ISSN: 2321-5690
IJOPT
INDIAN JOURNAL OF PHYSICAL THERAPY
AN INTERNATIONAL JOURNAL
INDIAN JOURNAL OF PHYSICAL THERAPY
AN INTERNATIONAL JOURNAL
editor.ijopt@gmail.com

THE EFFECTS OF CHANDRA NADI PRANAYAMA ON BLOOD PRESSURE, HEART RATE, AND SPASTICITY IN SUBACUTE AND CHRONIC STROKE PATIENTS: AN EXPERIMENTAL STUDY

[1]Dr. Foram Bavisa, [2]Dr. Karishma Jagad
Government physiotherapy college, old TB hospital, behind dental college, rameshwar nagar, jamnagar-361008

[1]Corresponding Author: fb995506@gmail.com

DOI: https://doi.org/10.63299/ijopt.060215

ABSTRACT

Background: Unilateral left nostril breathing pranayama may promote the parasympathetic division of the autonomic nervous system, resulting in lowered heart rate, blood pressure, and a relaxed state.
Objectives: To investigate the effects of Chandra Nadi Pranayama on blood pressure, heart rate, and spasticity in subacute and chronic stroke patients.
Methods: A random sample of 36 hypertensive, subacute and chronic stroke male and female patients were recruited. Subjects were selected and allocated into one of the two groups namely Chandra nadi pranayama group and Control group. Patients in both groups underwent conventional therapy for 45 minutes. Chandra nadi pranayama group performed 10 cycles, 3 sets of Chandra nadi pranayama before conventional therapy for 15 minutes. All participants received training 5 sessions a week for a period of 4 weeks. BP, HR, and MAS were taken before and after 4 weeks of the intervention for analysis.
Results: Data was analysed using SPSS 27.0 version. For within group comparison of BP, MAS were done with Wilcoxon signed-rank test and for HR paired t-test. Inter group comparison for BP, MAS were done with Mann-Whitney U test and for HR independent t-test. Statistically significant differences were observed in outcome measures systolic BP and spasticity (MAS). A minor or non-significant difference was observed in outcome measure HR and no significant changes were observed in diastolic BP.
Conclusion: Chandra nadi pranayama is an effective method for improving heart rate, systolic blood pressure, and spasticity in stroke patients.
Keywords: Chandra nadi pranayama, Blood pressure, Heart rate, Spasticity

INTRODUCTION

A stroke, also known as a cerebral vascular accident (CVA), is an abrupt loss of neurological function brought on by a disruption in the blood supply to the brain. Neurological deficits must last for at least 24 hours to be considered a stroke.(1)

Stroke is a leading cause of disability globally, impacting millions of people each year. The World Health Organization (WHO) states that stroke is a key contributor to long-term disability and the

second greatest cause of mortality. As the world's population ages and cardiovascular risk factors including obesity, diabetes, and hypertension increase, the burden of stroke has dramatically increased.(2) Cardiovascular instability, spasticity, cognitive impairments, and poor motor control are all post-stroke consequences that have a detrimental effect on a patient's independence and quality of life.

Spasticity, a major motor disability brought on by lesions in the higher motor neurons, is typified by rigidity in the muscles, heightened reflexes, and trouble moving voluntarily. After a stroke, 19–42% of people develop spasticity, and many of them need long-term rehabilitation treatments.(3) Management of spasticity is a crucial part of stroke therapy since it can impair movement, self-care, and everyday activities. Each person experiences spasticity to varying degrees, affecting various joints and muscle groups, such as the shoulder, elbow, wrist, hip, knee, and ankle. To properly manage spasticity, a variety of therapy techniques are needed.

The standard treatment for spasticity includes physical therapy, medications like baclofen and botulinum toxin, and in extreme situations, surgery. Nevertheless, pharmacological treatments frequently have adverse effects, and not all patients may benefit from long-term use. Yoga and breathing techniques are examples of complementary and alternative methods that have drawn interest because of their potential to safely and efficiently alter brain and autonomic processes.

