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Case Report

Effects of sectional breathing on cardio-pulmonary function in a patient with coexisting bronchial asthma and pre-hypertension: a single case report

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ABSTRACT

Non-communicable diseases (NCDs), such as cardiovascular diseases, chronic respiratory conditions, diabetes, and cancer, remain leading causes of morbidity and mortality worldwide. Hypertension and bronchial asthma are prevalent conditions that significantly contribute to cardiovascular risk. While pharmacological treatments are commonly used, alternative therapies like sectional breathing have gained attention for their potential role in improving cardiopulmonary function. This study explores the effects of sectional breathing on a patient with coexisting bronchial asthma and pre-hypertension. This single-case study involved a patient diagnosed with bronchial asthma and pre-hypertension. The intervention consisted of a structured, sectional breathing program over a specified period. Cardiopulmonary parameters, including pulmonary function tests (PFT), blood pressure, and heart rate, were assessed before and after the intervention. Patient adherence, comfort, and any adverse effects were also monitored throughout the study duration. Post-intervention, pulmonary function parameters, such as forced expiratory volume in one second (FEV1) and peak expiratory flow rate (PEFR), significantly improved. Additionally, blood pressure decreased, suggesting a potential autonomic regulatory effect of sectional breathing. Subjectively, the patient reported enhanced respiratory ease and a decrease in dyspnea episodes, reinforcing the physiological benefits of the intervention. The findings indicate that sectional breathing may be a promising adjunctive therapy for individuals with coexisting bronchial asthma and pre-hypertension. The observed improvements in pulmonary function and blood pressure suggest a potential role for non-pharmacological interventions in managing cardiopulmonary conditions. Further research with larger sample sizes and controlled study designs is recommended to validate these findings and elucidate the underlying physiological mechanisms.

Keywords: Bronchial asthma, Pre-hypertension, Pulmonary function test, Sectional breathing

INTRODUCTION

Non-communicable diseases (NCDs), commonly known as chronic diseases, pose a significant global health challenge due to their high morbidity and mortality rates.[1] The four leading causes of premature death among NCDs are cardiovascular diseases (CVDs), chronic respiratory conditions, diabetes, and cancer.[2] According to the world health organization (WHO), NCDs account for 71% of all global deaths annually, with cardiovascular diseases causing 17.9 million deaths, respiratory illnesses 3.9 million, diabetes 1.6 million, and cancer 9.0 million. Key risk factors contributing to NCD-related mortality include unhealthy diets, air pollution, tobacco use, excessive alcohol consumption, and physical inactivity.[3]

Hypertension, commonly referred to as high blood pressure, is a chronic condition characterized by persistently elevated systolic blood pressure (SBP) above 130 mmHg or diastolic blood pressure (DBP) above 80 mmHg.[4] WHO estimates that approximately 1.28 billion adults worldwide have hypertension.[5] Major risk factors include age, family history, high-salt diet, physical inactivity, smoking, excessive alcohol intake, and underlying conditions such as diabetes, obesity, and kidney disease.[6] Management strategies involve pharmacological interventions, including angiotensin-converting enzyme inhibitors (ACEIs), angiotensin receptor blockers (ARBs), calcium channel blockers (CCBs), and thiazide diuretics.[7]

Bronchial asthma is a chronic inflammatory disease affecting the airways, leading to bronchial narrowing and respiratory distress.[8] It affects approximately 262 million people globally and is characterized by wheezing, chest tightness, coughing, and shortness of breath.[9] Risk factors include genetic predisposition, socioeconomic status, environmental pollution, smoking, and psychological factors like anxiety and depression. Standard pharmacological treatment consists of inhaled corticosteroids (ICS) and long-acting beta-agonists (LABA).[10]

Non-pharmacological approaches, such as yoga therapy, have been found to improve cardiovascular and metabolic health, reducing the burden of NCDs.[11] Yoga practices, including physical postures, pranayama (controlled breathing), and meditation, help in stress reduction, which plays a key role in NCD progression.[12] Pranayama has been shown to positively affect autonomic function, pulmonary health, sleep quality, and cardiorespiratory efficiency.[13,14] Studies indicate that pranayama techniques effectively lower SBP and DBP in individuals with hypertension while improving forced vital capacity (FVC), forced expiratory volume in 1 second (FEV1), and peak expiratory flow rate (PEFR) in asthma patients.[15]

