International Journal of Advances in Medicine
Ponnathota V et al. Int J Adv Med. 2019 Feb;6(1):1-5
http://www.ijmedicine.com
pISSN 2349-3925 | eISSN 2349-3933
DOI: http://dx.doi.org/10.18203/2349-3933.ijam20185109

Original Research Article

Evaluation of efficacy and utility of spirometry data in elderly (>65years) individuals with or without lung diseases

Vindhya Ponnathota[1], Sujatha Gogineni[2]*, Silpa Kasireddy[3]

[1]Department of Pulmonary Medicine, Malla Reddy Medical College for Women, Suraram, Hyderabad, Telangana, India
[2]Department of Pulmonary Medicine, Dr. Pinnamaneni Siddhartha Institute of Medical Sciences and Research Foundation, Chinna Avutapalli, Vijayawada, Andhra Pradesh, India
[3]Department of Neurology, Andhra Medical College, Visakhapatnam, Andhra Pradesh, India

Received: 03 December 2018
Accepted: 08 December 2018

***Correspondence:**
Dr. Sujatha Gogineni,
E-mail: goginenisujatha@gmail.com

ABSTRACT

Background: Spirometry is an important diagnostic monitoring tool for various lung disorders. Ventilatory function can be assessed by spirometry. Also, we can find whether it is obstructive or restrictive disease. An appropriate technique is essential to ensure accurate results. Spirometry requires proper understanding and cooperation of the patient while doing the test. The objective was to evaluate the efficacy and utility of spirometry data in elderly (>65years) individuals with or without lung diseases.
Methods: A hospital based cross sectional study was carried out among 199 subjects who were then divided into 100 controls and 99 cases. Spirometry was carried out among all subjects. The values of spirometry were compared among cases and controls as well as across age and sex groups. Student's t-test was applied.
Results: After studying the spirometric data in elderly population with or without lung disease, there was significant difference between cases and controls as far as pack years of smoking was concerned. There was significant difference in FEV1, FVC and FEV1/FVC between the cases and controls. As the age increased the spirometric values decreased. The spirometry was normal in controls in majority compared to none in cases.
Conclusions: Spirometry should be used by all primary care and specialist physicians even in elderly population.

Keywords: Cases, Control, Elderly, Lung diseases, Spirometry

INTRODUCTION

Lung function tests are powerful tools in the assessment of respiratory conditions. Lung function tests not only help in diagnosis but also to make an objective assessment of severity and monitor the response to treatment. The lung function tests measure a few variables of respiratory system. It is easy and reliable to use these variables. They tell accurately about the function of the lungs.[1] As children grow in height, their lungs grow. The relationship between height and lung function changes during adolescence when the rate of lung growth appears to lag the rate of increase in height during the growth spurt. Lung growth appears to stop around the age of 16 in girls and 18 in boys but pulmonary function may not peak until the early 20s, and it can be as late as early 30s especially in males.[2]

Thus, a single prediction equation cannot accurately describe the complex relationship between growth development and lung function. There is plateau in lung function between the ages of 20 and 30. Thereafter lung

function begins to decline slowly and steadily from middle age into old age.

With aging compliance of chest wall and respiratory system and lung elastic recoil decreases resulting in static air trapping (increased RV, increased FRC), and increased work of breathing. FEV1 declines by 30-35ml per year in normal population, and around 50ml per year in smokers.[3]

Vital capacity decreases while residual volume increases, leaving total lung capacity unchanged. Functional residual capacity also increases with age. The diffusion capacity declines linearly with age. The rate of decline in FEV1 and FVC with age is greater in cross-sectional versus longitudinal studies and in men than women. In non-smokers the FEV1 begins to decline at 30-35years of age, this may be earlier in smokers. The rate of decline is more rapid in patients with increased airway reactivity.[4]

Due to increased life expectancy, the geriatric aspects of the most common health problems are attracting increased attention. Asthma and COPD are highly prevalent in older population. One of the reasons for under diagnoses or misdiagnosis is limited application of functional measurements in elderly.[5,6] Spirometry is a measure of airflow and lung volumes during a forced expiratory manoeuvre from full inspiration. Properly performed spirometric measurements are cornerstone for the diagnosis.[7]

The spirometry equipment must be in a good condition. It should be maintained properly. Then only it gives reliable results. For good quality results, the person performing the spirometry must be capable.[8] Spirometry is not extensively used in elderly population. Moreover, high prevalence of co-morbid conditions with similar symptoms tends to confound the diagnosis in this age group. This is a study to evaluate the efficacy and utility of spirometry in elderly with or without lung diseases.

