The Effect of Acupressure at the Extra 1 Point on Subjective and Autonomic Responses to Needle Insertion

Young-Chang P. Arai, MD*
Takahiro Ushida, MD*
Tomoaki Osuga, MD*
Takako Matsubara, PT*
Kahori Oshima†
Kana Kawaguchi†
Chiaki Kuwabara†
Sigeya Nakao†
Atsushi Hara†
Chihiro Furuta†
Erina Aida†
Shugyoku Ra†
Yui Takagi†
Kyoko Watakabe†

BACKGROUND: Premedication with sedatives can decrease the discomfort associated with invasive anesthetic procedures. Some researchers have shown that acupressure on the acupuncture extra 1 point is effective for sedation. We investigated whether acupressure on the extra 1 point could alleviate the pain of needle insertion.

METHODS: We investigated the effect of acupressure at the extra 1 point or a sham point on needle insertion using verbal rating scale (VRS) pain scores and heart rate variability (HRV). Twenty-two healthy female volunteers were randomly allocated to two groups: the extra 1 group received acupressure at the extra 1 point, and the sham group received acupressure at a sham point. After starting the electrocardiogram record, a 27-gauge needle was inserted into the skin of a forearm. Thereafter, another needle was inserted into the skin of the other forearm during acupressure.

RESULTS: Acupressure at the extra 1 point significantly reduced the VRS, but acupressure at the sham increased the VRS. Acupressure at the extra 1 significantly reduced the low frequency/high frequency ratio of HRV responding to needle insertion.

CONCLUSIONS: Acupressure at the extra 1 point significantly reduced needle insertion pain compared with acupressure at the sham point. Also, acupressure at the extra 1 point significantly reduced the low frequency/high frequency ratio of HRV responding to needle insertion, which implies a reduction in sympathetic nervous system activity.

(Anesth Analg 2008;107:661–4)

Patients can experience less discomfort during invasive anesthetic procedures such as catheterization of peripheral vein and epidural blockade when using a variety of techniques, including eutectic mixture of local anesthetic cream,[1] lidocaine or tetracaine patches,[2–4] nitrous oxide inhalation,[5] and premedication with sedatives.[6] Although sedative premedication is routinely administered to reduce preanesthetic anxiety, sedatives have their own side effects. Thus, several researchers have investigated the effect of acupuncture and related techniques on sedation or on the electroencephalogram of volunteers and patients,[7–9] and some researchers have shown that these techniques on the acupuncture extra 1 point are effective for sedation.[8,9]

Physiological responses to pain have been assessed by heart rate (HR) variability (HRV).[10–12] HRV is a reliable method to obtain information on sympathetic and parasympathetic contributions to HR, and several studies showed that pain increases sympathetic activity. Frequency fluctuations of HRV in the range of 0.04–0.15 Hz (low frequency, LF) are considered to be markers of sympathetic and parasympathetic nerve activity, and high frequency (HF) fluctuations in the range of 0.15–0.4 Hz are considered markers of parasympathetic nerve activity. Thus, the LF/HF ratio is considered to be an index of sympathetic nerve activity.[13,14]

We hypothesized that acupressure on the extra 1 point can induce sedation, thereby reducing pain of invasive procedures and the sympathetic activation responding to the invasive procedures. In the present study, we investigated whether acupressure on the extra 1 point could alleviate pain of needle insertion and modulate HRV responding to needle puncture.

From the *Multidisciplinary Pain Center, and †Society for Chinese and Kampo Medicine, Aichi Medical University, Aichi, Japan.

Accepted for publication March 26, 2008.

Address correspondence and reprint requests to Young-Chang P. Arai, MD, Multidisciplinary Pain Center, Aichi Medical University, 21 Karimata, Nagakutecho, Aichigun, Aichi, 480-1195, Japan. Address e-mail to arainon@aichi-med-u.ac.jp.

DOI: 10.1213/ane.0b013e31817b8495

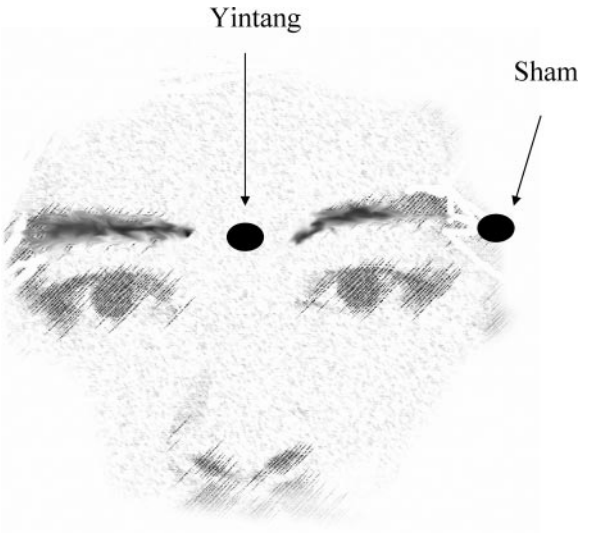

Figure 1. Location of Yintang and sham points.

