

**Olfactory ensheathing cell transplantation combined with  
kinesitherapy for autonomic dysreflexia after spinal cord injury in  
rats**

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**Objective:** To investigate the effect of olfactory ensheathing cell transplantation combined with kinesitherapy on autonomic dysreflexia after spinal cord injury in rats.

**Methods:** 230-250g healthy SD rats were selected to be fed according to the standard of cleanliness. They were completely assigned in different groups: ①Blank group(N=24)-only opened the lamina without spinal cord injury, and then sutured after hemostasis. ②Control group (N=24)-The vertebral plate of them was adopted to establish the level of SD rat T4 impact model of spinal cord injury using the improving Alien's heavy fall device, no therapeutic intervention was given. ③Cell transplantation group (N=24)-After the same model was established according to the above method, a certain volume of OECs suspension was transplanted to the injury location before hemostasis and layered suture. ④Kinesitherapy group (N=24): 1 week after the establishment of the same model, kinesitherapy intervention was started, including trommel reticulate trainer and weight bearing treadmill. ⑤Combined treatment group: After the same model was established according to the above method, a certain volume of OECs suspension was transplanted to the injury location before hemostasis and layered suture, besides, the same intervention as in the kinesitherapy group was performed.

Heart rate and blood pressure of each group were measured by non-invasive

blood pressure testing system. 5 weeks after surgery, the autonomic dysreflexia(AD) model was induced by bladder hyperperfusion in each group, compare with the variation degree of the heart rate and blood pressure of each group. Frozen sections of the injured spinal cord were taken and used for observing the number and morphology of nNOS intermediate neurons in the spinal cord of rats by immunohistochemical PV method. Besides, the expression of NMDAR1, GABA- $\alpha$  1 and AT1R proteins in the medulla oblongata cardiovascular center were detected by using Western blotting method.

**Results:** ①Blood pressure and heart rate monitoring showed that compared with the blank group, after spinal cord injury, the resting blood pressure of other four groups was decreased, and the heart rate was increased ( $P<0.05$ ). In addition to the blank group, overperfusion of the bladder in other groups can induce AD, and the blood pressure rised sharply during the onset of AD with slow heart rate. Among the above four groups, the combined treatment group could improve the resting blood pressure level, reduce the rate of AD induction, and shorten the recovery time of blood pressure after AD induction ( $P<0.05$ ). ②Immunohistochemical staining results showed that after spinal cord injury, the number of nNOS positive intermediate neurons in the injured spinal cord increased with the size increased cell body and nucleus increased. Obviously, compared to the control group, both of the cell transplantation group, kinesitherapy group and the combined treatment group could reduce its expression, especially, the treatment effect of combined group is better than that of the cell transplantation group and kinesitherapy group. ③Western blotting results showed that after spinal cord injury, the expressions of excitatory transmitters such as NMDAR and AT1R proteins in the medulla oblongata cardiovascular center were increased, while the expressions of inhibitory transmitter such as GABA- $\alpha$  1 were decreased. Moreover, only OECs transplantation and only kinesitherapy group had little effect on the changes in the expression of cardiovascular central receptors ( $P<0.05$ ), while the expression in the combined group was significantly changed ( $P<0.01$ ).

**Conclusion:** Spinal cord injury of rats was prone to leading AD, the increased receptor expression of the medulla oblongata cardiovascular central and excited interneurons of injured spinal cord showed closed relation to that. By olfactory ensheathing cells transplantation combined kinesitherapy could obviously reverse interneurons and cardiovascular center receptor, thus effectively improve the autonomic nerve function of the rats after spinal cord injury.

**Key words:** spinal cord injury, autonomic dysreflexia, OECs transplantation, Kinesitherapy, combined treatment