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Effect of Traditional Acupuncture on Canine Gastric Motility

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Abstract : The effect of traditional acupuncture on gastric motility was investigated in dogs. Six healthy dogs, of mixed breed, were used in this study. The gastric motility was evaluated by electrogastromyograms (EGMG) of the smooth muscle of the pyloric region. The acupoints investigated were ST-36, ST-40, ST-41, ST-42, ST-45, BL-21 and CV-12. The gastric motility was increased by traditional acupuncture at ST-36 and BL-21 but decreased by traditional acupuncture at CV-12. However, there were no significant changes in the gastric motility after acupuncture at ST-40, ST-41, ST-42 and ST-45.

Key words : traditional acupuncture, acupoints, gastric motility, dog

Introduction

Numerous studies have documented the efficacy of acupuncture in the treatment of gastrointestinal disorders. Stimulation to acupuncture points has various physiological effects on the gastrointestinal system, including gut motility and secretions[4-7].

Acupuncture has a diverse effect on gastrointestinal motility. The regulatory effect of intestinal peristalsis, which is accelerated by vagostigmin, was significantly suppressed, while its suppression by atropine was significantly accelerated, by stimulation with acupuncture or moxibustion[7]. Qian et al10 reported that electroacupuncture at ST-36 and PC-6 in dogs enhanced the gastric migrating myoelectrical complex by decreasing the length of phase I and increasing the length of phases II and III. On the other hand, Kudo *et al*[5] reported that the gastric contraction was depressed by the stimulation of BL-19 in dogs.

There have been few studies on the effects of traditional acupuncture on gastric electrical activity in dogs. The purpose of this study was to investigate the effect of traditional acupuncture on the fed-state gastric myoelectric activity in dogs.

Materials and Methods

Experimental animals

Six healthy dogs, of mixed breed, weighing between 10 and 21 kg and aged between 2 and 5 years, were used in this study. The dogs were raised in cages, and fed regularly at 9 am.

Electrodes implantation

The dogs were premedicated with acepromazine (0.1 mg/kg, IV, Sedaject®, Samwoo Co, Korea) and atropine sulfate (0.05 mg/kg, SC, Atropine®, Samil Pharm Co, Korea). Ampicillin (20 mg/kg, IV, Penbrex®, Samyang Pharm Co, Korea) and enrofloxacin (5 mg/kg, SC, Baytril®, Bayer Korea, Korea) were administered prior to the induction of anesthesia with a bolus injection of thiopental sodium (15 mg/kg, IV, Penthotal sodium®, Joongwei, Korea). The dogs were intubated, and anesthesia was maintained at a surgical plane with isoflurane (Aerane®, Ilsung, Korea). Lactated-Ringer solution (Hartmann®, Daehan Pharm Co, Korea) was infused at a rate of 10 ml/kg/h during the operation. The dogs were placed in dorsal recumbency position for a midline celiotomy. A pair of silver cup electrodes (E6SH, Grass, USA) were implanted between the seromuscular and mucosal layers of the pylorus, with a 5 mm distance between each electrode. The distal ends of the electrodes were placed in the right flank through the subcutaneous tunnel.

Recording of electrogastromyograms (EGMG)

Recordings of gastric electrical activities were initiated the 8th day after the electrode implantation. Twenty minutes after the dogs were fed, the EGMG was recorded for 60 min prior to and 90 min following acupuncture stimulation or medical treatment with either atropine sulfate (0.05 mg/kg, IM), or metoclopramide (1 mg/kg, IM, Meteran®, Dongwha Pharm, Korea) using a physiograph (Narco Biosystem, USA).

