



Neurometry Applied to Three Points Used for Positive Impulse in Auriculotherapy

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

The auricular acupuncture is the therapeutic applied in the microsystem of outer ear. In this area, the local innervations stimulate the brain regions resulting in diagnostic and treatment system. There are three auricular acupuncture points used together as positive impulse to the therapy: Shen men (SHM), Kidney (K), Autonomic Nervous System (sympathetic) (ANS). Neurometry is the neuroscience tool that uses computing to observe, through images, the brain's response to external stimuli. Our aim is to identify the brain answers to the three auricular acupuncture points used together, SHM, K, ANS through the neurometry. It was observed three volunteers during four different moments: in the beginning, before the procedure; 15 minutes, 24 hours and 48 hours after the needles application. Central nervous system effects, physical health patterns, emotional exhaustion, anxiety control, blood flow, respiratory and cardio functional changes were recorded. We conclude that the chosen points positively interfere in the control of anxiety, in the cardio-functional system, in the sympathetic nervous system and in parasympathetic functional oxygenation and that neurometry is qualified for further studies on the subject.

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1. INTRODUCTION

Acupuncture, ancient Chinese therapy, has been known to Asians since the beginning of its history. However, it was only in the last century that it gained attention among health professionals of the western world, when it reached the status of science in academies.

The neuroscience has proved that the brain activities are modulated through acupuncture, that occur different answers according to the characteristics of the stimulus, intensity, anatomic local, type, and the physiological aspects, psychological and cognitive. Each specific stimulus, in the central nervous system, was showed using several functional imaging techniques, such as functional magnetic resonance imaging (fMRI), positron-emission tomography (PET), and electroencephalography (EEG) [1-4]. Likewise, acupuncture has been shown to activate the frontal, parietal, occipital and temporal lobes, cerebellum, frontal, coronal and sagittal cortex and the limbic system [5-10].

The neurometry is an interdisciplinary method, computerized, which works in real time analyzing the brain physiology, allowing to observe structures and functions through stimuli. In this way, it provides the functional leading through central peripheral nervous system besides the dysfunction diagnoses [11,10].

The auricular acupuncture is the therapeutic applied in to the microsystem of outer ear. The external ear has four mixed nerves and the cervical plexus allowing a very special connection with the nervous system, these innervations when stimulated reach the cerebral cortex. Thus, it is an independent system for the treatment and diagnosis of diseases [12].

According to Souza, 2012, there are three points in the anterior part of pinna, located into the auriculotemporal peripheral nerve extension (NC V3) which cause the therapeutically effect observed: Shen Men (SHM), Kidney (K) and Autonomic Nervous System (ANS). These acupoints improving the auriculotherapy effect, when used together and respecting the presented sequence [13].

The neurometry is characterized by a record of changes in the brain caused by several established body movements, dorsal decubitus,

standup, orthostatic (DLO), initially described by the manufacturer. These data allow the analysis of the physiological aspects of the central and peripheral nervous system, in real time, adopting reference standards of physical and emotional health, blood and respiratory flow, functional cardio, anxiety level, among others [14].

The health standards were evaluated according to the emotional exhaustion, changes in blood and respiratory flow, cardio functional aspects, anxiety control among others, when submitted to these three points of ear acupuncture.

Our aim is to measure the auriculotherapy stimuli on the brain through the neurometry.

2. METHODS

It's a clinical study, with a prospective analysis of the three healthy volunteers were invited, two male (39 and 55 years) and one female (25 years). They do not use continuous medication, have no pain, do not smoke neither have known disease.

The reading was performed by sensors applied to the frontal region of the head, the tips of the index and middle fingers, the proximal phalanx of the annular finger, the digital pulp of the thumb and the functional breathing sensor, according to the manufacturer's instructions.

The neurometry reading started on "zero" moment, before any intervention, followed by positions (DLO) dorsal decubitus, standing and back to rest, the period of reading was defined by the program. After this initial examination, it was applied semi-permanent needles of auricular acupuncture with 1.5 mm to the SHM, K and ANS points on the dominant side of the volunteer.

