

Prehospital Analgesia with Acupressure in Victims of Minor Trauma: A Prospective, Randomized, Double-Blinded Trial

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Untreated pain during the transportation of patients after minor trauma is a common problem in emergency medicine. Because paramedics usually are not allowed to perform invasive procedures or to give drugs for pain treatment, a noninvasive, nondrug-based method would be helpful. Acupressure is a traditional Chinese treatment for pain that is based on pain relief followed by a short mechanical stimulation of specific points. Consequently, we tested the hypothesis that effective pain therapy is possible by paramedics who are trained in acupressure. In a double-blinded trial we included 60 trauma patients. We randomly assigned them into three groups ("true points," "sham-points," and "no acupressure"). An independent observer, blinded to the treatment assignment, recorded vital variables and visual analog scales for pain and anxiety before and after treatment.

At the end of transport, we asked for ratings of overall satisfaction. For statistical evaluation, one-way analysis of variance and the Scheffé F test were used. $P < 0.05$ was considered statistically significant. Morphometric and demographic data and potential confounding factors such as age, sex, pain, anxiety, blood pressure, and heart rate before treatment did not differ among the groups. At the end of transport we found significantly less pain, anxiety, and heart rate and a greater satisfaction in the "true points" groups ($P < 0.01$). Our results show that acupressure is an effective and simple-to-learn treatment of pain in emergency trauma care and leads to an improvement of the quality of care in emergency transport. We suggest that this technique is easy to learn and risk free and may improve paramedic-based rescue systems.

(Anesth Analg 2002;95:723-7)

In most European countries, patients with minor trauma and small injuries, such as digital fractures, small wounds, and contusions, are transported to the hospital by ambulance (1). In Central Europe, the accompanying paramedics are not allowed to perform any invasive procedures or to use any drugs for pain treatment. The United States also strictly limits pharmacological pain treatment by paramedics. Therefore, victims of minor trauma, who do not require treatment by an emergency physician, often experience pain during transport (2). This situation is uncomfortable both for the patient and the paramedic. Besides this emotional component, pain provokes autonomic responses that markedly increase adrenergic nerve activity and plasma

catecholamine concentrations (3). The consequences are increased heart rate (4), hypertension (5), arteriolar vasoconstriction, reduced wound perfusion, and decreased tissue partial pressure of oxygen, which increases the risk of wound infection (6).

To reduce these unfavorable side effects, the availability of a noninvasive, nondrug-based therapy would be beneficial. The technique of acupuncture, which originated in China during the Xia dynasty (2140-1711 BC), is widely used for pain treatment (7). The successful use of acupuncture for pain treatment has been reported for a broad spectrum of different pain conditions, e.g., neuropathy (8), headache (9), herpes zoster (10), neurosurgical (11), orthopedic (12), dental (13), postoperative (14), and chronic (15). The National Institutes of Health (NIH) Consensus Development Conference on the Integrated Approach to the Management of Pain classified acupuncture as an effective tool for pain treatment (16). The technique is based on the concept that the continuous flow of *chi*, "life energy," is vital to one's health and aims to improve health by inserting hair-thin needles into specific points on the body that are thought to enhance

Accepted for publication May 22, 2002.

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DOI: 10.1213/01.ANE.0000025704.39845.61

the flow of chi (17). Critical scientists argue that psychological factors, such as belief in the method, may also play a certain role (18). Acupressure is based on the same traditional concepts and mechanisms as acupuncture. Acupressure has been used to treat different types of pain, such as tension headaches, histamine cephalgia, migraine, and labor pain (19). A significant analgesic effect has also been described for relief of postoperative pain (17).

Therefore, acupressure is likely to provide an effective method for pain treatment that can be performed by paramedics in charge of victims of minor trauma. Accordingly, we conducted a prospective, randomized, double-blinded study to test the hypothesis that performing acupressure on victims of minor trauma in the prehospital setting decreases pain. We also expected that the acupressure treatment would decrease anxiety and increase patient satisfaction. Finally, it was our aim to prove that belief in acupressure has no effect on the effectiveness of our treatment.

