

Comparison of Jacobson's progressive muscle relaxation and diaphragmatic breathing technique on cardio-respiratory parameters and level of stress on pre hypertensive patients.

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Abstract

Background And Objectives:- Hypertension is silent killer. One billion of world population is suffering from hypertension and many more don't know that they are at risk. In 21st century every person at every moment is going through some form of stress. Hence, the present study was done to compare the effect of JPMR and diaphragmatic breathing exercise (DBE) on cardio-respiratory parameters and level of stress in pre hypertensive males.

Material and method:- After approval from ethical committee, the present experimental study conducted in 60 adult participants (8 participants were dropout) who are working in and around Aurangabad. In this sixty participants were recruited on the basis of inclusion and exclusion criteria by convenient sampling method. Group A participants were given Jacobson's progressive muscle relaxation as mentioned by E. Jacobson's and Group B participants were given diaphragmatic breathing exercise for 12 min with interval of 1 min. Each group was given training of one week of their intervention. Baseline parameters (PR, RR, SBP, DBP and score of perceived stress scale) were checked at start and subsequently after each week till 4th week.

Results:- In the present study, statistical analysis of baseline parameters and after 4th week for both the groups were done. It showed significant improvement in PR ($p < 0.05$), RR ($p < 0.05$), SBP ($p < 0.05$), DBP ($p < 0.05$), RR ($p < 0.05$) and Score of PSS ($p < 0.05$), in both groups pre and post parameter which is more than $p < 0.05$. In intergroup data analysis of post values showed not significant improvement in PR, RR, SBP, DBP and score of PSS.

Conclusion:- We can conclude by the result that both the techniques are equally effective in reducing cardio-respiratory parameters and level of stress. So we can use any one technique or in combination of both these technique to reduce prevention of hypertension.

Key words:- Pre hypertension, perception of stress, cardio-respiratory parameters, JPMR, relaxation response.

Introduction

Hypertension is a progressive cardiovascular syndrome arising from complex interrelated etiologies.^{8,28,29} Blood pressure is generated by the blood flowing through the vessels, the vascular smooth muscle tone is controlled by the autonomic nervous system (parasympathetic or sympathetic).²⁸ The sympathetic stimulation increases the smooth muscle tone, thereby increasing the pressure. If a consistently increased activity of the sympathetic system is seen, leading to the sustained elevation of the resting blood pressure (systolic > 140 and diastolic > 90), then it results in condition called hypertension.³⁸

Psychological stress has been thought to play a significant role in the development of hypertension by acting on the autonomic nervous system.⁵⁹ Chronic activation of the sympathetic nervous system has been linked to essential hypertension.¹³ As for the emotions, they sustain stress, activating physiological alterations which comprise the stress response and negative emotions contribute significantly to the psychological and physical effects of stress.^{12,13}

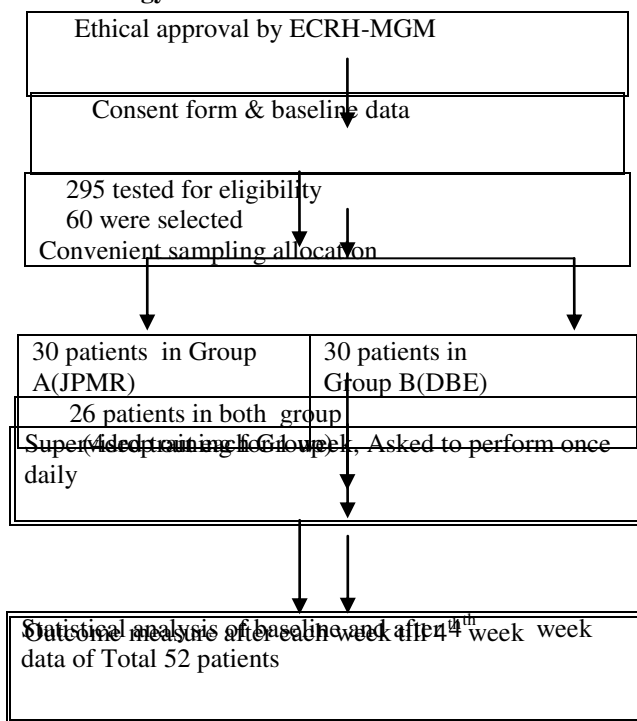
Joint National committee (J.N.C.) classifies hypertension as Normal < 120 and < 80 , Pre hypertension 120-139 or 80-89, Stage 1 hypertension 140-159 or 90-99, Stage 2 hypertension ≥ 160 or ≥ 100 , Stage 3 hypertension > 180 or > 110 .²⁹ J.N.C.-7th 1st time used the term Pre hypertension. There are different forms of breathing exercises like diaphragmatic, slow, deep breathing, fast breathing, of which deep slow breathing is found to be effective in controlling hypertension. The control breathing technique or

