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

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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

Electrophysiology: At 2 in vitro recordings were performed in mature (300-400 g) male Wistar rats. VTA GABA neurons were recorded (filtered at 1-3 kHz, 2000X) with 3M KCl-filled micropipettes under isoflurane anesthesia in a stereotaxic apparatus on an antivibration table and characterized according to spiking characteristics in response toafferent input (Steffensen et al., 1998; Stobbs et al., 2004, Allison et al., 2006; Lassen et al., 2007).

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

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

MORPHINE AND CONCLUSIONS

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.

 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 countering the rewarding properties of ETOH.

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