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Prevalence and Risk Factors Associated with Pulmonary Tuberculosis in Diabetics in Conakry

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Abstract

Objectives: To determine the prevalence of pulmonary tuberculosis in diabetics, to identify risk factors associated with pulmonary tuberculosis in diabetics, and to describe the clinical features of the association of pulmonary tuberculosis and diabetes. **Materials and method:** This was a cohort study that took place from November 18, 2015 to January 31, 2018 at the Department of Endocrinology, Diabetology and Metabolic Diseases of the University Hospital of Donka. **Results:** among the 1912 diabetic patients screened for tuberculosis, 46 had bacteriologically confirmed pulmonary tuberculosis, *i.e.* a prevalence of 2.4% and 01 had clinically diagnosed pulmonary tuberculosis with 0.1%. A female predominance was noted with a sex ratio of 0.8. The 45 - 54 age group was the most affected with a mean age of 46 years. Body Mass Index ($p = 0.001$), smoking ($p = 0.0101$) and history of infection ($p = 0.001$) were significantly associated with pulmonary tuberculosis. The history of smoking ($p = 0.0101$), the notion of contagion ($p = 0.001$), the cough ($p = 0.001$), the fever ($p = 0.001$), the nocturnal sweat ($p = 0.001$) and the hemoptysis ($p = 0.001$) were the clinical characteristics significantly associated with pulmonary tuberculosis. **Conclusion:** The results of this study show a remarkably high prevalence of tuberculosis in diabetic patients in Guinea highlighting the need for urgent action to better understand and treat the double burden of tuberculosis and diabetes.

Keywords

Tuberculosis, Diabetes, Prevalence, Risk Factors, Guinea

1. Introduction

According to the 2021 Global Tuberculosis Control Survey, there were approximately 9.87 million new TB patients worldwide, with an incidence rate of 127 per 100,000 in 2020 [1]. Although substantial efforts have contributed to the decline in the global TB epidemic, the pace of progress must be accelerated to reduce the burden of TB and achieve the goals of the WHO "TB control strategy."

With regard to diabetes, it is recognized that it is an important risk factor for TB with an estimated Odds Ratio (OR) of 2.44 to 8.33 compared to the general population [2]. It has been estimated that the prevalence of diabetes will double by 2030 in most African countries with more than 440 million diabetics in 2030, three quarters of whom will live in developing countries [3] [4]. Assuming that the increase in TB prevalence due to diabetes could mimic that of HIV, there is a need to define now measures to detect TB in diabetic patients in order to treat them earlier, but also to define what TB prevention measures could be implemented in these patients.

The growing epidemic of diabetes may contribute to an increased burden of TB [5]. Diabetes also has a major effect on TB treatment outcomes [6] [7]; in particular, it is associated with delayed sputum culture conversion, increased risk of treatment failure and increased risk of TB relapse and mortality [8].

With the accumulation of recent evidence supporting the association of TB and diabetes, there is a need for an updated understanding of the magnitude of the association of TB and diabetes in Guinea. The purpose of this study was to determine the prevalence of pulmonary tuberculosis in diabetics, to identify risk factors associated with tuberculosis in diabetics, and to describe the clinical features of the association between tuberculosis and diabetes.

2. Materials and Method

This was a cohort study conducted over a period of 2 years from November 18, 2015 to January 31, 2018 at the Endocrinology, Diabetology and Metabolic Diseases Department of the Donkateaching hospital. The survey concerned diabetic patients received in outpatient clinic and having accepted to participate in the study.

Diabetic patients already undergoing anti-tuberculosis treatment for any form of tuberculosis were excluded from the study.

After giving their consent, diabetic patients were included consecutively during patient visits to this diabetes management center. Demographic information (age, sex: the participant was male or female; residence: the participant resided in an urban or peri-urban or rural area) and clinical information (Body Mass Index: which was obtained by dividing weight in kilograms by height (in meters) squared; Active smoking: the number of pack-years the participant smoked at the time of inclusion in the study; notion of contagion: whether the participant had cohabited or worked with a person with tuberculosis; specific clinical signs of tuberculosis: cough, fever, emaciation, night sweats) were collected. Chest

X-rays were taken.

