

ORIGINAL ARTICLE

A PROSPECTIVE STUDY OF ELECTROCARDIOGRAPHIC CHANGES IN COPD

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ABSTRACT: OBJECTIVES OF STUDY: To study the electrocardiographic findings in Chronic obstructive pulmonary disease. To correlate these findings with duration, severity of the disease and pulmonary function test. **MATERIALS AND METHODS:** This study consists of 50 patients selected randomly from the cases admitted in the medical wards with symptoms suggestive of airway obstruction of more than 2 years duration, and in whom clinical diagnosis of chronic obstructive pulmonary disease was made. All these patients were subjected to Spirometric tests, the values of forced expiratory volume in first second (FEV₁) less than 80% of the expected value, which does not alter significantly after bronchodilator inhalation (<200ml) were included in this study. The cases like Bronchial asthma, Pulmonary tuberculosis, Bronchiectasis, Cor pulmonale in failure, Cardiac illness, hypertension, and diabetes mellitus were excluded from the study. **RESULT:** 50 patients of chronic obstructive pulmonary disease were studied Majority of patient had moderate airflow obstruction. The commonest ECG changes were P wave axis $\geq +90^\circ$, QRS axis $\geq +90^\circ$ and P wave height in L₂ ≥ 2.5 mm. R wave in V₆ < 5 mm and R/S ratio in V₅ V₆ ≤ 1 were seen less commonly. Unifocal right ventricular ectopics and RBBB were seen rarely. **CONCLUSION:** E.C.G. changes correlate significantly with low value of FEV₁/FVC ratio. The commonest ECG changes were P wave axis $\geq +90^\circ$, QRS axis $\geq +90^\circ$ and P wave height in L₂ ≥ 2.5 mm. R wave in V₆ < 5 mm and R/S ratio in V₅ V₆ ≤ 1 were seen less commonly. Unifocal right ventricular ectopics and RBBB were seen rarely.

KEYWORDS: Chronic Obstructive Pulmonary Disease; Electrocardiogram; Spirometry; FEV₁-Right Ventricle.

INTRODUCTION: COPD is a leading cause of morbidity and mortality worldwide and results in an economic and social burden that is both substantial and increasing.¹ The prevalence and burden of COPD are projected to increase in the coming decades due to continued exposure to COPD risk factors and the changing age structure of the world population.¹

COPD is characterized by slowly progressive air flow obstruction, resulting in dyspnea and exercise limitation, and pulmonary arterial hypertension is its major cardiovascular complication.² Right ventricular (RV) dysfunction is common in patients with COPD particularly in those with low oxygen saturation. It occurs in upto 50% of the patients with moderate to severe COPD.³ When present, it can reduce exercise tolerance, increase dyspnea, and contribute to an overall decrease in functional status, and portends a higher mortality rate. Its recognition and treatment may lead to prolonged survival and improved quality of life.¹

There have been several studies to define the course of events in COPD. The major morbidity of COPD is due to the impact on cardiac performances, which is directly due to pulmonary arterial hypertension. Since the electrocardiogram is a very simple convenient bed side investigation, it would be of great important, if it can be established that a high degree of correlation between E.C.G. and spirometric studies is present which indicate the severity of COPD.

OBJECTIVES:

1. To study the electrocardiographic findings in chronic obstructive pulmonary disease.
2. To correlate these findings with duration, severity of the disease and pulmonary function test.

MATERIALS AND METHODS: This study consists of 50 patients selected randomly from the cases admitted in Yenepoya Medical College Hospital, Mangalore. Study period: from JULY 2007 to MAY 2009.

Inclusion Criteria: The patients who were admitted in the medical wards with symptoms suggestive of airway obstruction of more than 2 years duration, and in whom clinical diagnosis of chronic obstructive pulmonary disease was made. All these patients were subjected to Spirometric tests, the values of forced expiratory volume in first second (FEV₁) less than 80% of the expected value, which does not alter significantly after bronchodilator inhalation (<200ml) were included in this study.

Exclusion Criteria: The cases like Bronchial asthma, pulmonary tuberculosis, Bronchiectasis, Cor pulmonale in failure, Cardiac illness, hypertension, and diabetes mellitus were excluded from the study.