deep slow breathing consists of deep inhalation and prolong exhalation through pursed lip.⁴⁹ It is also studied that the hyperactivity of the sympathetic nervous system not only causes vasoconstriction, but also result in the chemoreflex activation.¹² Slow deep breathing exercise daily for one weeks 4 times a day for 10 min has significantly decreased the systolic and diastolic blood pressure as well as heart rate of patients newly diagnosed with essential hypertension.³⁶ Deep breathing exercise performed 2-3 times daily for 14 days for duration of 10 min at time ,was associated with significant reduction in blood pressure in women with hypertension by clinically meaningful value of 24/14 mm hg for systolic and diastolic blood pressure repectively³⁷

On other hand JPMR is helpful in sports like players belong to progressive relaxation training is performed better in cognitive anxiety, somatic anxiety and self confidence as compared to control group⁶ The Jacobson's Progressive Muscle Relaxation Technique was found to be effective in decreasing the social in anxiety¹⁶ decrease in blood pressure and decrease in respiratory rate³²,level of stress.⁴⁷

According JNC VII, Non pharmacology measures are only treatment choice for pre hypertensive population. In our present we are using Jacobson's progressive muscle relaxation and diaphragmatic breathing exercises an important form of non pharmacology measure. In previous studies has proved usefulness of JPMR and DB technique as relaxation technique. But there is hardly any evidence that practicing regular relaxation technique reduces risk of progression of pre hypertension. There are very few studies which have used Jacobson's progressive muscle relaxation and diaphragmatic breathing exercise on cardio-respiratory parameters in essential hypertension.

Figure 1: Flow chart of methodology



and approval

ethical committee experimental study was initiated in MGM hospital research centre. 60 subjects with pre hypertensive according to the JNC7 guidelines in the age group of 30 to 60 years had been included in the study. Written consent from each patient has been taken of each patient. The subject recruited in study by convenient sampling method and allotted in both experimental group by lottery method. The resting parameters of all the subjects have been taken, i.e. systolic and diastolic blood pressure, respiratory rate and level of stress (Perceived stress scale). An acclimatization period for ten minutes was used to minimize natural fluctuation in body temperature and heart rate due to prior activity. Systolic and diastolic blood pressure was measured on the dominant arm, using a regularly checked manual sphygmomanometer. Heart rate has been measured by palpation method on radial artery for 1 min. Respiratory rate has been

Material Method

After from University

measured visually by recording inspiratory excursions over one minute. Level of stress with Perceived stress scale at the start of study then subsequently after each week for four week.

Discussion

In this study we found that, in the both Experimental group A Jacobson's progressive muscle relaxation technique & Group B Diaphragmatic breathing exercise showed significant decline in the SBP, DBP, PR, RR & PSS. But there was no significant change in respiratory rate in Group A. In Group A, there was a drop in the mean SBP from 134 to 124.8, mean DBP from 85.77 to 85.15, mean PR from 82.62 to 74.77, mean PSS from 17.65 to 6.731, Mean RR from 19.46 to 16.9. All of them were statistically significant, as the p value was <0.05. In Group B, there was drop in the mean systolic blood pressure from 133.5 to 126.5, mean Diastolic blood pressure from 84.23 to 80.96, mean pulse rate from 82.69 to 75.54, mean respiratory rate from 19.46 to 17.15 and mean perceived stress scale score from 18.69 & 7.043.

A large number of positive psychosomatic responses can be achieved by training the mind through various techniques. Two such technique Jacobson's progressive muscle relaxation and diaphragmatic breathing exercise was employed in the present study on pre hypertensive males. The role of cortico- limbic-hypothalamo-pituitary pathway is active in hypertensive leading to activation of sympathetic nervous system and raised blood pressure. The possible mechanism underlying this observation could be that relaxation reduces the arousability of cerebral cortex, thereby decreasing the impulse from various centers to the hypothalamus, decreasing the sympathetic tone and thus a decrease in blood pressure.

