Comparing the effects of acupressure at LI4 and BL32 points on intramuscular injection pain

Yasaman Raddadi a, Mohsen Adib-Hajbaghery b,*, Zahra Ghadirzadeh a, Davood Kheirkhah c

* Student Research Committee, Kashan University of Medical Sciences, Kashan, Iran
b Trauma Nursing Research Center, Faculty of Nursing and Midwifery, Kashan University of Medical Sciences, Kashan, Iran

Received 7 December 2016; received in revised form 29 January 2017; accepted 29 January 2017

Abstract

Introduction: The effectiveness of some acupressure techniques in relieving the acute pain of intramuscular injection pain has been assessed in previous studies. However, the effects of acupressure at LI4 point have still remained unknown. The aim of this study was to compare the effects of acupressure at LI4 and BL32 points on intramuscular injection pain.

Methods: This after-only interventional study was made on 90 women who referred to the injection unit of the Central Emergency Department, Kashan, Iran, in 2015 for receiving an intramuscular injection of penicillin. The women were randomly allocated to three 30-person groups, namely control, LI4 acupressure, and BL32 acupressure groups. After intramuscular injection of penicillin, the level of intramuscular injection pain of all women was assessed by using a 0–10 visual analog scale. Data were analyzed through doing the Kruskal–Wallis, the Chi-square, and the Fisher’s exact tests, and Spearman correlation coefficient.

Results: The means of pain intensity in the control, LI4 acupressure, and BL32 acupressure groups were 2.76 ± 1.75, 2.33 ± 1.80, and 1.76 ± 2.45, respectively. In other words, the mean pain intensity in the control group was significantly higher than the LI4 and BL32 acupressure groups by 0.43 and 1.0 points, respectively (p = 0.011). Except for educational status, intramuscular injection pain was not significantly correlated with the participants’ other demographic characteristics as well as injection time.

Conclusion: Acupressure can significantly relieve intramuscular injection pain. This simple, cost-effective, and easily applicable therapy can be used in all healthcare settings for relieving intramuscular injection pain.

© 2017 Elsevier GmbH. All rights reserved.

Keywords: Intramuscular injection; Pain; Acupressure; LI4 point; BL32 point

1. Introduction

Intramuscular injection (IMI) is among the most common routes for delivering medications to the body. The World Health Organization estimated that 16 billion injections are administered annually throughout the world [1], among them about twelve billion are IMIs [2]. About 96% of IMIs are performed to administer antibiotics, vitamins, and analgesics [3]. The number of annual IMIs has been reported to be 0.9–8.5 per person [4].

IMI is a painful procedure the pain of which can cause patients intense fear and disrupt the process of treatment. Farhadi and Esmailzadeh used a visual analog scale (VAS) and found that the pain intensity of the IMI of penicillin benzathin was as high as 7.4–10, denoting that the IMI of this medication is extremely painful [5]. Thus, physicians and nurses have developed different strategies to alleviate IMI pain [6], including cold compress [7], massage [8], and acupressure [3,9].

http://dx.doi.org/10.1016/j.eujim.2017.01.015
1876-3820/© 2017 Elsevier GmbH. All rights reserved.
Acupressure is the application of pressure to specific areas of the body for therapeutic purposes including for the relief of pain [3]. Although acupressure points are the same as acupuncture points (acupoints), needle insertion is not used in acupressure [10]. Thus, acupressure is less likely to have any of the potential complications which have been associated with acupuncture such as fainting, infection, bleeding, and hepatitis [11]. Acupressure can be used alone or in combination with other therapies for managing illnesses without causing any kind of complications [12]. The exact mechanism of acupressure is unknown [13]. Some scholars reported that it may redress the balance in a vital force or energy called qi in the body [14].

