Section: Respiratory Medicine

Original Research Article

CLINICAL FACTORS ASSOCIATED WITH PULMONARY HYPERTENSION IN PATIENTS WITH BRONCHIECTASIS IN A TERTIARY CARE CENTRE

Suresh Durai[1], Sathya Chandrasekar[1]

[1]Assistant Professor, Department of Respiratory Medicine, Stanley Medical College, Government Hospital of Thoracic Medicine, Chennai, Tamilnadu, India

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Corresponding Author:
Dr. Sathya Chandrasekar,
Email: sathya1989c@gmail.com

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Abstract

Background: Bronchiectasis is a morphological term describing abnormal, irreversibly dilated, thick-walled bronchi. It is an important cause of suppurative lung disease with a significant impact on the quality of life. The study aims to evaluate the clinical factors and their association with pulmonary hypertension in bronchiectasis patients from patients without pulmonary hypertension in a tertiary care hospital. **Materials and Methods:** This prospective observational study was conducted on 120 patients diagnosed with bronchiectasis attending the Department of Respiratory Medicine, Stanley Medical College and Govt Hospital of Thoracic Medicine, Tambaram Sanatorium, for one year. The study population was divided into two groups: one with bronchiectasis and one without pulmonary hypertension, and each risk factor was studied in both groups, tabulated and analysed by standard statistical methods. Routine blood investigations were done, including CBC, RFT, and LFT. Six-minute walk tests were performed. HRCT, ECG and ECHO were taken. **Result:** Among 120 individuals, 60% were female and male subjects (40%) with a mean age of 54.3 years, 62.5% prior history of antituberculous treatment, 68.7% recurrent respiratory tract infection, 32.5% positive smoking history, 57.5% underweight, and 38.3% normal weight. Most subjects had lower lobe predominance, with cystic bronchiectasis and tubular bronchiectasis on the HRCT chest. There is a significant difference in age, smoking history, Hb, PCV, FEC1%, and 6MWT between groups. **Conclusion:** FEV1%, 6-minute walk distance and hematocrit can be used to diagnose pulmonary hypertension early in patients with bronchiectasis and prevent further progression to cor pulmonale in resource-limited and emergency settings.

INTRODUCTION

Bronchiectasis (broncos- airways; ectasia- dilatation) is a morphological term describing abnormal, irreversibly dilated, thick-walled bronchi. It is an important cause of suppurative lung disease with a significant impact on the quality of life of affected individuals. The cause of more than half of the affected individuals were idiopathic. Patients with bronchiectasis usually present with chronic coughs with copious mucopurulent expectoration.[1,2] It principally affects medium-sized bronchi but extends into the distal bronchi and bronchioles.[3] The dilated bronchi are often filled with purulent secretions. There is transmural inflammation, cratering, mucosal oedema, ulceration and neovascularization. It is associated with airway epithelial remodelling, mucus cell metaplasia, and decreased ciliated cells.[4,5]

Complications of bronchiectasis include recurrent respiratory tract infections, hemoptysis, sinusitis and pulmonary hypertension progressing to cor pulmonale.[6] Pulmonary hypertension (PHT) is a progressive disease defined by excessive small pulmonary vascular remodelling and increased pulmonary vascular resistance, which can finally lead to right heart failure and death.[7] Pulmonary hypertension from chronic lung diseases due to hypoxia will significantly affect a patient's quality of life. It usually presents with dyspnea on exertion, light-headedness and syncope.[8]

Pulmonary hypertension, a complication of bronchiectasis, is associated with increased morbidity and mortality. Hence, assessing the clinical factors associated with pulmonary hypertension in bronchiectasis patients is paramount to diagnosing and treating them before they develop complications. Therefore, the study aims to evaluate the clinical factors and their association with pulmonary hypertension in bronchiectasis patients from patients without pulmonary hypertension in a tertiary care hospital.