Methods

With IRB approval and patients' informed consent, we included 60 minor trauma patients aged from 19 to 99 yr with minor trauma or small injuries, such as simple fractures, small wounds, and contusions. Results were evaluated on an intention-to-treat basis once patients were admitted to the study. We excluded all patients with insufficient knowledge of the German language and those who were unable to give informed consent, any patients with neurological or psychiatric disorders, all patients who were taking any analgesics for chronic pain disorders, and all patients having a pain visual analog scale (VAS) score of >8 . Especially for those patients with severe pain, an ambulance car with an emergency physician was called for advanced medical pain control.

At the site of the accident, the patient was approached by two paramedics, Paramedic A (treatment) and Paramedic D (data collection). The patient was treated according to the Austrian Red Cross Ambulance Service's guidelines. These guidelines are accepted as the basis of paramedical education in Austria, which guarantees a standard of prehospital trauma care.

After the medical intervention (e.g., bandaging of the wound), the patient was asked to participate in the study. After obtaining informed consent, Paramedic A left the site. Paramedic D recorded demographic and hemodynamic variables, including noninvasive blood pressure and heart rate. The patient was asked to rate his or her pain and anxiety by using a VAS, then Paramedic D left the patient. Moreover, the patient was asked whether he or she believed in acupressure as a treatment for pain. Paramedic A opened an envelope to assign the patient to one of three groups:

1. Group 1 ("true acupressure"): patients in this group were stimulated at the acupressure points Di4 (Hegu), KS9 (Zhongchong), KS6 (Neiguan), BL60 (Kunlun), and LG20 (Baihui).
2. Group 2 ("false acupressure"): these patients were stimulated at sham points (middle of dorsal wrist, lateral metacarpalphalangeal junction of the second finger, middle of clavicle, middle of patella, and middle of lateral malleolus).
3. Group 3 ("no acupressure group"): these patients did not receive any acupressure.

Patients were treated according to group assignment for approximately 3 min (in case of Group 3, this resulted in waiting). Stimulation was performed with a finger of Paramedic A. Afterward the patient was brought to the ambulance. Paramedic D had to sit in front of the car while Paramedic A stayed with the patient in the back of the car (sections of the ambulance are separated by a rigid wall). On arrival at the hospital, the same values were again recorded by Paramedic D. Data collection was always performed in the absence of Paramedic A. Finally, the completed datasheets were put into opaque envelopes and sealed by Paramedic D to ensure complete blinding.

To minimize bias, Paramedic A was not told that he was using a true or a sham technique. Instead, he was instructed that the aim of this study was to compare two acupressure techniques by using different points. None of the paramedics involved in the study had knowledge about or was experienced with acupressure or similar treatments. To ensure the accuracy of treatment performance, Paramedic A was intensively trained by a physician with significant experience in acupressure and acupuncture at the University Hospital of Vienna. Great care was spent ensuring that either treatment or data collection was performed in the absence of the other investigator. The car provides no possibility for Paramedic D to become aware of the treatment during transport. To ensure that the blinding system was obeyed and that the treatment was performed accurately, a physician otherwise not involved in data collection or treatment performed 10 on-site audits of the methodology and data collection.

Morphometric and demographic data were recorded. This included type of injury, sex, and age. The hemodynamic variables included noninvasive blood pressure and heart rate. Pain and anxiety were rated by the patient with the help of 100-mm VAS. Zero was counted as "no pain" or "no anxiety," and 100 was regarded as "maximum pain" and "maximum anxiety." The measurement of hemodynamic variables and the rating of pain and anxiety were performed at the site of the accident and on arrival at the hospital. At the hospital, the overall satisfaction was also measured with a 100-mm VAS. Zero was counted as "maximal satisfaction," and 100 was regarded as "absolute

dissatisfaction." Belief in acupressure was scored as "great," "moderate," and "no belief at all."

Normally distributed values in the three groups were compared with one-way analysis of variance and then compared by use of the Scheffé F test. Results are presented as mean \pm SD; $P < 0.05$ was considered statistically significant.