METHODS

After receiving ethics committee approval from Aichi Medical University and written informed consent, 22 healthy female volunteers were recruited in this prospective, blinded, randomized, controlled trial. Individuals were not familiar with acupuncture or related techniques. Exclusion criteria were concomitant sedative or analgesic medication, chronic pain syndrome, neurological disease, or a skin lesion at the site of a needle puncture.

The volunteers were randomly allocated to two groups: the extra 1 group received acupressure at the extra 1 point; and the sham group received acupressure at a sham point. All measurements were performed during afternoon hours. Each volunteer was lying comfortably in a bed in a quiet environment. The extra 1 acupressure point, Yintang point, is located midway between the medial ends of the eyebrows at the root of the nose and the sham point is located 2 cm lateral and horizontal from the lateral end of the left eyebrow[7–9] (Fig. 1). After arrival in the quiet environment, the volunteers were allowed to relax for 10 min. During the period, 27-gauge needles were marked to a length of 3 mm under sterile condition.[3] Thereafter, the record of the electrocardiogram (ECG) signals started. Five minutes later, one of the needles was inserted vertically into the skin of a forearm 3 mm and was kept there for 30 s. For the verbal rating scale (VRS), the volunteer was asked to verbally rate her level of perceived needle pain intensity on a numerical scale from 0 to 10 (0 = no pain, 10 = worst pain imaginable). Acupressure was then started by the pulp of the right thumb in a rotary fashion at 20–25 cycles per minute.[7–9] Three minutes later, one of the needles was inserted vertically into the skin of the other forearm 3 mm and kept for 30 s, and acupressure was discontinued. The pain was rated using the VRS.

During these measurements, ECG electrodes were attached for HRV analysis for an assessment of the autonomic responses, and the ECG signals were obtained from a conventional anesthesia monitor (Hewlett Packard, Model 66s). The data were transferred to an online computer loaded with HRV analysis software (TARAWA/WIN; Suwa Trust, Tokyo, Japan). For real-time analysis, the RR intervals were obtained with the accuracy of 1 ms and analyzed with the "MemCalc" computer program.[14] The two series of power of the RR intervals (ms 2), LF (0.04–0.15 Hz), and HF (0.15–0.5 Hz), were calculated. HR and the LF and HF values and LF/HF ratios of HRV were recorded.

Table 1. Demographic Data

	Extra 1	Sham	*P*
Age (yr)	24 (19–33)	22 (19–26)	0.26
Height (cm)	156 (151–170)	154 (148–174)	0.767
Weight (kg)	51 (39–70)	50 (42–69)	0.718

Values are median (range).

A pilot study using 10 volunteers showed the mean (SD) of VRS to needle insertion before and during acupressure to be 2.8 (1.3) and 2.1 (0.8) in the extra 1 group, and 3.1 (0.9) and 4.5 (1.4) in the sham group, respectively. Thus, the sample size of 10 was needed for each group to show a difference of 1.0 (1.0) within the group (before and after acupressure) and 2.0 (1.0) between the groups, respectively, with a significance level of 0.05 ($\alpha = 0.05$) and a power of 80% ($\beta = 0.20$). Data are presented as median (range or interquartile range). Data were analyzed using Wilcoxon's signed-ranks test, Mann–Whitney test, or Friedman test where appropriate. After Friedman test for repeated-measure analysis, *post hoc* multiple comparison tests were performed with Student–Newman–Keuls method. A P value <0.05 was considered statistically significant.

RESULTS

There were no significant differences in the median (range) of age, height, and weight between the two groups (Table 1). Acupressure at the extra 1 point significantly reduced the VRS for needle insertion pain, whereas acupressure at the sham point significantly increased the VRS (Fig. 2). Needle insertion significantly increased the LF/HF ratio of HRV in the extra 1 group (Fig. 3). Acupressure at the extra 1 point significantly decreased the LF/HF ratio, and acupressure at the extra 1 point significantly reduced the LF/HF ratio of HRV responding to needle insertion in line with the decrease of the VRS (Fig. 3). In contrast, acupressure at the sham point induced no change in the LF/HF ratio of HRV responding to needle puncture (Fig. 3).