Various pranayama techniques, including Bhramari, Nadi Shodhana (Alternate nostril breathing), Sheetali, and Ujjayi pranayama, are known to enhance respiratory and cardiovascular function by increasing parasympathetic activity.[11,13,14,16-18] However, there is limited research on the specific effects of sectional breathing in individuals with both hypertension and bronchial asthma. This study aims to explore the impact of sectional breathing on cardiopulmonary function in a patient with coexisting asthma and hypertension, addressing a critical gap in existing research.

CASE REPORT

A 29-year-old female university student with a history of bronchial asthma and pre-hypertension presented for a routine follow-up. She was pre-diagnosed with asthma at the age of 17 and has since managed her condition with daily low-dose inhaled corticosteroids and a short-acting beta-agonist for acute exacerbations, typically using the rescue inhaler twice a week, especially during physical activity. Her asthma symptoms have been inconsistent, with exacerbations triggered by allergens, exercise, and seasonal changes. At the age of 29, she was also diagnosed with pre-hypertension.

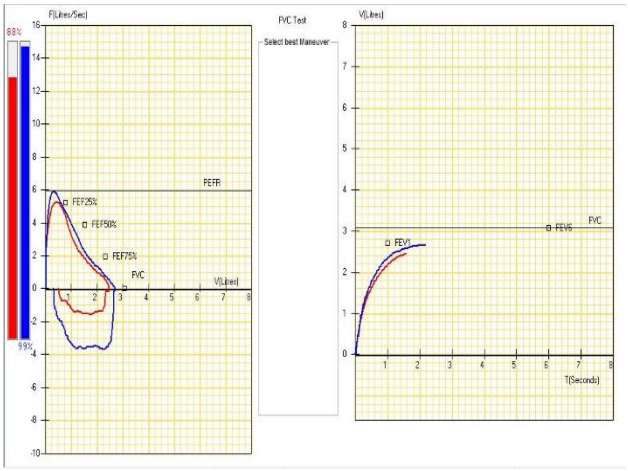

Figure 1: Pulmonary function test.

Her anthropometric measurements revealed a height of 162 cm, weight of 58 kg, and a BMI of 22.1 kg/m², placing her in the healthy weight range. On examination, her vital signs were stable, with a blood pressure of 138/86 mmHg, a pulse rate of 82 beats per minute, a respiratory rate of 18 breaths per minute, oxygen saturation of 97% on room air, and a body temperature of 36.7°C. Cardiovascular assessment showed normal peripheral pulses with no murmurs, while a respiratory examination revealed occasional wheezing but no crackles or respiratory distress. Her abdominal examination was unremarkable, and neurological assessment indicated normal strength and sensation.

She engages in light physical activity but reports occasional fatigue, particularly during asthma exacerbations or fluctuations in blood pressure levels. Her family history includes asthma in her mother and

hypertension in both parents. She lives in a dormitory and manages her chronic conditions independently, though she faces challenges balancing her treatment regimen with academic responsibilities. Despite this, she actively avoids asthma triggers and follows dietary controls for hypertension management.

Diagnostic assessment

The patient underwent a comprehensive diagnostic assessment before the intervention, including pulmonary function tests (PFTs) and cardiovascular evaluations to establish baseline values. Pulmonary function parameters such as forced expiratory volume in 1 second (FEV1), forced vital capacity (FVC), and peak expiratory flow rate (PEFR) were measured to assess respiratory efficiency. Blood pressure measurements, including systolic blood pressure (SBP) and diastolic blood Pressure (DBP), were recorded to evaluate cardiovascular status. In addition, pulse rate (PR), pulse pressure (PP), double product (DOP), rate pressure product (RPP), and mean arterial pressure (MAP) were assessed to determine the cardiac workload and autonomic function. These parameters provided insight into the patient's cardiovascular efficiency and response to stress. PP was calculated as (SP−DP); RPP as (heart rate (HR)× SP/100); and Do P as (HR×MP/100); MAP as (DP+⅓PP).