After applying the above inclusion and exclusion criteria, the selected patients 46 males and 04 females, were studied in detail.

In every case thus selected a detailed history was elicited and thorough clinical examination was done as indicated in the proforma.

Urine analysis, Blood ESR, Complete haemogram Chest X-ray, Electrocardiogram, Spirometry, arterial blood gas analysis, blood urea, serum, creatinine, sputum culture and sensitivity, sputum for AFB were done in all cases.

For Spirometric study, computerized spirometry was used. This spirometry gives age, sex, race, weight and height matched preselected expected and patients present values. Sixteen parameters were available in graphic recording. Among these forced expiratory volume in first second and FEV₁/FVC ration analyzed, best of the three attempt value was selected.

The standard twelve lead ECG was taken in every case, long leads in II and V₁ was analyzed in detail, especially the changes associated with COPD.

1. QRS axis more than +90°
2. P wave height >2.5mm in lead II
3. P wave axis ≥+ 90°
4. R wave height in V₆ ≤ 5mm
5. R/S in V₅ V₆ ≤ 1
6. Right Bundle Branch Block (RBBB)
7. R wave height in V₁ > 7mm
8. R/S in V₁ ≥ 1
9. Arrhythmias like Multifocal Atrial Tachycardia, Atrial Fibrillation, and ventricular Ectopics.

STATISTICAL ANALYSIS: Data was tabulated, frequency and percentage of cases was analyzed. Statistical analysis is done by using 't' test and one way ANOVA and SPSS Vs. 15 software was used to.

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DISCUSSION: COPD is characterized by slowly progressive air flow obstruction, resulting in dyspnea and exercise limitation, and pulmonary arterial hypertension is its major cardiovascular complication.⁴ Right ventricular (RV) dysfunction is common in patients with COPD particularly in those with low oxygen saturation. It occurs in upto 50% of the patients with moderate to severe COPD.³ When present; it can reduce exercise tolerance, increase dyspnea, and contribute to an overall decrease in functional status, and portends a higher mortality rate. Its recognition and treatment may lead to prolonged survival and improved quality of life.¹

There have been several studies to define the course of events in COPD. The major morbidity of COPD is due to the impact on cardiac performances, which is directly due to pulmonary arterial hypertension.

Since the electrocardiogram is a very simple convenient bed side investigation, it would be of great important, if it can be established that a high degree of correlation between E.C.G. and spirometric studies is present which indicate the severity of COPD.

The present study included fifty patients of chronic obstructive pulmonary disease and 46 of them were males and 4 were females (Table 1). The mean age in our study was 64.4 years (figure 1).

All the male patients and one female patient were smokers and remaining female patient were non- smokers (figure 2). In female's patient's h/o exposure to smoke of fuels was present.

All the patients presented with cough & expectoration, 92% had breathlessness and 70% had wheezing, only 26% of patients presented with fever (Figure 3). The duration of illness was 6-10 years (Table2). Decreased breath sound intensity, diminished chest movement, Crepitations, Rhonchi, muffled heart sound and pushed down Liver were present in majority of patients (figure 4). All patients had normal hemoglobin levels, sputum for AFB was negative in all patients, FBS, blood urea, serum, creatinine were normal in all patients.

76% of patient's chest x- ray suggestive of chronic bronchitis with emphysema, 20% patient's chest x-ray suggestive of chronic bronchitis & 4% of patients had normal x- ray. (Figure 5).

In assessing the severity of the diseases computerized Spirometry was used. Majority of patient had moderate airflow obstruction. There was statistical significant difference in Mean FEV₁ in Various stages of FEV₁ (P=.001). 34% of the patients had mild (FEV₁), i.e., air flow obstruction, 38% of patients were present in moderate (FEV₁) obstruction group

28% of the patients were present in severe (FEV₁) obstruction group (figure 6). 28% of patients were present in FEV₁/FVC ratio 21- 40% group, 38% of patients were present in FEV₁/FVC ratio 41 to 60% group, and 34 % patients were present in FEV₁/FVC ratio 61- 80% group. (Figure 7).

Present study consists of 28% of patients with FEV₁/FVC less than 40%, Tandon MD study group consisted of 20.94% and V.K. Singh, S.K. Jain group consisted of 19.9% of patients with less than 40% FEV₁/ FVC ratio (Table no:3).

