Acupuncture Reduces Ethanol Inhibition of VTA GABA Neuron Activity and Ethanol Self-Administration: Role of Endogenous Opioids

Jung J. Park
Bryan Blumell
Brian Hoyt
Mandy M. Foote

Follow this and additional works at: https://scholarsarchive.byu.edu/fhssconference_studentpub

Part of the Psychology Commons

The Annual Mary Lou Fulton Mentored Research Conference showcases some of the best student research from the College of Family, Home, and Social Sciences. The mentored learning program encourages undergraduate students to participate in hands-on and practical research under the direction of a faculty member. Students create these posters as an aide in presenting the results of their research to the public, faculty, and their peers.

BYU ScholarsArchive Citation
Park, Jung J.; Blumell, Bryan; Hoyt, Brian; and Foote, Mandy M., "Acupuncture Reduces Ethanol Inhibition of VTA GABA Neuron Activity and Ethanol Self-Administration: Role of Endogenous Opioids" (2010). FHSS Mentored Research Conference. 6. https://scholarsarchive.byu.edu/fhssconference_studentpub/6

This is brought to you for free and open access by the Family, Home, and Social Sciences at BYU ScholarsArchive. It has been accepted for inclusion in FHSS Mentored Research Conference by an authorized administrator of BYU ScholarsArchive. For more information, please contact scholarsarchive@byu.edu, ellen_amatangelo@byu.edu.
INTRODUCTION

Acupuncture of the Shenmen (HT-7) channel has a strong inhibitory effect on ethanol (ETOH)-induced dopamine (DA) release and prevents the reduction of dopamine (DA) by chronic ETOH (Zhao et al., 2006). GABA neurons in the ventral tegmental area (VTA) regulate DA neuron activity and release in the nucleus accumbens (NAcc). They also express mu-opioid receptors (Fig. 1) and their firing rate is inhibited by ETOH and opioids (Fig. 2).

METHODS

ETOH self-administration: ETOH self-administration was performed in daily 30 min session for five days a week (Monday to Friday) during rat's dark cycle. Responses on the active lever produce a 0.1 ml drop of 10% (v/v) ETOH solution to one of the two drinking cups which placed in center panel of operant chamber, whereas responses on the inactive lever were record but had no consequence. Rats were trained to orally self-administer ETOH using the modification of sucrose loading method as previously described (Samson H.H., 1986). The detailed procedure was as follows: 2 to 3 sessions with 10% sucrose, 3 sessions with 2% ETOH in 10% sucrose, 3 sessions with 5% ETOH in 10% sucrose, 4 sessions with 10% ETOH in 5% sucrose. Finally, 10% ETOH alone was presented as the preload. After rats showed stable responding for 10% ETOH and met an established criterion for ETOH baseline responding, behavioral testing was begun. Typically, this required approximately 6-8 weeks following initiation of sucrose training. Acupuncture was given to rats whose baseline responding had been determined prior to the test session. The effect of acupuncture on self-administration were evaluated in a between session and within-subjects Latin square design.

RESULTS

Modulation of VTA GABA neuron firing rate by sensory stimulation vs acupuncture HT-7 (Shenmen) point stimulation

Mu-opioid receptor antagonists block the late inhibition produced by HT-7 stimulation

HT-7 stimulation blocks ETOH inhibition of VTA GABA neuron firing rate

HT-7 acupuncture reduces ETOH-reinforced behavior

SUMMARY AND CONCLUSIONS

- VTA GABA neurons express mu-opioid receptors and are inhibited by opiates.
- Sensory stimulation transiently activates the firing rate of VTA GABA neurons.
- HT-7 (Shenmen) point, but not Tail, stimulation inhibits VTA GABA neuron firing rate with recovery in 5 min, suggesting that stimulation of this specific acupuncture point modulates the activity of midbrain GABA neurons.
- HT-7 inhibition of VTA GABA neuron firing rate is blocked by naloxone, suggesting that HT-7 acupuncture modulates the activity of these neurons via endogenous opioid activation of their mu-opioid receptors.
- HT-7, but not Tail or PC-6, acupuncture, reduces ETOH self-administration.
- HT-7 acupuncture does not affect food reinforcement.
- Morphine abolished the suppressive effect of HT-7 acupuncture on ETOH self-administration, suggesting that there is a complex interaction between endogenous opioids and ETOH for the effects of HT-7 acupuncture on reduction of ETOH self-administration.
- These findings demonstrate that stimulation of specific acupuncture points modulates the activity of GABA neurons in the VTA via mu-opioid receptors and that endogenous opioid activation by acupuncture may be useful in counteracting the rewarding properties of ETOH.
- Particularly, delta-opioid receptor, Naltrindole seems to block the ethanol inhibition of VTA GABA neurons firing rate.

ACKNOWLEDGEMENTS

We would like to thank Dr. Scott Steffen for being a great mentor and teacher.
Special thanks to ORCA and BYU for supporting student research.

Funds for this research were supported by PHS NIH NIAAA grant AA13666 to SCS.