Following the 10-day intervention of sectional breathing exercises, post-intervention assessments were conducted to evaluate physiological changes. The results demonstrated a reduction in SBP and DBP, improved pulmonary function, and better cardiovascular parameters, indicating the potential benefits of sectional breathing in managing coexisting asthma and pre-hypertension.

Intervention

The patient was guided through a structured 20-minute breath awareness training session for 10 days, focusing on abdominal, thoracic, and clavicular breathing in a progressive sequence. Each session began with the patient lying in a supine position, placing the right hand on the abdomen and the left hand on the chest, observing natural breathing for two minutes. The first phase involved six minutes of abdominal (diaphragmatic) breathing, where she inhaled deeply, allowing the abdomen to expand while keeping the chest still, and exhaled fully, feeling the abdomen contract naturally, maintaining a slow and rhythmic breath cycle.

The second phase involved six minutes of thoracic breathing, engaging the ribcage muscles while disengaging the diaphragm, expanding the ribcage outward and upward during inhalation, and allowing it to contract naturally during exhalation. The third phase consisted of four minutes of clavicular breathing, extending inhalation to involve the upper lungs, shoulders, and collarbones, with a sequential release of breath from the upper chest to the ribcage.

Each breath phase followed a structured cycle of inhalation for four seconds, exhalation for six seconds, and a brief two-second pause. The session concluded with two minutes of relaxation and spontaneous breath observation, allowing the patient to integrate the practice naturally. Over the 10 days, the intervention progressed from understanding and refining each breathing phase to improving breath control and ultimately integrating all three types into a seamless and effortless practice.[19]

Follow up and outcomes

The results demonstrated a notable improvement in pulmonary function and a reduction in blood pressure parameters following the intervention. The patient showed enhanced respiratory efficiency, lowered systolic and diastolic blood pressure, and improved cardiovascular markers, including pulse rate, double product, rate-pressure product, and mean arterial pressure. These findings suggest the positive impact of sectional breathing exercises on cardiopulmonary health (Table 1 and 2; Figure 1).

After the intervention period, the patient was advised to continue practicing sectional breathing techniques at home to sustain the benefits. Additionally, bimonthly follow-up calls were conducted to ensure adherence to the breathing practices, monitor progress, and assess for any potential adverse effects. Regular follow-ups were recommended to track long-term improvements and reinforce the integration of breathing exercises into daily life.

Table 1: Pulmonary function test parameters before and after intervention.

Parameter	Predicted level	Before pre	% PRED	After post	% PRED	IMP
FVC	3.07	2.46	80	2.69	88	+09
FEV1	2.69	2.19	81	2.35	87	+07
FEV1/ FVC%	87.62	89.02	102	87.36	100	-02
FEF 25-75	3.61	2.34	65	2.46	68	+05
PEFR	5.96	5.23	88	5.84	98	+12

PRED, predicted value; IMP, improvement; FVC, forced vital capacity; FEV1, forced expired volume in the first second; FEV1/FVC, forced expiratory volume in the first second and forced vital capacity ratio; FEF, forced expiratory flow; PEFR, peak expiratory flow rate.

Table 2: Measurement of blood pressure before and after intervention.

Parameter	Pre	Post
SBP	138	119
DBP	88	74
PR	92	76
PP	50	45
DOP	96.23	67.64
RPP	126.96	90.44
MAP	104.6	89

SBP- Systolic Blood pressure; DBP- Diastolic blood pressure; PR- Pulse Rate; PP- Pulse Pressure; DOP- Double Product; Rate Pressure Product; MAR- Mean arterial Pressure

DISCUSSION

To the best of our knowledge, this is the first documented case examining the effects of sectional breathing on cardiorespiratory function. The findings from this case indicate that sectional breathing has a positive impact on pulmonary function by increasing forced vital capacity (FVC), forced expiratory volume in 1 second (FEV1), forced expiratory flow (FEF) 25-75%, and peak expiratory flow rate (PEFR) while reducing the FEV1/FVC ratio from 102% to 100% in an individual with bronchial asthma. Additionally, sectional breathing demonstrated favourable effects in lowering systolic blood pressure (SBP) and diastolic blood pressure (DBP), pulse rate (PR), double product (DOP), rate pressure product (RPP), and mean arterial pressure (MAP).