METHODS

This was an institution (hospital) based prospective case control study conducted between 1 December 2011 to 1 December 2012 (12months) of study period in respiratory outpatient department of a medical college hospital.

Inclusion criteria

- Patients >65 years of either sex attending our outpatient department with from obstructive lung diseases enrolled as cases,
- All patients without any documented lung diseases or co morbid conditions will be enrolled as controls.

Exclusion criteria

- Patients with acute severe disease,
- More than 120 heart rates,
- Systolic blood pressure >180mmHg and diastolic blood pressure >100mmHg,
- Patients not willing to participate.

The study was approved by the institutional ethics committee and an informed written consent was obtained from all patients before enrolment into the study. A total sample of 200 with age >65years are included in the study. They include both the cases and controls. Cases are the elderly population who are having documented obstructive lung disease. Controls are the elderly population who are not having any documented lung diseases. Clinical thorough examination, routine blood and urine investigations, body mass index, were carried out for all patients. The spirometry was conducted according to American thoracic guidelines and it was supervised by the investigator. The spirometer we have used is Koko spirometer.

Spirometry was not performed in patients who were not able to sit upright, having pneumothorax, having unstable angina, had hemoptysis, had aneurysm of aorta, had suspected infectious disease. Before starting the test, the patient's parameters such as age, sex, height, weight and ethnicity must be entered.

The purpose of the test should be clearly explained. The procedure should be demonstrated to the patient and he must be instructed to take a full breath and blow out as fast as possible. Enquiry should be made regarding the last use of bronchodilator.

Pre-test requirements of spirometry

- No Smoking for 24hours prior to the test and no alcohol consumption for at least 4hours,
- No vigorous exercise for at least 30minutes prior to the test,
- No tight clothing,
- No heavy meal at least 2hours prior to tests,
- The patient is clinically stable and free from infection,
- No caffeine containing drinks for 12hours prior to testing.

Spirometer was attached with a disposable mouth piece. Patient was asked to take a deep breath and hold it for few seconds and then blow the air with complete force and speed. The patient was asked to repeat the same procedure twice. Out of the two reading, best reading was recorded.

Bronchodilator reversibility testing

Short acting bronchodilators should be withheld for six hours and long acting bronchodilators for 12hours. The bronchodilator should be given by MDI, ideally through spacer. FEV1/FVC should be measured before and 15 to 30minutes after bronchodilator is given.

Statistical analysis of data was analyzed using IBM SPSS (Statistical Package for Social Sciences) Software V. 20. Data was presented as.

For category variables, percentages were used and for continuous variables, values are represented as Mean±SD and independent sample t-test was used to analyze the data between cases and controls.

RESULTS

Table 1 shows the base line patient parameters. The mean age was 69.28±4.09 in controls and 69.79±3.83 in cases. Both the groups were similar in terms of age, as they were matched for age. The mean BMI, FEV1/FVC ratio, FEV1 value, FVC value in controls was significantly more. The smoking index as measured by pack years was significantly more in cases compared to the controls. Percentage change of FEV1 and FVC was also significantly more in cases compared to the controls.

