

Pulmonary Function Tests in Hypertensive Patients

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Abstract:

Introduction: Hypertension is the disease which affects the various systems of the body. The effect of hypertension on respiratory system is less studied.

Objective: To assess the influence of pathophysiology of hypertension on pulmonary function in hypertensive patients.

Materials and Methods: Study group consisted of 80 hypertensives and control group consisted of 80 nonhypertensives. Pulmonary function test (PFT) was performed with computerised spirometer: RMS Helios 401. The following PFT parameters were recorded and studied : FEV 1, FVC, FEV 1/FVC, PEFR in both the groups. These parameters were compared in both the groups by applying unpaired t test.

Results: Hypertensive subjects have significantly lesser values of FVC, FEV1, FEV1/ FVC and PEFR (p<0.01) as compared to normotensive subjects.

Conclusion: Hypertension does have its deleterious effects on Pulmonary function. Hypertensives should be routinely screened for pulmonary function to reduce morbidities.

Key Words: Hypertension, spirometer, pulmonary function test

I. Introduction

Hypertension is a public health issue globally. It is the major cause of heart disease, stroke and kidney failure and premature mortality and disability. It usually affects the low- and middle-income countries' populations, where health systems are weak¹.

The current estimation is that more than 1 billion individuals in the world have HTN (Hypertension) and it is the cause of more than 7 million deaths annually². Hypertension represents the tip of an iceberg³.

In India, hypertension is found to be directly responsible for 57% of all stroke deaths, 24% of all coronary heart disease deaths and 10% of all deaths⁴. The number of hypertensives is expected to nearly double from 118 million in 2000 to 213 million by 2025⁵.

Hypertension and antihypertensive drugs have deleterious effect on respiratory system⁶. But there are very few studies showing involvement of respiratory system in HTN in India.

The association between blood pressure and lung function parameters in Indian population is much less investigated. Thus the aim of the study was to assess the pulmonary function in hypertensive patients.

Aims

To assess the pulmonary function in hypertensive patients

Objectives

To assess the influence of pathophysiology of hypertension on pulmonary function in hypertensive patients.

II. Materials And Methods

Study period:

The present study was carried out in March 2015 for a period of one month.

Study design and participants:

Computerized PFT was conducted on 80 hypertensive and 80 normotensive male subjects who were age, BMI matched. Average blood pressure readings in sitting posture after 10 minutes of physical and mental rest was taken on three consecutive days at the same time of the day (between 9:00 am and 9:30 am). These subjects were selected from rural areas of Bangalore.

Hypertensive subjects were selected based on the following criteria:

Inclusion criteria.

1. Hypertensive for > 5 years and < 10 years.
2. Average systolic pressure > 140 but < 180 mm Hg
Average diastolic pressure > 90 but < 104 mm Hg
3. Age between 40 to 60 years.

Exclusion criteria:

1. Smokers.
2. History of any lung diseases, restrictive or obstructive such as asthma or any other COPD.
3. Tobacco users.
4. Deformities of chest wall or spine
5. History of or symptoms of any neuromuscular disorders
6. Diabetics.
7. Those with severe or communicable lung infections like tuberculosis.
8. Hypertensives on beta blockers.

Normotensive subjects were similarly selected with blood pressure values:

Average Systolic blood pressure < 120 mm Hg, Average diastolic blood pressure < 80 mm Hg

The procedure of Pulmonary Function Test was explained to the subject in his own language and a written informed consent was taken. Institutional ethical clearance has been obtained. The anthropometric parameters and blood pressure values were recorded. The random blood sugar was estimated using a glucometer. The PFT was conducted using a computerised spirometer: RMS Helios 401. Sufficient care was taken to sterilise the filters and disposable mouth pieces were used.

The following PFT parameters were recorded and studied:

FEV₁, FVC, FEV₁/ FVC, PEFR

Data thus obtained were analyzed by unpaired t-test using the statistical software namely SPSS version 20.0.

III. Results

The study group included 80 hypertensives and control group included 80 healthy controls. The demographic characteristics of the study group and the control group are summarized in Table 1. There was no statistical significance in the differences between the mean age and BMI of the study group and the control group ($p>0.05$).

In our study we found that Hypertensive subjects have significantly lesser values of FVC, FEV₁, FEV₁/FVC and PEFR ($p<0.01$) as compared to normotensive subjects (Table 2).

