



## A Study To Evaluate the Effect of Hypertension on Lung Function Parameters in South Indian Population

**Dr.A.Jeya Jancy Selvi Ratnam**

Assistant Professor, Institute of Physiology, Madurai Medical College, Madurai.

**ABSTRACT**

**BACKGROUND:** Hypertension is becoming an increasingly important public health challenge both in developing and developed countries. The burden of the disease in India is increasing.  
**AIM:** To assess and compare lung function tests in patients with hypertension and age and BMI matched normotensive controls.  
**MATERIALS AND METHODS:** Pulmonary function tests FVC, FEV<sub>1</sub>, FEV<sub>1</sub>% and PEFR were measured using computerised spirometer in 40 hypertensive patients and 40 normotensive controls.  
**RESULTS:** The results showed significant difference in FVC, and PEFR values between hypertensives and normotensives. No significant difference was noted in FEV<sub>1</sub>% values between the two groups.  
**CONCLUSION:** Thus, it becomes imperative to screen susceptible persons with hypertension for decreased lung function tests and follow up.

**KEYWORDS**

hypertension, lung function tests, cardiovascular risk factor.

**BACKGROUND**

Hypertension is an epidemic in the modern civilised world. It is estimated that there are 1 billion hypertensives globally. Hypertension is becoming an increasingly important public health challenge both in developing and developed countries.<sup>[1]</sup> According to World Health Organisation’s global health statistics the burden of the disease in India is increasing. India is waiting to become the hypertensive capital of the world. Hypertension is associated with pathology in almost all systems of the body like kidneys, heart, eye, brain, and blood vessels.<sup>[2]</sup> Beside the interactions between hypertension and vascular comorbidities, several studies showed that blood pressure and lung function are associated.<sup>[3-5]</sup> Hypertension and antihypertensive drugs have deleterious effects on respiratory system.<sup>[3]</sup> The association between hypertension and lung function parameters in south Indian population is much less investigated. The aim of this study is to determine whether hypertension had an adverse effect on lung functions.

**AIM AND OBJECTIVES**

The study was planned with the following objective

To assess and compare lung function tests in patients with hypertension and age and BMI matched normotensive controls.

**MATERIALS AND METHODS**

**Ethics statement:**

Written informed consent was taken from all subjects - cases and controls. Institutional ethical clearance has been obtained.

**Participants of the study:**

Forty hypertensive patients were selected from hypertension clinic of a Tertiary care Hospital, and forty normotensive subjects who were matched in age, socioeconomic status and BMI were selected as controls.

**Design and Procedure:**

Blood pressure was measured using mercury sphygmomanometer (Diamond). Readings were taken in sitting posture after 10 minutes of physical and mental rest on three consecutive days at the same time of the day (between 10:00 am and 10:30 am). The mean of the three values was considered for the study. Hypertensive subjects were selected based on the following Inclusion criteria. 1. Hypertensive for 5 to 10 years. 2. Systolic blood pressure 140 -180 mm Hg 3. Diastolic

blood pressure 90-100 mmHg. 4. Age – 40 to 60 years. Exclusion criteria: 1. Smokers. 2. History of any cardiopulmonary diseases. 3. Deformities of chest wall or spine. 4. DM 5. Any other major illness. 6. Hypertensives on beta blockers. Normotensive subjects were similarly selected with blood pressure values 120/ 80 mm Hg or less. The anthropometric measurements were recorded. PFT was performed using a computerized spirometer: Helios 401 (RMS India). Disposable mouth pieces were used and care was taken to sterilize the filters. Before the tests the examiner demonstrated the correct performance of the manoeuvres and then the individuals were supervised throughout the test. According to the recommendations of ATS, the tests were done with subjects in sitting position wearing nose clips. The subjects performed the test three times in order to get two repeatable values. The following parameters were recorded and studied: FEV<sub>1</sub>, FVC, FEV<sub>1</sub>/FVC, PEFR. Data thus obtained were analyzed by unpaired t-test using the statistical software: SPSS version 20.0.

**RESULTS**

**Table 1--Physical characteristics of subjects**

parameters	cases (n=50) mean±s.d	controls (n=50) mean±s,d	p value
age(yrs)	47.95 ± 4.24	50.38 ± 4.99	0.025
Height(cm)	161.05 ± 5.73	159.35 ± 4.10	0.132
BMI	22.90 ± 1.60	23.76 ± 1.57	0.018
MAP(mmHg)	114.12 ± 6.25	91.03 ± 5.97	<0.0001
Duration of HT(yrs)	7.51 ± 2.63	-	-

\*\*\*Independent sample t test

**Table 2—Comparison of pulmonary function tests in subjects**

PARAMETER	CASES (n=50) Mean±S.D	CONTROL(n=50) Mean±S.D	P value
FVC	75.89±12.72	86.95±12.54	<0.001
FEV <sub>1</sub>	71.72±15.88	78.80±14.07	0.038
FEV <sub>1</sub> %	79.39±12.24	83.71±9.54	0.080
PEFR	72.22±12.99	79.12±9.69	0.009

\*\*\*Independent sample t test

## DISCUSSION

This study has shown that the pulmonary function test parameters in hypertensives were significantly lesser than normotensive controls ( $p < 0.05$ ): [Table: 1]. Hypertension is a disease which affects multiple systems of the body. Many studies have shown that, not only hypertension is a risk factor for compromised lung function, but reduced pulmonary function tests increases the risk of development of hypertension. 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.<sup>[3]</sup> In a study done by Jacobs DR J et al. A reduction in FVC is found to pave the way for cardiovascular disease morbidity and mortality.<sup>[6]</sup> Sparrow et al and Selby et al reported a significant association between FVC and the incidence of hypertension.<sup>[7-8]</sup>

The reasons for the association between reduced lung function and hypertension are not known clearly. One explanation is that left ventricular failure causes pulmonary vascular engorgement and interstitial oedema, which may reduce the compliance of the lungs and result in lower FVC. Another possible explanation is the confounding effect of age, since blood pressure increases with age and lung function decreases. Therefore, we adjusted our analysis for age. The possibility of smoking and beta blockers as other causes are ruled out in this study because of exclusion criteria.