It has been found that, there is an altered arterial baroreceptor reflex sensitivity seen in the hypertensive patients, leading to an overactive sympathetic stimulation.^{3,9,12} This fails to reduce the blood pressure in them. Such imbalance is present in not only borderline and early hypertension, but also contributes to the maintenance of established hypertension.⁷ It is important to consider that, cardio respiratory systems share common higher control mechanisms, therefore one would expect that modifying one system can bring about changes in the other system.^{3,12}

The breathing control technique consciously tries to influence the involuntary sympathetic nervous system that regulates the heart rate, blood pressure and other bodily functions by breathing modulation.^{12,13} Whereas in progressive muscular relaxation, through a reduction of tension from region to region of the body, leads to overall relaxation and bringing about reduction in BP.⁵⁴

Respiratory modulation can be considered of clinical significance in hypertension, since it enhances the parasympathetic activity that can cause blood pressure control.³ Also it is seen that, the slow breathing exercise increases the frequency and the duration of inhibitory neural impulses by activating pulmonary stretch receptors during above tidal volume inhalation as in the Hering Breuer reflex. Also there is reduction in the after load. This brings about the withdrawal of the sympathetic tone in the skeletal muscles of the blood vessels, resulting in the reduction in peripheral resistance and thereby helping to reduce the blood pressure.¹

In previous study conducted speculated that the repeated response to slow and regular breathing pattern reverses the vascular pathophysiology associated with hypertension, which is partially determined by the vascular tone, which is under the control of the sympathetic activity.⁹

A previous study found that the peripheral sympathetic activity was reduced during the slow breathing exercise and during Jacobson's progressive muscle relaxation these findings have clinical implications not only for the hypertensive patients, but also the heart failure patients who have autonomic dysfunction.^{7,55,56}

The changes seen in the Group A:

In Group A, we have given Jacobson's progressive muscle relaxation training for 26 patient for 25 to 30 min for 7 subsequent days, asked them to repeat it regularly at home for four weeks. When we analyzed the data between baseline and 4th week it showed mean difference of 10 mm hg in SBP, 0.62 difference in DBP, 7.85 difference in PR, 2.54 difference in RR and 10.92 difference in PSS. All of them were significantly improved.

It proves in previous study done on immediate effect Jacobson's progressive muscle relaxation in hypertensive patient showed significant drop in systolic & diastolic blood pressure, respiratory rate and heart rate.⁴³ In other studies progressive muscle relaxation helps in modulation of heart rate, blood pressure, and lipid profile after 3 month of PMR training in healthy normal adult male and female individuals.^{2,3} In one particular study Progressive Muscle Relaxation Therapy is effective in reducing the stress level of the staff nurses.⁴⁷ In our study there was drop of 10 mm hg in SBP, 7.85 bpm drop in PR, 2.54 bpm drop in RR, 10.92 drop in PSS & 0.62 mm hg drop DBP after 4 weeks of training which was much more from

previous studies.⁵⁵ He found a decline of 5.1 mm Hg SBP and DBP 3.1 mm hg after 4 week of relaxation training .In other studies found decline in 5.5mmhg SBP, and drop of 3.5 mm hg in DBP.

The main idea of initiating the relaxation response in this way is to take control of the voluntary muscles through creation of tension in them, followed by forcing them into state of relaxation. When the body is aware of the presence of the tension, it will respond by triggering the muscle to relax, where the rest of the other components of relaxation response naturally follow. Probable reason behind much more drop in SBP is could be reduction in mean stress level 17.65 to 6.731. As in Jacobson's progressive muscle relaxation person makes each part of body voluntarily contracts and let it go. This process makes person more aware about tension in body and overcome.^{43,47,55,56}

The changes seen in the Group B :

In Group B we have given patient diaphragmatic breathing exercise for 1 min and 1min interval for 12 min in crook lying position for 7 day training .We asked them to repeat it regularly at home. When we analyzed the baseline and after 4th week, there was drop of 7.15 in Pulse rate, drop of 2.31 respiratory rate, drop of 7mm hg in systolic blood pressure, drop of 3.27 in diastolic blood pressure and drop of 11.64 in perceived stress score. This changes shows there is significant improvement in all parameters after diaphragmatic breathing exercise training.