The neurometry examination was carried out in three moments after auriculotherapy consisted of 15 min, 24 hours and 48 hours. It was registered the anxiety control considering the parameters: 1-acceptable, 2-mild, 3-moderate, 4-serious and 5-severe according to the reading provided by the equipment. Also, the variations in cardio-functional, oxygen and hemodynamics response were determined according to the indices of blood pressure, respiratory and cardiac rhythm, and were classified according to the same graduation of the item anxiety.

The Sympathetic Nervous System and Parasympathetic were also measured in five different items: 1-satisfactory, 2-adrenergic sympathetic activity, 3-autonomic limit, 4-susceptibility to pain and sensitivity and 5-nervous tension and exhaustion.

3. RESULTS

The results were collected, analyzed before and after the auriculotherapy, individually, and plotted in the Table 1.

In the first exam, before ear therapy, the three results showed excellent reading conditions according to the equipment. Observing the parameter "anxiety control" for deficiency levels, volunteer 1 presented severe deficiency and severe adrenal stress, with physical and emotional exhaustion, while the second individual had a severe degree and the third, a mild degree. After 48 hours, they showed "good variability" according to the same equipment, which means reduced anxiety, as well as the cardio-functional activity of the first and second volunteers showed variations after the therapy.

The anxiety is closely associated with the sympathetic and parasympathetic nervous system, and the individuals studied previously showed autonomic dysfunction compatible with exhaustion. The stimulation of these three points changed the autonomic standards in to the first and second volunteers which started to present a regular autonomous condition. It is remarkable the best situation of the individuals, once they weren't compatible with exhaustions in the moment next of the auricular acupuncture. Even the third volunteer, showed a condition of moderate alternation observed through the physiological capacity and periodic depletion, no more compatible with exhaustion.

The Oxygen functional results were improved for the auriculotherapy applied in these three points. Also, the hemodynamic response of individual number 1 changed from severe to moderate condition.

The anxiety control module is the analysis of the sympathetic response to the emotional reaction, and it is reported in percentage as showed on a graphical scale of 0 to 100% being 0% severe and 100% to normal. (Chart 1)

The three patients demonstrated at zero time with mild, severe and severe levels of anxiety, respectively. The patient with mild level (2), at

fifteen minutes after the stimulus with ear acupuncture, the normal level of anxiety was already obtained and maintained, for the two patients who had higher levels of anxiety, we observed a response in 24 hours when already occurred an improvement in both levels of anxiety, and at 48 hours all patients reach a grade considered normal for anxiety index.

3.1 Sympathetic Nervous System and Parasympathetic

The Autonomic Nervous System was analyzed by performance and monitoring of sympathetic (SNS) and parasympathetic (SNP) system. The activities of SNS and SNP were calibrated through graphics that relates respiratory rate (R-R) by seconds, during DLO moments at zero, 15 min, 24 and 48 hours.

The highlighted R-R in the three individuals is indicative of exhaustion, during the zero moment, prior to the application of the therapy and, 24 hours after the application, the volunteer 2 had already reached a satisfactory index while the other two volunteers also presented alterations. In the end of 48 hours all of them had responded to therapy (Chart 2)

3.2 Cardio-functional, Oxygen and Hemodynamic Response

The cardio-functional performance was analyzed through the frequency and cardiac variability in blood flow, the hemodynamic response and the influence of the baroreflex.

The intensity of the colors observed in the images defines the potential of the stimulus in the brain. The absence of defined colors, in the cerebral images, implies no brain stimulation; faint, blurry color with poor definition means low stimulation; diffuse color is caused by a random stimulus; the predominance of a color is a centered stimulus, and a single color indicates a fixed stimulus.

During the zero time, all the volunteers were exhaust, nervous tension. All of the movements, stand up and orthostatic, shows red and orange a quite evident in many of the observed areas of the brain (Fig. 1). On the other hand, diffuse areas were registered when in resting and moving to rise. The limbic and frontal areas are marked by the well-defined red color which determines the fixed stimulus. The coronal region showed the tissue of the motor area that disappears at the orthostatic moment.

