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Original Article

Prevalence of Altered Pulmonary Function in Subjects with Past History of Pulmonary Tuberculosis

Prévalence de l'altération de la fonction pulmonaire des sujets avec antécédents de tuberculose pulmonaire

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Key words: Altered pulmonary function; Pulmonary tuberculosis; Cameroon.

RÉSUMÉ

Introduction. La tuberculose est une maladie chronique qui peut causer des dommages structurelles de l'organe atteint et ainsi êtreresponsable à long terme d'altérations anatomiques et fonctionnelle avec pour conséquences chroniques. La réduction du volume expiratoire maximal seconde (VEMS) est un facteur prédictif indépendant de la mortalité en rapport avec les maladies respiratoires. **Objectifs.** Déterminer la prévalencede l'altération de la fonction pulmonaire chez les patients ayant un antécédent de tuberculose pulmonaire(TBP). **Méthodes.** Il s'agissait d'une étude transversale incluant tous les participants âgés de 19 ans et plus avec des antécédents de TBP dans cinq villes du Cameroun : Yaoundé, Douala,Bandjoun,Garoua et Figuil entre 2014 et 2018. Nous avons analysé les caractéristiques sociodémographiques, cliniques et spirométriques des participants. Une altération de la fonction pulmonaire était définie comme un VEMS inférieur à la limite inférieure de la normale (LIN). La prévalence de l'altération de la fonction pulmonaire a été calculée comme une proportion des participants présentant le trouble ventilatoire avec un intervalle de confiance de 95%. **Résultats.** Des 137 participants définitivement inclus dans notre étude, 51,1% (70 sujets) étaient des hommes et 48,9% (67 sujets) étaient des femmes avec un âge moyen (± écart type) 47 ± 13.9 annéesUne altération de la fonction pulmonaire a été identifiée chez 15 des 137 participants donnant ainsi une prévalence (Intervalle de confiance a 95%) l'AFP de (10,9 %[6,2% - 17,4%]). Cette AFP était modérée dans 80% des cas. **Conclusion.** La prévalence de l'altération de la fonction pulmonaire dans notre population d'étude était de 10.9%. La majorité présentait une altération de la fonction pulmonaire modérée.

ABSTRACT

Introduction. Tuberculosis is a chronic disease which can cause structural damage to the affected organs, thereby resulting in long term anatomical and functional abnormalities with chronic consequences. Reduced FEV1 has been shown to be an independent predictor of respiratory disease-related mortality. **Objective.** To investigate the prevalenceof altered pulmonary function in subjects with past history of pulmonary tuberculosis (PTB). **Methods.** It was a cross sectional study including all participants aged nineteen years and above with past history of PTB from five towns in Cameroon: Yaounde, Douala, Bandjoun, Garoua and Figuil between 2014 and 2018. We analysed socio-demographic, clinical and spirometric characteristics of participants. An altered pulmonary function (APF) was defined as FEV1 below the lower limit of normal. The prevalence of APF was calculated as a proportion of those with the outcome. **Results.** Of the 137 subjects finally included in our study 51.1% (70 subjects) were men and 48.9% (67 subjects) were women, with a mean age (±standard deviation) of 47 ± 13.9 years. Pulmonary impairment was identified in 15 of the 137 participants giving a prevalence of pulmonary impairment (95% Confidence interval) of 10.9% [6,2% - 17,4%].This pulmonary function impairment was moderate in 80% of the cases. **Conclusion.** The prevalence of an APF in our population of study was 10.9%.The majority of those with APF had moderate pulmonary function impairment.

INTRODUCTION

Tuberculosis (TB) is a chronic communicable disease and one of the top 10 causes of death in the world ranking above the Human Immunodeficiency Virus/Acquired Immunodeficiency Syndrome (HIV/AIDS) (1). Globally, TB incidence rate has fallen to 2.3 % between 2018 and 2019(2).

The incidence of tuberculosis in Cameroon has gradually fallen from 309 cases per 100 000 people in 2000 to 179 cases per 100 000 people in 2019 (3). About 24582 cases of TB, all forms combined, were diagnosed in Cameroon

in 2019, with men representing 61 % women 39 %, with a sex ratio male-female of 1.5 (4).