DISCUSSION

This study showed that acupressure at the extra 1 point significantly reduced the VRS to needle insertion, whereas acupressure at the sham point significantly increased the VRS. Acupressure at the extra 1

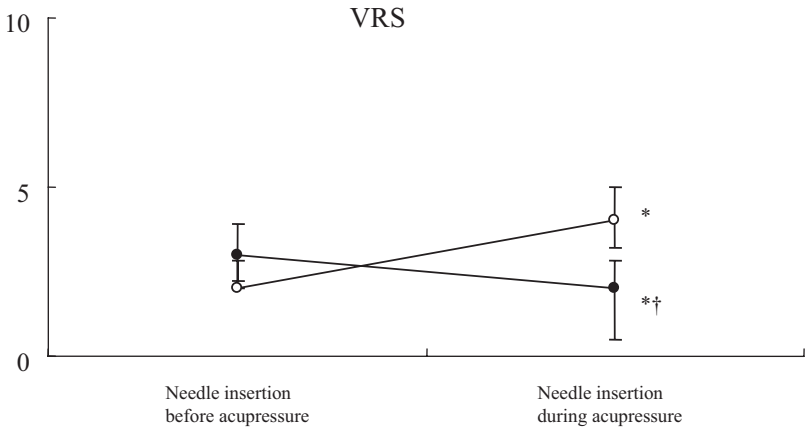

Figure 2. Verbal rating scale (VRS) pain scores to needle insertion before and during acupressure. Values are presented as median (interquartile range). ●, the extra 1 group. ○, the sham group. *, different from the VRS before acupressure ($P < 0.05$). †, different from the VRS of the sham point ($P = 0.006$).

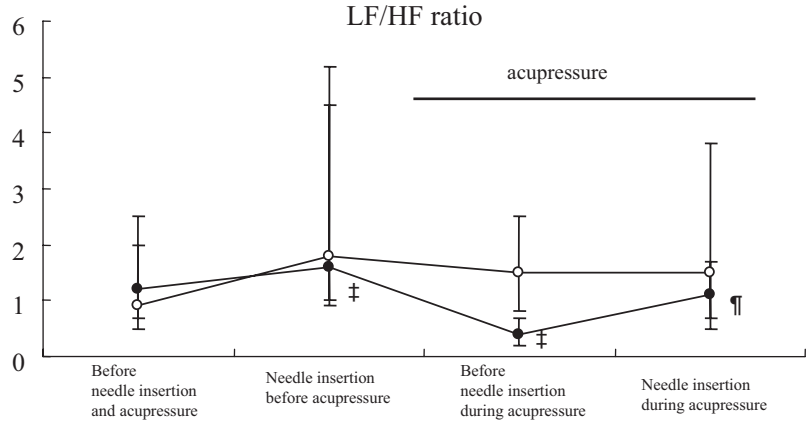

Figure 3. LF/HF ratio of heart rate variability. ●, the extra 1 group. ○, the sham group. Values are presented as median (interquartile range). ‡, different from the values of "Before needle insertion and acupressure" ($P < 0.05$). ¶, different from the values of "Needle insertion before acupressure" ($P < 0.05$).

point significantly reduced the LF/HF ratio of HRV responding to needle insertion.

Acupuncture and related techniques have been used for treatment of acute and chronic pain and the control of postoperative nausea and vomiting.[9,15–18] Several researchers investigated the effect of acupressure at the extra 1 point on sedation and/or electroencephalogram and some of them showed that acupressure at the point is effective for sedation.[7–9] In the present study, acupressure at the extra 1 point reduced pain to needle puncture compared with acupressure at a sham point. Also, acupressure at the extra 1 point significantly reduced the LF/HF ratio of HRV responding to needle insertion. Thus, we believe that the sedating effect of acupressure at the extra 1 point alleviates pain to needle insertion and suppresses the sympathetic nervous system.

As there are several acupuncture points near the area we chose to be the sham point, acupressure at the sham point might have induced an unidentified effect in the present study. However, several researchers compared the effect of acupressure at the extra 1 point with that at the sham point[7–9] similar to our study. Thus, we used the point in the present study. Since electroacupuncture at acupuncture points influences the autonomic nervous system,[19,20] acupressure at the sham point might have influenced HRV in the present study. Therefore, further study is required using different acupuncture points.