Table 1. Results of equipment reading before and after the auricular acupuncture of the three volunteers

| Volunteer | Moment of Neurometry | Anxiety control | Cardio-functional | Sympathetic nervous system and parasympathetic | Oxygen functional and respiratory rhythm | Hemodynamic response |
|------------------|-----------------------------|------------------------|--------------------------|--|---|-----------------------------|
| 1 | zero | serious deficiency | moderate disorder | Compatible with exhaustion, nervous tension | moderate | severe alteration |
| | 48 h | good variability | normal disorder | regular autonomous condition | mild | moderate alteration |
| 2 | zero | severe deficiency | serious disorder | Compatible with exhaustion, nervous tension | regular | mild alteration |
| | 48 h | good variability | moderate disorder | regular autonomous condition | optimum | mild alteration |
| 3 | zero | mild deficiency | severe disorder | Compatible with exhaustion, nervous tension | moderate | moderate alteration |
| | 48 h | good variability | severe disorder | Moderate alternation physiological capacity and periodic depletion | regular | mild alteration |

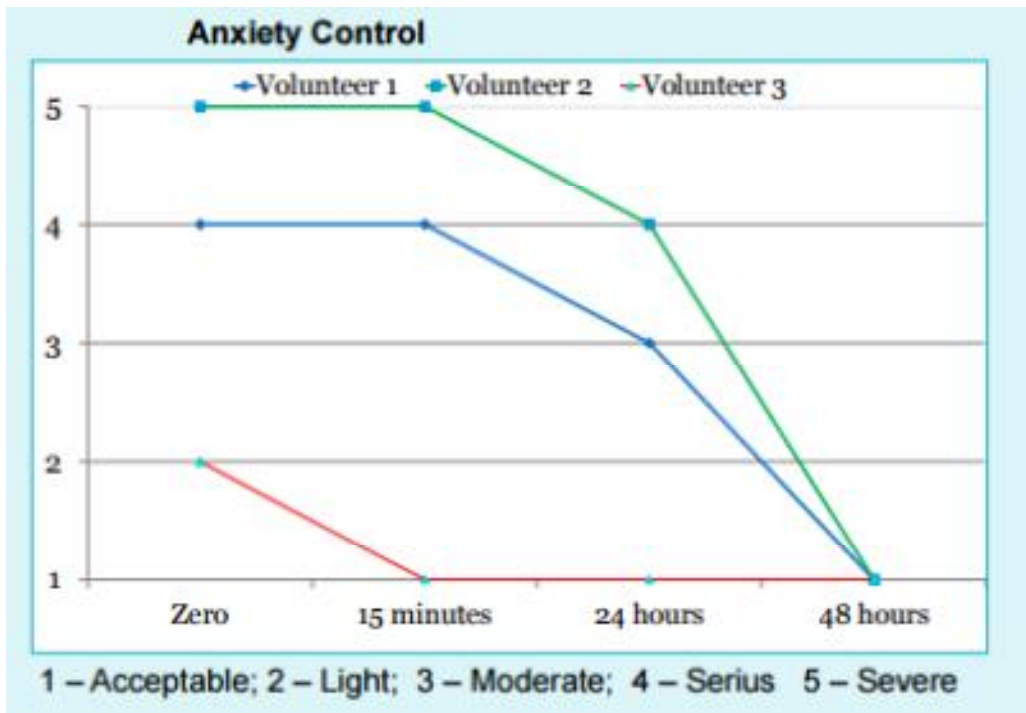


Chart 1. The anxiety control module observed before and after auricular acupuncture on zero to 48 hours period