There are different acupoints throughout the body, the stimulation of which can relieve pain and anxiety [13,14]. The results of previous studies showed that acupressure at BL31 (shāngliáo) and BL32 (cǐliáo) can relieve IMI pain [3,9]. However, both these points are located in the sacral area and locating and pressing it may cause feeling of shame for patients. Thus, using more easily accessible acupoints may improve patients’ acceptance of acupressure.

Another acupoint is LI4 or Hégu which is the most important acupoint for pain relief [15,16]. The point is located on the dorsum of the hand on the most prominent spot of the adductor muscle of the thumb when this finger is brought close to the index finger [15,17]. This point can be easily stimulated by gentle pressure, needle, or cold compress [15]. Different studies showed that the stimulation of this point can alleviate different types of bodily pain, including labor pain [15,18], toothache [19], and pain caused by removal of chest drain tube [20]. However, no study has yet investigated the effectiveness of pressing the LI4 and the BL32 points on IMI pain. The results of our unpublished pilot study revealed that stimulation of the LI4 point can relieve IMI pain. Two questions raised here are, “Is acupressure at LI4 effective in relieving IMI pain?” and “Is there any difference between the pain-relieving effects of acupressure at LI4 and BL32?” The present study sought to answer these questions. The aim of the study was to compare the effects of acupressure at LI4 and BL32 points on IMI pain.

2. Methods

2.1. Study design and participants

This after-only interventional study was made on women who referred to the outpatient injection unit of the Central Emergency Department (CED), Kashan, Iran, in 2015 for receiving an IMI of penicillin. The CED is a medical emergency department in the central part of the Kashan city. This department has two injection units that perform intramuscular and intravenous injections, one for outpatient males and the other for female clients. This department and all its units are active 24 h a day, seven days a week. The eligibility criteria were an age of 18–60, no experience of recent trauma or road accident, full consciousness at the time of acupressure and injection, no history of acute myocardial infarction or mental illness, and no skin lesion, edema, or fracture at the injection site or acupoints.

The sample size was determined based on the results of a previous study which reported that the means of pain intensity in a BL31 acupressure and a control group were 3.0 ± 2.0 and 5.0 ± 2.0, respectively [3]. Accordingly, with an alpha of 0.01 and a power of 0.80, the necessary sample for each group of the present study was determined to be 24 women. In order to improve the credibility of the findings, we recruited 30 women to each group—90 in total. Sample size was calculated by using the following formula, $n = \left(\frac{z_1-\alpha/2 + z_1-\beta/2}{\mu_1 - \mu_2}\right)^2$.  

2.2. The group allocation method

After calculating the sample size and before sampling, a random sampling plan was generated by using the SPSS software. Accordingly, numbers 1-90 were entered into the software and then, the ‘random numbers’ command from the ‘compute’ menu as well as the ‘function group box’ command from the ‘transform’ menu were used to allocate 90 hypothetical samples to three groups. After that, a coin was tossed to allocate these three groups to the three interventions of the study. Thereafter, the first author used the generated list of the numbers and groups to randomly allocate each eligible woman to either the LI4 acupressure, the BL32 acupressure, or the control groups.

2.3. Data collection instruments

The data collection instrument was a datasheet in which the results of measuring the participants’ weight, age, literacy level, and IMI time were documented. Besides, a VAS was used for pain assessment. The scale consisted of a horizontal line which had been divided into points from 0 to 10. The point 0 and 10 stood for no pain and the severest pain perceived by the respondent, respectively.

2.4. The procedure

We identified and recruited women at the study center who were going to receive penicillin G procaine 800,000 IU (Pen®, made by Jaber ibn Hayyan Pharmaceutical Company, Tehran, Iran) through an IMI. All injections were performed by the same female nurse into the upper exterior quarter of the dorsogluteal muscle based on the World Health Organization recommended technique for IMIs. For each injection, the skin of the area was initially disinfected by using an alcohol prep pad. Then, the skin was pulled to one side, the needle was inserted, and the suspension of penicillin was injected at a rate of one milliliter per two second. The volume of penicillin suspension was three milliliters. Disposable five-milliliter syringe with a 22 gauge needle was used for all patients.

