

# **Autonomic Monitoring and Clinical Outcomes in the Acupuncture Clinic**

## **Protocol Parameters, Pitfalls, and Progress**

### **Abstract**

**Background:** Acupuncture has been shown to affect autonomic balance in studies using Fmri, peripheral sympathetic tone and other measures. Heart Rate Variability (HRV), a noninvasive autonomic monitoring system, has been studied in academic acupuncture settings comparing points used, the type of stimulation, and various HRV parameters for autonomic response. There is evidence that acupuncture needling increases HRV over minutes to hours (short term), and even over weeks to months (long term). This improved HRV measurement may correlate with clinical efficacy. In monitoring HRV there may be an opportunity to identify treatment strategies that improve autonomic balance and improve clinical results.

### **Objectives**

1. To illustrate the current iteration of this clinical HRV monitoring protocol and its potential uses
2. To test/validate published needling protocols and related interventions shown to affect autonomic balance using the HRV protocol
3. To show how HRV improves with acupuncture short term and long term inferring improved autonomic balance.

**Materials and Methods:** Acupuncture clinic patients with various medical issues were monitored before and during treatment based on TCM. Needling strategies and associated techniques from the research shown to have an autonomic effect were added to standard treatment for study.

**Results:** All patients profiled for this study had definitive clinical improvement. HRV data will be shown and discussed.

**Conclusions:** The HRV protocol used did not consistently validate the autonomic effects claimed by published literature studies, but was able show HRV improvement over time.

### **Introduction**

This study is part of an ongoing project to develop a practical heart rate variability (HRV) analysis protocol for use in the acupuncture clinic. Identifying and achieving optimal and reproducible clinical outcomes by adding an autonomic biomarker is the core of this effort.

### **Implications of HRV and Acupuncture**

Stress has negative impacts on the immune system,<sup>i ii</sup> aging<sup>iii</sup>, mood<sup>iv</sup>, inflammation<sup>v</sup> and pain. Acupuncture has been shown to affect all of the above. Recent Acupuncture and Neuroimaging<sup>vi</sup> studies have confirmed that acupuncture can affect the autonomic nervous system (ANS), as has long been established in the acupuncture literature<sup>vii. viii ix</sup>. Indeed, acupuncture brain-imaging research reveals central nervous system (CNS) involvement of areas suggestive of a shift in the ANS balance.<sup>x</sup>

HRV, a noninvasive monitor of autonomic balance, gives a detailed record of patients' stress levels. Reducing patients' stress boosts health by improving pain levels, mood, longevity and immune function. Having the data to show this improvement would be helpful to the field of acupuncture on many levels.

Systems biology<sup>xi</sup>, explains how small inputs can cause physiological cascades leading to outsized effects. HRV is uniquely positioned to capture nuanced global physiological changes on a second by second basis by registering subtle shifts in autonomic balance. ~~The immediate HRV response to needling may give additional information about the patients' response and/or responsiveness to acupuncture.~~

A potential advantage of autonomic monitoring in conjunction with acupuncture treatment is that according to one study<sup>xii</sup> placebo effect does not extend to autonomic response, so actual physiological shifts might be distinguished from placebo.

### **Correlation of HRV with Clinical Outcomes: Previous HRV/Acupuncture Studies**

One aspect of this ongoing project is correlating HRV with clinical outcomes. HRV and acupuncture have been studied in academic settings mostly in healthy volunteers or animals to evaluate various physiological effects of needling. There have been fewer studies on clinical outcomes with acupuncture treatment correlating with HRV results. Some clinical<sup>xiii xiv</sup> studies have suggested that HRV improves after needling in patients most likely to respond to treatment. In patients who are clinical "non-responders" their HRV does not improve after needling. The hypothesis in this line of inquiry is that by ensuring an increase in HRV after needling the likelihood of positive clinical results is improved. Furthermore, there is some evidence that HRV improves over weeks to months with continued acupuncture treatment.<sup>xv xvi xvii.</sup>

### **Development of the Clinical HRV Monitoring Protocol**

Time Windows:

Ideally, the monitoring protocol should be able to detect minute by minute changes in autonomic activity, but also be able to pick up trends in stress levels over time i.e. weeks to months. There is evidence that needling causes autonomic shifts within seconds. So capturing the very rapid autonomic response to needling as well as the aftermath over minutes and then over weeks to months is the challenge. Because HRV measurement is characterized by "noise" with erratic swings, the time windows for study must be small enough to pick up the subtle shifts with needling and afterward, but large enough to see the trend over the treatment session and over weeks to months. In this iteration of the protocol, there is a 5 minute baseline reading, then a needling segment usually between 4 to 7 minutes, and then continuous monitoring through needling and for the duration of the time needles are in place divided into 3 minute intervals.

HRV parameters:

There are different ways of analyzing HRV data: time, frequency and nonlinear methods. For this study, only frequency data were demonstrated since frequency data gives a representation of sympathetic activity(LF), parasympathetic activity (HF) and a ratio of the two (LF/HF) representing autonomic balance. The time domain and nonlinear measures may prove to be valuable, but not included in this discussion.

### **Verifying Published Treatment Strategies to Induce Autonomic Effects**

In this study, to further test the validity and limits of this clinical HRV protocol, the author employed the protocol to evaluate various published treatment strategies shown to affect autonomic activity. ~~Other protocols have been evaluated in the clinic, but not presented.~~

### **Auricular Vagal Nerve Stimulation or “Estim” and HRV**

Indwelling vagal electrostimulation devices are currently being explored by several groups<sup>xviii</sup> to improve immune function, epilepsy, depression and other conditions. Estim could enhance vagal activity<sup>xix</sup> by stimulating the auricular branch of the vagus nerve without the side effects of indwelling stimulators. Since autonomic balance and monitoring have been the focus of this ongoing HRV project, using electrical auricular stimulation (estim) in conjunction with acupuncture was a logical step as an adjunct therapy to try.

### **Electroacupuncture LI11—>LI10 2HZ**

Electroacupuncture at Large Intestine(LI)10 and LI11. This protocol was described in an animal study<sup>xx</sup>. Sympathetic activity decreased compared to electroacupuncture at a control point. This protocol is also relevant because LI 11 and LI 10 are alternative points for Longhurst’s hypertension protocol.<sup>xxi</sup> The addition of these points to standard acupuncture treatment was used on hypertension patients in the clinic.

### **Electroacupuncture LI11—>LI4 100Hz**

This study<sup>xxii</sup> showed that electroacupuncture at 100 Hz increased parasympathetic activity 20 minutes after needling and then decreased nasal IGA 40 minutes after needling. This protocol was added to standard acupuncture treatment in patients with allergy diagnosis.

## **Materials and Methods**

### **Study Participants:**

Patients receiving treatment in Acupuncture Clinic with a variety of conditions are included for presentation here. Diagnoses include, migraine, hypertension, allergies of various types, and anxiety. Ages, clinical response listed in Results.

Patients selected for presentation had decisive clinical improvement. Patients’ conditions are described with their data. Written consent was obtained for monitoring and treatment.