TB causes structural damage or vascular compromise, frequently resulting in long term anatomic alterations with chronic complications.

Studies in patients with pulmonary tuberculosis (PTB) have demonstrated that 33.3-94.0 % of such patients develop impaired pulmonary function (6).

An Altered pulmonary function (APF) following the treatment of PTB can be defined as any clinically meaningful condition contributing to long term mortality and morbidity in former TB patients (7).

During the treatment of active PTB, pulmonary impairment is usually restrictive. This may persist, resolve or become obstructive in nature and now be characterised as PTB-associated airflow obstruction (AFO) (8).

Pefura and col.(9) conducted a cross sectional study for several months (18 months) including 400 treated new cases of PTB cases. They observed that there was a negative association between spirometric parameters and presenting symptoms prior to PTB treatment. However, the association became positive when considering FEV1/FVC ratio with duration of symptoms prior to TB treatment.

The aim of our study was to determine the prevalence of APF in patients treated for PTB.

PARTICIPANTS AND METHODS

Study design:

We carried out a cross sectional study using a multilevel stratified random sampling method across two urban areas (Yaoundé, Douala) two semi-urban areas (Garoua) and one rural area (Figuil) from 2014 to 2018 in Cameroun.

Study population

Target and source population included all participants who had past history of PTB and registered from 2014-2018. The study population consisted of all consecutive adults aged 19 years and above with a previous history of PTB during the study period.

Study procedure

From 2014-2018, 137 patients with a previous history of PTB, underwent pulmonary function tests (PFTs).

They completed questionnaires which were designed to collect data on:

- Demographic characteristics (age, gender, residency, level of education and marital status), past history of chronic bronchitis, high blood pressure, diabetes, past history of pneumonia and asthma. Exposure to biomass, consumption of alcohol and tobacco
- Pulmonary function test: Spirometry was performed on all eligible participants as per standard, using a turbine pneumotachograph (spiro USB, care fusion, Yorba Linda-USA), in accordance with the recommendations of the American Thoracic Society/European Respiratory Society (ATS/ERS) 1994 standards. The test was performed by well-trained experienced technicians. The ATS/ERS 1994acceptability and reproducibility criteria were applied. As it is usually done, at least three tests were done per participant with the maximum being eight tests and observing a rest period of at least one minute between consecutive tests to establish a FVC curve.
- Spirometric variables that were measured were Forced Expiratory Volume in 1 second (FEV1), Forced Vital Capacity (FVC) and FEV1/FVC ratio. FEV1 and FVC values retained were the best out of the three tests which fulfilled the acceptability criteria (maximal difference below 5% and 150ml). All these measurements were expressed in absolute values and as percentages of the predicted value. The predicted values and the lower limits of normal for each measurement were estimated using the Global Lung Initiative (GLI) 2012 reference valuesAn altered pulmonary function was defined as FEV1 below the LLN.Participants were further classified as having mild, moderate, severe or very severe lung function impairment if the FEV1 was ≥ 80% of the predicted, < 80% of the predicted but ≥50 % of the predicted,< 50% of the predicted but ≥ 30% of the predicted or < 30% of the predicted values respectively.

Data management and statistical issues

Data was collected using a face-to-face interview, let by a trained 7th year under graduate medical student, using a questionnaire then computerized using the Epi Data entry 3.1 manager (Epidata Association, Odense, Denmark) software. Data was well checked to ensure that there was no missing value then exported to the SPSS-IBM software windows 23 version (IBM, Chicago, USA).

Qualitative data were summarised using proportions while quantitative data were summarised using the mean with standard deviation or the median with the interquartile range (IQR).

Prevalence of APF in study population was calculated as a proportion of with APF in study population with a 95% confidence interval.

Ethical and administrative procedures:

Ethical clearance for the study was obtained from the institutional review Board of the Faculty of Medicine and Biomedical Sciences of the University of Yaoundé 1.

Administrative authorization to carry out the study using pre-collected data was granted by the research group on respiratory medicine in Cameroon.

RESULTS

A total of 10707 subjects were seen and interrogated during the study period and of these, 10570 were excluded for the absence of prior PTB. Hence, we finally included 137 participants in our study.