Results

With IRB approval of the Ethical Board of the Vienna Red Cross and written informed consent, we enrolled 60 patients in this study. Group 1 consisted of 19, Group 2 of 20, and Group 3 of 21 patients. All patients who started the study also finished; none had to be handled as dropouts, either for technical or for medical reasons. Patient characteristics were comparable regarding age (Group 1, 64 ± 21 yr; Group 2, 78 ± 18 yr; and Group 3, 63 ± 21 yr), sex (Group 1, 11 men and 8 women; Group 2, 12 men and 8 women; and Group 3, 11 men and 10 women), and type of injury (Group 1, 12 contusions and 7 fractures; Group 2, 12 contusions and 8 fractures; and Group 3, 12 contusions and 9 fractures). Belief in acupressure did not differ significantly among the groups. In Group 1, a significant ($P < 0.01$) pain reduction was recorded in all cases, with a score falling from 61.8 ± 11.8 to 34.0 ± 16.9 (45%); Group 2 remained unchanged, and Group 3 remained unchanged on average (Fig. 1).

Anxiety was reduced in 68% of the patients in Group 1, 50% of the Group 2 patients, and 52% of the patients in Group 3. In Group 1 the score changes were significant ($P < 0.01$; 59.9 ± 28.7 to 33.2 ± 18.6 ; 45%); in Group 2 a nonsignificant ($P = 0.64$) anxiety decrease was noted (65.2 ± 25.4 to 61.6 ± 23.4 ; 6%). Similarly, in Group 3 a nonsignificant ($P = 0.56$) change of anxiety was found (67.0 ± 17.6 to 53.4 ± 24.3 ; 20%).

Heart rate scores showed similar trends as pain scores: in Group 1 a significant ($P < 0.01$) heart rate reduction was observed in 89% of the cases (86.6 ± 10.4 to 72.4 ± 9.2 ; 17%), whereas in Group 2 and Group 3 the heart rate remained unchanged (Figs. 2 and 3).

After treatment the three groups differed in a highly significant way ($P < 0.01$) in pain, anxiety, and heart rate. There were no significant changes in blood pressure, either among the groups or within the groups before and after treatment. Patient satisfaction scores after treatment were significantly ($P < 0.01$) better in Group 1 (17.6 ± 13.2) compared with Group 2 (28.1 ± 13.7) and Group 3 (35.1 ± 16.5).

Discussion

The administration of analgesics is restricted in paramedic-based rescue systems (2). In some countries, such as Austria, drug administration is prohibited because by law any medical treatment is strictly

restricted to physician use. The logical consequence of this lack of treatment is that thousands of patients every year have to experience significant pain before they reach the hospital. Consequently, it was our aim to find a noninvasive and nondrug-based treatment for pain after nonlife-threatening trauma.

Despite the slow progress of scientific evidence, acupuncture and related techniques have become increasingly popular in Western medical culture over the last few decades (7). In fact, the NIH issued a position statement promoting acupressure for the treatment of various medical conditions (such as pain, nausea, and vomiting) in hospital care (16). The NIH panel of scientists also encouraged further research to uncover additional areas in which acupuncture may be useful.

The main result of this trial is that well performed acupressure—even by a nonphysician—is a fast and effective treatment of pain. Furthermore, anxiety decreased, probably as a logical consequence of reduced pain and more comfort. The correctly treated patients were significantly more satisfied with the quality of care given to them. Patients with correct acupressure were significantly more satisfied than those in the sham group or in the no-treatment group. The changes in the VAS for pain and anxiety were not only statistically significant, but they were also of significant clinical relevance, which is supported by the observed clear decrease of heart rates in our true-acupressure group.

Stimulating particular points by using either needles or pressure causes a measurable release of endorphins into the blood (20). The activation of small myelinated nerve fibers sends impulses into the spinal cord, midbrain, pituitary, and hypothalamus (21,22). Various endorphins block incoming pain information through the release of serotonin, norepinephrine, and possibly γ -aminobutyric acid (17,21).

There are different traditions and styles of acupuncture (17). Acupuncturists from different schools may recommend a very different choice of points for any particular patient. There is, however, good agreement on the location of commonly used classic points. Acupressure is an essentially risk-free, noninvasive, and cost-effective treatment for pain. The effect of acupressure for acute pain relief lasts approximately 30 minutes or, in some cases, even for a few days (23).

