Intratecal administration of nicotinic agonists attenuates pain-related behavior in a rat model of trigeminal neuropathic pain

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Background and Goal of Study

Nicotinic acetylcholine receptors (nAChRs) are widely expressed in the spinal cord and modulate nociceptive transmission. Spinal administration of the nicotinic agonists has been shown to produce antinociception. The contribution of spinal nAChRs in inhibiting the trigeminal neuropathic pain remained unclear. Chronic constriction injury to the infraorbital nerve (ION-CCI) has proven a useful model for trigeminal neuropathic pain. The present study evaluated the possible role of spinal nAChRs in ION-CCI rat model.

Materials and Methods

Surgical procedures

Male Sprague Dawley rats underwent unilateral CCI to the right ION. Two nylon (5-0) ligatures were tied around the ION. A polyethylene (PE-10) catheter was implanted for upper cervical spinal injection of drugs on day 14 after surgery.

Drug testing

The potential anti-allodynic effects from intrathecal administration of a nAChR agonist nicotine and an alpha 7 nAChR agonist PNU 282987 were examined. The role of nAChR and alpha 7 nAChR in these effects was assessed by determine whether the anti-allodynic effects were prevented by intrathecal administration of a nAChR antagonist mecamylamine or an alpha 7 nAChR antagonist methyllycaconitine.

Series of von Frey filaments were used to determine pain hypersensitivity to mechanical stimulation. Withdrawal thresholds were measured before and, 30, 60, 90 and 120 min after drug injection.

Figure 1 Experimental schedule

Results and Discussion

Figure 2 Intrathecal administration of nicotine (nAChR agonist) produced dose-dependent antiallodynic effects. (n=8)
* P < 0.05 compared with vehicle (DW) group.
P < 0.05 compared with 3 µg-treated group.

Figure 3 The anti-allodynic effect of nicotine 10 µg (nAChR agonist) was significantly reduced by mecamylamine 30 µg (nAChR antagonist). (n=8)
* P < 0.05 compared with vehicle (DW) + nicotine 10 µg group.

Figure 4 Intrathecal administration of PNU 282987 (alpha 7 nAChR agonist) produced dose-dependent antiallodynic effects. (n=8)
* P < 0.05 compared with vehicle (DW) group.
P < 0.05 compared with 3 µg-treated group.

Figure 5 The anti-allodynic effect of PNU 282987 10 µg (alpha 7 nAChR agonist) was significantly reduced by methyllycaconitine 10 µg (alpha 7 nAChR antagonist). (n=8)
* P < 0.05 compared with vehicle (DW) + PNU 282987 10 µg group.

Conclusion

The results indicated that spinal nAChRs and alpha 7 nAChRs may play an important role in a rat model of trigeminal neuropathic pain.

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