If the patient presented any of the clinical signs (cough, fever, weight loss, night sweats) of the WHO clinical screening algorithm [9] or a radiographic abnormality, two sputum specimens (one on the same day, the other the next day upon rising) were collected for microscopy for BAARs, culture and GeneXpert testing. All patients with undiagnosed tuberculosis are followed for 6 months (the time during which tuberculosis is expected to "occur" if not misdiagnosed at the time of inclusion in the study. At the end of follow-up (*i.e.*, 6 months)), patients were routinely visited with a check for clinical signs suggestive of TB, sputum BAAR testing, and sputum culture. Any clinical event suggestive of tuberculosis that occurred during the 6-month post-inclusion follow-up period was investigated.

Data were analyzed using R-3.4.4 and MedCalc version 18 software. The proportion of diabetic patients who had tuberculosis during follow-up was determined, followed by bivariate logistic regression to identify factors that were statistically significant with a $p < 0.05$ and then multivariate logistic regression of all significant factors to identify factors associated with tuberculosis.

3. Results

A total of 1912 diabetics were screened, and 47 were diagnosed with pulmonary tuberculosis.

1-Description of the study population:

The average age was 46 years [25; 65]. Female gender was predominant in our series with 55.3%. Gender was not associated with comorbidity of tuberculosis and diabetes ($p = 0.0654$).

The majority of patients were from the urban area (95.7%) while 4.3% of patients were from the peri-urban area. The place of residence was not associated with co-morbidity of tuberculosis and diabetes ($p = 0.7983$).

2-Prevalence of pulmonary tuberculosis in diabetics.

The prevalence of tuberculosis in diabetics was 2.5%, of which 2.4% were bacteriologically confirmed cases and 0.1% were clinically diagnosed cases.

3-Factors associated with tuberculosis in diabetics.

Body mass index ($p = 0.001$), smoking ($p = 0.0101$) and the notion of contagion ($p = 0.0008$) were significantly associated with tuberculosis (see **Table 1**).

4-Clinical characteristics of the association between tuberculosis and diabetes

The history of smoking ($p = 0.0101$) and the notion of contact ($p = 0.0008$) were significantly associated with the co-morbidity of tuberculosis and diabetes while the history of BCG scarring ($p = 0.8792$) was not associated with tuberculosis in diabetics.

Cough ($p = 0.001$), fever ($p = 0.001$), night sweats ($p = 0.001$) and hemoptysis ($P = 0.001$) were the clinical signs statistically associated with TB in diabetics. Weight loss ($p = 1.00$) was not associated with TB and diabetes comorbidity.

Table 1. Distribution of patients according to factors associated with pulmonary tuberculosis in diabetics.

Associate factors	TB	%	NoTB	%	TOTAL	%	P
Age	46						p = 0.1776
Sex							
Male	21	{44.7}	596	{32.0}	617	{32.3}	p = 0.0654
Female	26	{55.3}	1269	{68.0}	1295	{67.7}	
Notion of contagion							
Yes	15	{31.9}	267	{14.3}	282	{14.7}	p = 0.0008
No	32	{68.1}	1598	{85.7}	1630	{85.3}	
Body mass Index (kg/m²)							
<16.5	7	{14.9}	55	{2.9}	62	{3.2}	
[16.5 - 18.5[	9	{19.1}	110	{5.9}	119	{6.2}	
[18.5 - 25[	22	{46.8}	792	{42.5}	814	{42.6}	p < 0.001
[25 - 30[	9	{19.1}	567	{30.4}	576	{30.1}	
[30 - 35[	0	{0.0}	238	{12.8}	238	{12.4}	
[35 - 40[	0	{0.0}	79	{4.2}	79	{4.1}	
≥40	0	{0.0}	24	{1.3}	24	{1.3}	
Smoking							
Never smoked	33	{70.2}	1556	{83.4}	1589	{83.1}	p = 0.0101
No longer smokes	14	{29.8}	270	{14.5}	284	{14.9}	
Currentlysmokes	0	{0.0}	39	{2.1}	39	{2.0}	