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MATERIALS AND METHODS

This prospective observational study was conducted on 120 patients diagnosed with bronchiectasis attending the Department of Respiratory Medicine, Stanley Medical College and Govt Hospital of Thoracic Medicine, Tambaram Sanatorium, for one year. The study was approved by an institutional ethical committee and informed consent from the study participants was obtained.

Inclusion Criteria

All Bronchiectasis patients confirmed by High-resolution computerised tomography (HRCT) scan of the lungs were included.

Exclusion Criteria

Patients not willing to participate, severe immunosuppression, such as in solid-organ or bone-marrow transplantation or HIV/AIDS, or receiving chemotherapy or other immunosuppressive drugs, active tuberculosis, cystic fibrosis (CF), pulmonary interstitial disease, and unstable angina were excluded.

Patients attending OPD with symptoms of bronchiectasis are evaluated clinically and radiologically. Those diagnosed with bronchiectasis and satisfying the inclusion criteria alone are subjected to the study after getting written consent. The purpose of the study is clearly explained to the patients and their relatives.

All patients are subjected to thorough history taking and clinical examination, spirometry, and age, height and weight are recorded. Routine blood investigations are done, including CBC, RFT, and LFT. Body mass index is calculated by weight in kg divided by the square of height in metres and the initial chest radiograph taken for all patients.

Six-minute walk test was performed according to guidelines in the corridor distance able to walk was calculated in metres. HRCT (High-resolution Computed Tomography), ECG (Electrocardiography) and ECHO (Echocardiography) were taken. Based on the ECHO findings, the study population was divided into two groups: one with bronchiectasis and another without pulmonary hypertension. Each risk factor was studied in both groups, tabulated and analysed by standard statistical methods.

Data were entered in a Microsoft Excel spreadsheet, and statistical analysis was performed using SPSS (version 18.0). Categorical variables were summarised as frequencies and percentages. Continuous variables were presented as mean and standard deviation or median and interquartile range based on the normality of data. Normality was assessed using the Kolmogorov-Smirnov test.

When a categorical variable is associated with a categorical variable, the variables are represented by tables and bar diagrams. For the test of significance, the chi-square test is used. Fisher's exact test is used when more than 20% of the cell values are expected to be < 5. For comparison of baseline and follow-up values of categories, McNemar's Test is used.

When a continuous variable is associated with categorical variables such as patient groups independent t-test is used after checking for normality. Otherwise, non-parametric tests were used. For comparison of baseline and follow-up values of numerical variables, a paired t-test is used. For comparison of more than two groups ANOVA test is used. A p-values < 0.05 were considered statistically significant.

RESULTS

Among 120 individuals, the gender distribution in this study shows a female preponderance of 60% compared to male subjects (40%). The mean age was 54.3 years (SD=13.1 years), the minimum age was 19, and the maximum was 76 years. Most fall into the age group of 46- 60 and above 60 years.

Prior history of antituberculous treatment was present in 75 subjects (62.5%), and recurrent respiratory tract infection was present in 68 individuals (56.7%). Thirty-nine individuals (32.5%) had a positive smoking history, and the other 81 (67.5%) had never smoked.

57.5% of subjects were underweight, 38.3% were normal weight, 0.8% were overweight, and 3.3% were obese. 75% of subjects had a previous hospital stay of 1 or 2 times in the last year. Five subjects (4.2%) had as high as five times admission in the last year due to underlying disease [Table 1].

Twenty-four subjects (20%) had grade II dyspnea, 82 subjects (68.3%) had grade III dyspnea, and 14 subjects (11.7%) had grade IV dyspnea as per mMRC grading. Four lobes were involved in 16.7%, three in 15.8%, two in 35.8%, and one in 25.8%.

The majority, 46.7% of subjects, had lower lobe predominance, and the second highest, 30.8%, had middle & lower lobe predominance. One hundred ten subjects (91.7%) had cystic bronchiectasis, and 10 (8.3%) had tubular bronchiectasis on the HRCT chest.