Acupoints and stimulation

Acupuncture needles were applied for 20 min to each of the 7 important acupoints ST-36, ST-40, ST-41, ST-42, ST-45, BL-21 and CV-12, which are known to be associated with gastric function. The locations of each acupoint are as follows: ST-36; three-sixteenth the distance from the depression on the ventral margin of the patella to cranial tarsus, about one digit breadth lateral to the tibial crest, in the lateral portion of the cranial tibial muscle, ST-40; at the midpoint of the

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line between the ventral margin of the patella and the lateral malleolus of the fibula. The point is between the muscles of the cranial tibia and the long digital extensor, ST-41; on the dorsal aspect of the tarsal joint, in a depression between tendons of the cranial tibia and the long digital extensor muscle, ST-42; on the dorsal aspect of the tarsal joint, at the junction of the second and third tarsal bones and the bases of the second and third metatarsal bones, ST-45; on the lateral coronary border of the second phalanx, at the base of the nail, BL-21; lateral to the caudal border of the spinous process of the thirteenth thoracic vertebra, along the longitudinal line of the costal tubercula, CV-12; at the midpoint between the xiphoid process and the umbilicus.

Results

Diurnal changes in gastric motility

The electrogastromyograms (EGMG) of the smooth muscle of the pars pylorica had a regular and continuous rhythm for 3 hours following feeding. A 21 hour EGMG recorded 3 hours after feeding, until the next feeding time, showed an irregular rhythm (dysrhythmia). The irregular EGMG returned to the regular and continuous pattern following feeding.

Effect of medical treatment on gastric motility

Intramuscular administration of atropine sulfate, at a dose of 0.05 mg/kg, suppressed the gastric motility (Fig 1). Dysrhythmia, with a mild elevation of the slow-wave, was shown after intramuscular administration of metoclopramide(1 mg/kg) (Fig 2).

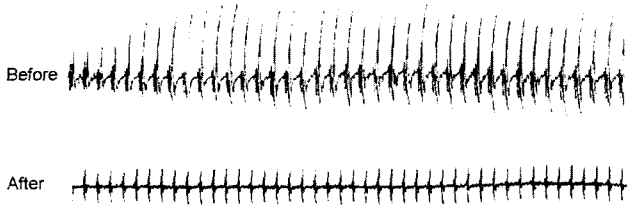

Fig 1. Electrogastromyograms after intramuscular administration of atropine sulfate at a dose of 0.05 mg/kg in a dog. Gastric motility was decreased.

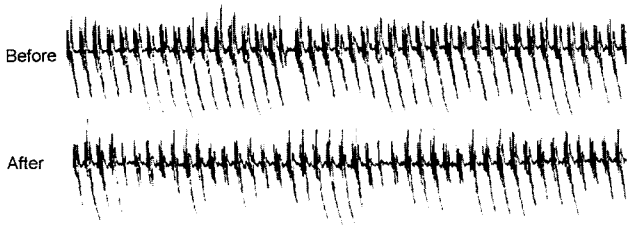

Fig 2. Electrogastromyograms after intramuscular administration of metoclopramide (1 mg/kg). Dysrhythmia with mild elevation of slow-wave was shown.

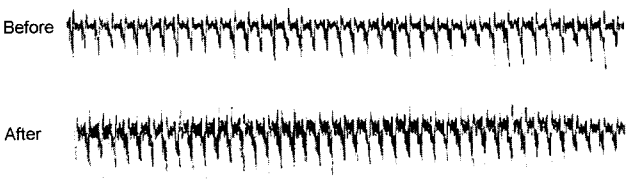

Fig 3. Electrogastromyogram following traditional acupuncture at ST-36 in a dog. Increased gastric motility was observed. ST-36; Three-sixteenth the distance from the depression on the ventral margin of the patella to cranial tarsus, about one digit breadth lateral to the tibial crest, in the lateral portion of the cranial tibial muscle.

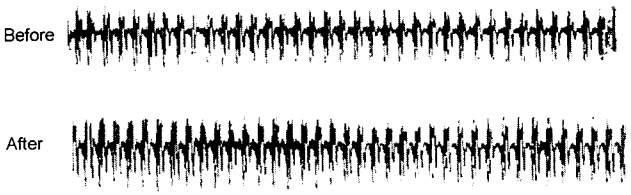

Fig 4. Electrogastromyogram following traditional acupuncture at ST-40 in a dog. There was no significant change in gastric motility after acupuncture. ST-40; At the midpoint of the line between the ventral margin of the patella and the lateral malleolus of the fibula. The point is between the muscles of the cranial tibia and the long digital extensor.