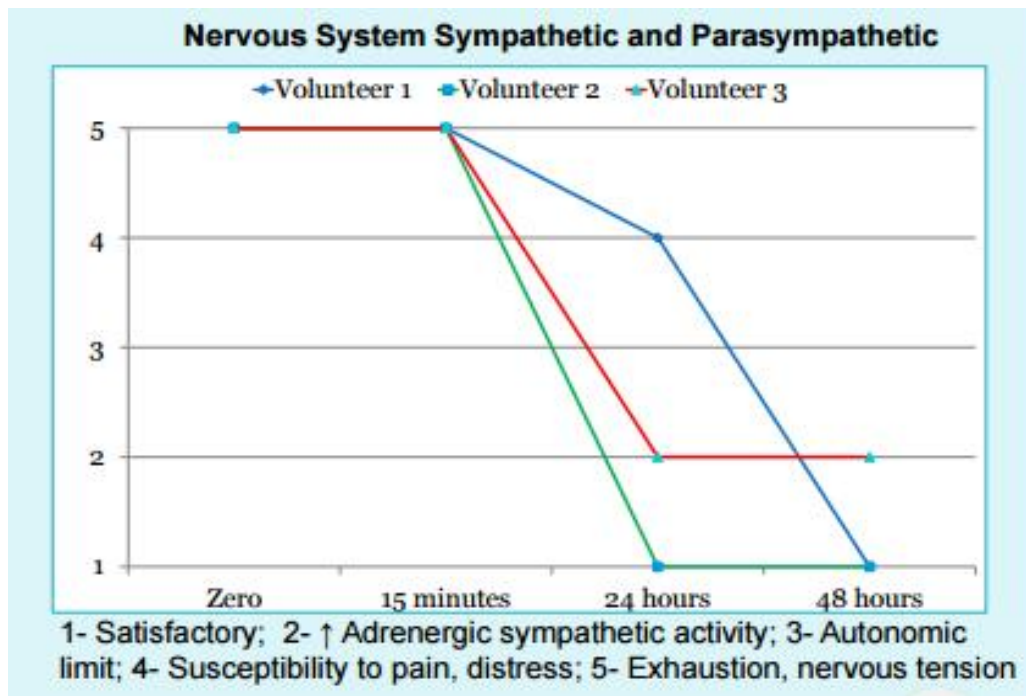


Chart 2. The Autonomic Nervous System observed before and after auricular acupuncture on zero to 48 hours period