The autonomic nervous system is influenced by controlled breathing techniques used in pranayama, a fundamental yoga practice. It is well known that Chandra Nadi Pranayama, or left nostril breathing, increases parasympathetic nervous system activity, which results in physiological advantages like decreased blood pressure, heart rate, and muscular relaxation.(4) Pranayama can help stroke patients regulate their spasticity and autonomic dysfunction naturally by stimulating the vagus nerve and encouraging a relaxation response.

Previous studies have demonstrated the benefits of pranayama in reducing sympathetic activity and improving cardiovascular parameters, but limited research exists regarding its specific impact on post-stroke spasticity. This study aims to evaluate the effects of CNP as an adjunct to conventional stroke rehabilitation and compare it with conventional therapy alone. Understanding the potential role of pranayama in stroke rehabilitation could open new avenues for non-pharmacological interventions that enhance recovery and quality of life.

METHODOLOGY

Study Design: Experimental Study

Participants: 36 hypertensive subacute and chronic stroke patients (18-70 years)

Inclusion Criteria:

- Stroke onset >2 weeks
- Ability to sit for 15 minutes
- Ability to comprehend and follow verbal instructions
- No prior experience with CNP

Exclusion Criteria:

- Aphasia or Cognitive impairments
- Visual or hearing impairments
- Other neurological conditions
- Use of anti-spasticity or psychotropic drugs

Procedure:

Sample size of the study was 36 patients with subacute and chronic stroke. The sample size was determined to be 18 for each group. Ethical clearance was obtained from the ethical committee of M.P. Shah Government Medical College, Jamnagar (Ref: Project No. 27/01/2023).

A total number of 36 patients, including subacute and chronic stroke (> 2 weeks) were selected for the study on the basis of inclusion criteria and asked to sign the consent form after receiving an adequate description of the study's goals and methods.

Subjects were allocated into one of the two groups namely Group A (CNP + Conventional therapy group) and Group B (Conventional therapy group).

Conventional Physiotherapy was decided according to the condition and need of the patients. 36 patients were divided into two groups; 18 patients in group A and 18 patients in group B.

Basic information like name, age, gender, affected side, height, weight, contact number and address were collected from the patients. The intervention duration was 4 weeks.

Heart rate, Blood pressure and Modified Ashworth scale were taken before and after 4 weeks of the intervention as outcome measures.
The final analysis of 36 patients was done.

Interventions:

Group A (CNP group): 18 patients received Chandra nadi pranayama plus conventional therapy.

Group B (Control group): 18 patients received conventional therapy.

Conventional Physiotherapy was decided according to the condition and need of the patients, which included stretching of tight muscles, strengthening of weak muscles, coordination exercise, balance and gait training.

Techniques:

Group A

The subjects were individually taught how to perform Chandra Nadi Pranayama. They were instructed to take up an erect sitting position with palms on their thighs. The unaffected thumb or finger was used to close their right nostril with gentle pressure. The Chandra nadi pranayama was then performed through the unblocked left nostril in a calm and regular manner with a conscious effort to use low, mid and upper parts of the lungs in a sequential manner for both inspiration and expiration. 10 cycles and 3 sets of Chandra nadi pranayama.

The Patient received 15 minutes of Chandra nadi pranayama and 45 minutes of conventional therapy, 5 days a week for 4 weeks.

Figure 1: Chandra nadi pranayama

Group B

The patient received only 45 minutes of conventional therapy, 5 days a week for 4 weeks.

Conventional Physiotherapy was decided according to the condition and need of the patients, which included stretching of tight muscles, strengthening of weak muscles, coordination exercises, balance exercises, gait training, and fine motor activities.

RESULTS

Data analysis was conducted using SPSS 27.0, with significance set at $p < 0.05$.