The most frequent ECG change observed was P axis $\geq + 90^\circ$ (60%), then QRS axis $\geq 90^\circ$ (42%), followed by P wave height ≥ 2.5 mm in lead II (40%), R wave in V₆ <5mm (28%) and R/S ratio in V₅ V₆ < 1(26%) (Table 4). It was observed that, the mean FEV₁ and FEV₁/FVC values were consistently lower in patients with positive

ECG changes against the patients with negative ECG changes and it was statistically significant (Figure 8). The ECG changes were invariably present in low FEV₁ /FVC% group, and minimum or absent in high FEV₁ / FVC% group (Table no:5).

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The commonest ECG changes were P wave axis $\geq +90^\circ$, QRS axis $\geq +90$ and P wave height in Lead 2 ≥ 2.5 mm. R wave in $V_6 < 5$ mm and R/S ratio in $V_5 V_6 \leq 1$ were seen less commonly. Unifocal right ventricular ectopics and RBBB were seen rarely.

CONCLUSION:

1. E.C.G. changes correlate significantly with low value of FEV1/FVC ratio. E.C.G is a useful bedside screening test to assess severity of COPD when spirometry is not available.
2. The commonest ECG changes were P wave axis $\geq +90^\circ$, QRS axis $\geq +90$ and P wave height in L2 ≥ 2.5 mm. R wave in $V_6 < 5$ mm and R/S ratio in $V_5 V_6 \leq 1$ were seen less commonly. Unifocal right ventricular ectopics and RBBB were seen rarely.
3. Computerized spirometry is very much a useful investigation in the management of chronic obstructive pulmonary disease. FEV1 values can be used as diagnostic, as well as to assess the severity of the disease.

