Evaluation of the neuroprotective effects of carvedilol on the expression of inflammatory factors following spinal cord injury in adult male rats

Abstract

Background: Neuroinflammation is one of the important features of secondary spinal cord injury. Inflammasomes are involved in inducing apoptosis and inflammation in various tissues. These complexes initiate apoptosis and inflammation cascades following spinal cord injury.

Aim: Evaluation of the effect of carvedilol (CVL) on the expression of inflammatory factors after spinal cord injury

Materials & Methods: In the in vitro part, the effect of CVL on the expression of inflammatory cytokines in LPS-stimulated BV2 cells was investigated by RT-PCR, ELISA, and Western blot. In the in vivo part, the expression level of the NLRP3 inflammasome complex and inflammatory cytokines in rat models of spinal cord injury was measured using RT-PCR. Also, a locomotor activity evaluation and histological analysis were performed to assess the size of the cavity formed after the spinal cord injury.

Results: The results of the in vitro part demonstrated that carvedilol can reduce inflammatory cytokines and oxidative stress in LPS-stimulated BV2 cells. It also alters the ratio of M1/M2 cells. CVL exerts these effects through the regulation of Notch and PPAR-γ signaling pathways. The results of locomotor activity evaluation and histological and molecular assessment demonstrated that carvedilol could reduce the cavity size of the lesion site and the expression of NLRP3 and NF-kB p65 that were elevated after spinal cord injury.

Conclusion: By affecting the inflammatory complex and inflammatory cytokines, influencing the upstream pathways, and switching microglia toward the M2 phenotype, CVL can reduce inflammation after spinal cord injury and control the rate of cell death and oxidative stress factors.

Keywords: Carvedilol, Spinal cord injury, Inflammation, Inflammasome