NAME AND DESCRIPTION OF STATISTICAL TEST USED FOR ANALYSIS:

- Shapiro-Wilk test was done to check the normality distribution of the data.
- Paired t test was done to compare pre and post outcome measures of Heart rate for within Group A and Group B
- Wilcoxon signed-rank test was done to compare pre and post-outcome measures of MAS score, Systolic and Diastolic blood pressure for within group A and group B.
- Independent t test was done to compare post outcome measures of Heart rate between the group A and group B.
- Mann Whitney U test was used to compare post outcome measures of MAS score, Systolic and Diastolic blood pressure between the group A and group B.
- The basic details of subjects like age, gender, height, weight, group allocation and the side affected are as mentioned in table.

Table 1: Basic Details of Participants

Group	N	Mean Age (years)	Male	Female	Height (cm)	Weight (kg)	Affected Side (Right/Left)
A	18	54.28 ± 8.50	11	7	160.83 ± 6.31	66.33 ± 12.78	9/9
B	18	52.67 ± 11.57	15	3	162.66 ± 5.45	72.38 ± 11.55	10/8

Table 2: Normality Distribution (Shapiro-Wilk Test)

Outcome Measure	p-value	Normality
Pre-Heart Rate	0.855	Normally distributed
Pre-Systolic BP	0.002	Not normally distributed
Pre-Diastolic BP	0.003	Not normally distributed

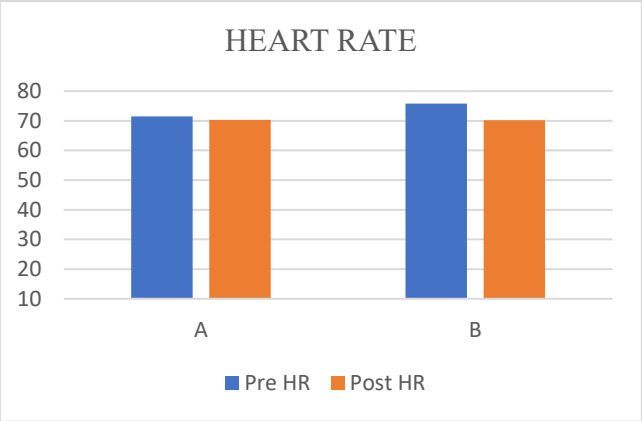
The MAS score was ordinal data, so normality has not been checked.

Table 3: Heart Rate Analysis

Group	Pre-Mean HR (bpm)	Post-Mean HR (bpm)	Mean Difference	p-value
A	71.50 ± 11.64	70.28 ± 6.3	1.22	0.383
B	75.80 ± 10.12	70.14 ± 8.42	5.66	0.032*

Interpretation:

Graph 1: Within-group comparison of mean of pre-treatment and post-treatment data (Heart Rate), within and between-group analysis of group A and group B

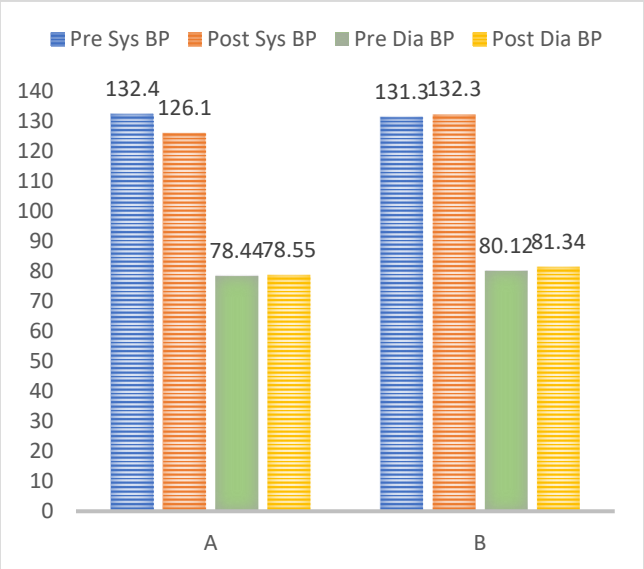


Group A:
The p-value (0.383) is greater than 0.05, indicating that the reduction in HR is not statistically significant.
Group B:
The p-value (0.032) is less than 0.05, indicating a statistically significant decrease in HR.
Comparison Between Groups:
Group B showed a larger and significant reduction in HR, whereas Group A showed only a minor and non-significant change.