## **Acupuncture Treatment**

Needling protocols were based on TCM principles and varied from patient to patient. Needles used were DBC™ Spring Ten Acupuncture Needles .25X30 and .16X30. Typically 10 to 20 needles were used, twisted 3 to 5 times, no de qi elicited. Treatment frequency was 2 treatments/week for two weeks and then weekly for two more weeks if possible. For longer term patients, frequency was at least monthly, sometimes weekly as shown in data results. Unless otherwise stated, the frequency of electroacupuncture was 2 Hz or 100Hz depending on the protocol. The devices used were Dual Channel Milli-Amp / Micro-Current.

## **Auricular Ear Stimulation (Estim)**

Auricular stimulation was a TENS unit (TENS TX-2M) during treatment segment and ear electrode clip applied to the cymba concha region, or a modified TENS unit pad was trimmed to fit into the concha and cymba concha region of the ear. Grounding pad placed on shoulder lateral to neck. Right or left ear stim was used 2Hz, or 100hz.

## **HRV Monitoring and Measurement**

**Patient Monitoring:** Patients were monitored for 5 minute baseline then during needling (4 to 7 minutes) and then for 20 min with needles in. Most patients were monitored and treated in the supine position, but some in the prone position as noted in Results. If patients received two-sided treatment, every attempt was made to monitor HRV supine, and then treat prone without monitoring.

**Data Capture:** Nonin OEM Evaluation Program Rev. 15, from Nonin Medical, Inc. was used either on the right forefinger or right first or second toe for heart rate measurement connected wirelessly to a standard laptop computer for heart rate capture. The heart rate data was stored as a text file and then uploaded to Vivosense Heart Rate Variability Analysis 2.4 software from Vivonoetics, for analysis. Each tracing was examined for artifact and corrected on a beat by beat basis. Then the data was divided into time windows with a 5 minute baseline, a needling segment, and then 3 minute segments of time on the table with needles in.

## **HRV Data Analysis**

HRV was quantified using registration of percentage changes in R–R intervals in the time domain (TP, RMSSD and Pnn50) as well as the changes in the frequency range (HF, HF norm, LF, LFnorm, LF/HF) by analysis of pulse form power spectra. Parameters are recommended by the task force of the European Society of Cardiology and the North American Society of Pacing

and Electrophysiology.<sup>1</sup> Calculation of EKG, or pulse oximeter peak-to-peak measures of power spectra are thought to provide a representation of the contributions of the sympathetic and parasympathetic systems on HRV. It is known that vagal and sympathetic activities affect low frequencies (LF: 0.04-0.15 Hz), whereas vagal tone only affects high frequencies (HF: 0.15-0.4Hz). Nonlinear measures were measured (Sample Entropy, Poincaré plots, DFA1) and tabulated but not included in this particular study.

## **Clinical Assessments**

Clinical outcomes were patients' self-reporting of symptoms (number of migraines, number of anxiety attacks, sleep quality etc...) and in some cases blood pressure measured in the clinic. The clinical assessments were the equivalent of a chart review. Only patients with decisive clinical improvement are reported here, for purposes of focus.

### **Results:**

To best illustrate the features of this protocol, individual cases will be presented.

Parameters: When measuring HRV the following were measured. Not all of these will be reported here.

#### **Frequency Measures**

Low Frequency(LF) LF and LF norm measure of **sympathetic tone** → in general, **lower is healthier**

High Frequency(HF) HF and HF norm measure of **parasympathetic tone** → in general **higher is healthier**

LF/HF a measure of **sympathetic/parasympathetic tone** → in general **lower is healthier**

#### **HRV Values over weeks to months.**

In the cases presented here, though the data has lots of variation, one can perceive the overall decline in stress levels over weeks to months. In all 3 of the patients' data here, we see a decrease in LF/HF, or an increase in HF over a 3 month period and beyond.

#### **Electroacupuncture 2Hz at Large Intestine (LI) LI10→LI11**

In the cases presented here, there was no appreciable change in sympathetic activity with the protocol compared to standard treatment.

#### **Electroacupuncture at LI4→LI11 100Hz**

In both patients presented here, there was some increase in their parasympathetic activity as predicted by the protocol.

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<sup>1</sup> Heart rate variability: Standards of measurement, physiological interpretation, and clinical use. Task Force of the European Society of Cardiology and the North American Society of Pacing and Electrophysiology. Eur Heart J. 1996;17(3):354–381.

### **Auricular Vagal Nerve Stimulation (Estim)**

In one case (Fig 9), the auricular vagal stimulation actually caused a spike in LF/HF when used. The patient had no untoward effects, had no change in mood or sensations of any kind, and it did not provoke a migraine. In the other two cases presented here, the patients both had a profound sense of calm and had marked reduction in LF/HF or increase in HF.

Fig 1 Ma.Ke. 40+ year old female with phobias and allergic esophagitis.

**Clinical Response:** Improved mood, decreased anxiety, improved sleep and esophageal symptoms within 2 months.

**HRV:** Improved sympathetic/parasympathetic balance, and parasympathetic levels over months.

**Basic points used:** 4LI, 7K, 4Sp, 6PC, 6Lu, 20GB, 10Bl, 11Bl, 15 TH, sishencong

Fig 2 Jo.Ka.60 yr old with cervical dystonia 60 y.o. female nurse with disabling cervical dystonia characterized by stiffness, pain, and involuntary “pulling” of her head. Wanting to avoid further Botox injections, she sought Acupuncture treatment.

**Clinical Response:** Though the acupuncture helped her sleep better and improved her overall wellbeing, she still requires periodic Botox injections, thus her clinical improvement is only partial.

**HRV:** Improved Parasympathetic Activity over months.

**Basic Points Used:** 1Li, 2Li, 3Li, 3K, 7Lu, 6PC, 5PC, 14DM

Fig 3 Em.Mi.25 yr old with anxiety and poor immunity.

**Clinical Response:** Within a few visits her anxiety diminished decisively

**HRV:** Improved Parasympathetic Activity over weeks to months.

**Basic Points Used:** 4SP, 3LI, 7He, cymba concha ear needling, AnMien, yintang, 15 TH, 21GB

### **Electroacupuncture 2hz at Large Intestine LI 10→ LI11**

Fig 4 Ed.Hi is a 34 year old F with hypertension.

**Clinical Response:** Patient’s blood pressure initially was 142/90. With ongoing Acupuncture treatment she has remained off medication with BP between 110/69 to 141/79

**HRV:** LI10/LI11 protocol seemed to increase her parasympathetic activity and complexity (not shown). There also is a decrease in her sympathetic activity as predicted by the protocol as shown by arrow.

**Basic Points Used:** 3Liv, 36St, 37St, 4LI, 11LI, 10LI, 6PC

Fig 6 Te.Ca. 50+ year old female with anxiety and hypertension.

**Clinical Response:** Initial BP 143/85 now maintained 109 to 126 systolic, 70 to 78 diastolic. Her anxiety was reduced decisively within 3 visits.

**HRV:** Electroacupuncture at LI10 and LI11 protocol may have caused some decrease in sympathetic activity as shown by arrows.

**Basic Points Used:** 2Li, 3Li, 36St, 4LI, 11LI, 6PC, 7He, Sishencong

### **Electroacupuncture at LI4→LI11 100HZ**

Fig 7 Ti.We.40+ year old with allergic rhinitis and sinusitis.

**Clinical Response:** Her allergies became more episodic over the first 3 months, then diminished to rare, with further treatment.