Diaphragmatic muscle activity increases blood and oxygen flow to the brain to function in its optimal state. It creates a connection between mind and body that can lead to greater self-awareness, mindfulness and clear thinking, improves circulation, which improves heart health, energy levels and helps the body eliminate toxins, as well as reduces stress.⁵⁵ Slow diaphragmatic breathing improves vagal activity and therefore decreases baseline heart rate and blood pressure. This is associated by improving vagal tone and by decreasing sympathetic discharge. Improvement in both sympathetic and parasympathetic reactivity may be the mechanism that is associated in those practicing the slow breathing exercises.⁴⁶ Heart rate increases during inspiration and decreases during expiration. Recordings from cardiac autonomic nerves reveal that neural activity increase in sympathetic fibers during inspiration and increases in vagal fibers during expiration⁵³

Previous study showed a decrease of SBP by 8.4 mm hg, DBP by 3.6 mm hg, HR by 6.20 beats/mi and RR by 4.57 breaths /min following 12 min of diaphragmatic breathing exercise.⁵⁰ In our study showed similar change there is drop of 7.15 in Pulse rate, drop of 2.31 respiratory rate, drop of 7 mm hg in systolic blood pressure, drop of 3.27 in diastolic blood pressure and drop of 11.64 in perceived stress score. The possible mechanism to modulate blood pressure is through slow and regular breathing affecting reflex control of cardiovascular system. More specifically lung inflation which increases with decreasing respiratory rate, stimulates slowly adapting pulmonary stretch receptors. This neural activity acts as an input to the medulla and is integrated with the information about BP level generated by the arterial baroreceptors.

The central mechanism responsible for relaxation response is due to stimulation of the trophotropic center in the hypothalamus resulting in generalized parasympathetic activity. This occurs due to the close anatomic location of the cardiovascular receptors, respiratory receptors and pulmonary receptors in the medulla. The primary sites of interaction of arterial chemoreceptors, receptors within the heart as well as the airway ad lungs within the central nervous system is at the level of nucleus tractus solitaries the potential site of cardio-respiratory integration.

Recent study has shown diaphragmatic breathing exercise resulted in decrease of cortisol level. Thereby DBE is able to alter the hypothalamic-pituitary-adrenocortical axis, which causes stress related diseases. This could be other possible mechanism leading to decrease in blood pressure and heart rate following diaphragmatic breathing exercise.

Intergroup changes between both the groups

Intergroup comparison of both group showed difference between post mean values of all parameters but it is not statistically significant. Difference of Mean SBP of Group A & B is 10 & 7 respectively, P value is 0.7221(not significant), mean DBP of Group A & B is 0.62 & 3.27 respectively, P value is 0.8236(not significant), mean PR of Group A & B is 7.85 & 7.15 respectively, Pvalue 0.8672 (ns), mean RR of Group A & B is 2.54 & 2.31 respectively, P value 0.9729(ns) & mean PSS of Group A & B is 10.92 to 11.647 respectively ,P value is 0.1595(not significant). As unpaired t-test of both Group pre as well as post values are not statistically significant, hence proves null hypothesis that both groups effective in reducing stress level and cardio-respiratory parameters in pre hypertensive. During study Group A who received Jacobson's progressive muscle relaxation showed clinically significant improvement compare to Group B.

Probable reason behind no significant difference in both the group is that both these techniques are body to mind type means relaxing a body first then mind. Both relaxation technique shows reduction in sympathetic tone due to its relaxation response.^{40,41} Diaphragmatic muscle is primary respiratory muscle of respiration. It works in each breathing exercise like slow, fast, deep and various types of Pranayama. Breathing has direct relationship with stress. When person is at stress, breathing pattern changes from diaphragmatic breathing to chest breathing. Learning to perform diaphragmatic breathing is process. Diaphragmatic breathing has direct connection with hemodynamic parameters. When person starts breathing diaphragmatically hemodynamic parameters lowers,⁵⁴ Whereas JPMR works on peripheral resistance, reduces peripheral resistance and improves venous return to heart. In JPMR person contracts each muscle of upper limb and lower limb, hold that contraction, feel the contraction and let it go. This technique helps how to relax muscle and body.^{55,56} Hence we can use one relaxation technique or combination of both technique to reduce progression of hypertension as well as primary prevention of cardiovascular disease.

Conclusion-

We can conclude that both technique Jacobson's progressive muscle relaxation and diaphragmatic breathing exercise are equally effective in reducing cardio-respiratory parameters and level of stress. So we can use any one technique or in combination of both these technique to reduce progression of hypertension.

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