Immediate cardiovascular effects of pranava relaxation in patients with hypertension and diabetes

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Summary

Study aim: To assess immediate cardiovascular effect of pranava pranayama in the supine position in patients with concomitant hypertension and diabetes.

Material and methods: Twenty-nine established patients having both hypertension and type 2 diabetes and attending regular therapy sessions were recruited and randomly allotted to pranava or control groups. Heart rate (HR) and blood pressure (BP) were recorded before and after 10 minutes of “sham relaxation” in the control group and 10 minutes of pranava pranayama in the study group.

Results: Significant (p<0.05) decreases of blood pressure and heart rate were observed. However, responses in the pranava and control groups were different: systolic pressure, pulse pressure, as well as mean pressure significantly decreased in the pranava group and this was not observed in the control group.

Conclusions: Pranava pranayam in the supine posture produces an integrated relaxation response, clinically valuable in patients with hypertension and diabetes.

Key words: Yoga relaxation – Pranava pranayama – Hypertension – Diabetes

Introduction

Comprehensive reviews have reported that Yoga is potentially beneficial for patients with hypertension (HT) and diabetes mellitus (DM), and that it reduces the risk profile in such populations [7,8]. Another review of relaxation therapy concluded that relaxation therapy is useful in the clinical management of HT, especially for those individuals with high BP despite pharmacological treatment [9]. Earlier studies from our laboratories have demonstrated that shavasan, a yogic relaxation technique, reduces load on the heart in normal subjects by blunting sympathetic responses with enhanced parasympathetic activity [11], while yogic relaxation training for a month reduces blood pressure (BP) and restores autonomic regulatory reflex mechanisms in hypertensive patients [20]. We have recently reported immediate beneficial effects of sukha pranayama on cardiovascular parameters in patients with HT after just 5 minutes of the technique [4].

Pranava pranayama is an important technique of the Gitananda tradition, involving slow and deep inhalation with conscious use of complete yogic breathing (mahat yoga pranayama), followed by an audible vibratory resonance of a prolonged AUM chant. This technique is usually done in the sitting position and is one of the practices taught in the comprehensive yoga therapy schedules imparted for HT and DM patients at ACYTER, JIPMER, in Puducherry, India. As the supine position is normally used for relaxation, the present study was designed to determine the immediate cardiovascular effects of pranava pranayama while resting in the supine position.

Material and Methods

The present study was conducted at the Advanced Centre for Yoga Therapy Education and Research (ACYTER), established in JIPMER, Puducherry, India. Ethical approval has been obtained by ACYTER from the Institutional Ethics Committee for studies on the effect of yoga therapy on HT and DM. The present pilot study was conducted as part of this larger study on the effects of yoga therapy in patients with HT and DM.

Twenty-nine patients receiving standard medical care for both essential HT and type 2 DM, and who were attending regular yoga therapy sessions for more than a month at ACYTER, were selected for this study by random sampling. Patients with secondary HT and those with history / signs and symptoms / laboratory reports suggestive of nephrological, neurologic, and ophthalmologic complications due to HT or DM were excluded from the study.

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For this study, 15 of the patients were male and 14 of the patients were female; the average age was 56.66 ± 10.9 years, the average BMI was 25.99 ± 3.5. All subjects were receiving standard medical management for more than 3 years with antihypertensive and oral antidiabetic medications under the supervision of consultants in the department of medicine at JIPMER. Patients on medication were selected, as it has been previously suggested that the combination of relaxation and medication has the maximum effect [6].

Subclassification of the subjects according to JNC VII [17] revealed that based on either systolic pressure (SP) or diastolic pressure (DP) values, 16 were in the prehypertensive range, 7 in Stage I HT, and one in Stage II HT, even with regular medication. This is pertinent, as a previous review had concluded that relaxation therapy is useful in the clinical management of HT, especially for individuals with high BP despite pharmacological treatment [9].

Informed consent was obtained by one of the investigators and the subjects were then randomly allotted to either the pranava or control groups. There were 8 males and 7 females in the pranava group with an average age of 53.47 ± 12.5 years. The control group consisted of 7 males and 7 females with an average age of 60.07 ± 7.9 years. The difference in age between groups was statistically insignificant (p = 0.103).

Subjects were familiarized with the study protocol and then given 5 minutes of supine rest. Heart rate (HR) and BP were then recorded from their left upper arm in the supine position using a non-invasive semi-automatic BP monitor (CH-432, Citizen Systems, Tokyo, Japan) with an instrumental accuracy of ± 5% for HR and ± 3 mm Hg for BP.