Sixty-eight subjects (56.7%) had no PHT, 38 subjects (31.7%) had mild PHT, ten subjects (8.3%) had moderate PHT, and only four subjects (3.3%) had severe PHT [Table 1]. The mean age was 54.3 years (SD=13.1), the mean BMI was 17.7 (SD=4.5), the mean PCV was 40.2 (SD=4.2), and the mean FEV1% was 49.9% (SD=14.7).

Twenty-nine subjects (67.4%) in the age group of more than 60 had PHT, and 28 subjects (93.3%) in the age group of <45 years had no PHT with a p-value of<0.001. Also, the mean age for subjects with PHT is 60.9 years (SD=9.7) compared to those without PHT, which is 49.3 years. Twenty-nine subjects (74.4%) with positive smoking history had PHT, and 58 subjects (71.6%) among non-smokers had no PHT.

Thirty subjects (43.5%) with underweight and two subjects (50%) with morbid obesity had PHT, which

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is not significantly correlated (p=0.692). Eighteen subjects (40%) with one hospital stay, 17 subjects (37.8%) with two admissions, 11 subjects (64.7%) with three admissions and three subjects with 4 or 5 admissions had pulmonary hypertension, which is not significantly correlated (p=0.385).

Nine subjects (37.5%) among grade II, 34 subjects (41.5%) among grade III and nine subjects (64.3%) among grade IV dyspnea had pulmonary hypertension, which is not statistically significant (p=0.229). Fifty-two subjects with a mean Hb of 10.4 had PHT when compared to 68 subjects with a mean Hb of 12.1 had no PHT, which is statistically significant (p<0.001).

Fifty-two subjects with a mean PCV of 42.3 had PHT when compared to 68 subjects with a mean PCV of 38.7 had no PHT, which is statistically significant (p<0.001). This shows that a patient with a fall in hematocrit has a greater risk of developing PHT. Fifty-two subjects with a mean FEV1% of 38.8% had PHT compared to 68 subjects with a mean FEV1% of 58.3% who had no PHT, which is statistically significant (p<0.001). This shows a significant fall in predicted FEV1% in pulmonary hypertension patients.

Fifty-two subjects with a mean 6MWT of 333.5 metres (lower limit-180 metres; upper limit-370 metres) had PHT when compared to 68 subjects with a mean 6MWT of 387.5 metres (lower limit-280 metres; upper limit-570 metres) who had no statistically significant PHT (p=0.001). This shows that 6MWT strongly correlate with a patient with pulmonary hypertension [Table 2].

Table 1: Demographic data of the study

		Frequency	Percentage
Gender	Male	48	40
	Female	72	60
Age	Up to 45	30	25.0
	46-60	47	39.2
	Above 60	43	35.8
Prior H/o ATT	Yes	75	62.5
	No	45	37.5
H/o recurrent RTI	Present	68	56.7
	Absent	52	43.3
History of smoking	Yes	39	32.5
	No	81	67.5
BMI	<18.5	69	57.5
	18.5-24.9	46	38.3
	25-29.9	1	0.8
	30 and above	4	3.3
Previous exacerbation rate	0	7	5.8
	1	45	37.5
	2	45	37.5
	3	17	14.2
	4	1	0.8
	5	5	4.2
mMRC grading	II	24	20.0
	III	82	68.3
	IV	14	11.7
Number of lobes involved	1	31	25.8
	2	43	35.8
	3	19	15.8
	4	20	16.7
	5	7	5.8
Lobar predominance	Lower	56	46.7
	Middle	17	14.2
	Middle & lower	37	30.8
	Upper	10	8.3
Type of Bronchiectasis	Cystic	110	91.7
	Tubular	10	8.3
Severity of PHT	No PHT	68	56.7
	Mild PHT	38	31.7
	Moderate PHT	10	8.3
	Severe PHT	4	3.3

Table 2: Association of clinical factors with PHT

		PHT	No PHT	P-value
Age	Up to 45	2 (6.7)	28 (93.3)	<0.001
	45-60	21 (44.7)	26 (55.3)	
	>60	29 (67.4)	14 (32.6)	
Smoking history	Yes	29 (74.4)	10 (25.6)	<0.001
	No	23 (28.4)	58 (71.6)	
Hb		10.4 ± 0.8	12.1 ± 1.1	<0.001
PCV		42.3 ± 3.4	38.7 ± 4.1	<0.001