This study was designed to prove that acupressure is a suitable and easy-to-use technique in first aid and prehospital emergency medicine. Our study fits well with other trials showing that acupressure is an effective pain control treatment. However, this study shows us a new horizon for its use. There are several reasons why acupressure seems to be an ideal way to reduce pain in first aid. First, no equipment is needed. This means that any physician, nurse, paramedic, or emergency medical technician can perform this treatment at once at the site of accident without having to wait for any assistance or complex device. Second, only a brief training period is

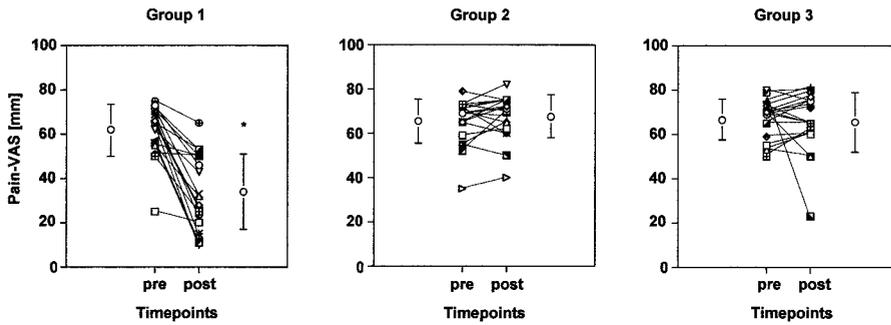


Figure 1. Changes in pain visual analog scores (VAS) (mm) before and after transportation; * $P < 0.01$.

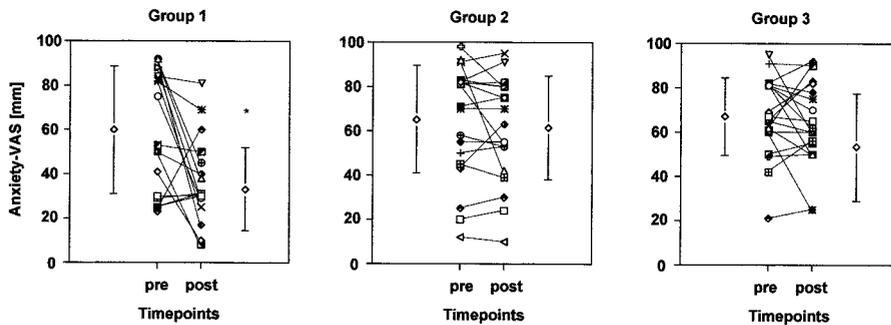


Figure 2. Changes in anxiety visual analog scores (VAS) (mm) before and after transportation; * $P < 0.01$.

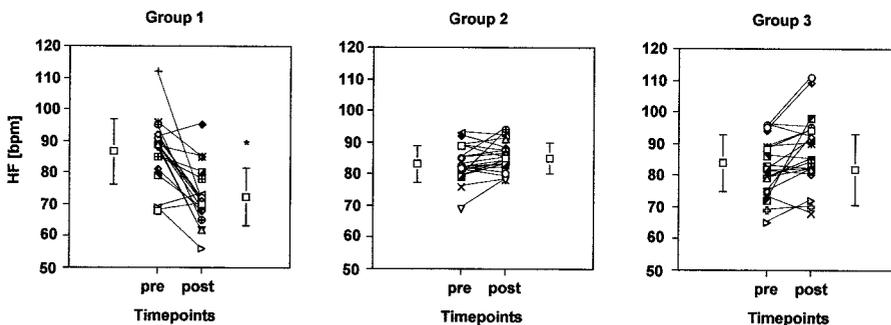


Figure 3. Changes in heart frequency (HF) (bpm) before and after transportation; * $P < 0.01$.

needed to learn a few simple points, indicating that this treatment can be performed by any specialty of medical doctor. Even physicians who have little or no experience in first aid or emergency medicine can learn this technique within a few hours and consequently use it whenever needed. Finally, acupressure is a “no-cost” treatment, because it is simply performed by the helper’s finger. Because pain provokes autonomic responses that markedly increase adrenergic nerve activity and plasma catecholamine concentrations (3), it is especially clear that elderly and coronary-impaired patients need an effective pain control soon after their trauma.

In summary, our results could show that acupressure is an effective and easy-to-learn treatment for pain in first aid and emergency trauma care. We recommend this technique for emergency physicians and also for nonacademic personnel, such as nurses, paramedics, firefighters, or emergency medical technicians.

strongly supported this study by dispatching suitable study patients to our “research-ambulance-car.” For his support in mathematics, we thank Werner Jaegersberger, MS, who supported our statistical evaluation.

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We would like to especially thank the physician-in-chief Dr. Kaff of the Vienna Ambulance Service and his emergency dispatchers, who

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