFECT OF INTRAVITREAL MESENCHYMAL STEM CELL SECRETOME ON TNF-α EXPRESSION AND RETINAL GANGLION CELL DENSITY IN A RAT MODEL OF TRAUMATIC OPTIC NEUROPATHY

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ABSTRACT

Purpose: Traumatic optic neuropathy (TON) is an optic nerve injury causing permanent visual impairment due to retinal ganglion cell loss. Tumor Necrosis Factor-Alpha (TNF-α) is a proinflammatory cytokine mediating retinal ganglion cell apoptosis after injury. Retinal ganglion cell density is a key indicator of neuronal survival. No strong evidence supports a standard TON treatment. This study analyzes the effect of intravitreal mesenchymal stem cell secretome on TNF-α expression and retinal ganglion cell density in a rat TON model, addressing the unmet clinical need for an evidence-based neuroprotective treatment.

Material & Methods: True-experimental, post-test only control group study. Fourteen male Wistar rats modelled for TON (aged 8–10 weeks, 200–300 g) were randomized into treatment (5 µL secretome) and control (5 µL PBS) intravitreal groups, n=7 each, three days post-injury. TNF-α expression was assessed by immunohistochemistry, retinal ganglion cell density by hematoxylin-eosin staining. Data were analyzed using independent sample t-test and Pearson correlation.

Results: TNF-α expression was significantly lower in the treatment group (5.743 ± 0.326) than control (6.557 ± 0.355) ($p = 0.001$). Retinal ganglion cell density was significantly higher in the treatment group (454.869 ± 69.56) than control (311.615 ± 111.57) ($p = 0.014$). A significant negative correlation was found between TNF-α expression and retinal ganglion cell density ($r = -0.543$; $p = 0.045$).

Conclusion: TNF-α expression was lower and retinal ganglion cell density was higher in the secretome group than control, suggesting potential as a neuroprotective therapeutic strategy for TON.