MedPharmRes

journal of University of Medicine and Pharmacy at Ho Chi Minh City
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Original article

Effect of auricular acupuncture on exam anxiety in first-year medical students

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Received July 13, 2019: Revised August 15, 2019: Accepted August 17, 2019

Abstract: ***Background and Objectives:*** Exam anxiety is a commonly seen problem among medical students. Auricular acupuncture has been shown to have an anxiety-reducing effect, however, data on exam anxiety are limited. Research in dental and preoperative anxiety has indicated that anxiety level could be reduced by using ear acupoints on the non-dominant side. Therefore, this study aims to determine whether needling at acupoints on the non-dominant side can reduce exam anxiety in medical students. ***Method:*** This is a prospective observational study on 32 first-year students at The Faculty of Traditional Medicine, University of Medicine and Pharmacy at Ho Chi Minh City. Eligible students received auricular acupuncture on the non-dominant side at the master cerebral, tranquilizer and relaxation points. Levels of anxiety were measured using a visual analogue scale before and after the intervention as well as before the exam. The State-Trait Anxiety Inventory, heart rate, exam performance and adverse events occurring during the study were also collected. ***Results:*** Exam anxiety level and heart rate decreased 30 minutes after auricular acupuncture ($p<0.05$). Before the exam, exam anxiety level and heart rate increased significantly compared to after the intervention but still lower than the baseline ($p<0.05$). The exam anxiety level with heart rate at each time point did not differ significantly in gender and trait anxiety levels ($p>0.05$). No adverse events from auricular acupuncture were observed. ***Conclusion:*** Auricular acupuncture at the master cerebral, tranquilizer and relaxation points on the non-dominant side is effective in reducing exam anxiety in first-year medical students.

Keywords: Exam anxiety; auricular acupuncture; State-Trait Anxiety Inventory.

1. INTRODUCTION

Exam anxiety, a type of situational anxiety, is a commonly seen problem among college students, especially in medical courses [1, 2]. All kinds of exams can possibly trigger different levels of anxiety. Undesirable physiological and mental manifestations of exam anxiety may negatively influence academic performance [3, 4]. Various mindfulness-based behavioral interventions have been established and proved to be able to reduce exam anxiety [5]. However, these methods are difficult to be used in anxiety treatment prior to an upcoming exam, due to their time-consuming treatment [6].

Auricular acupuncture (AA), a combination of modern and traditional techniques, has been proved to be effective in reducing situational anxiety, such as dental anxiety and pre-operative anxiety [7-9]. For exam anxiety, data on the effect of AA are limited. Only one randomized control trial demonstrated AA as an effective intervention. In this study, acupoints located on both ears were used [6]. Researches on AA for other situational anxiety types have indicated that

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DOI: 10.32895/UMP.MPR.3.2.3

anxiety level could be reduced by using acupoints on the non-dominant side [7-9]. Therefore, this study aims to determine whether AA points on the non-dominant side can reduce exam anxiety in medical students.

2. MATERIALS AND METHOD

Experimental design

This is a prospective observational study conducted on 32 first-year students at Faculty of Traditional Medicine Ho Chi Minh City University of Medicine and Pharmacy from December 2018 to May 2019. Students were provided with all the information about the study, the procedure, the effect and the feelings they were supposed to have. This study was approved by the Ethics Board in Biomedical Research at University of Medicine and Pharmacy at Ho Chi Minh City (approval number 436/ĐHYD-HĐĐĐ).

The inclusion criteria were: healthy students in their first year at university, undergoing an anatomy exam, without any history of alcohol abuse, opioid use or psychotropic medication, not taking any medications at the time of the study, and they agreed to participate in the research. Students, who had an auricular infection and inflammation, or those who consumed alcoholic drinks, coffee, tobacco within 24 hours prior to the study, or had a needle phobia were excluded.

In the afternoon prior to the exam, the students who were fulfilled the inclusion criteria were asked to sign the inform consent and then rated their exam anxiety level on the Vietnamese version of Spielberger's State-Trait Anxiety Inventory form Y1 (STAI-Y1; ranging from 20 = no anxiety to 80 = maximum imaginable anxiety). To exclude students that did not feel any anxiety, only students with a STAI-Y1 score of ≥ 40 were enrolled in the study. The eligible students then received AA on the non-dominant side at three points:

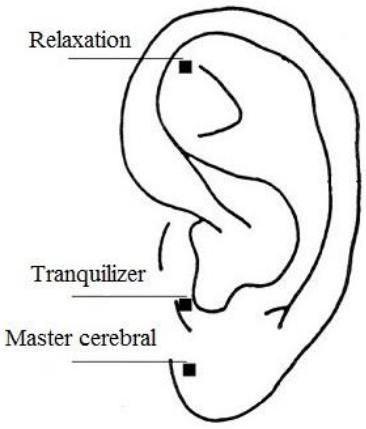

Fig.1. The anatomic location of the auricular acupuncture points

master cerebral, tranquilizer and relaxation points (Fig. 1) according to the AA nomenclature of French classification documented in a French AA textbook [10]. This method was performed by the second authors, who are medical doctors in traditional medicine with more than five years of experience in AA. Sterile, stainless steel, single-use acupuncture press needles (length 1.3mm, diameter 0.22mm, Suzhou Hualun Medical Appliance Co., Suzhou, China). Three needles were inserted percutaneously till 1.3 mm deep and fixed with flesh-colored adhesive tape and retained in situ, press continuously in 3 minutes, then no press needle until the following morning and were removed after the exam. Exam anxiety level assessed with visual analogue scale (VAS-100mm; from 0 = no anxiety to 100 = maximum imaginable anxiety) and STAI-Y1, heart rates were collected at three time points: before the intervention (Time I), 30 minutes after the intervention (Time II) and immediately before the exam (Time III). Trait anxiety level was assessed with the Vietnamese version of STAI form Y2 before the intervention (Time I). Exam performance (passed or failed), as well as adverse events occurring during the study, were also collected.

Statistical analysis

Data were processed by Epidata 3.1 and analyzed by Stata 13.0. We used the chi-square test to compare the students' status before the intervention. The paired t-test was used to compare the exam anxiety level and heart rate measured at three-time points.

3. RESULTS AND DISCUSSION

The STAI has 2 subscales. STAI form Y1 evaluates the current state of anxiety, which can be defined as fear, nervousness, discomfort and the arousal of the autonomic nervous system induced by different situations that are perceived as dangerous [11]. In this study, this scale was used to assess changes in exam anxiety over time. STAI form Y2 is used to measure the trait anxiety level. This scale evaluates relatively stable aspects of "anxiety proneness" [11].

There are four levels of trait anxiety based on STAI-Y2 scale included low (≤ 30 points); moderate (31-45 points); high (46-64 points) and anxiety proneness (≥ 64 points) [12]. Students with a moderate level of trait anxiety accounted for the majority (Table 1).

Table 1: Trait anxiety level in gender

Trait anxiety level	Male		Female	
	No.	%	No.	%
Low (< 30)	0	0.00	0	0.00
Moderate (31 – 45)	10	31.25	13	40.63
High (46 – 64)	4	12.50	5	15.62
Anxiety proneness (> 64)	0	0.00	0	0.00

There was no student in the low level group. This can be explained that the students with low trait anxiety level will show a low level of state anxiety [13], so that their STAI-Y1 scores will be under the proposed cutoff point to detect clinically significant symptoms [11], which does not meet the selection criteria. This study had no student in the anxiety proneness level, possibly because students in this group often need to take psychotropic medication, which does not meet the selection criteria.

No statistically significant difference was found between male and female students in trait anxiety level ($p>0.05$, chi-square test) (Table 1).

The exam anxiety level assessed with STAI-Y1 and VAS-100mm as well as heart rate measured before the intervention did not differ significantly in gender and trait anxiety levels (Table 2 and Table 3 respectively) ($p>0.05$).

Table 2: Baseline exam anxiety level and heart rate in gender

	Trait anxiety level		*Difference between moderate level and high level group*
	Moderate	**High**	
STAI-Y1	45.70 ± 2.98	46.11 ± 2.57	***P = 0.716***
VAS-100mm	51.52 ± 8.33	51.33 ± 8.25	***P = 0.954***
HR	91.00 ± 8.81	95.22 ± 10.93	***P = 0.263***

Data are given as mean ± SD and analyzed using Unpaired t-test.
STAI, State - Trait Anxiety Inventory; VAS, Visual Analogue Scale; HR, heart rate

Table 3: Baseline exam anxiety level and heart rate in trait anxiety levels

	Gender		*Difference between male and female group*
	Male	**Female**	
STAI-Y1	45.57 ± 3.20	46.00 ± 2.59	***P = 0.678***
VAS-100mm	49.64 ± 8.60	52.89 ± 7.78	***P = 0.272***
HR	91.07 ± 8.16	93.06 ± 10.52	***P = 0.565***

Data are given as mean ± SD and analyzed using Unpaired t-test.
STAI, State - Trait Anxiety Inventory; VAS, Visual Analogue Scale; HR, heart rate

STAI-Y1 score, VAS-100mm score, and heart rate were significantly different among each time point ($p<0.05$) (Table 4). Exam anxiety level assessed with STAI-Y1 and VAS-100mm decreased significantly 30 minutes after the intervention ($p<0.05$). Also, there was a remarkable decrease in heart rate after 30 minutes ($p<0.05$). At time III, exam anxiety level as well as heart rate increased significantly compared to time II but still lower than time I ($p<0.05$).