In conclusion, although acupressure at the extra 1 point significantly reduced the VRS for needle puncture, acupressure at the sham point significantly increased the VRS. Acupressure at the extra 1 point significantly reduced the LF/HF ratio of HRV responding to needle puncture in line with the decrease of the VRS.

REFERENCES

1. Hallen B, Carlsson P, Uppfeldt A. Clinical study of a lignocaine-prilocaine cream to relieve the pain of venepuncture. Br J Anaesth 1985;57:326–8
2. Long CP, McCafferty DF, Sittlington NM, Halliday HL, Woolfson AD, Jones DS. Randomized trial of novel tetracaine patch to provide local anaesthesia in neonates undergoing venepuncture. Br J Anaesth 2003;91:514–8
3. Arai YC, Ueda W. Warm steaming enhances the topical anesthetic effect of lidocaine. Anesth Analg 2004;98:982–5
4. Sobue K, Tsuda T, Yumoto M, Nakagawa T, Nakano M, Katsuya H. Skin analgesia with lidocaine tape prior to epidural blockade. Can J Anaesth 2003;50:95–6
5. Crecelius C, Rouhfar L, Beirne OR. Venous cannulation and topical ethyl chloride in patients receiving nitrous oxide. Anesth Prog 1999;46:100–3
6. Hall DL, Rezvan E, Tatakis DN, Walters JD. Oral clonidine pretreatment prior to venous cannulation. Anesth Prog 2006;53:34–42
7. Fassoulaki A, Paraskeva A, Patris K, Pourgiezi T, Kostopanagiotou G. Pressure applied on the extra 1 acupuncture point reduces bispectral index values and stress in volunteers. Anesth Analg 2003;96:885–90
8. Wang SM, Gaal D, Maranets I, Caldwell-Andrews A, Kain ZN. Acupressure and preoperative parental anxiety: a pilot study. Anesth Analg 2005;101:666–9

9. Agarwal A, Ranjan R, Dhiraaj S, Lakra A, Kumar M, Singh U. Acupressure for prevention of pre-operative anxiety: a prospective, randomised, placebo controlled study. Anaesthesia 2005;60:978–81
10. Aslaksen PM, Myrbakk IN, Hoifodt RS, Flaten MA. The effect of experimenter gender on autonomic and subjective responses to pain stimuli. Pain 2007;129:260–8
11. Terkelsen AJ, Mølgaard H, Hansen J, Andersen OK, Jensen TS. Acute pain increases heart rate: differential mechanisms during rest and mental stress. Auton Neurosci 2005;121:101–9
12. Terkelsen AJ, Andersen OK, Mølgaard H, Hansen J, Jensen TS. Mental stress inhibits pain perception and heart rate variability but not a nociceptive withdrawal reflex. Acta Physiol Scand 2004;180:405–14
13. Huang HH, Chan HL, Lin PL, Wu CP, Huang CH. Time-frequency spectral analysis of heart rate variability during induction of general anaesthesia. Br J Anaesth 1997;79:754–8
14. Nishiyama T, Misawa K, Yokoyama T, Hanaoka K. Effects of combining midazolam and barbiturate on the response to tracheal intubation: changes in autonomic nervous system. J Clin Anesth 2002;14:344–8
15. Zárate E, Mingus M, White PF, Chiu JW, Scuderi P, Loskota W, Daneshgari V. The use of transcutaneous acupoint electrical stimulation for preventing nausea and vomiting after laparoscopic surgery. Anesth Analg 2001;92:629–35
16. Chen L, Tang J, White PF, Sloninsky A, Wender RH, Naruse R, Kariger R. The effect of location of transcutaneous electrical nerve stimulation on postoperative opioid analgesic requirement: acupoint versus nonacupoint stimulation. Anesth Analg 1998;87:1129–34
17. White PF. Electroanalgesia: does it have a place in the routine management of acute and chronic pain? Anesth Analg 2004;98:1197–8
18. White PF. Use of alternative medical therapies in the perioperative period: is it time to get on board? Anesth Analg 2007;104:251–4
19. Li Z, Jiao K, Chen M, Wang C. Effect of magnitopuncture on sympathetic and parasympathetic nerve activities in healthy drivers–assessment by power spectrum analysis of heart rate variability. Eur J Appl Physiol 2003;88:404–10
20. Haker E, Egekvist H, Bjerring P. Effect of sensory stimulation (acupuncture) on sympathetic and parasympathetic activities in healthy subjects. J Auton Nerv Syst 2000;79:52–9