In hypertension, sectional breathing enhances parasympathetic activity, which helps lower heart rate and blood pressure through the baroreceptor reflex.[20] The increased parasympathetic dominance contributes to better cardiovascular regulation by promoting sympathovagal balance.[21] Slow, deep breathing maximally expands the lungs, triggering pulmonary stretch receptors that reduce sympathetic tone in blood vessels, leading to vasodilation and a subsequent reduction in peripheral resistance and diastolic blood pressure.[22]

Additionally, as blood pressure rises, the baroreceptor response increases vagal activity while decreasing sympathetic outflow to the sinoatrial (SA) and atrioventricular (AV) nodes, thereby lowering the heart rate.[23] Research suggests that the autonomic nervous system (ANS) shifts toward parasympathetic dominance due to inhibitory signals and hyperpolarizing currents generated within the central and peripheral nervous systems, as well as in surrounding tissues.[24] Furthermore, slow breathing increases inspiratory and expiratory volumes, improving oxygenation, reducing activation of the hypothalamic-pituitary-adrenal (HPA) axis, and promoting arteriolar dilation, all of which contribute to reductions in SBP and DBP.[25,26]

In bronchial asthma, pranayama and sectional breathing techniques facilitate the removal of mucus from the bronchial tree and alveoli, reduce airway inflammation, and prevent mast cell degranulation, leading to a decrease in airway obstruction and improved airflow.[13] This practice normalizes carbon dioxide (CO_2) levels, mitigating bronchospasm and dyspnoea by reducing hyperventilation and hyperinflation.[27] Additionally, by engaging both thoracic and abdominal breathing, sectional breathing enhances diaphragmatic contraction, leading to improved lung function through continuous thoracic and abdominal pressure variations.[28]

The activation of slow-adapting receptors (SARs) during deep breathing further aids in regulating the autonomic nervous system through neural projections to the nucleus of the solitary tract (NTS) in the brainstem.[29,30] The repetitive inflation and deflation of the lungs during controlled breathing exercises strengthen the respiratory muscles, enhance lung clearance, and extend expiration time, contributing to improved pulmonary function.[31] Studies suggest that pranayama can improve oxygen intake by up to five times, optimizing tissue oxygenation and reducing lung hyperinflation.[32,33]

In this case report, we observed that sectional breathing played a significant role in establishing parasympathetic dominance, thereby improving both cardiovascular and pulmonary function in a patient with coexisting hypertension and bronchial asthma.

Patient perspective

Over the 10 days, the patient reported noticeable improvements in breathing capacity, a sense of lightness in the chest, and reduced breathlessness. She experienced increased lung expansion, enhanced breath control, and a greater sense of relaxation after each session. By the end of the intervention, she expressed feeling more in tune with her breath, with an overall improvement in respiratory efficiency and well-being.

Strengths and limitations

This case study highlights the novel use of sectional breathing as a non-pharmacological intervention for managing bronchial asthma and pre-hypertension. It demonstrates a safe, cost-effective, and integrative approach that improves cardiopulmonary parameters, including FVC, FEV1, FEF25-75%, PEFR, SBP, DBP,

PR, PP, DOP, RPP, and MAP. The study underscores the potential long-term benefits of breathwork in autonomic regulation and respiratory efficiency, supporting its integration into conventional treatment strategies. However, the findings are limited by the single-case design, lack of a control group, and short intervention duration, which restricts the generalizability of results. Additionally, external factors such as lifestyle, diet, and medication adherence could have influenced the outcomes. Further studies with larger sample sizes and randomized controlled trials are needed to confirm the reliability and reproducibility of these findings.

CONCLUSION

Sectional breathing demonstrated notable improvements in pulmonary function and cardiovascular parameters in a patient with coexisting bronchial asthma and pre-hypertension. The intervention effectively enhanced respiratory efficiency, reduced airway resistance, and promoted autonomic balance, contributing to better blood pressure regulation. These findings suggest that integrating sectional breathing into routine management may offer a simple, cost-effective, and non-invasive approach to improving cardiopulmonary health. However, further research with larger cohorts and controlled trials is necessary to validate these results and establish standardized protocols for clinical application.

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