Sex	Number of cases	Percentage
Male	46	92
Female	04	08
Total	50	100

Table 1: Sex distribution

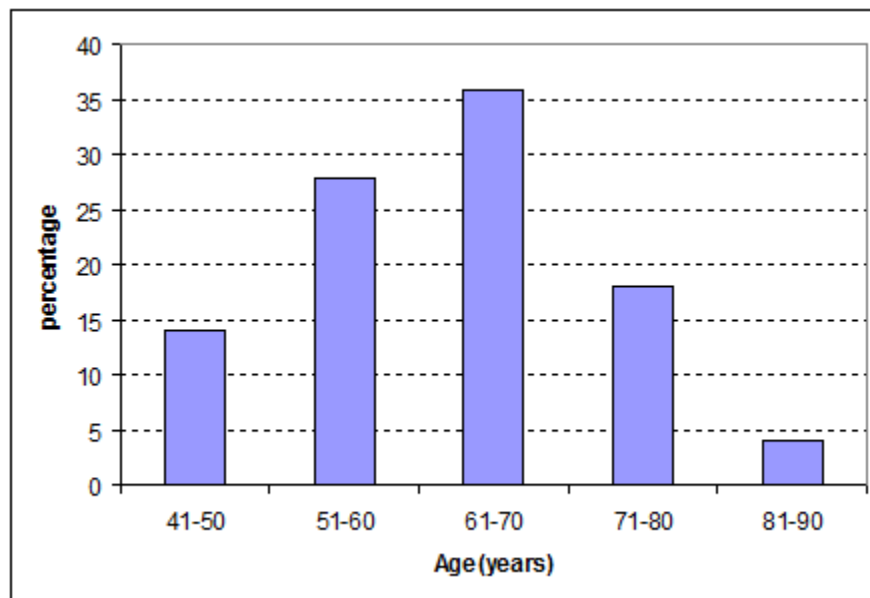


Figure 1: Bar diagram showing age distribution

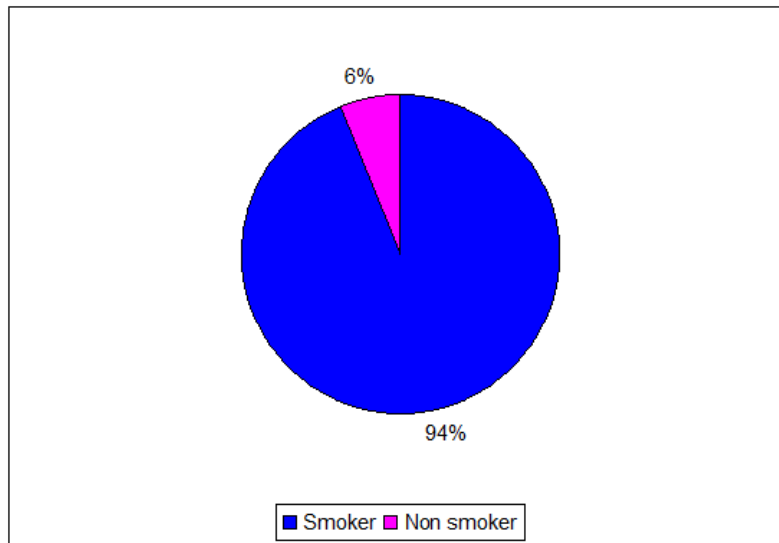


Figure 2: Pie diagram showing smoking habits

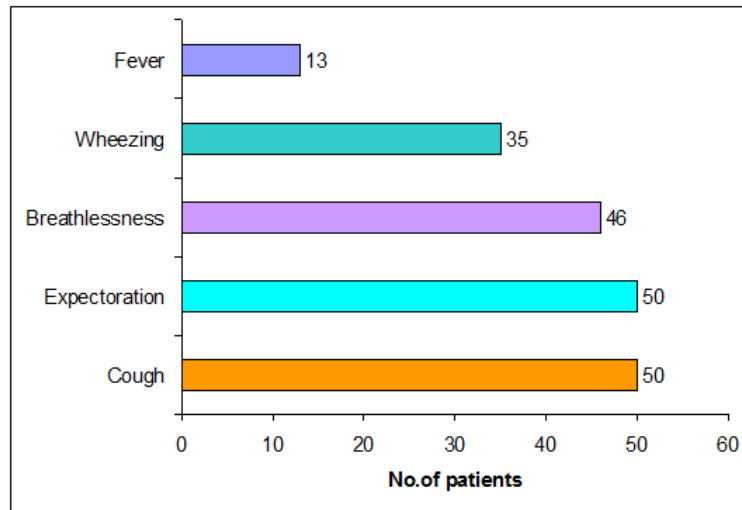


Figure 3: Bar diagram showing presenting symptoms

Duration of illness (yrs.)	Male	Female	Total	Percentage
2-5	12	01	13	26
6-10	17	03	20	40
11-15	14	00	14	28
16-20	03	00	03	06
Total	46	04	50	100