**HRV:** Her parasympathetic activity increased somewhat with the protocol as shown by arrows.

**Basic Points Used:** 13Bl, 23Bl, 43Bl, 3K,36St, 4LI, 20GB, Bitong, 26DM, yintang

Fig 8 Da.Ba. 60+ year old with allergic rhinitis when exposed to dogs.

**Clinical Response:** Patient's allergies decreased within 4 treatments and attacks have remained rare.

**HRV:** Some increase in parasympathetic activity with protocol as shown by arrow.

**Basic Points Used:** 3K,36St, 4LI, 6Lu, yuyao, 26DM, 23DM,

### **Auricular Vagal nerve stimulation "Estim"**

Fig 9 Ne. Be. 60+ year old with severe 3/week migraines

**Clinical Response:** Patient responded definitively to treatment within 3 months. His migraines remain under control with less than 1/90 days.

**HRV:** This patient had marked spikes in stress levels (LF/HF) with estim compared to standard treatment as shown by arrows.

**Basic Points used:** 4Sp, 3Li, 2Li, 3K, AnMien, 7He, cymba concha, 36St, 6PC, 5PC, 4LI

Fig 10 Sh.In 60+ year old with anxiety and allergic rhinitis and asthma and fatigue. She is an ongoing patient who has significant reduction in her allergies and asthma.

**Clinical Response:** She had profound results with the estim feeling energized and clear and is using the device at home.

**HRV:** Marked reduction in LF/HF during treatment with estim compared to standard treatment as shown by arrows.

**Basic Points Used:** 4Sp, 3Li, 36St, 4LI, 20LI, 21LI, yintang, 20GB

Fig 11 De.Bo. 60+ year old with anxiety and allergies.

**Clinical Response:** She had profound results feeling calm and able to sleep and is using the device at home.

**HRV:** Marked reduction in LF/HF during treatment with estim compared to standard treatment as shown by arrows.

**Basic Points Used:** 41GB, 5T H, 36St, 4LI, 7K, 6Sp, sishencong, yintang, yuyao, 8Bl

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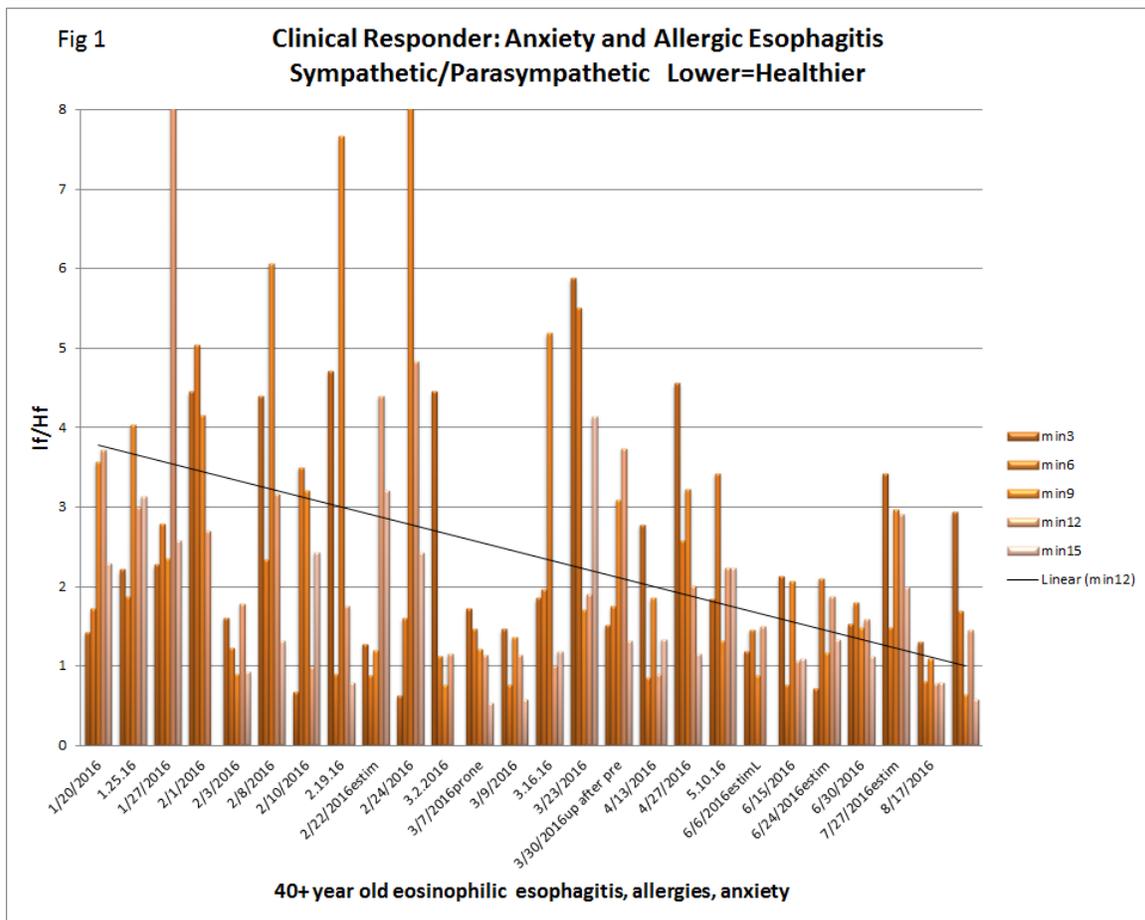


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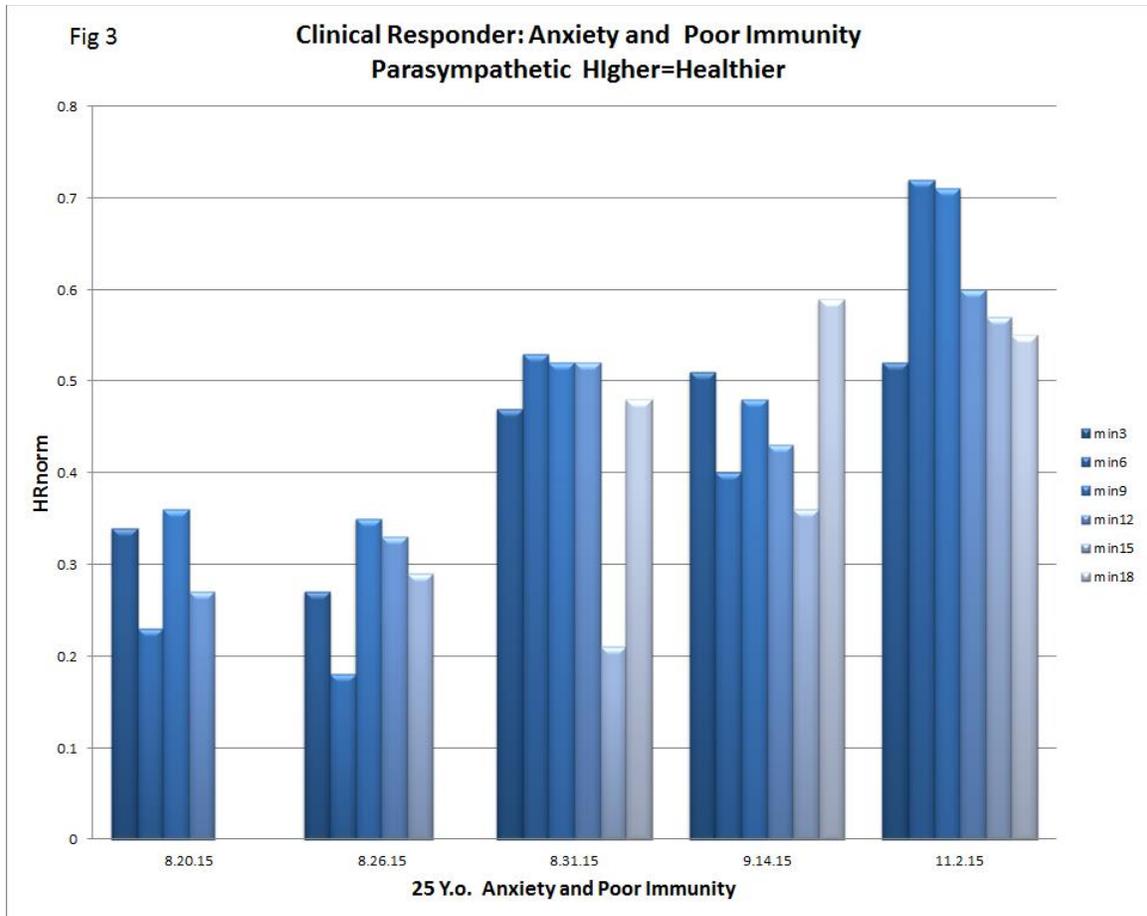