Study intervention was implemented by a therapist (the first author) who had already received the necessary training about acupressure at LI4 and BL32 from an acupressure specialist (i.e., a medical doctor who passed special courses on traditional Chinese medicine and acupressure at the Traditional Medicine University of Armenia and China and is officially licensed for
practicing in Kashan, Iran). Before each injection, the therapist showed the VAS to the participant, trained her how to rate her own pain by using the VAS. Then, she was asked to rate her IMI pain immediately after receiving the injection. For illiterate participants, the therapist showed them the VAS again after the injection, remind them how to rate their pain and marked an X on the point that they pointed to.

Women in the control group received IMI without any acupressure. In the LI4 acupressure group, the therapist circularly pressed the LI4 acupoint (Fig. 1) on one of the hands of the participant for one minute. Then, the therapist gently pinched the point for three two-second rounds. Afterwards, the injection was given. In the BL32 acupressure group, each woman was positioned in prone position and the BL32 point was located. The location of the point is in the second sacral foramen, medial and inferior to the posterior superior iliac spine (Fig. 2) and close to the IMI site [9]. Then, the point was gently pressed circularly for one minute. After that, the point was pressed intermittently for three two-second rounds. Immediately afterwards, the injection was given at the dorsogluteal muscle of the same side of the body. In order to provide the study intervention to the participants in similar conditions, three nurses were recruited to implement the intervention. One nurse performed acupressure, one gave injections, and one assessed pain intensity.

2.5. Data analysis

The version 13th of the SPSS software (SPSS Inc. Chicago, Illinois, USA) was employed for data analysis. Initially, the Kolmogorov–Smirnov test was run to test the normality of the distributions of the study variables. The test revealed that the distributions of IMI pain scores were non-normal. Consequently, the non-parametric Kruskal–Wallis test was done for comparing the groups in respect of the intensity of IMI pain. Moreover, pairwise between-group comparisons were made by using the Mann–Whitney U test. Besides, the groups were compared with each other in terms of the women’s educational status, age, and IMI time by running the Chi-square, the Kruskal–Wallis, and the Fisher’s exact tests, respectively. The Spearman correlation coefficient was also used to examine the correlation between IMI pain and age, height, weight, IMI time.

2.6. Ethical considerations

This research was approved by an Ethics Committee affiliated to Kashan University of Medical Sciences, Kashan, Iran. The code of approval was IR.KAUMS.REC.1394.75. Moreover, official permissions were obtained from the authorities of the university and the study setting. After explaining the aim of the study to the participants and assuring them about the confidential management of their data, their informed consents were secured. Participation in the study was voluntary and withdrawal from it did not negatively affect the quality of care provided to the participants. The Iranian Registry of Clinical Trials registered the study with the code of IRCT138901223618N2.

3. Results

A total of 90 women with the age range of 16–65 and a mean age of 35.55 ± 12.15 were included in the study. Most of them were literate (78.9%). The weight and height of the women ranged from 43 to 110 kilograms and 143–187 cm with means of 69.22 ± 13.11 kg and 162.16 ± 13.30 cm, respectively. 63.3% of the IMIs were given in the night shift while 27.8% and 8.9% of them were given in the evening and the morning shifts, respectively (Table 1).

The means of pain intensity in the control, LI4 acupressure, and BL32 acupressure groups were 2.76 ± 1.75, 2.33 ± 1.80,
Table 1
Comparison of the characteristics of the three groups.

