The Anti-Inflammatory Effect of Auricular Electro-Acupuncture: Characteristics and Mechanism

CHUNG Wai Yeung

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Principal Supervisor: Dr. ZHANG Shi Ping

Hong Kong Baptist University

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ABSTRACT

Background: Acupuncture is a traditional therapy that has been used for treatment of many inflammatory conditions. However, the practice of acupuncture takes many forms, but the relative effectiveness of the different forms of practice have yet been determined. Auricular acupuncture (AA) is one form of acupuncture treatment, and recent clinical studies show that AA can provide better pain relief than body acupuncture in musculoskeletal and post-operative conditions. As with body acupuncture, the underlying mechanism of AA is not clear, although previous studies have suggested that opioid and cholinergic receptors are involved in acupuncture actions. The aim of the current study was to examine the characteristics and possible mechanism of AA in anti-inflammation. The objectives of the current studies were (1) to determine factors affecting the efficacy of AA in a well-established animal model of acute inflammation; (2) to examine the characteristics of AA anti-inflammatory effect; (3) to investigate the possible role of opioid and cholinergic receptors in mediating the anti-inflammatory effect of AA.

Methods: SD rats (200-260g) were anesthetized with chloral hydrate (400mg/kg, i.p.). Inflammation was induced by intraplantar injection of CA (1mg) in the left hind paw. Electro-acupuncture was given to auricular points bilaterally for 45 minutes. The severity of inflammation was assessed by measuring changes in paw volume, and in thermal and pressure pain thresholds. Tissue samples of the inflamed paw were taken at the end of the experiment for the analysis of inflammatory mediators with the Enzyme-Linked Immunosorbent Assay. The possible involvement of opioid and cholinergic receptors was investigated with the pretreatment of naloxone (NX, opioid receptor antagonist) or methylatropine (AT, peripheral cholinergic receptor antagonist).

Results: (1) Points at the anteromedial region of the auricle, which is mainly innervated by vagal afferents, were found to produce consistent anti-edematous
effect, whereas points at other regions were more variable. (2) Stimulation at 0.7-1.0mA was more effective than those of higher or lower intensity. (3) AA given prophylactically, simultaneously or 1 hour after inflammatory induction were all effective. (4) The AA treatment inhibited the increase in paw volume due to inflammation and reduced the pressure hyperalgesia (p<0.05 in both cases). However, no effect was seen in thermal hyperalgesia. (5) The level of IL-1β in paw exudates was reduced by AA, but those in paw skin was unchanged. (6) Administration of methyl-atropine intraperitoneally or at the site of CA-injection attenuated the anti-inflammatory effects of AA. (7) Systemic administration of naloxone had no significant effect on the anti-inflammatory action of AA.

The above results showed that stimulation at a physiological range of intensity at the region innervated by the afferent vagus nerve produced anti-inflammatory effects, which include the reduction vascular extravasation and mechanical hyperalgesia. The antagonistic action on AA anti-inflammation produced by the muscarinic antagonist indicates, for the first time, that the effect of AA was mediated by the muscarinic receptors at the site of inflammation. The opioid receptors seem to play little role in mediating the anti-edematous and analgesic effects observed. To conclude, this study has documented the characteristics of AA effect in a common model of acute inflammation and provided evidence for a novel role of peripheral muscarinic receptors in mediating the anti-inflammatory effect of AA.
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