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**Basic Points Used:** 3Liv, 36St, 37St, 4LI, 11LI, 10LI, 6PC

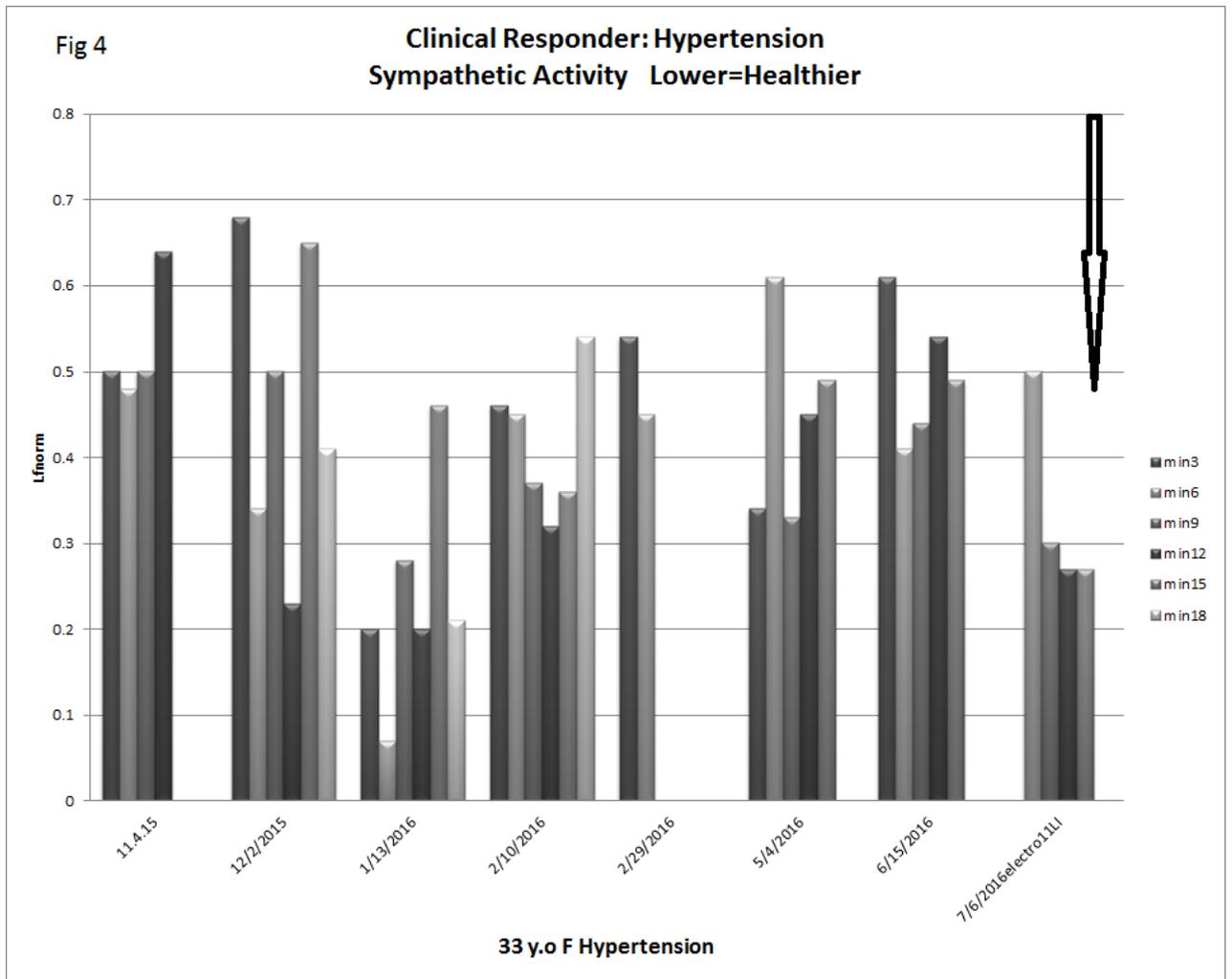


Fig 5 Vi.Sa. 40+ year old female with hypertension.

**Clinical Response:** Patient maintains her blood pressure 100 to 110 systolic 60 to 75 diastolic

**HRV:** The protocol does not affect her parasympathetic activity nor complexity (not shown), and does not decrease her sympathetic activity as shown by arrow.

