The difference between electroacupuncture only and electroacupuncture with manipulation on analgesia in rats

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Abstract

Plain acupuncture uses manipulation (rotation or varying the depth of insertion of the needle) to increase its effect. However, in commonly used electroacupuncture (EA), variable manipulations have not been used. This study was performed to investigate the possibility of an increase in analgesic effect by adding manipulation to EA. The pain index used was the Tail±Flick latency (TFL) of the rat, which was lightly anesthetized with thiopental sodium (intraperitoneally). Four types of manipulation were used. Rotation and varying the depth of the needle (RN and VN) was employed using two different types of manipulation during each 20 min stimulation of EA. Each manipulation persisted for 1 min out of every 5 min (long - duration and long - interval: LDLI) or 12 s every 1 min (short - duration and short - interval: SDSI). EA produced an increase in TFL; peak value was 49.7 ± 12.2% of the pre - EA and occurred immediately after cessation of 20 min of EA stimulation. Performing RN or VN combined with EA also increased TFL more than just EA and a greater peak increase in TFL was observed with a SDSI - RN and SDSI - VN as compared to a LDLI - RN and LDLI - VN (77.5 ± 13.8, 79.2 ± 19.8 and 67.3 ± 14.0%, 65.6 ± 23.7% of the pre - EA, respectively). These results indicate that manipulation combined with EA produces a more potent antinociception than when only EA is applied. © 2000 Elsevier Science Ireland Ltd. All rights reserved.

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Since ancient times, one of the most famous physical techniques for relieving pain has been acupuncture [10]. Numerous studies show that acupuncture stimulation increases experimental pain threshold in various animal species [1,6]. The acupuncture analgesic effect has been mediated by descending inhibitory system and endogenous opioid [7]. Also, it has been suggested that acupuncture control the activities of the autonomic nervous system and have a suppressive effect on stress responses [8,12,17]. Recent studies have shown that electroacupuncture (EA) has different analgesic effects according to the parameters of stimulation [16]. Traditionally, plain acupuncture uses manipulation (rotation or varying the depth of insertion of the needle) to increase its effect [18]. However, in EA, manipulation has not been used. This study was performed to investigate the possibility of an increase in analgesic effect by complementing manipulation to EA using rats.

Male Sprague-Dawley rats weighing 250–300 g were housed in cages in a temperature (20 ± 2°C) and light/dark (08:00–20:00 h light, 20:00–08:00 h dark) controlled room and given lab chaw and tap water ad libitum. The rats were slightly anesthetized with thiopental sodium (40 mg/kg) at a level of anesthesia in which the corneal blink and tail flick reflexes were present, but no spontaneous movements or vocalizations occurred [13,16,20]. Supplemental injections of thiopental sodium were not given after the beginning of the tail flick testing protocol. Using this method the rats were kept under a stable anesthesia during the 90 min of the testing period. The intensity of the light bulb was set so the baseline reaction time was 2 ± 0.3 s [19]. The light was turned out as soon as the rat flicked its tail and the time lapse between the onset of irradiation and the flick of the tail could be read directly from the digital display to an accuracy of 0.1 s. The latency was measured from the time of application of a heat spot (4 mm in light

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spot) in a marked part of the rat’s tail. The experiment was performed in the daytime. Thirty minutes after anesthesia was given, five measurements in a 2-min interval were conducted in order to determine the baseline latency of the particular rat. When TFL (Tail–Flick Latency) exceeded 7 s during an experimental procedure, the light bulb was switched off to minimize tissue damage of the tail. The degree of analgesia was expressed as a percentile change in TFL and was determined as follows [5,19]

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\text{Acquired TFL change} = \frac{\text{post.acup. TFL} - \text{control TFL}}{\text{control TFL}} \times 100\%
\]

Through the slight preanesthesia, the baseline was not constant, but showed some decrease as time progressed. In order to level this effect out, the following equation was used when determining the results: Acquired TFL change (%) = TFL change (%) of simple anesthetized rat.

The Zusanli (ST36) point which is located at the anterior tibial muscle and about 10 mm below the knee joint was chosen for the manual acupuncture and also for the electro-acupuncture. This point has been used in clinical practice for tooth pain relief as well as for stomach pain relief and it has been also known to produce an analgesic effect in the tail as related to the noxious thermal Tail–Flick response [9].

For EA, train-pulses (3 Hz, 0.3-ms pulse width, 0.2–0.3 mA) were applied to the inserted needle for the period of insertion. The other needle (anode) was inserted into the anterior tibial muscle at a point 5 mm distal to the first one. Anodal and cathodal leads from a electric stimulator were connected to the two acupuncture needles. For combining manipulation with EA, manipulation was performed during the acupuncture period.

Four types of manipulation were used. Rotation or varying the depth of insertion of the needle was used during each 20 min stimulation period. In RN, the stainless acupuncture needle was inserted vertically through the skin to a depth of about 3±8 mm and occurred immediately after cessation of 20 min of stimulation period. In VN, the needle was sunk and lifted about 5 mm, and then rotated manually right and left three times per second within a depth of about 3±8 mm. Each manipulation persisted for 1 min in every 5 min (long-duration and long-interval: LDLI) and 12 s in every 1 min (short-duration and short-interval: SDSI).

EA produced an increase in TFL; peak increases were 49.7 ± 12.2% of the pre-acupuncture control, respectively, and occurred immediately after cessation of 20 min of acupuncture (Fig. 1). Performing combination combined with EA increased TFL more than EA itself by showing a greater peak increase in TFL. However there were no significant differences between the two types of manipulation used (Fig. 1). Performing both RN and VN combined with EA also increased TFL more than EA itself and a greater peak increase in TFL was observed with a SDSI-RN and SDSI-VN as compared with a LDLI-RN and LDLI-VN (77.5 ± 13.8, 79.2 ± 19.8 and 67.3 ± 14.0%, 65.6±

![Fig. 1. EA (n = 6), group of electroacupuncture where train-pulses (3 Hz, 0.3-ms pulse width, 0.2–0.3 mA) were applied for 20 min into a Zusanli (ST36) acupuncture point which is located at the anterior tibial muscle about 10 mm below the knee joint; EA+RN (n = 6), group of EA combined with rotation methods; EA+VN (n = 6), group of EA combined with varying the depth of the needle methods. *P < 0.05 analyzed by ANOVA and Bonferroni test for comparison of EA with EA+RN or EA+VN groups. Both manipulations enhanced the analgesic effect of EA without any significant difference between rotation and varying the depth of the needle method.](image)
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