Identification and treatment of hypertension is currently the main strategy for prevention of stroke and heart failure. Therefore measurements of FVC and FEV1 may be useful like certain other conventional cardiovascular risk factors currently used to guide clinical decisions about the management of patients with mild hypertension.<sup>[9,10]</sup>

The biomarkers of endothelial dysfunction and inflammation (fibrinogen, C-reactive protein, soluble intracellular adhesion molecule-1, and interleukin-6) are seen in patients with reduced arterial elasticity (AE) and FVC, suggestive of pathophysiological changes of lower arterial elasticity occurring simultaneously with changes in lung function.<sup>[11]</sup> 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.<sup>[5]</sup>

A study by Hisashi Masugata 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.<sup>[12]</sup>

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.<sup>[4]</sup>

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.<sup>[13]</sup> Some studies indicate that reduced lung function is seen in patients with high blood pressure using beta-blockers, but not other antihypertensive medication.<sup>[14]</sup>

## CONCLUSION

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 at least retard the rate of cardiovascular deterioration and impending fatalities.

## REFERENCES

- [1] Kearney PM, Whelton M, Reynolds K, Whelton PK, He J: Worldwide prevalence of hypertension: a systematic review. *J Hypertens* 2004, 22(1):11-19
- [2] Flack JM, Peters R, Shafi R, Alrefai H, Nasser SA, Crook E: Prevention of hypertension and its complications: theoretical basis and guidelines for treatment. *J Am Soc Nephrol* 2003, 14(7 suppl 2):S92-S98.
- [3] Engstrom G, Hedblad B, Valind S, Janzon L: Increased incidence of myocardial infarction and stroke in hypertensive men with reduced lung function. *J Hypertens* 2001, 19(2):295-301.
- [4] Enright PL, Kronmal RA, Smith VE, Gardin JM, Schenker MB, Manolio TA: Reduced vital capacity in elderly persons with hypertension, coronary heart disease or left ventricular hypertrophy. The cardiac health study. *Chest* 1995, 107(1):28-35.
- [5] Margretardottir OB, Thorleifsson SJ, Gudmundsson G, Olafsson I, Benediktsson B, Janson C, Buick AS, Gislason T: Hypertension, systemic inflammation and body weight in relation to lung function impairment-an epidemiological study. *COPD* 2009, 6(4):250-255.
- [6] Jacobs DR, Yatsuya H, Hearst MO: Rate of decline of forced vital capacity predicts future arterial hypertension: the Coronary Artery Risk Development in Young Adults Study. *Hypertension*. 2012;59(2):219-25.
- [7] Selby, J. V., Friedman, G. D. and Quesenberry, C. P. (1990). Precursors of Essential Hypertension: Pulmonary Function, Heart Rate, Uric Acid, Serum Cholesterol, and other serum chemistries. *American Journal of Epidemiology*, 131(6), 1017-1027.
- [8] Sparrow, D., Weiss, S. T., Vokonas, P. S., Cupples, L. A., Ekerdt, D. J. and Colton, T. (1988). Forced Vital Capacity and the risk of hypertension. *American Journal of Epidemiology*, 127(4), 734-741
- [9] Strachan, D. P. (1991). Ventilatory function as a predictor of fatal stroke. *British Medical Journal*, 302, 84-87.
- [10] Kannel, W. B. (1996). Blood pressure as a cardiovascular risk factor: prevention and treatment. *Journal of the American Medical Association*, 275, 1571-1576.
- [11] Duprez DA, Hearst MO, Lutsey PL, Herrington DM, Ouyang P, Barr RG, et al. Associations Among Lung Function, Arterial Elasticity, and Circulating Endothelial and Inflammation Markers: The Multiethnic Study of Atherosclerosis. *Hypertension* 2013;61(2):542-548.
- [12] Masugata H, Senda S, Okada H, Murao k, Inukai M, Himoto T, et al. Association between arterial stiffness and pulmonary function in hypertensive patients. *Hypertension Research* (2012 ) 35, 388-392.
- [13] Schnabel, E., Karrasch, S., Schulz, H., Gläser, S., Meisinger, C., Heier, M., Peters, A., Wichmann, H-E, Behr, J., Huber, R. M. And 58 Heinrich, J., for the Cooperative Health research in the Region of Augsburg (KORA) Study Group. (2011). High blood pressure, antihypertensive medication and lung function in a general adult population. *Respiratory research*, 12: 50. Accessed on July 10, 2011. Available from [http://respiratoryresearch.com/content/12/1/50]
- [14] Lee, J. Y., Ahn, S. V., Choi, D. P., Suh, M., Kim, H. C., Kim, Y. S. and Suh, I. (2009). Association between Hypertension and Pulmonary Function in Rural Adults in Korea. *Journal of Preventive Medicine and Public Health*, 42(1), 21-28.