**Basic Points Used:** 6Sp, 36St, 37St, 3K, 7He, 6PC, yintang, Bitong,

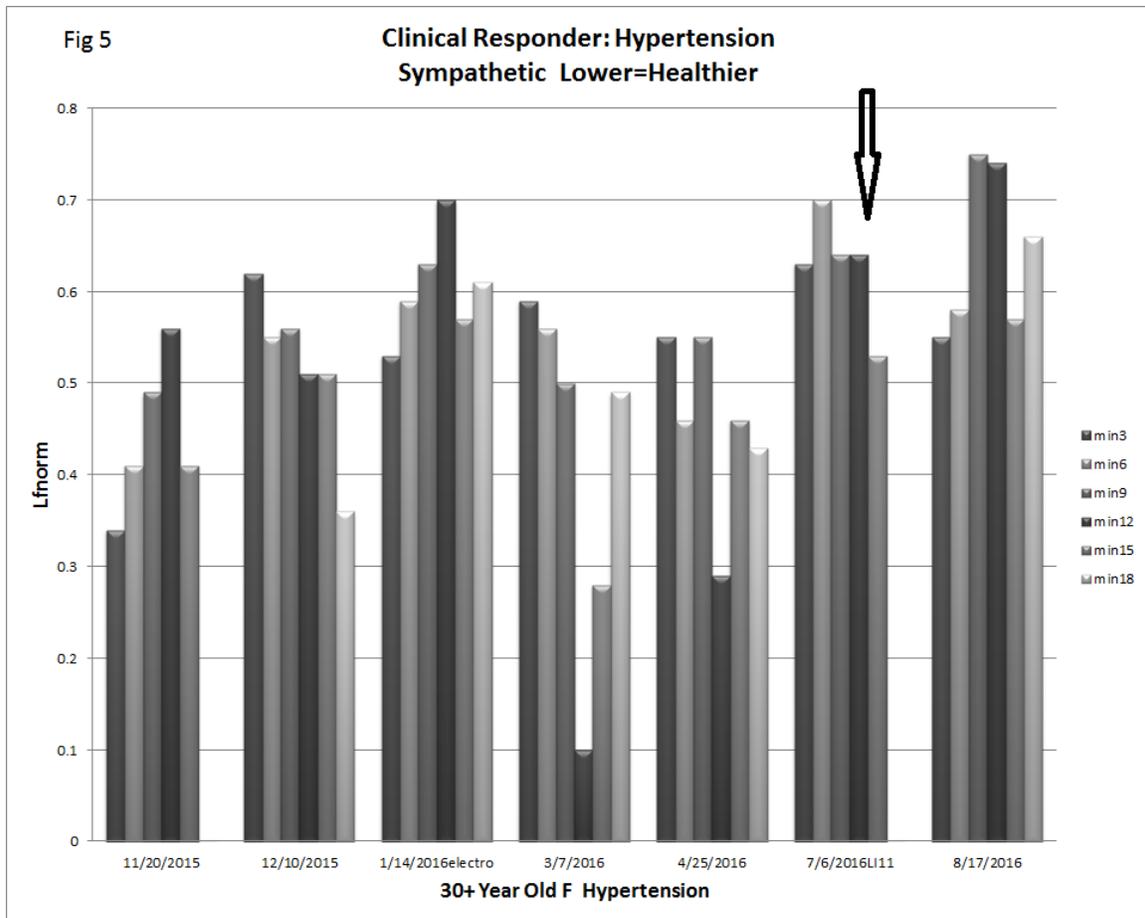
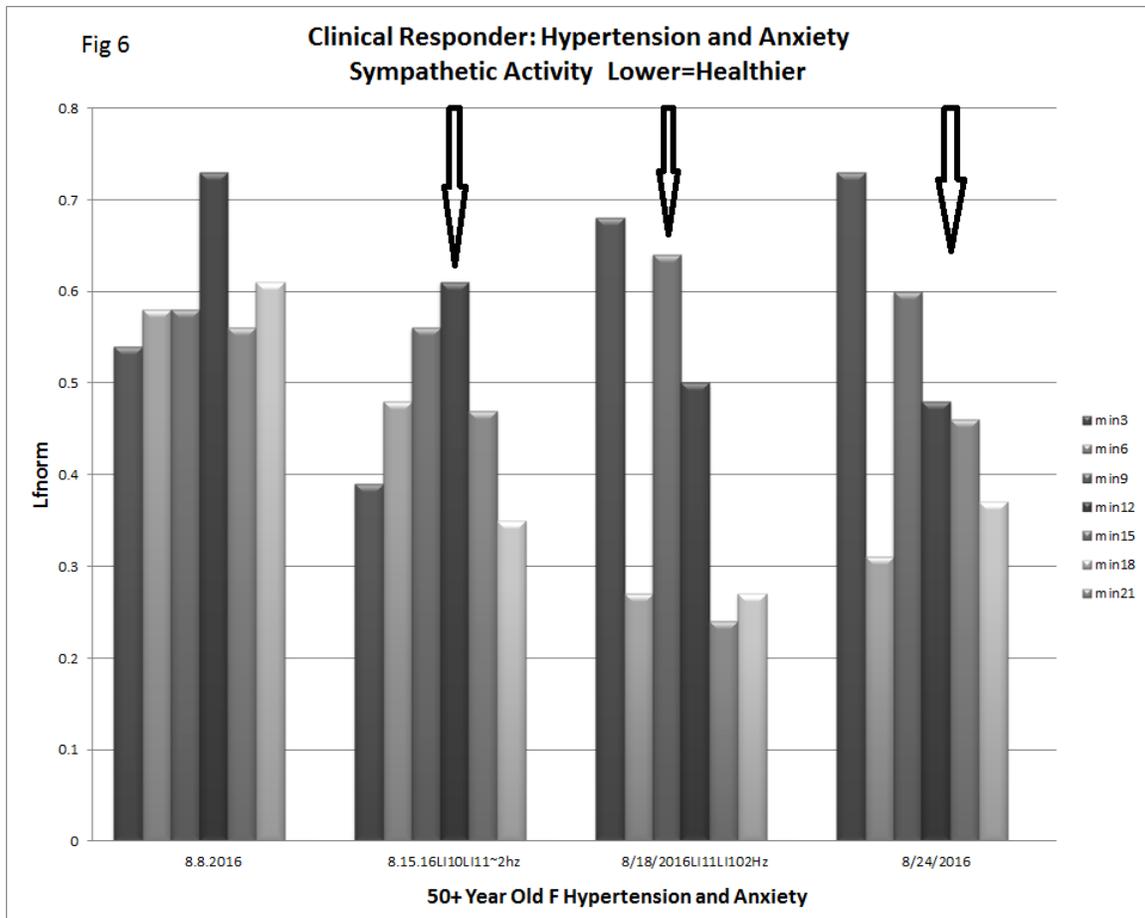