Among 100 controls normal spirometric values were observed in 66 (66%), mixed pattern was seen in 7 (7%), obstructive pattern in 16 (16%), restrictive pattern was observed in 11 (11%). Among 99 cases, 9 (9.09%) people were showing obstruction with post bronchodilator reversibility >12%, 90 (90.90%) were showing COPD pattern out of which 12 (12.12%) had very severe obstruction, 55 (55.55%) had severe obstruction, 24 (24.24%) had moderate obstruction. Table 2 shows sex wise distribution among cases and controls. Males were more (92.5%) than females (7.5%) overall and among cases and controls also, males were more than females. there were 99 cases and 100 controls. They were matched as per number, age and sex. That is why there was no significant difference in their number, age and sex.

Table 1: The base line patient parameters.

Parameter	Controls	Cases	T value	P value
No. of subjects	100	99	-	-
Age	69.28±4.09	69.79±3.83	0.9077	0.3651
Body mass index	26.05±4.74	22.55±4.86	5.1429	0.0001
Pack years	10.63±5.28	31.24±7.81	21.8276	0.0001
FEV1/ FVC	94.60±7.87	58.77±6.78	34.5561	0.0001
FEV1	79.28±16.06	39.19±11.03	20.3766	0.0001
Percentage change of FEV1	4.64±4.04	7.56±7.03	3.5968	0.0004
FVC	81.91±15.17	59.49±16.13	10.0075	0.0001
Percentage change of FVC	5.10±4.41	6.73±5.29	2.3619	0.0192

Table 2: Sex wise distribution among cases and controls.

Sex	Male		Female		Total	
Groups	Number	%	Number	%	Number	%
Cases	95	95.96	04	4.04	99	49.7
Controls	89	89	11	11	100	50.3
Total	184	92.5	15	7.5	199	100

Figure 1 shows sex wise comparison of both cases and controls. The FEV1/FVC ratio was more in females i.e. 87.26% compared to 75.91% among males.

The FEV1 value was slightly more among males i.e. 59.55% compared to 56.66% among females. Percentage change of FEV1 was almost similar in both the sexes. The FVC value was more in males i.e. 71.51% compared to 61.53% among females. Percentage change of FVC was almost similar in both the sexes.

Table 3 shows spirometric pattern among cases. No case had normal spirometric pattern. 24.2% had shown moderate obstruction while majority i.e. 54.6% have shown severe obstruction. 12.1% cases have shown very severe obstruction. Only nine cases had bronchial asthma.

Table 3: Spirometric pattern among cases.

Spirometric pattern	Number	%
Normal	0	0
Moderate obstruction	24	24.2
Severe obstruction	54	54.6
Very severe obstruction	12	12.1
Bronchial asthma	09	9.1
Total	99	100

Table 4 shows spirometric pattern among control. Majority of the control i.e. 66% were normal on

spirometry while no one in the cases was having normal spirometry. Only 16% had shown obstruction and 11% had shown restriction whereas mixed pattern was seen in 7% of the controls. No one was seen with bronchial asthma.

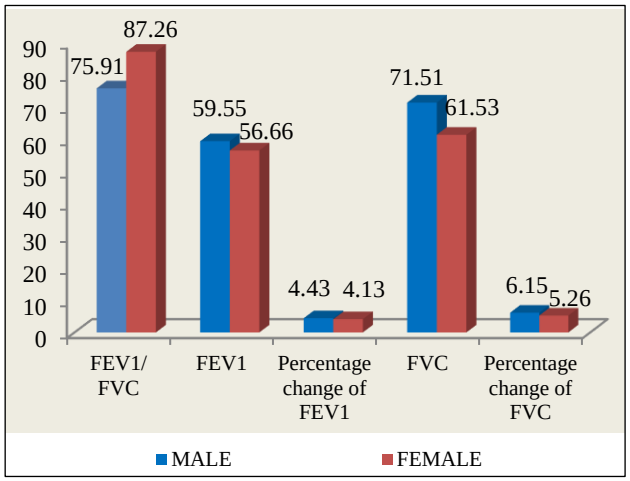

Figure 1: Sex wise comparison of both cases and controls.

Table 4: Spirometric pattern among control.

