

EXPERIMENTAL STUDY

Effect of manual acupuncture on bowel motility in normal kunming mouse

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Abstract

OBJECTIVE: To observe the effects of acupuncture on motility of jejunum and distal colon at different acupoints on normal Kunming mice.

METHODS: The jejunal and colorectal motor activity of forty Kunming mice were recorded by the intra-intestinal capsule. The capsules contained with distilled water were placed into the cavities of jejunum and distal colon. The changes of bowel were compared with the background activity recorded before any stimulation. The chosen acupoints were as follows: Zusanli (ST 36) on the lower legs, Tianshu (ST 25) on the mid-lower abdomen.

RESULTS: Manual acupuncture (MA) at Zusanli (ST 36) significantly promoted the motility of jejunum and distal colon (manifested as increased change rate of average amplitude and increased change rate of mean area under the contractile curve) of

normal Kunming mice ($P < 0.01$). MA at Tianshu (ST 25) significantly inhibited the motility of jejunum (manifested as decreased change rate of average amplitude, decreased change rate of mean area under the contractile curve, and the reduced frequency) of normal Kunming mice ($P < 0.01$), while significantly increased the distal colonic motility (manifested as increased amplitude and increased mean area under the contractile curve) of normal Kunming mice ($P < 0.01$).

CONCLUSION: MA at specific acupoints [Zusanli (ST 36), Tianshu (ST 25)] has different effects on the motility of jejunum and distal colon, which might involve the segmental innervations of the related nerve.

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Key words: Hand acupuncture; Point ST 36 (Zusanli); Point ST 25 (Tianshu); Gastrointestinal motility

INTRODUCTION

Acupuncture has been used in China for more than 3000 years.^{1,2} It has been tried against various diseases, including gastrointestinal (GI) disorders. A large amount of experimental and clinical evidence indicate the effectiveness of acupuncture in treating GI diseases, such as diarrhea,^{3,4} constipation,^{5,6} irritable bowel syndrome (IBS),⁷⁻⁹ and functional bowel disorder (FBD).¹⁰ Though there were vast researches on the acupuncture treatment of bowel diseases, the evidence about the role of acupuncture on bowel motility of rodents in normal state, especially for the mice, did not abound. Previous studies have demonstrated the effects of acupuncture stimulation on gastric motility in anesthe-

tized rats.^{11,12} Nevertheless, rare experiments were carried out to record the motility of jejunum and colon of rodents *in vivo*, and even less studies relating to the effects of acupuncture on that kind of bowel motility were reported.

The aims of this study were to investigate the effects and underlying mechanisms of acupuncture Zusanli (ST 36) or Tianshu (ST 25) on intestinal and colorectal motility of Kunming mice in normal state.

MATERIALS AND METHODS

Animals

Adult male mice of specific pathogen-free grade [Kunming mice, (20 ± 2) g] were obtained from China Academy of Military Science [Certificate of quality No. SCXK-(Army) 2012-0004]. Animals were housed 3-4/cages and maintained under controlled conditions of temperature (22-25) °C and light (6 AM on, 6 PM off) and fed ad libitum with standard rodent chow and tap water. All protocols were approved by the Institutional Animal Care and Use Committee of China Academy of Chinese Medical Sciences.

Drugs and Instruments

Urethane was purchased from Sinopharm Chemical Reagent Co., Ltd., (Shanghai, China). Miniaturized solid-state pressure transducer catheter TSD104A (Biopac Inc., Goleta, CA, USA) and transducer amplifier MP150CE were from Biopac Inc (Goleta, CA, USA). Transducer control unit 1401, Micro 1401 interface, and Spike 2 version 7 data acquisition software were from Cambridge Electronic Design Limited (Cambridge, England). Acupuncture needles (0.3 mm in diameter) were from Suzhou Medical Appliance Factory (Suzhou, China).

Animal preparation

Mice were anaesthetized with urethane [10%, 2 g/kg, intraperitoneally (ip)]. A miniaturized solid-state pressure transducer catheter with a water capsule in the end was inserted into the lumen of the jejunum through the incision on the intestinal surface. Another catheter of the same type was inserted into the distal colon through the anus. The capsules were placed 1.5 and 1 cm above the incision of jejunum and the anus, respectively.

Data acquisition and analysis

Each miniature pressure transducer catheter was connected to a transducer control unit, whose output signal was subsequently amplified further using a transducer amplifier in differential mode. This output was acquired *via* a Micro 1401 interface and recorded using Spike 2 version 7 data acquisition software.

Experimental protocols

All experimental studies were conducted in adult over-

night fasted mice which were anesthetized with urethane (10%, 2 g/kg, ip) and there after kept on a thermostatically controlled electric heating pad for experimental animal to maintain body temperature within 39-41 °C. Thirty mice were randomly designated into two groups: Jejunum recording group ($n = 15$), and Distal colon recording group ($n = 15$). Mice were left undisturbed for at least 30 min after intra-intestinal placement of the pressure transducer catheter and the water capsule. At the end of the experiment, all of the mice were euthanized by an overdose of ip urethane (40%).

Acupuncture procedure in anesthetized mice

After recording of basal intestinal contractions for at least 30 min, acupuncture was performed. Needles were inserted to a depth of 5 mm into the skin and underlying muscles at either Zusanli (ST 36) or Tianshu (ST 25) points. Zusanli (ST 36) is located at 5 mm lateral and lower from the anterior tubercle of the tibia in mice.¹³ Tianshu (ST 25) is located 20 mm above the symphysis pubis and 5 mm lateral from the midline in mice.¹⁴ For each mouse in both two groups (Jejunum recording group and Distal colon recording group), acupuncture needles were inserted unilaterally into both Zusanli (ST 36) and Tianshu (ST 25) acupoints, and were twisted, lifted and thrust manually at a frequency of 2 Hz¹⁵ for 30 s (Jejunum recording group) or 60 s (Distal colon recording group).

It's important to note that acupuncture stimulation in Zusanli (ST 36) and Tianshu (ST 25) was not operated in the same time. We stimulate one point [Zusanli (ST 36) or Tianshu (ST 25)] for 30 s, then stop stimulation for a while, and stimulate the other point after the intestinal contractions returned to the basal level. Repeat such operation three times.

Statistical analysis

All the data in the present study were expressed as means ± standard deviation ($\bar{x} \pm s$), and analyzed by two-tailed Student's *t*-test or one-way analysis of variance with SPSS software 13.0 (IBM, Armonk, NY, USA). The least significant difference test was used to compare mean values among groups. $P < 0.05$ was considered significant.

RESULTS

Effect of manual acupuncture (MA) on the contractility of jejunum

Spontaneous jejunal pressure was monitored for 2 h after insertion of the manometric catheter into the jejunum cavity in a total of 15 urethane anesthetized Kunming mice (Figure 1).

MA at Zusanli (ST 36) significantly promoted the jejunum motility of normal Kunming mice. Both the change rate of average amplitude and the change rate of mean area under the contractile curve (AUC) during

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