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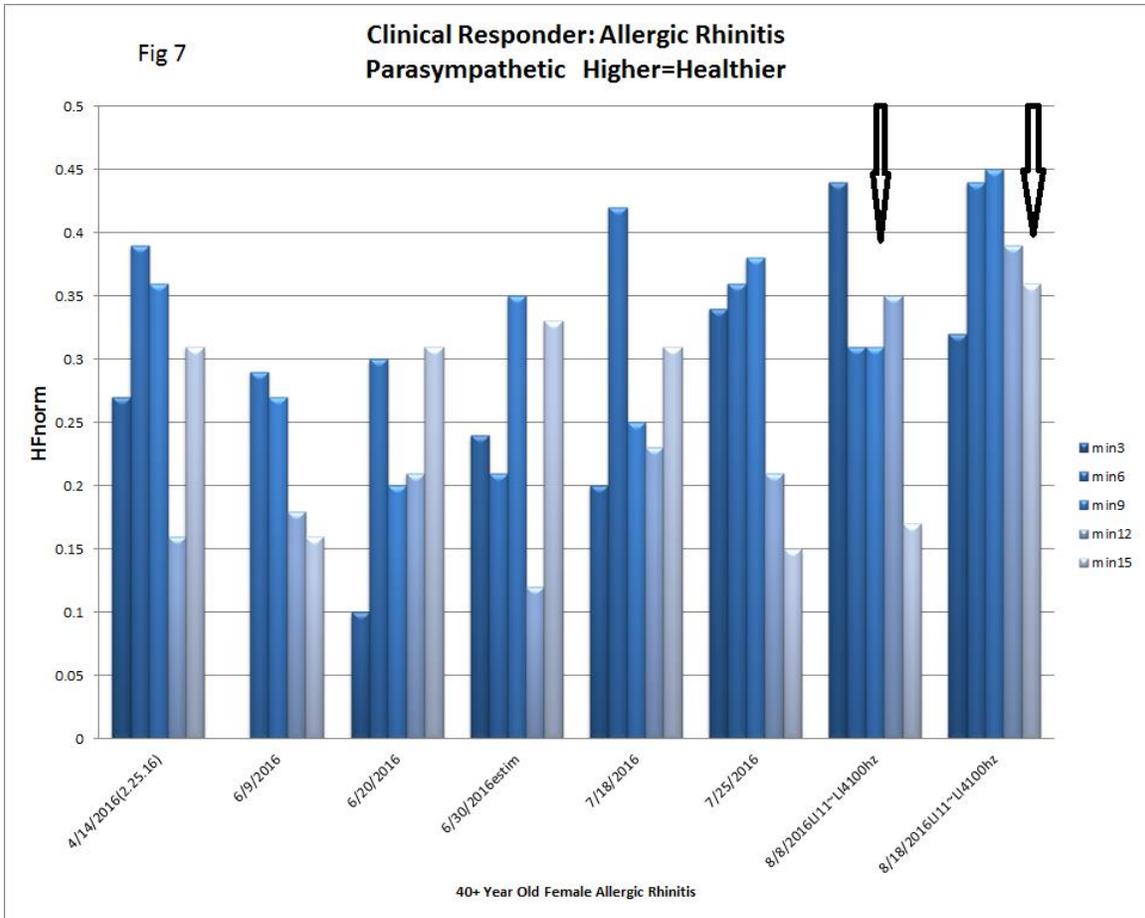
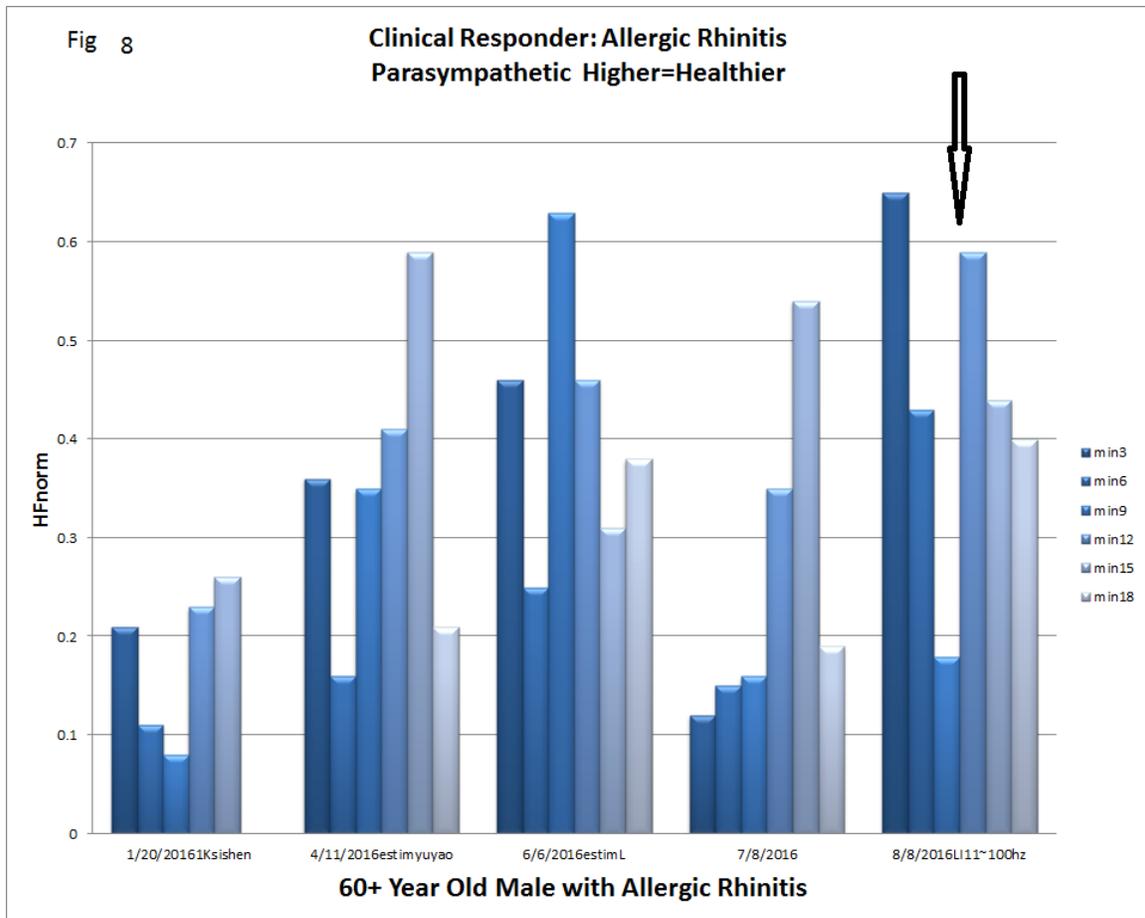
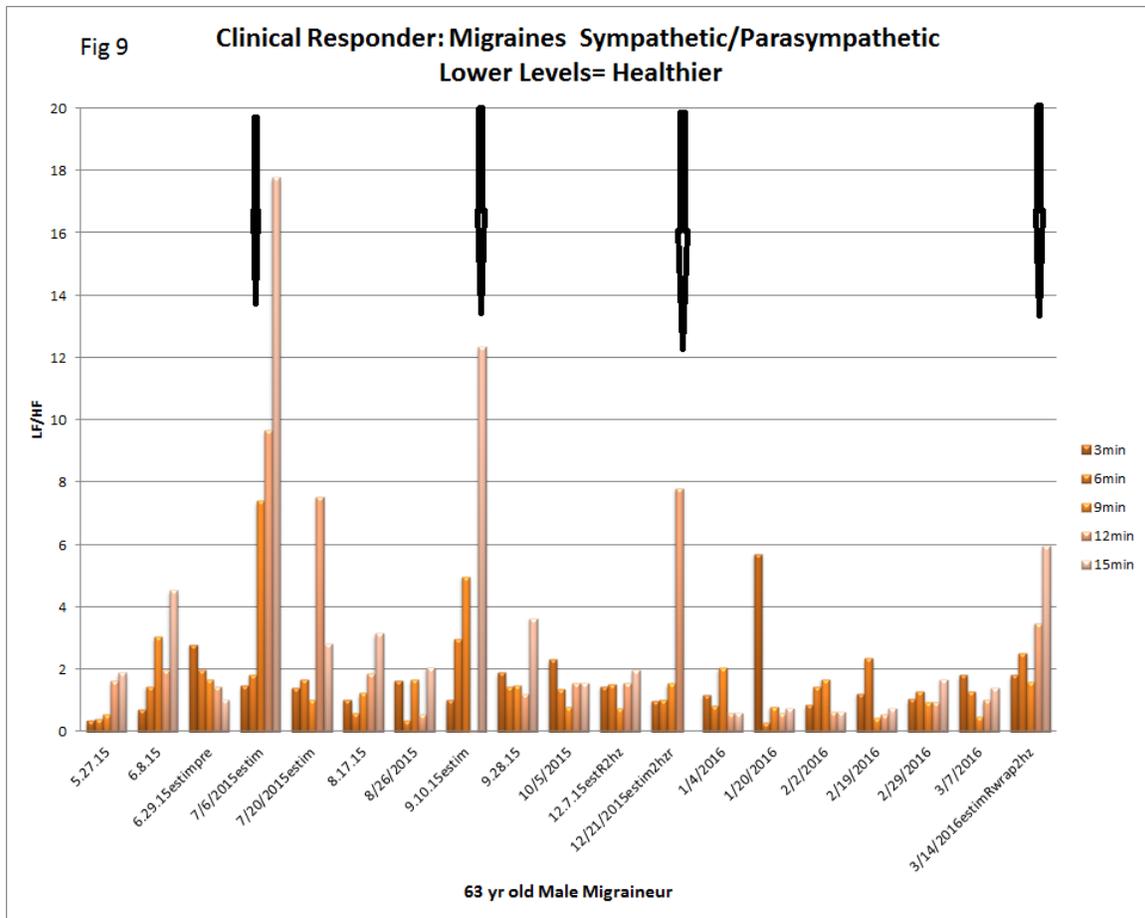