Table 4: Blood Pressure Analysis

BP Type	Group A Pre (mmHg)	Group A Post (mmHg)	p-value	Group B Pre (mmHg)	Group B Post (mmHg)	p-value
Systolic BP	132.4 ± 6.88	126.1 ± 5.42	0.000**	131.3 ± 5.94	132.3 ± 6.12	0.721
Diastolic BP	78.44 ± 7.93	78.55 ± 7.09	0.837	80.12 ± 6.73	81.34 ± 7.15	0.402

Interpretation:



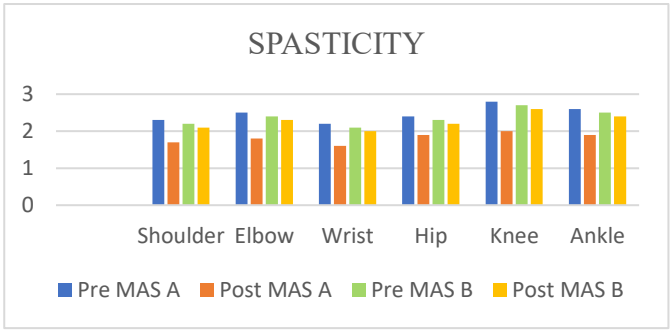
Graph 2: Within-group comparison of mean of pre-treatment and post-treatment data (Blood Pressure), within and between-group analysis of group A and group B

Systolic BP
Group A:
Group A showed a significant reduction in systolic BP ($p < 0.01$). This suggests that the intervention in this group effectively lowered systolic BP.
Group B:
The p-value (0.721) indicates no significant change in systolic BP for Group B. This suggests that the intervention did not affect systolic BP in this group.
Diastolic BP
Group A:
There is no significant change in diastolic BP in Group A ($p = 0.837$). The intervention had minimal or no effect on diastolic BP.
Group B:
Group B also showed no significant change in diastolic BP ($p = 0.402$). The intervention did not have a notable impact on diastolic BP in this group.

Table 5: Spasticity Analysis (Modified Ashworth Scale - MAS)

Joint	Group	Pre-MAS Score	Post-MAS Score	p-value
Shoulder	A	2.3 ± 0.6	1.7 ± 0.5	0.002**
	B	2.2 ± 0.7	2.1 ± 0.6	0.234
Elbow	A	2.5 ± 0.6	1.8 ± 0.4	0.001**
	B	2.4 ± 0.7	2.3 ± 0.6	0.215
Wrist	A	2.2 ± 0.5	1.6 ± 0.3	0.002**
	B	2.1 ± 0.6	2.0 ± 0.5	0.198
Hip	A	2.4 ± 0.7	1.9 ± 0.5	0.003**
	B	2.3 ± 0.6	2.2 ± 0.6	0.210
Knee	A	2.8 ± 0.7	2.0 ± 0.5	0.000**
	B	2.7 ± 0.6	2.6 ± 0.6	0.234
Ankle	A	2.6 ± 0.6	1.9 ± 0.4	0.001**
	B	2.5 ± 0.7	2.4 ± 0.6	0.220

Interpretation:
Graph 3: Within-group comparison of mean of pre-treatment and post-treatment data (Spasticity), within and between-group analysis of group A and group B



Group A:
Group A showed a statistically significant reduction in spasticity across all measured joints ($p < 0.01$), indicating that the intervention was effective in reducing muscle tone and improving movement.
Group B:
Group B did not show any statistically significant improvement in spasticity in any of the joints (all p-values > 0.05). This suggests that the intervention used in Group B was not effective in reducing spasticity.