Fig 5. Electrogastromyogram following traditional acupuncture at ST-41 in a dog. There was no significant change in gastric motility after acupuncture. ST-41; On the dorsal aspect of the tarsal joint, in a depression between tendons of the cranial tibia and the long digital extensor muscle.

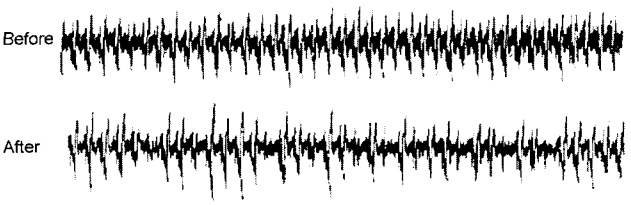

Fig 6. Electrogastromyogram following traditional acupuncture at ST-42 in a dog. There was no significant change in gastric motility after acupuncture. ST-42; On the dorsal aspect of the tarsal joint, at the junction of the second and third tarsal bones and the bases of the second and third metatarsal bones.

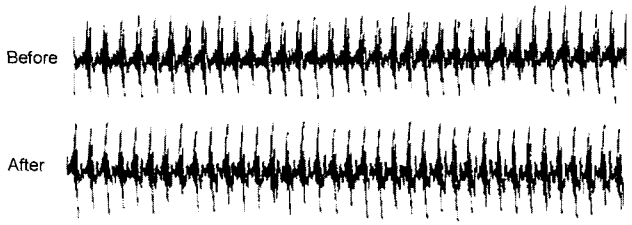

Fig 7. Electrogastromyogram following traditional acupuncture at ST-45 in a dog. There was no significant change in gastric motility after acupuncture. ST-45; On the lateral coronary border of the second phalanx, at the base of the nail.

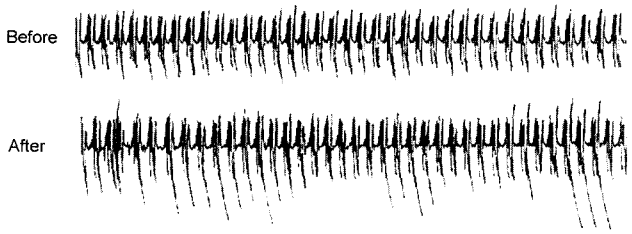

Fig 8. Electrogastromyogram following traditional acupuncture at BL-21 in a dog. Increased gastric motility was observed. BL-21; Lateral to the caudal border of the spinous process of the thirteenth thoracic vertebra, along the longitudinal line of the costal tubercula.

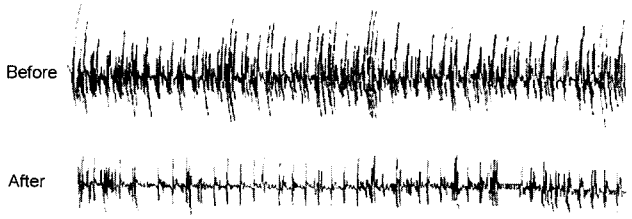

Fig 9. Electrogastromyogram following traditional acupuncture at CV-12 in a dog. Gastric motility was decreased after acupuncture. CV-12; On the ventral midline of the abdomen, at the midpoint between the xiphoid process and the umbilicus.

Effect of traditional acupuncture on gastric motility

The gastric motility was increased by traditional acupuncture at ST-36 (Fig 3) and BL-21 (Fig 8), but was decreased by traditional acupuncture at CV-12 (Fig 9). There were no significant changes in gastric motilities following acupuncture at ST-40 (Fig 4), ST-41 (Fig 5), ST-42 (Fig 6) and ST-45 (Fig 7).