Table 1: Demographic characteristics of subjects

Parameter	Hypertensive subjects Mean±SD	Normotensive subjects Mean±SD	Significance(p value)
Age(yrs)	51.97± 2.03	52.09± 1.02	$p>0.05$
BMI	24.06± 1.82	24.48 ± 2.61	$p>0.05$

Table 2: Comparison of PFTs in patients of HT and controls

PFT Parameters (Average values)	Normotensive subjects Mean±SD	Hypertensive subjects Mean±SD	Significance(p value)
FVC	3.12±0.27	2.74±0.51	<0.01
FEV ₁	2.48±0.19	2.24±0.15	<0.01
FEV ₁ /FVC	0.86±0.06	0.79±0.13	<0.01
PEFR	5.87±0.71	5.01±0.92	<0.01

IV. Discussion

The study showed that pulmonary function test parameters in hypertensives were statistically significantly lesser than normal controls ($p<0.05$): [Table: 2].

There was no statistical significance in the differences between the mean age and BMI of the study group and the control group ($p>0.05$): [Table: 1]. Hypertension is a disease which affects the various systems of the body. There are various complications of Hypertension and are well studied but research is on-going.

Several prospective studies have shown that not only hypertension is a risk factor for reduced lung function, but compromised pulmonary function tests increases the risk of development of hypertension. It has been suggested that both forced vital capacity and serum uric acid may lead to the development of hypertension and probably are intermediate steps in the pathological process of developing hypertension.⁷

Engström et al concluded that in normotensive men, FEV₁ was significantly associated with mortality. Further, they found that mortality among hypertensive men increased due to reduced lung function and

associated cardiovascular disease.⁶ A reduction in FVC is found to pave the way for cardiovascular disease morbidity and mortality in a study done by Jacobs DR J et al.⁸

Hypertensives with currently normal blood pressure with medication might have had high blood pressure for long duration before it was diagnosed and treated. The high blood pressure could have its deleterious effects on the pulmonary function. One possible hypothesis is that chronic hypertension causes left ventricular dysfunction. This results in increased left atrial pressure. This might lead to an increase in pulmonary artery pressure resulting into an increase in interstitial edema in the lung causing a decrease in FEV₁ and FVC values.⁹

The biomarkers of endothelial dysfunction and inflammation (fibrinogen, hs-C-reactive protein, soluble intracellular adhesion molecule-1, and interleukin-6) are seen in patients with reduced arterial elasticity (AE) and FVC, particularly in men. These findings are suggestive of pathophysiological changes of cardiovascular disease occurring simultaneously with lower arterial elasticity and lung function. This is also suggestive of probable physiological pathways of elastic changes in the vasculature and in lung parenchymal tissue.¹⁰ This could be the possible reason for involvement of respiratory system in HT.

Margretardottira OB et al have found that hypertension and increased inflammatory markers like CRP levels are independently and additively found to be associated with lower FEV₁ and FVC. A higher BMI is also said to be associated with lower FVC. They also found that the use of beta blocking antihypertensives was not related to lung function.¹¹

A study by HisashiMasugata et al found that an increased CAVI (cardio-ankle vascular index (CAVI) is seen in patients with reduced pulmonary function and increased pulmonary age. Hypertensive patients with high CAVI may need to be monitored for the progression of COPD.¹²

In a study by Enright PL et al, FEV₁ and FVC are reduced in elderly persons with hypertension, ischemic heart disease, higher LV mass, and congestive heart failure, though the magnitude of these associations is relatively small unless heart failure supervenes.¹³

Similarly, a study by Eva Schnabel et al suggests that a combination of high blood pressure and antihypertensive treatment may result in reduced lung function and not hypertension alone.¹⁴ Some studies indicate that reduced lung function is seen in patients with high blood pressure using beta-blockers, but not other antihypertensive medication.¹⁵ Beta-adrenergic receptors play a major role in the regulation of tone of bronchial muscle. Few studies have shown that beta blockers even relatively cardioselective beta blockers do produce bronchoconstriction.¹⁶

Thus, it becomes imperative to screen susceptible persons with hypertension for decreased lung function tests and follow up. These may be indicative of development of further cardiovascular complications which seem to have similar pathophysiological pathways as the deterioration of lung functions. This also provides an opportunity to institute pharmacological interventions to prevent or atleast retard the rate of cardiovascular deterioration and impending fatalities.

V. Limitations

In this study, the effect of hypertension and antihypertensive drugs on lung function could not be segregated.

VI. Conclusion

Persistent high blood pressure is responsible for altered pulmonary functions. PFTs may be used to screen hypertensive patients and reduce further complications and mortality by implementing suitable medical intervention. PFTs can be thus used as an integral part of screening methods for hypertensive patients and thereby improve their quality of living by retarding progression to complications.

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