Table 2: Duration of illness

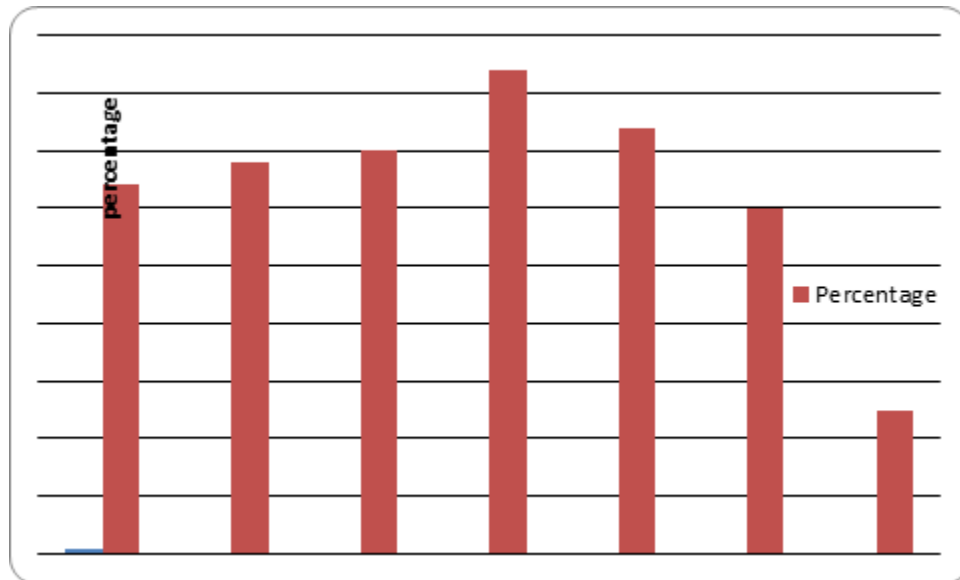


Figure 4: Respiratory signs

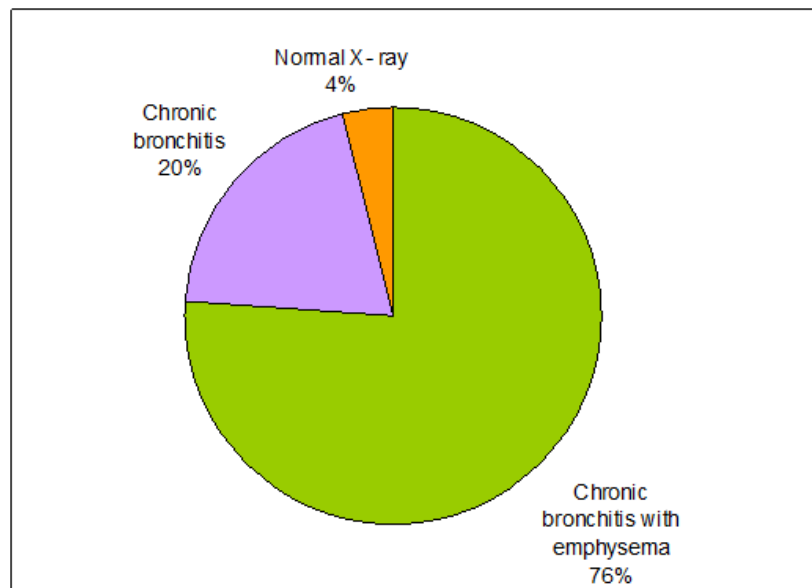


Figure 5: Pie Diagram Showing X-Ray Finding

Study	10-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90
Tandon MD ⁵ 1973	2	5.84	13.1	15	21.4	25.3	12.33	5.2
V.K.Singn ⁶ , S.K.Jain ⁷ 1989	1.5	4.6	13.8	20	32.3	16.15	11.5	0
Present	0	10	18	16	22	28	06	0

Table 3: Distribution of cases according to FEV₁/ FVC %

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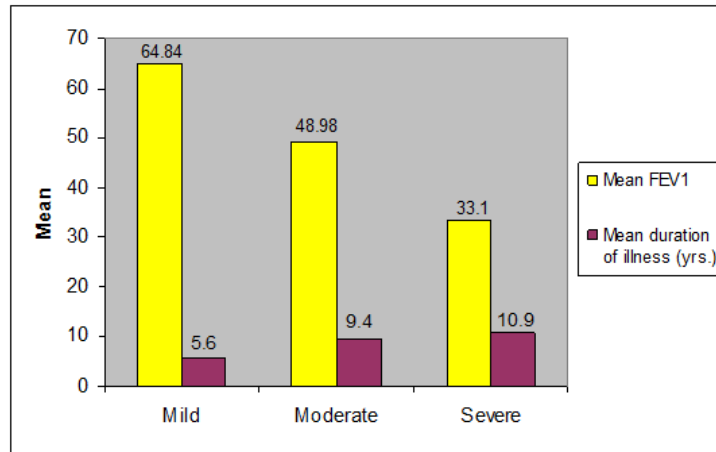


Figure 6: Histogram showing the degree of air flow obstruction and mean duration of illness in years