<table>
<thead>
<tr>
<th>Variables</th>
<th>Group</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>BL32</td>
<td>LI4</td>
</tr>
<tr>
<td><strong>Education level</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Literate</td>
<td>24 (80)</td>
<td>25 (83.3)</td>
</tr>
<tr>
<td>Illiterate</td>
<td>6 (20)</td>
<td>5 (16.7)</td>
</tr>
<tr>
<td><strong>Time of injection</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Morning</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Afternoon</td>
<td>9 (30)</td>
<td>10 (33.3)</td>
</tr>
<tr>
<td>Evening</td>
<td>21 (70)</td>
<td>20 (66.7)</td>
</tr>
<tr>
<td><strong>Age, year</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>32.16 ± 10.94</td>
<td>37.96 ± 11.78</td>
</tr>
<tr>
<td><strong>Height, cm.</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>163.41 ± 8.21</td>
<td>165.06 ± 8.20</td>
</tr>
<tr>
<td><strong>Weight, kg.</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>65.26 ± 12.16</td>
<td>73.43 ± 14.26</td>
</tr>
</tbody>
</table>

* Data are presented as n (%) or mean ± SD.
** Chi-square test.
*** Fisher’s exact test.
**** Kruskal–Wallis test.

Table 2
Between groups comparison of the mean and standard deviation of pain intensity.

<table>
<thead>
<tr>
<th>Pain intensity in target group (Mean ± SD)</th>
<th>Pain intensity in comparison groups (Mean ± SD)</th>
<th>p value**</th>
<th>p value***</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control (2.76 ± 1.75)</td>
<td>LI4 (2.33 ± 1.80)</td>
<td>0.051</td>
<td>0.011</td>
</tr>
<tr>
<td></td>
<td>BL32 (1.76 ± 2.45)</td>
<td>0.006</td>
<td></td>
</tr>
<tr>
<td>LI4 (2.33 ± 1.80)</td>
<td>BL32 (1.76 ± 2.45)</td>
<td>0.030</td>
<td></td>
</tr>
</tbody>
</table>

** Mann–Whitney U test.
*** Kruskal–Wallis test.

and 1.76 ± 2.45, respectively. The results of the Kruskal–Wallis test illustrated that the groups differed significantly from each other with respect to the mean score of IMI pain (p = 0.011). The Mann–Whitney U test revealed that the mean score of IMI pain in the control group was higher than the LI4 acupressure and the BL32 acupressure groups (p = 0.051 and 0.006, respectively). The mean score of pain was also significantly less in the BL32 acupressure group than that of the LI4 acupressure group (p = 0.030) (Table 2).

Study findings also revealed that IMI pain was not significantly correlated with age (r = −0.007; p = 0.947), height (r = −0.041; p = 0.705), weight (r = −0.022; p = 0.840), and IMI time (r = −0.010; p = 0.891). However, illiterate participants experienced significantly higher levels of IMI pain compared with literate participants (2.07 ± 1.78 vs. 3.10 ± 2.74, p = 0.002).

4. Discussion

The present study sought to compare the effects of acupressure at LI4 and BL32 points on IMI pain. Findings revealed that acupressure was effective in relieving IMI pain. There were significant differences among the groups regarding IMI pain. The IMI pain of women in the BL32 acupressure group was significantly lower than the control and the LI4 acupressure groups. In other words, the highest and the lowest levels of IMI pain were observed among women in the control and the BL32 acupressure groups, respectively.

IMI is a common nursing procedure worldwide [1]. Pain and anxiety from injections are also common and may even lead to syncope attacks [21]. Therefore, a number of strategies were investigated to decrease this pain (i.e. through physical, pharmacological, or psychological interventions). Manual pressure is among the physical interventions and might be implemented through two different strategies; first by direct manual pressure to the injection site [1,8] and the second, by applying pressure to an acupoint near or far from the injection site [3]. However, few studies are available on the effect of manual pressure strategies on IMI pain. In a systematic review of measures for reducing immunization pain in adults, Hogan et al. found only one experiment on the effect of manual pressure to the injection site and reported that there is limited evidence to support the use of this method for reducing injection pain [21]. Also, we could only find two studies on the effect of acupressure on IMI pain. In one of these studies, Suhrabi and Taghinejad examined the effect of BL32 acupressure on IMI pain and reported that acupressure at BL32 was effective in reducing the pain severity [8]. In the second study, Masoudi Alavi et al. found acupressure at BL31 effective in relieving pain related to the IMI penicillin injection [3]. Despite the scarcity of studies on the effect of acupressure on IMI pain, the available studies are in line with our findings and show that acupressure of BL32 is effective in decreasing the IMI pain.