Sociodemographic and clinical characteristic of patients n=137

Male gender represented 51,1%; mean age was 47 ± 13.9 years; biomass exposure was predominated 64,2%; many patients live to Douala 53,3%; dyspnea was the principal respiratory symptom 16,1%

Table I: Sociodemographic and clinical characteristic of patients n=137		
Gender	male	70(51,1%)
	female	67(48,9%)
Age (mean age ± standard deviation)		47 ± 13.9 years
Regional distribution	Garoua	8%
	Figuil	8,8%
	Bandjoun	14,6%
	Yaoundé	15,3%
	Douala	53,3%
Past medical history		
	Pneumonia	9(6,6%)
	Asthma	3(2,2%)
	Chronic bronchitis	12(8,8%)
	High blood pressure	10(7,3%)
	Diabetes	5(3,6%)
	Biomass exposure	88(64,2%)
	Tobacco smoking	40(29,2%)
Respiratory symptoms		
	Cough	10(7,3%)
	Dyspnea	22(16,1%)
	Wheezing	10(7,3%)
BMI (kg/m^2)	Thin	8(5,8%)
	Overweight	51(37,2%)
	Obesity	14(10,2%)
	Normal	64(46,7%)

Prevalence and severity of AFP

Of the 137 subjects finally included in our study, 15 subjects had an altered pulmonary function (FEV1 lower than LLN) with a prevalence (95% confidence level) of 10.9% (6,2-17,4) %.Among these 15 subjects with impaired pulmonary function, 80%, 6,7% and 13,3% had moderate, severe and very severe pulmonary function impairment respectively.

DISCUSSION

The prevalence of an APF in our population of study was 10.9% (6,2 -17,4) %. Using the American Thoracic Society/European Respiratory Society criteria, 1994 we classified the degree of abnormality as moderate in majority of participants (80%).

According to literature, the prevalence of lung function impairment ranges from 30% to 80% (15). A cross sectional study carried out by Chushkin et al. (6) from Russia in 2016, on 214 participants who had been treated for PTB, found a prevalence of 28.0%. This prevalence goes beyond what we obtained in our study (10.9%).

This first suggests that prior pulmonary tuberculosis contributes to the occurrence of an APF in countries with high burden of TB. In his study participants who were treated for PTB had pulmonary function tests done at least 1 year after the end of treatment. Thereby giving enough time for chronic complications to stabilize. In our study, the time duration between the end of treatment and the PFT is unknown as we carried out a descriptive study on previously collected data.

Hnizdo et al. (14) in a cross-sectional study conducted in the year 2000 on 27 660 black South African gold miners found a prevalence of 18.4% with FEV1 lower than 80% in patients with past history of one episode of PTB, 27.1% in those with 2 episodes and 35.2% in those with 3 or more episodes of PTB. The value we had in our study is lower and may be explained by the fact that, the black South African gold miners had chronic non documented exposure to silica dust which has proven to potentiate the extent of lung damage due to PTB.

Khosa et al. (16) in a Mozambican prospective cohort study conducted in 2020 on 62 participants had a prevalence of 64.5%; Mbatchouet al. (15) in Cameroon in 2016 had 45.4%; Ojuawo et al. (18) from Nigeria in 2020 on 308 participants had a prevalence of 72.1% after PTB treatment. These data suggest that impaired pulmonary function after PTB is a major cause of chronic lung disease.

A possible explanation for the discrepant result in this study compared to other studies can be the differences in definition of pulmonary impairment as we defined an APF as a FEV1 < LLN. Most studies defined lung impairment based on the presence of any spirometric abnormality. Moreover, the time lapsed between the end of TB treatment and PFTs is not the same in all previously cited studies which varied from 1 year to a mean of 29 years after treatment. Also, the mean age of our study population was 47 years which is relatively young and may explain why the prevalence of APF could be higher in other studies with older participants.

CONCLUSION

The prevalence of an APF in our population of study was 10.9% and the majority of those with pulmonary function impairment had moderate pulmonary function impairment.

CONTRIBUTIONS OF AUTHORS

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CONFLICTS OF INTEREST;

None

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