Spirometric pattern	Number	%
Normal	66	66
Obstruction	16	16
Restriction	11	11
Mixed	07	07
Total	100	100

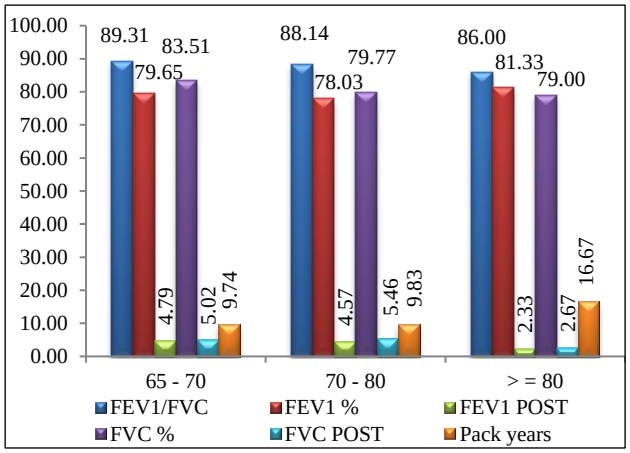

Figure 2: Comparison of variables between age groups in controls.

Figure 2 shows comparison of variables between age groups in controls. It has been seen from above figure that as the age increased the spirometry values deteriorated. The FEV1/FVC value decreased from 89.31 in the age group of 65-70years to 86.00 above 80years of age. There was not much difference in the FEV1 value across the age groups. The FEV1 post, FVC%, FVC post decreased significantly from 4.79 in 65-70years age group to 2.33 at 80years of age.

Figure 3 shows comparison of variables between age groups in cases. The FEV1/FVC ratio decreased from 59.67 (65-70years) to 57.88 (70-80years) but again increased to 59.40 in 80years of age. The FEV1% decreased from 40.53 (65-70years) to 31 in the age group of 80years and above. The FEV1 post increased from 7.18 (65-70years) to 9 in the age group of 80years and above. The FVC% initially increased but then decreased as the age increased. The pack years of smoking increased as the age increased.

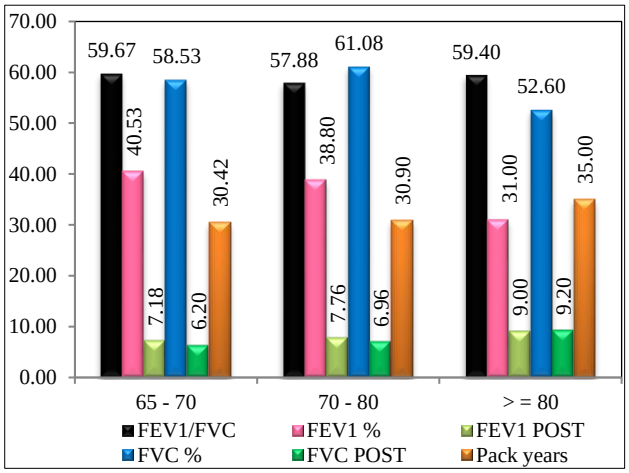

Figure 3: Comparison of variables between age groups in cases.

DISCUSSION

We have conducted a study on the spirometric data in the elderly population (age >65years) with or without lung diseases. We have chosen a sample size of 199 divided into two groups. Controls include the elderly (age >65years) population without any documented lung diseases with sample size 100. Cases include the patients attending to the pulmonology OP with documented obstructive lung diseases without exacerbations with sample size 99. Bellia V et al, evaluated the spirometry and studied the factors that affect the quality of readings of spirometry among the elderly patients.