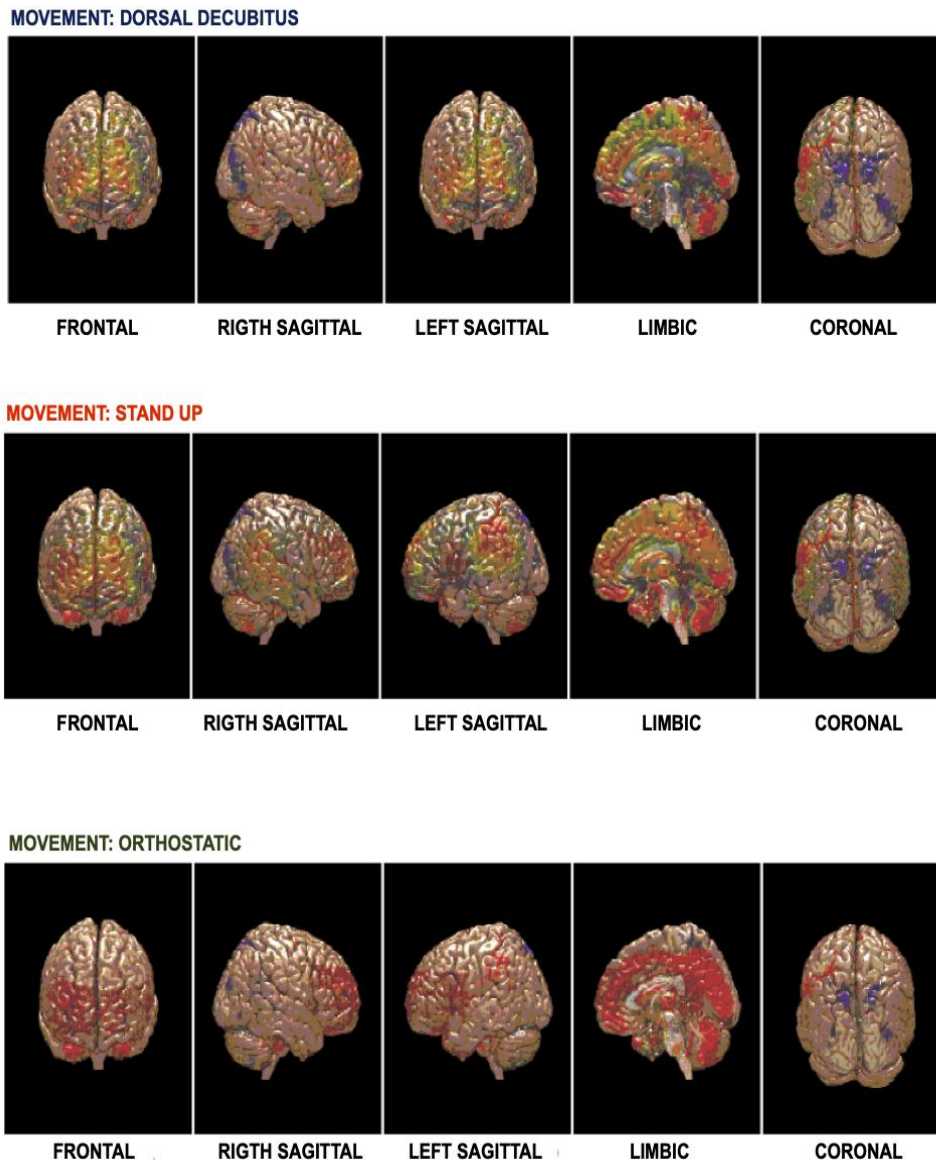


Fig. 1. Brain images neurometry program, registered in zero time prior to auriculotherapy application

After 48 hours of auriculotherapy, it was observed that frontal area showed less red colors in their brain images, specially on the cerebellar region. The cerebellar region acts on the postural sensation, in the proprioception. In the orthostatic movement, Fig. 1, the colors are blurred, mixed and with the red less defined on the left hemisphere. In addition, there are some cold colors (blue and green) in the right hemisphere and in the limbic area (pre-motor area), which were absent at time zero.

4. DISCUSSION

We are relating the effects of applying the three acupuncture points, without other complementary points, with the proposal to specifically evaluate the performance of these acupuncture points. They were previously indicated as essential to obtain qualified results in some models of auricular acupuncture. Neurometry was adopted as a mechanism to evaluate the effect of these three points, and it was observed that its stimulus

causes positive changes in the individuals studied. (Fig. 2)

The three points were recorded before, during and after therapy and we observed an improvement in the control of anxiety identified through cardio-functional evaluation, sympathetic, parasympathetic nervous system, functional and hemodynamic oxygen and with images of stimuli in the brain regions. These results are in agreement with those presented by Arai et al. (2013) who evaluated the response to the Shen men stimulus and the zero point, and demonstrated, by electrocardiography, that these auricular acupuncture points induce the activation of the parasympathetic system [15,16].

The neurometry equipment allowed a more deepen study, detailed through the functional analysis of the cognitive and nervous system. The analysis of the functional performance of the Autonomic Nervous System (ANS) with heart rate variability, chronotropic (decubitus versus HR max), vascular compensatory response (HR min versus HR max) and orthostatic relationship (decubitus vs. orthostatic) provides amplitude and frequency autonomic. Thus, it was possible to prove the changes caused by the needles applied at the right points and their effects on the ANS, both in the sympathetic and parasympathetic systems. Demonstrating individual variability and physiological changes associated with acupuncture, widely reported in the literature [17,4].