It has previously been suggested that one needs a sham treatment group rather than a mere nonspecific relaxation or “no treatment” control group when studying and comparing effects of psycho-physiologic therapies [5]. Hence, in the present study we have used a “sham relaxation” control group that performed 10 minutes of simple supine resting for the first and last 2 minutes; they were given verbal commands suggesting relaxation of different body parts from feet to head for the intervening 6 minutes. HR and BP were recorded again at the end of the 10 minutes of “sham relaxation.” The pranava group, on the other hand, performed 10 minutes of supine rest that included simple conscious resting in shavasana for the first and last 2 minutes with a performance of pranava pranayama for the intervening 6 minutes. The technique of pranava pranayama involves the performance of 3 rounds of slow and deep yogic breathing into low chest, mid chest and upper chest, followed by the prolonged audible rendition of the akara, ukara, and makara nada (Aaa, Uuu, and Mmm sounds), respectively, during exhalation phase. Following this, subject performs 3 rounds of the complete yogic breathing (mahat yoga pranayama) technique with an audible rendition of omkara nada (AUM sound) during exhalation phase. The time taken for the exhalation with nada is approximately 3 times the time taken for each inhalation, thus maintaining a ratio of 1:3. After completing pranava pranayama, which took approximately 6 minutes, the subject continued to rest in the supine position for another 2 minutes, before post-intervention HR and BP were recorded. Pulse pressure (PP) was calculated as the difference between systolic pressure (SP) and diastolic pressure (DP), mean pressure (MP) as DP + 1/3 PP, rate-pressure product (RPP) as HR × SP / 100, and double product (Do P) as HR × MP / 100.

All data passed normality testing by Kolmogorov-Smirnov Test and was therefore analyzed using ANOVA for repeated measures followed by Tukey’s test (post hoc). Effects of Group (pranava, control) and Measurement (pre, post) as well as their interaction were assessed. Statistical analysis was done using STATISTICA 9.1 (StatSoft, USA). The level of α=0.05 was considered significant.

Results

The mean ± SE values of cardiovascular variables before and after performance of pranava pranayama and “sham relaxation” control are presented in Table 1. Significant changes of means (Measurement effect) were observed for all variables tested except DP, while the effects of Group were not found. Significant interactions of Group × Measurement occurred for SP (F1,27 = 17.69, p<0.001), PP (F1,27 = 26.06, p<0.001) and MP (F1,27 = 6.63, p<0.05). Interactions revealed differential responses in the pranava and control groups. Post-hoc tests showed that SP, PP, as well as MP decreased significantly in the pranava group; this was not observed in the control group.

Discussion

Enhanced cardiac parasympathetic tone is postulated to be an important mechanism underlying the beneficial effects of the relaxation response [15]. It has also been suggested that a holistic and complete sympathovagal homeostatic development is possible only by the practice of yoga in its true form and spirit [13]. A previous study conducted by our laboratories reported significant blunting of cold pressor-induced increase in HR, BP, and RPP following the practice of shavasana, thus giving evidence that shavasan reduces the load on the heart by blunting the sympathetic response along with an enhanced parasympathetic activity [11].
Table 1. Immediate effect of pranava pranayama in supine position on cardiovascular variables in patients having concomitant hypertension and diabetes (mean ± SE)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Pranava Group (n=15)</th>
<th>Control Group (n=14)</th>
<th>Pre-post changes</th>
<th>Int.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Pre</td>
<td>Post</td>
<td>Pre</td>
<td>Post</td>
</tr>
<tr>
<td>HR (beats/min)</td>
<td>77.5 ± 3.3</td>
<td>75.3 ± 3.1</td>
<td>84.8 ± 3.5</td>
<td>80.0 ± 3.5</td>
</tr>
<tr>
<td>SP (mm Hg)</td>
<td>134.3 ± 3.8</td>
<td>124.7 ± 3.2</td>
<td>136.3 ± 4.1</td>
<td>138.3 ± 4.2</td>
</tr>
<tr>
<td>DP (mm Hg)</td>
<td>77.2 ± 1.3</td>
<td>74.9 ± 1.2</td>
<td>77.4 ± 2.2</td>
<td>76.9 ± 1.6</td>
</tr>
<tr>
<td>PP (mm Hg)</td>
<td>57.1 ± 3.7</td>
<td>49.9 ± 3.0</td>
<td>58.9 ± 3.2</td>
<td>61.4 ± 3.5</td>
</tr>
<tr>
<td>MP (mm Hg)</td>
<td>96.2 ± 1.7</td>
<td>91.5 ± 1.5</td>
<td>97.0 ± 2.6</td>
<td>97.4 ± 2.2</td>
</tr>
<tr>
<td>RPP</td>
<td>104.5 ± 5.9</td>
<td>94.2 ± 4.9</td>
<td>116.3 ± 6.9</td>
<td>111.3 ± 6.7</td>
</tr>
<tr>
<td>Do P</td>
<td>74.8 ± 3.7</td>
<td>69.1 ± 3.2</td>
<td>82.7 ± 4.7</td>
<td>78.3 ± 4.5</td>
</tr>
</tbody>
</table>

Legend: HR - Heart rate; SP - Systolic pressure; DP - Diastolic pressure; MP - Mean pressure; PP - Pulse pressure; RPP - Rate-pressure-product; Do P - Double product; Int. - Group×Measurement interaction; Significantly different from pre-test: * p<0.05, ** p<0.01, *** p<0.001; Significant effect: ** * p<0.05, ** p<0.01, *** p<0.001. All baseline comparisons between groups were insignificant with p>0.05.