They noted that if the quality of spirometer is maintained properly, then factors like age, or obstructive disease can not affect the reproducibility of the spirometric tests.[9]

In this study 79.83% of cases and 76.92% of controls were able to perform the test with three acceptable curves. Those who were unable to perform the according to the guidelines was due to lack of cooperation between the patient and technician. In this study sample of 199, age was not found to be incompatible with highly reproducible spirometric test. There was significant difference in the spirometric values between the cases and controls of same age group. Pezzoli L et al, studied

715 elderly and found that out of 715, the proportion who did perform the spirometry was 81.8% remaining were not able to do so.[10]

This study showed good performance among the population with good educational level while doing the test. BMI was found to be significant with a p value <0.00 when compared between cases and controls. As per this study also age itself cannot be considered as a risk factor because controls were able to perform spirometry and there is significant difference (p<0.00) between FEV1/FVC, FEV1, and FVC between the cases and controls. The present study correlates with the study done by Pezzoli L et al.[10] Woo J et al, studied 129 males and 210 females for spirometry. They observed that age related decrease in the spirometry values was more pronounced in females compared to males.[11] In this study only 11% of controls were females and 4.04% of cases were females. Since there is male predominance, we were unable to find any sex related decline with age. Burr ML et al derived FEV and FVC values of elderly people of 418 persons over the age 70 years and provided standards for the assessment.[12]

The study concluded that there was a decline in FEV1 and FVC cross-sectionally with age and continued adverse effect of smoking. A history of cough and phlegm was strongly related to impairment.[12] Within the sample that can perform acceptable spirometry, age was not an independent determining factor for poor performance of spirometry.

CONCLUSION

Spirometry determines lung age. Spirometry is single most broadly useful noninvasive test of ventilatory lung function. Spirometry is a simple and safe technique for diagnosing and monitoring lung disorders. Age itself cannot be considered as risk factor for poor performance of spirometry. Spirometry should be used by all primary care and specialist physicians even in elderly population.

Funding: No funding sources
Conflict of interest: None declared
Ethical approval: The study was approved by the Institutional Ethics Committee

REFERENCES

1. Tager IB, Segal MR, Speizer FE, Weiss ST. The natural history of forced expiratory volumes. Am Rev Respir Dis. 1988;138:837-49.
2. Enright PL, Kronmal RA, Higgins M, Schenker M, Haponik EF. Spirometry reference values for women and men 65 to 85years of age. Am Rev Respir Dis. 1993;147(1):125-33.
3. Dow L, Fowler L, Phelps L, Waters K, Coggon D, Kinmonth AL, et al. Prevalence of untreated asthma in a population sample of 6000 older adults in Bristol, UK. Thorax. 2001;56(6):472-6.
4. Renwick DS, Connolly MJ. Prevalence and treatment of chronic airways obstruction in adults over the age of 45. Thorax. 1996;51(2):164-8.
5. Lee PN, Fry JS, Forey BA. Trends in lung cancer, chronic obstructive lung disease, and emphysema death rates for England and Wales 1941-85 and their relation to trends in cigarette smoking. Thorax. 1990;45(9):657-65.
6. Dow L, Coggon D, Holgate ST. Respiratory symptoms as predictors of airways lability in an elderly population. Resp Med. 1992;86(1):27-32.
7. Banerjee DK, Lee GS, Malik SK, Daly S. Underdiagnosis of asthma in the elderly. Brit J Dis Chest. 1987;81:23-9.
8. Miller MR, Hankinson JA, Brusasco V, Burgos F, Casaburi R, Coates A, et al. Standardisation of spirometry. Euro Resp J. 2005;26(2):319-38.
9. Bellia V, Pistelli R, Catalano F, Antonelli-Incalzi R, Grassi V, Melillo G, et al. Quality control of spirometry in the elderly: the SA. RA study. Am J Resp Critical Care Med. 2000;161(4):1094-100.
10. Pezzoli L, Giardini G, Consonni S, Dallera I, Bilotta C, Ferrario G, et al. Quality of spirometric performance in older people. Age Ageing. 2003;32(1):43-6.
11. Woo JE, Pang JO. Spirometry in healthy elderly chinese. Thorax. 1988;43(8):617-20.
12. Burr ML, Phillips KM, Hurst DN. Lung function in the elderly. Thorax. 1985;40(1):54-9.

Cite this article as: Ponnathota V, Gogineni S, Kasireddy S. Evaluation of efficacy and utility of spirometry data in elderly (>65 years) individuals with or without lung diseases. Int J Adv Med 2019;6:1-5.