Two main theories have been suggested to explain the pain relieving effect of acupressure. The first theory suggests that stimulating the acupoints with pressure or needles triggers the release of endorphins, which are the neurochemicals that relieve
pain. As a result, pain is blocked and the flow of blood and oxygen to the affected area is increased [22,23]. However, an induction time of 15–20 min is required for the development of an analgesic effect by this mechanism [23]. Then this mechanism might not explain the immediate effect of acupressure observed in the present study. The second theory is the gate control theory which proposes that acupressure activates inhibitory interneurons in the dorsal spinal roots that consequently inhibits the pain signals sent to the brain [24,25]. This theory seems to be more compatible with the rapid effect of acupressure observed in the present study. However, Colquhoun and Novella also reported that acupressure may just have a placebo effect because the participants in most of the acupressure studies were not blind to the interventions [26].

In the present study, IMI pain score in the LI4 acupressure group was lower than the control group, although the significance of the difference was at borderline level. No studies are available on the effect of acupressure at LI4 point on IMI pain. Although previous studies have shown the beneficial effects of acupressure at LI4 point on other types of pain (i.e. pain of venipuncture [27,28], and pain related to injection of local anesthetic before dental treatments [29]. The gate control theory might explain why acupressure at LI4 point was not as effective as BL32 acupressure. The BL32 point is located in the sacral area and therefore is in the pathway of the pain signals started at the IMI injection site in the dorsogluteal area. However, the LI4 acupoint is located on the dorsum of the hand and not at the IMI injection site. This premise can also explain the effectiveness of LI4 acupressure in previous studies cited above.

The present study also showed that IMI pain was not significantly correlated with the participants’ age, weight, and height. Consistent with these findings, Suhrabi and Taghinejad also reported no significant correlation between age and the effectiveness of acupressure in relieving pain [8]. Barnhill et al. also found no significant correlation between the pain relieving effect of pressure to the injection site and variables such as age, gender and weight, body mass index [8]. In contrast, Masoudi Alavi et al. reported a significant indirect correlation between age and IMI pain among patients who did or did not receive acupressure at BL31 point [3]. Although these findings denote that age has no considerable effects on the pain-relieving effects of acupressure, further investigations are still needed to provide convincing evidence.

Our findings also showed a significant difference among women with different educational status with respect to their IMI pain. In other words, women with lower educational status experienced higher levels of IMI pain. Moghaddas et al. also reported a significant correlation between educational status and pain perception [30]. In contrast, in Barnhill et al. study, no significant correlation was found between the pain relieving effect of pressure to the injection site and education [8]. These conflicting findings regarding the correlation of IMI pain and educational status necessitate further studies.

The present study was conducted only on females because the nurse responsible for acupressure was female and the ethics committee did not permit a female to perform intervention for males. Then, replication of a same study in males and also in a larger sample is suggested.

5. Conclusions

The findings of the present study demonstrated the effectiveness of acupressure at BL32 in alleviating IMI pain among women. However, the LI4 acupressure was not as effective as BL32 acupressure. Given the simplicity and cost-effectiveness of acupressure at BL32 acupoint, and the closeness of this point to the dorsogluteal area, nurses can use this complementary therapy to relieve patients’ IMI pain.

Conflict of interests

The authors declare that there is no conflicting interest.

Acknowledgements

We would like to profusely thank the Research Council of Kashan University of Medical Sciences, which financially supported this study. Moreover, we hereby appreciate the study participants as well as the administrators of Kashan’s central emergency department who supported us throughout the study.

References