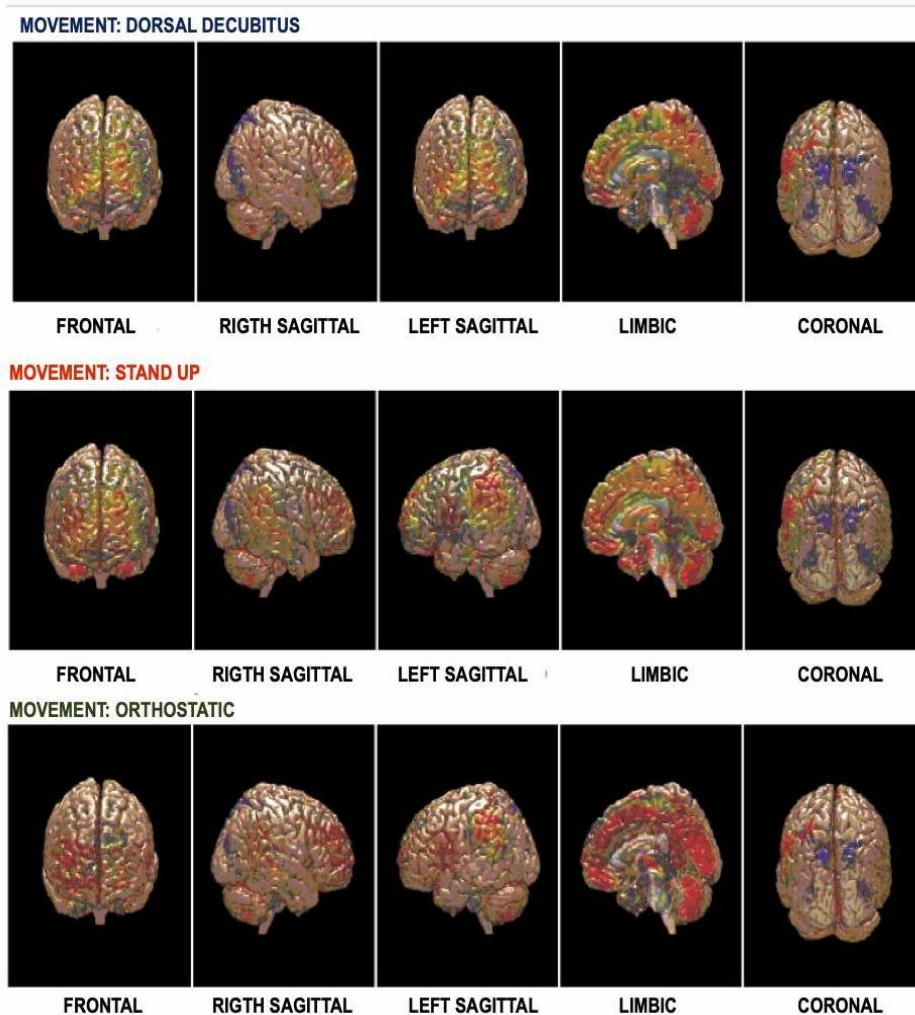


Fig. 2. Brain images neurometry program, registered 48 hours after auriculotherapy application

In order to qualify the effect of stimulation of these points on the level of stress by observing the autonomic response, as demonstrated by Lidaka et al. (2004), the index of baroreflex influence, hemodynamic and functional oxygen was evaluated, in these aspects the cardio-functional activity was moderate to normal and the hemodynamic response showed improvement, going from severe to moderate [17].

Observation of the brain response in real time, provided by neurometry, showed that auricular acupuncture acts in an impacting manner in the limbic and motor areas. The color characteristics observed in the images, provided by the equipment, defined the potential of the stimulus, diagnosing performance and functional responses. Similar results in the literature were also obtained by Yoo et al. (2004), where a study group was successfully submitted to stimulation of acupuncture during analysis of heart and respiratory and psychophysical factors through the fMRI exam [18].

The specific modulator effect of the stimulator is also consistent with studies that demonstrated effects of the electroencephalogram in the brain from variable frequencies of stimulation, for example, stimulation of acupuncture can differentially modulate cerebral blood flow [19], rates autonomic [20] and heart rate variability [21], and the blood pressure ion decreasing during acupuncture therapy [22,23] in a systematic review of the literature demonstrated that the measurement of the parameters of quantitative electro encephalopathy (qEEG), provided by neurometry, has been used successfully to monitor and evaluate the results in the treatment of deficit disorder attention and hyperactivity (ADHD).

The three basic points of auricular acupuncture, Shen men, Kidney and Autonomic Nervous System, are known for their function in catalyzing the effect of other acupuncture points. The three volunteers followed up in this study showed an increasing balance after the application of the therapy, as evidenced by neurometry.

5. CONCLUSION

The observed results allow us to infer that auricular acupuncture, and specially the three points studied when applied together, have an effect on the brain. Acting in to the levels of anxiety, cardio functional conditions, sympathetic

and parasympathetic nervous system, oxygenation and hemodynamic rates.

The study allows us to propose a new line of research adopting the neuroscience through the neurometry to understand a neurophysiological aspect of auriculotherapy.

CONSENT AND ETHICAL APPROVAL

All of the volunteers read and signed the consent in accordance with the Helsinki Declaration, and approved by the local ethical committee number 50167515.6.0000.5229, and also submitted to an interview and anamnesis followed by neurometry examination.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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