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FEV1%	38.8 ± 11.5	58.3 ± 10.7	<0.001
6MWT	333.5 ± 60.5	387.8 ± 102.8	0.001

DISCUSSION

Our study's mean age was 54.3 years (SD=13.1 years), the minimum age was 19 years, the maximum age was 76 years, and the majority fell into the age group of 46- 60. Among the study population, 29 subjects (67.4%) with an age group of more than 60 had PHT and 28 subjects (93.3%) with an age group of <45 years had no PHT with a p-value of<0.001. Also, the mean age for subjects with PHT is 60.9 years (SD=9.7) compared to those without PHT, which is 49.3 years which is statistically significant. This coincides with the study conducted by Ip M et al,[9] where the mean age of subjects with PHT was 58.3 years which is more than the subjects without PHT.

Among the study population, female subjects were 60% (n=72), and male subjects were 40% (n=48). This correlates with Ashour et al.10 studies with an increased female preponderance of 56.4% from his study population. In our study, 30 subjects (43.5%) with underweight and two subjects (50%) with morbid obesity have PHT, which is not statistically significant. This follows the study by Martinez-Garcia MA et al,[11] which showed no correlation between subjects' BMI and pulmonary hypertension.

In our study, 18 subjects (40%) with one hospital stay, 17 subjects (37.8%) with two admissions, 11 subjects (64.7%) with three admissions and three subjects with 4 or 5 admissions had pulmonary hypertension, which is not significantly correlated. So, there is no association of the exacerbation rate in the previous year with pulmonary hypertension. Nine subjects (37.5%) among grade II, 34 subjects (41.5%) among grade III and nine subjects (64.3%) with grade IV dyspnea had pulmonary hypertension, which is not statistically significant. Hence, the mMRC scoring of subjects was not associated with pulmonary hypertension. This follows the Alzeer AH et al.5 study, where the dyspnea score did not match the severity of pulmonary hypertension.

In our study, 52 subjects with a mean PCV of 42.3 had PHT and 68 subjects with a mean PCV of 38.7 had no statistically significant PHT. This shows that a patient with a fall in hematocrit has a greater risk of developing PHT in bronchiectasis patients. This follows the Yonghua Chen et al,[3] study with a mean PCV of 41 (36.2- 44.8), strongly correlated.

Our study shows 52 subjects with a mean FEV1% of 38.8% had PHT and 68 subjects with a mean FEV1% of 58.3% had no statistically significant PHT. This shows a significant fall in predicted FEV1% in pulmonary hypertension patients. This result coincides with the study conducted by Pieter Christian Goeminne et al,[4] with a significant fall in FEV1% (p<0.01) in PHT patients with bronchiectasis.

In our study, 52 subjects with a mean 6MWT distance of 333.5 metres (lower limit- 180 metres; upper limit- 370 metres) had PHT when compared to 68 subjects with a mean 6MWT of 387.5 metres (lower limit- 280 metres; upper limit- 570 metres) had no statistically significant PHT. This shows that 6MWT strongly correlate with a patient with pulmonary hypertension. This is in line with the study conducted by Lan Wang et al.2, which shows 6MWT of 300.8 m (p<0.001) in the PHT group.

CONCLUSION

In conclusion, determining FEV1, 6-minute walk distance and hematocrit are simple and inexpensive. These clinical parameters can diagnose pulmonary hypertension early in patients with bronchiectasis and prevent further progression to cor pulmonale in resource-limited and emergency settings. So this study suggests that these clinical factors can be used to predict pulmonary hypertension in bronchiectasis patients and for early intervention.

Limitations

This is a single-centre observational study; the sample size is small and cannot be generalized for a larger population. This study did not include follow-up results of bronchiectasis patients, and cardiac catheterization could not be performed in all subjects to confirm the diagnosis of pulmonary hypertension.

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