A review of relaxation therapy in the treatment of HT reported that task awareness adds to the treatment effect and suggested that relaxation therapy is useful in the clinical management of HT, especially for individuals whose BP remains high despite pharmacological treatment [9]. Most yogic relaxation practices have a task awareness element associated with them: as the performance of pranava pranayama while relaxing in the supine position is done with conscious awareness, it may be producing its beneficial effects in a similar manner to those of task awareness.

A study by Goldstein et al. [6] concluded that relaxation without drugs, although somewhat more effective than self monitoring alone, did not reduce BP as much as the combination of relaxation and medication. Interestingly, just as with our present study, they also found no significant changes in HR between groups. The significant decrease of HR in our control group may have been due to a reduction in physiological arousal that had been previously reported to occur from both guided relaxation and supine rest in a previous study [19].

Analysis of variance revealed significant interaction between group and measurement for SP, PP, and MP. The decreases of mean values of these variables were significantly greater in the pranava group as compared to the control group. This may be due to a decrease in venous return and resultant decrease in cardiac output occurring as a result of the prolonged exhalation phase in pranava pranayama producing a mild Valsalva-like effect due to the increased intrathoracic pressure and decreased preload to the heart. A previous study from our laboratories also reported that pranayama training of 3-month duration modulated ventricular performance by increasing parasympathetic activity and simultaneously decreasing sympathetic activity [18].

We have previously suggested that conscious deep breathing with prolonged exhalation and audible chanting during pranava pranayama may contribute towards a normalization of autonomic cardiovascular rhythms [3]. The beneficial effect of audible chanting in restoring these autonomic cardiovascular rhythms has been reported earlier [2]. It is plausible that the prolonged, audible chanting of the pranava in the present study may be producing a similar improvement in baroreflex sensitivity resulting in the normalizing of such autonomic cardiovascular rhythms.

The effects of interaction between group and measurement were not observed for RPP and Do P. However, the actual difference in Do P was greater in the pranava group (7.2%) as opposed to the control group (4.7%). This shows a trend that suggests further statistical significance of interaction could be achieved with a larger sample size. RPP and Do P are especially important in patient care, as they are indirect indicators of myocardial oxygen consumption and load on the heart, thereby signifying a lowering of strain on the heart [12]. RPP also provides a simple measure of overall heart rate variability (HRV) in hypertensive patients and is a surrogate marker in situations where HRV analysis is not available [14]. Reduction in RPP is thus representative of enhanced HRV power, implying better cardiac autonomic regulation in our subjects having concomitant DM and HT that are both major risk factors implicated in the causation of cerebrovascular accidents as well as other cardiovascular and neurological complications. Hence, this technique can be considered a means of primary prevention in this high-risk population, as we may be preventing the occurrence of future untoward and adverse events of high mortality and morbidity.

Pranava pranayama involves the audible chanting of the aaa, uuu, and mmm sounds and when performed in the
supine position is strikingly similar to the deep relaxation technique (DRT) popularized by SVYASA University, Bangalore [19]. A previous study from SVYASA reported that DRT improves sustained attention and reduces the state of anxiety [10], while another reported a decrease in sympathetic activity with significant reduction in O2 consumption, HR, and skin conductance along with decreased low-frequency (LF) power and increased high-frequency HF power of the HRV spectrum [19]. Satyapriya et al. [16] reported an increased HF band of the HRV spectrum along with a decreased LF band and LF/HF ratio during and after a guided relaxation period in pregnant women indicating improved sympathovagal balance. This improvement in sympathovagal balance following similar yogic relaxation techniques such as DRT is possibly one of the mechanisms behind the positive changes seen in our subjects. Hence, the reduction in RPP in our subjects having concomitant HT and DM implies a better autonomic regulation of the heart that is clinically valuable from both a qualitative and quantitative perspective.

Performance of pranava pranayama in the supine position may induce an integrated relaxation response similar to the one suggested by Benson et al. [1]: a wakeful hypometabolic state induced by simple, non-cultic mental techniques or by traditional meditational practices. They attributed this to an integrated hypothalamic response ("relaxation response") consistent with a state of decreased sympathetic nervous system activity. They have also reported that regular elicitation of the relaxation response is useful in the management of hypertensive subjects who are already on drug therapy. Based on our findings we suggest that pranava pranayama in the supine position can achieve the same benefits in those having concomitant HT and DM.

References


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