Discussion

Electrogastromyography of the seromusculo-mucosal layer of the pars pylorica (seromusculo-mucosal EGMG) showed different waveforms from that of the serosa. Two kinds of waveforms for gastric electrical activity can be detected from the serosal EGMG; a basic electrical rhythm (BER), and a burst of action potentials (AP)[5]. Action potentials are superimposed on the cycles of BER and always appeared just after the triphasic complex. When a peristaltic contraction occurs at the stomach, AP accompanies BER[2]. The greater the amplitude and duration of the AP burst, the greater the strength and duration of the contractions was observed. The present study showed a seromusculo-mucosal EGMG. Two waveforms were shown in this study, AP and BER. The amplitude of the AP was greater than that of the BER. Following administration of atropine, gastric contractile activity was completely abolished, and only the BER was recorded on the seromusculo-mucosal EGMG.

Metoclopramide has been widely used for the treatment of proximal gastrointestinal tract motility disorders[1]. Jean *et al*[3] reported that metoclopramide did not alter gastric contractile activities in normal dogs or in dogs with gastric dilatation volvulus (GDV) following surgical treatment.

In the present study, the gastric motility was accelerated by traditional acupuncture only at ST-36, but remained unchanged at ST-40, ST-41, ST-42 and ST-45. There have been several studies on the effects of ST-36 on gastric functions[4,9,10]. Qian *et al*[10] reported that electroacupuncture at ST-36 enhanced the gastric electric activity by reducing the length of phase I and increasing the length of phases II and III.

BL-21 (Weiyu) is known to have therapeutic effects on gastric distension, gastric torsion, gastritis, gastric ulcers, vomiting and abdominal pain. Nam8 reported that electrical stimulation of BL-21 greatly increased the ruminal contractile movement in cattle, and had good effects on ruminal atony and tympany. Kudo et al5 reported that electrical stimulation of BL-19 (Weiyu, author's description) suppressed gastric contraction in dogs. In the present study, acupuncture at BL-21 greatly enhanced gastric motility in dogs.

The gastric motility was severely suppressed by traditional acupuncture at CV-12. In human practice, CV-12 has been known to have therapeutic effects on vomiting, indigestion, gastric ulcers, and on acute and chronic gastritis, but there are few reports concerning the depression of the gastric motility by acupuncture at this acupoint in dogs. Sato *et al*[11] showed that gastric motility was inhibited by acupuncture-like stimulation applied to the abdomen and lower chest region in anesthetized rats. Lee and Lee[6] reported that acupuncture decreased serum gastrin, secretin, insulin and C-peptide levels, but increased those of serum glucagons.

In the present study, although, there were no significant changes in gastric motilities following acupuncture at ST-40, ST-41, ST-42 and ST-45, traditional acupuncture at ST-36 and BL-21 increasing gastric motility could be used for the treatment of diseases caused by a decreased gastric motility, and traditional acupuncture at CV-12 decreasing gastric

motility could be used to reduce gastric motility.

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침술이 개의 위 운동성에 미치는 영향

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요 약 : 본 연구는 침술이 개의 위 운동성에 미치는 효과에 관하여 알아보기 위하여 실시하였다. 건강한 잡종견 6두의 유문부 근층에 전극을 장착한 후 위근전도를 (electrogastromyograms, EGMG) 기록하여 위 운동성을 평가하였다. 침술은 ST-36, ST-40, ST-41, ST-42, ST-45, BL-21 및 CV-12 혈위에 실시하였다. ST-36 및 BL-21 혈위에 침술을 실시한 결과 위 운동성이 증가 되었으며, CV-12 혈위에서는 위 운동성이 감소되었다. 그러나 ST-40, ST-41, ST-42 및 ST-45 혈위의 침술은 위운동성에 영향을 미치지 않았다.

주요어 : 전통침술, 혈위, 위 운동성, 개