4. Discussion

The average age of the patients was 46 years. Therefore, we found that almost all of the patients were older than 30 years. This result corroborates previous findings on diabetes which state that the frequency of diabetes generally increases with age reaching about 7% of the population after the age of 65 years [10].

A female predominance in diabetic tuberculosis patients was noted with a sex ratio of 0.8. This result is in contradiction with those of Touré *et al.* [11] and Mboussa *et al.* [12] who noted a male predominance in their series with a proportion of men of 60 and 65.6% respectively.

Most of the diabetic tuberculosis patients came from the urban area in 95.7% of cases. Urban residence has been reported as a risk factor associated with the development of tuberculosis in diabetics [13] [14]. This may be due to reduced physical activity and consumption of a high-calorie diet among urban residents [14]. In addition, urban residents have better access for diagnosis of TB and diabetes.

The prevalence of diabetes among TB patients was 3.35% in 2006 in Guinea [15]. In our study, the prevalence of pulmonary tuberculosis in diabetic patients was 2.5%, highlighting the frequency of this association. Several studies have shown that there is a high burden of TB in diabetic patients worldwide [16].

The median overall prevalence of TB among patients with diabetes in the African studies was 5.6%. Only one study in North America (Mexico) showed a prevalence rate of 4.9% [16]. There was also one prevalence study in Europe that showed a prevalence rate of 1.82% [17]. Body mass index ($p = 0.0000$), smoking ($p = 0.0101$), and the notion of being infected ($p = 0.0008$) were risk factors significantly associated with TB. A number of studies have shown that smoking and body mass index are risk factors associated with co-morbidity of TB and diabetes [15]. Smoking causes inflammation and oxidative stress in the body's cells and increases the risk of developing TB [18]. Contact with a TB patient in the family has been reported as a risk factor associated with co-morbidity of TB and diabetes [14].

Clinical characteristics (history of smoking and notion of contagion) were significantly associated with tuberculosis in diabetics.

The frequency of type 2 diabetes was higher in our study, 97.9% of cases. This could be explained by the fact that in general type 1 diabetes appears to be increasingly rare in tropical countries like Guinea, probably due to the absence of one or more genes of the HLA complex or even environmental factors that seem to be associated with the occurrence of type 1 diabetes [10]. Another much more extensive study is needed to elucidate the role of these genes in the occurrence of type 1 diabetes in Guinea and other tropical countries. Also, it appears that type 2 diabetics have a high risk of developing tuberculosis because of the immune deficiency that favors severe respiratory infections and that could favor tuberculosis superinfection [10].

In our study, 100% of the patients were in glycemic control measured by an HbA1c < 7%. There was no statistically significant difference between diabetics with tuberculosis and diabetics without tuberculosis. Cough ($p = 0.001$), fever ($p = 0.001$), nocturnal sweating ($p = 0.001$) and hemoptysis were the clinical signs statistically associated with tuberculosis.

5. Conclusions

The results of this study show a remarkably high prevalence of tuberculosis in diabetic patients in Guinea highlighting the need for urgent action to better understand and treat the dual burden of tuberculosis and diabetes.

The clinical signs of pulmonary tuberculosis in diabetic patients do not appear to be different from those in tuberculosis patients alone.

In order to detect pulmonary tuberculosis in diabetics early and to control it, close collaboration between the National Tuberculosis Control Program (NTCP) and the National Program for the Control of Noncommunicable Diseases (NPCD) is necessary to break this vicious cycle.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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