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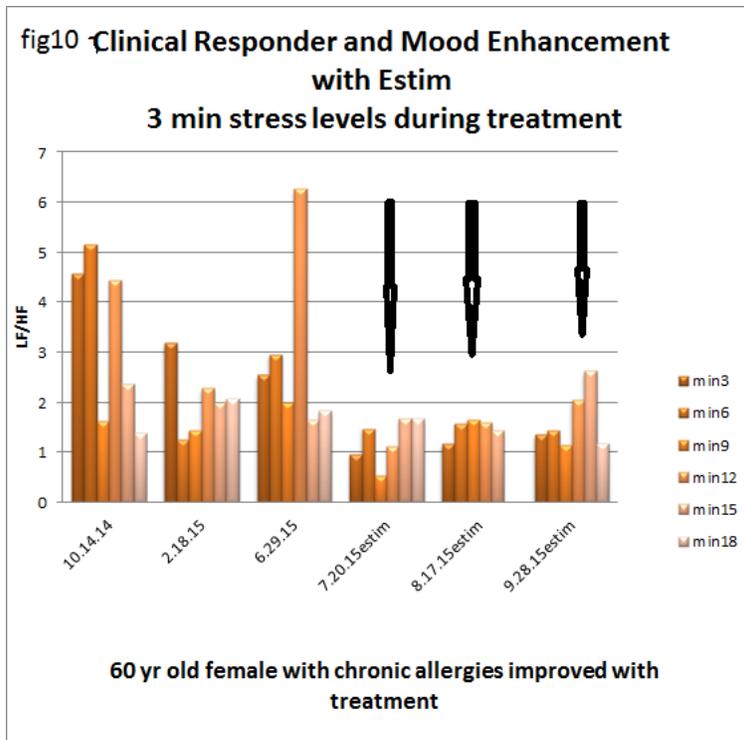
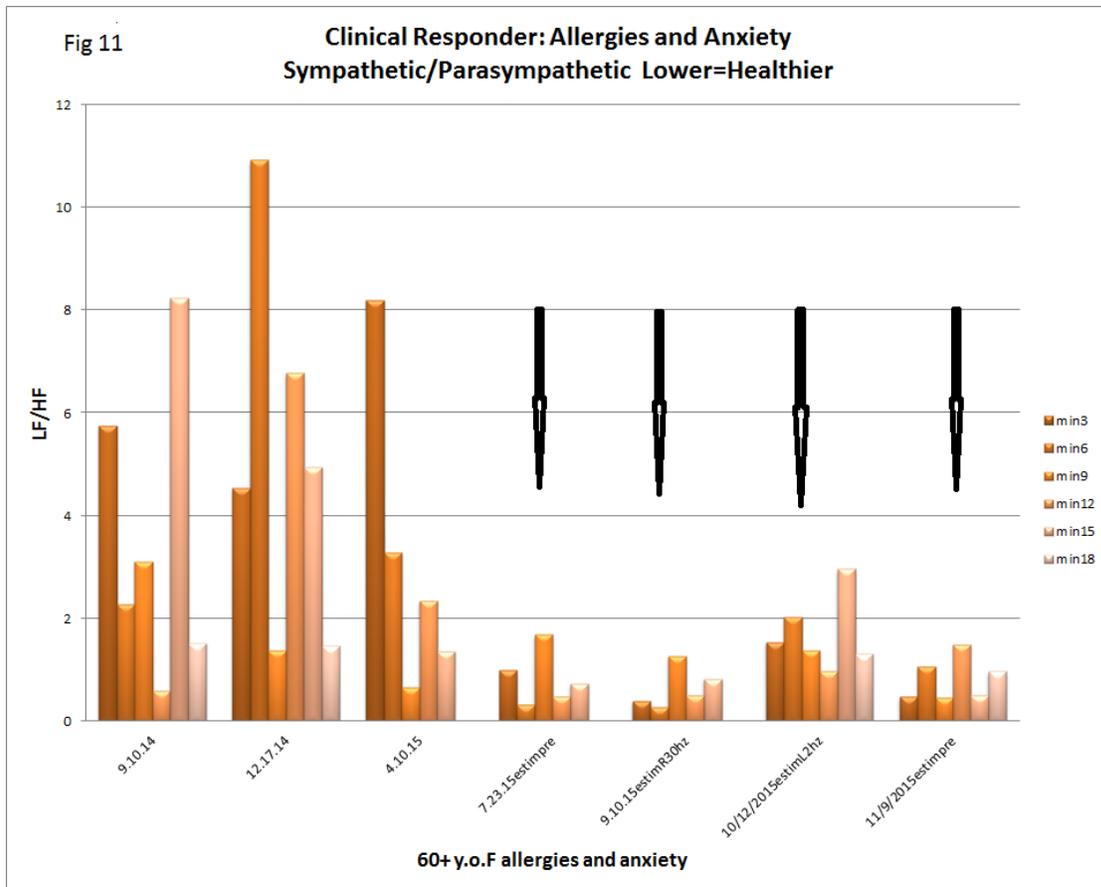


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## Discussion

### Pitfalls

There are serious drawbacks to observational studies like this one. Confirmation bias, lack of controls, blinding, lack of treatment uniformity etc... This inquiry aims to evaluate individual treatment effects on HRV on a minute by minute basis, and over time. The goal is to generate hypotheses as to the principles for effective treatment and there by identify most beneficial and reproducible treatment strategies. To detect patterns, the data of patients' who are definitive clinical responders is scrutinized in depth. Clinical HRV analysis is confounded by "noise". Mental state, coffee, sleeplessness, exercise, time of day can all impact readings. Evaluating aspects such as optimal segment length for analysis (3 minutes in this study), and which parameters to evaluate (LF/HF, HFnorm,) are just a part of protocol development. Choosing equipment has been key, i.e. artifact has been minimized working with the Vivosense system.