The results showed that 30 minutes after AA, exam anxiety level decreased by about 20% from baseline. This is in agreement with previous findings. Karst *et al.*, using the same acupoints to treat dental anxiety, reported that state anxiety scores reduced by about 18% from baseline after AA in 19 patients [7]. Similarly, Michalek-Sauberer *et al.* demonstrated a decrease by about 18% from baseline in state anxiety scores after AA in 61 patients for dental procedures [8]. For exam anxiety, Klausenitz *et al.* also showed that after the intervention, baseline anxiety level decreased by 20%, although this study had a different time of measuring anxiety level after the intervention. The level of anxiety tended to increase before the upcoming exam, without any interventions, the anxiety level kept rising constantly as Klausenitz *et al.* pointed out in their trial [6]. This explained why in this study the anxiety level assessed with both STAI and VAS-100mm immediately before the exam increased significantly compared to the level measured after treatment. Exam anxiety levels measured at the third time point were still lower than which were measured at baseline. Similar results were observed in the AA group of Klausenitz *et al*. [6]. All of these findings proved the effect of AA on exam anxiety in medical students. Since various neurotransmitters including γ-aminobutyric acid (GABA), serotonin, norepinephrine, glutamate, and cholecystokinin are thought to be involved in anxiety [14], the anxiety-reducing effect of AA might be related to these neurotransmitters. Further research is required to achieve a better understanding of the underlying mechanisms of AA.

The results of this study also showed that AA suppressed heart rate increase due to hyperactivity of the sympathetic nervous system induced by anxiety. Similar results were found by Karst *et al.* [7]. On the contrary, Klausenitz *et al.* found no difference in heart rate measured at each time point among the three groups [6], which might come from the use of different acupoints.

Table 4: Exam anxiety level and heart rate at each time point

Parameter	**Time point**	**Mean ± SD**
STAI-Y1	I	45.81 ± 2.83
	II	37.25 ± 2.62
	III	40.56 ± 3.65
	Difference between time I and time II	***P < 0.001***
	Difference between time II and time III	***P < 0.001***
	Difference between time I and time III	***P < 0.001***
VAS-100mm	I	51.47 ± 8.18
	II	40.16 ± 7.24
	III	48.69 ± 7.92
	Difference between time I and time II	***P < 0.001***
	Difference between time II and time III	***P < 0.001***
	Difference between time I and time III	***P = 0.008***
HR	I	92.19 ± 9.47
	II	79.16 ± 8.11
	III	87.00 ± 9.88
	Difference between time I and time II	***P < 0.001***
	Difference between time II and time III	***P < 0.001***
	Difference between time I and time III	***P < 0.001***

Data given as mean ± SD and analyzed using Paired t-test
STAI, State - Trait Anxiety Inventory; VAS, Visual Analogue Scale; HR, heart rate

Concerning exam performance, the students who passed the anatomy exam accounted for 84.38% (Table 5). Although similar results were demonstrated in Klausenitz *et al*. as in the AA group (81% of the students passed the exam), no significant difference in exam performance was found among

the three groups in this trial [6]. The acupoints used in this study were different from those used in Klausenitz *et al*. However, due to the lack of a control group, it could not be determined in this study whether AA at the master cerebral, tranquillizer and relaxation points on the non-dominant side had an ability to improve test results.

Table 5: Exam performance

Exam performance	No.	%
Passed	27	84.38
Failed	5	15.63

None adverse events from AA were observed in students, which is in line with findings of previous studies that stated that AA was a safe therapy [7, 9].

4. CONCLUSION

AA using master cerebral, tranquillizer and relaxation points on the non-dominant side is effective in reducing exam anxiety in first-year medical students. Further research is needed to clarify the underlying mechanisms of this effect.

ACKNOWLEDGEMENTS

Funding for this study was provided in parts by research grants from Ho Chi Minh City University of Medicine and Pharmacy.

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