DISCUSSION

The findings of this study suggest that Chandra Nadi Pranayama significantly reduces systolic BP, HR, and spasticity in stroke patients. The observed reduction in BP and HR can be attributed to the increased parasympathetic dominance induced by left nostril breathing, which has been reported in previous studies on pranayama.(4) By stimulating the vagus nerve, CNP can modulate autonomic balance, shifting the body into a state of relaxation and reducing the heightened sympathetic drive often seen in hypertensive stroke patients.

Spasticity, a common complication in stroke patients, was also significantly reduced in Group A. The improvement in spasticity can be attributed to the calming effects of controlled breathing, which may regulate abnormal stretch reflex excitability. Research has shown that deep breathing and slow respiratory rates can reduce corticospinal excitability and influence muscle tone.(3) The neuromodulatory effects of pranayama, particularly on spinal motor circuits, may explain the reduction in Modified Ashworth Scale scores observed in the CNP group.

Additionally, the control group (Group B) did not show significant changes in BP and spasticity, indicating that conventional therapy alone may not be sufficient for managing these conditions effectively. This underscores the need for complementary interventions such as CNP in stroke rehabilitation programs. Our results align with previous studies that have suggested yoga-based interventions as a beneficial adjunct in neurorehabilitation.(4)

A critical aspect of stroke rehabilitation is neuroplasticity—the brain's ability to reorganize itself by forming new neural connections. Emerging evidence suggests that breathing exercises and meditation can enhance neuroplasticity by influencing cortical networks and increasing brain oxygenation.(3) The role of breath control in stroke recovery requires further exploration, but preliminary studies suggest that pranayama practices, such as CNP, may support neuroplastic changes essential for functional recovery.

Furthermore, pranayama techniques have been associated with psychological benefits, including reduced stress, anxiety, and depression, which are common in post-stroke patients. Stress and emotional distress can exacerbate hypertension and autonomic dysfunction, hindering recovery. By promoting relaxation, CNP may contribute to improved emotional well-being, indirectly supporting physical rehabilitation.

Despite these promising findings, our study has some limitations. The duration of the intervention (4 weeks) may not fully capture the long-term benefits of CNP. Additionally, the sample size was relatively small, and future studies should include a larger cohort with extended follow-up to determine the sustainability of these effects. More objective measures, such as electromyography (EMG), could be used in future research to assess the neurophysiological mechanisms underlying the impact of pranayama on spasticity and motor recovery.

Clinical Implications:
CNP can be incorporated into stroke rehabilitation to enhance cardiovascular stability and motor recovery.

It provides a non-pharmacological approach to managing spasticity, reducing dependency on medications.

It is a cost-effective and accessible therapy that can be practiced at home under minimal supervision.
Integrating pranayama into stroke rehabilitation protocols could improve overall patient outcomes by enhancing autonomic balance and neuromuscular relaxation.

CONCLUSION

Chandra Nadi Pranayama, as an adjunct to conventional therapy, is an effective intervention for reducing heart rate, systolic blood pressure, and spasticity in subacute and chronic stroke patients.

REFERENCES

1. Fulk GD, Chui KK. O'Sullivan & Schmitz's PHYSICAL REHABILITATION, EIGHTH EDITION [Internet]. Available from: www.mohsenibook.com
2. Mendis S. Stroke disability and rehabilitation of stroke: World Health Organization perspective. Vol. 8, International Journal of Stroke. 2013. p. 3–4.
3. Lu L, Zhang X, Zhao C, Jin R, Li Yue Feng J, Copyright fneur, et al. Effectiveness and safety of acupuncture for post-stroke spasticity: A systematic review and meta-analysis [Internet]. 2019. Available from: https://www.news-medical.net/health/What-is-
4. Bhavanani A, Madanmohan, Sanjay Z. Immediate effect of chandra nadi pranayama (left unilateral forced nostril breathing) on cardiovascular parameters in hypertensive patients. Int J Yoga. 2012;5(2):108.