### Responder/Nonresponder:

In general responders will show a decrease in their stress levels during treatment session below baseline. This can help guide treatment. For example with Ma.Ke (fig 5) profile was not showing a relaxation response on the table, so positioning and treatment was changed after 2.24.2016 for a better relaxation response (decrease in LF/HF) and clinical

~~results. This is not always the case, however, some patients remain “nonresponders” in spite of changing treatment strategies. The converse is also true, where patients are profound clinical responders, but their stress levels do not change, but in general the pattern holds.~~

There is the possibility that the acupuncture is not relevant to the changes in HRV, and that they would be the result of a period of repose regardless of treatment. But in at least one study comparing sham to verum acupuncture showed that verum acupuncture produces autonomic response when sham does not.<sup>6</sup>

### **Improving HRV over weeks to months.**

Improving HRV over weeks to months implying a lower stress level is a key motivation for the use of HRV monitoring in the clinic. Since increased HRV correlates with resiliency, improved immunity, mood, sleep and pain, demonstrating improved HRV could be an important biomarker of improved health. In developing the HRV monitoring protocol, part of the methodology is to evaluate in detail patients who have definitive clinical response. ~~Migraine patients, in particular, are ideal for this since migraines are simple to track in number and intensity. It is important here to choose which HRV parameter to track. So in the case of Ne.Be. Fig 11, we can see a very gradual decrease in his DFA, but little change in his parasympathetic activity, or HFnorm fig 12. It could be postulated that this is because his parasympathetic activity is quite high to begin with, so is a less sensitive marker than his DFA. a complexity marker.~~ HRV data presented here corroborate the previous studies that show that responders show an increase in HRV after needling and also over time. In the cases presented, some saw clear improvement in their HRV in the first 3 to 6 months of treatment, or often even over weeks. Ideally, with more skillful treatment, either with different needling prescriptions, stimulation type, or optimal frequency, this time frame could be shortened.

### **Testing treatment strategies and protocols**

The HRV monitoring protocol ideally should be able to give a snapshot of patient’s autonomic balance at baseling, during needling, on the table needles in, and then over weeks to months. It is hypothesized that by optimizing each individual treatment for autonomic response, one obtains the best clinical response overall.

The strategies presented here are to illustrate the protocol used in the clinic. Other treatment strategies have been tried and tested also, eg. electroacupuncture on St36, abdominal points purported<sup>xxiii</sup> to activated the HPAA (hypothalamic-pituitary-adrenal axis), among others.

#### **Auricular Vagal Nerve Stimulation or Estim**

The Estim protocol produced varying results. In a few cases the HRV results and clinical results were dramatic and positive. But in others, as in the case of Ne.Be.Fig 9 , stress levels spiked with estim, and in many patients tested, the estim made no difference (data

not shown). Estim was explored because of the potential for in home treatment to augment and reinforce acupuncture sessions. But it was of interest, also, whether the HRV system could pick up any difference in autonomic activity with Estim. The hypothesis was that estim would show an increase in parasympathetic activity through vagal stimulation. These data were not convincing, however. Though some patients seemed to have a reduction in LF/HF, the majority did not (data not shown). This highlights the variation in response between individuals/clinical conditions, and suggests caution in prescribing “one size fits all” treatments, such as estim. Indeed, even indwelling vagal stimulators do not always lead to an increase in vagal tone<sup>xxiv</sup> and clinical improvement. The possibility remains that the current protocol just cannot detect the autonomic shift occurring because of the inherent inconsistency in the data.

LI4—>LI11 electroacupuncture 100Hz

This needling strategy induced improved parasympathetic activity and improved symptoms in the two cases presented here. In other (unpublished) cases, no additional increase in HRV was noted. The protocol published actually saw the parasympathetic activity improve most *after* needles were removed, so it is possible that if the clinical protocol would allow for a window of measurement after needles were removed, the results would be more in keeping with the published study.

LI10 —>LI11 electroacupuncture 2HZ

This protocol gave no convincing improvement in HRV nor pronounced decrease in sympathetic activity. The study that was being tested was performed in animals, so it is possible that the autonomic effect does not occur in the same way in humans.

## **Parameters and Going Forward**

### Timing and Windows of Analysis

#### Needling Segment

An aspect of treatment under study is whether the HRV response during the needling segment might give additional information. That data was not included here, but analyzing HRV data during needling may prove to be important since it captures the physiological response to the stressor of needling. “Hardiness”, or ability to weather unexpected inputs may be an indicator of better health<sup>xxv xxvi</sup>. There is sometimes a profound decrease in LF/HF level immediately after needling, may be a sign that a healing cascade has been triggered. HRV may be illustrating what complexity science explains; a small input can have outsized effects.

#### Post Treatment Segment

There remains the question of whether the largest autonomic response might occur after needles are removed and that the majority of the effect occurs minutes to hours after treatment, so is missed with this protocol. This segment would add to clinic visit time

and might be difficult to achieve for practical purposes. One study<sup>xxvii</sup> found improved HRV by Holter monitor in depressed patients using press tacks. This is a more ambitious approach, and would be an appropriate next step for an academic controlled study.

### Timing of Treatment Sessions

Another issue to examine is whether frequency of treatment has a bearing on clinical and HRV outcomes. Does more frequent lead to more rapid results? In some ways it seems logical, but the norm at least in the “Western” practice is to treat no more than 3 times per week. If we could demonstrate significant improvement in daily treatment, then clinics could be organized with that schedule in mind. Conversely, often the most pronounced improvement in HRV and clinical response is within the first 3 to 6 months of treatment. Would it be advisable to curtail treatment to monthly or even every other month after that? Since often patients are cash pay, to concentrate treatment early in the treatment sequence and then taper dramatically may be justified.

### HRV Parameters

Some researchers insist<sup>xxviii</sup> that nonlinear<sup>xxix</sup> measures are the better measure of autonomic balance rather than frequency (LF, HF, LF/HF) The expansion of the protocol to include nonlinear data has been helpful to detect improvement in HRV which is not picked up by frequency measures, such as HF. The data was not presented here, but in patients who are athletic and/or younger with a high HRV to begin with as measured by RMSSD and pnn50, DFA $\alpha$  might be a better measure of stress levels over time.

## **Protocol and Project: Going Forward**

### Correlation with Other Biomarkers

HRV has been correlated with other accepted and precise physiologic markers of stress and inflammation relevant to acupuncture treatment (e.g., cortisol<sup>xxx</sup>, norepinephrine, epinephrine, IL-6<sup>xxxi</sup>, functional magnetic resonance imaging (fMRI)<sup>xxxii xxxiii</sup> and telomere length<sup>xxxiv xxxv</sup>).

Further research to corroborate the decrease in stress levels with acupuncture represented by HRV with cortisol levels, Norepinephrine, Epinephrine, inflammatory markers, fMRI, telomeric length would be a next step.

### Streamlining and Improving Treatment

To identify strategies that can expedite and improve the odds of positive clinical effect is the goal of this project. In some cases the improvement in HRV was gradual over one year or more. Ideally, to achieve more rapid improvement would be beneficial. The

hypothesis here is that by causing optimal autonomic balance by testing needling strategies one treatment at a time, we might better achieve that goal.

### Personalized Precision Treatment

Variation in patient response is a challenge and an opportunity which Traditional Chinese Medicine (TCM) has sought to categorize and explain for millennia. As seen in this study, patients do not respond uniformly to treatment strategies such as estim. This may be an opportunity to further categorize patients by HRV profiles in addition to TCM segmentation. There is some indication that the initial HRV profile of a patient regarding HRV in the time domain suggests which strategies they might respond to (data not published here). To determine principles of treatment beyond the tenets of Traditional Chinese Medicine would be of benefit. For example, a recent Chinese study<sup>xxxvi</sup> used HRV values to categorize women with perimenopausal insomnia for treatment.

### Conclusion

This study shows that only in some cases is the clinical HRV protocol capable of discerning differences in autonomic effect as described in the published studies. Whether this is because of inherent flaws in the HRV protocol, or that the published strategies couldn't be corroborated for other reasons is the question. The protocol may be able to show that autonomic balance is improved over time in successfully treated acupuncture patients, however.

### AUTHOR DISCLOSURE STATEMENT

No competing financial interests exist.

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