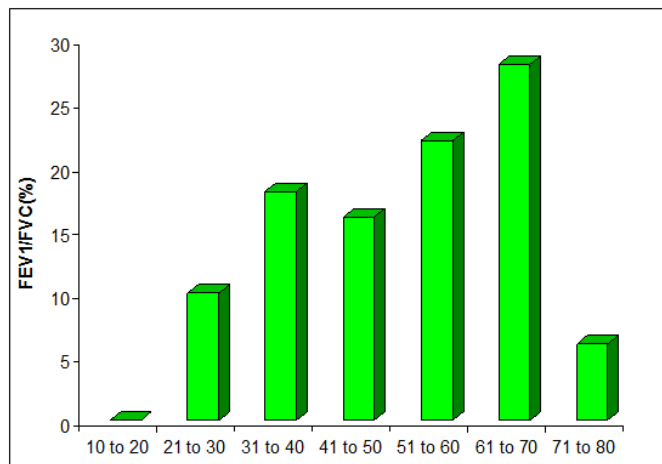


Figure 7: Bar Diagram Showing Distribution of Cases according to FEV1/FVC%

E.C.G. Criteria	No. of patients n=50	Percentage	Mean duration of illness in years
P wave height ≥ 2.5 mm in lead II	20	40	10.09
QRS axis $\geq 90^\circ$	21	42	11.09
P wave axis $\geq 90^\circ$	30	60	14
RBBB	04	8	11.09
R/S ratio in $V_5V_6 \leq 1$	13	26	10.97
R wave in $V_6 \leq 5$ mm	14	28	10
R wave $V_1 > 7$ mm	03	6	07

Table 4: E.C.G Changes and mean duration of illness of their occurrence

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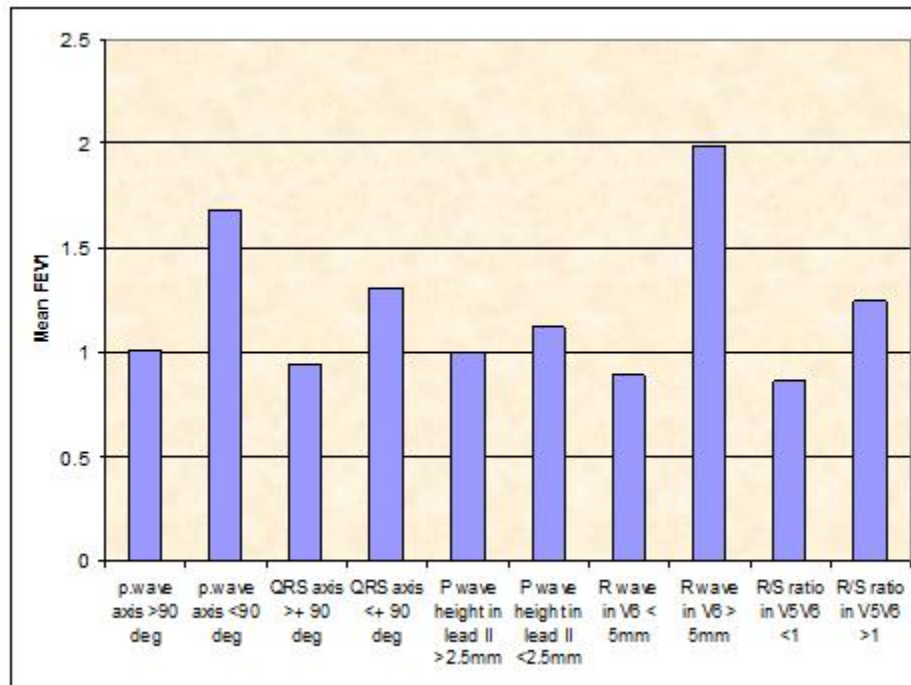


Figure 8: ECG criteria V/S spirometry

FEV ₁ /FVC	21-30 n=05	31-40 n=09	41-50 n=08	51-60 n= 11	61-70 n=14	71-80 n=4
P wave axis $\geq +90^\circ$	05(100%)	09(100%)	07(88%)	06(55%)	03(21%)	-
QRS axis $\geq +90^\circ$	05(100%)	09 (100%)	03(38%)	02(18%)	01(7%)	01(25%)
P wave ≥ 2.5 mm in lead II	05(100%)	09(100%)	05(62%)	01(9%)	-	-
R wave in V6 <5mm	2(40%)	06(67%)	4(50%)	1(9%)	1(7%)	-
R/S in V5-V6 ≤ 1	1(20%)	07(78%)	2(25%)	2(18%)	1(7%)	-
RBBB	1(20%)	1(11%)	-	1(9%)	1(7%)	-
R wave in V1 ≥ 7	1(20%)	01(11%)	1(13%)	-	-	-
Normal ECG	-	-	-	6(55%)	8(57%)	02(50%)

Table 5: ECG changes V/s FEV₁/FVC ratio distribution

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