Research Article

The therapeutic outcome of pulmonary tuberculosis in diabetic patients

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Abstract

Introduction: The coexistence of tuberculosis and diabetes poses a significant public health challenge, requiring integrated and careful management to optimize treatment and minimize risks. This study aims to analyze the progression of tuberculosis in diabetic patients.

Methodology: We conducted a longitudinal study from February to October 2023. The study included 73 patients with bacteriologically confirmed pulmonary tuberculosis, divided into three groups: (1) Diabetic patients, (2) prediabetic patients, (3) non-diabetic control patients. The patients were followed for 9 months of treatment, and anti-tuberculosis therapeutic success was determined as follows: Cure, treatment failure, death, and loss to follow-up. Survival analysis using Cox proportional regression was used to compare each group based on therapeutic success. The analyses were conducted using the R software.

Results: Out of 73 tuberculosis patients, 26 (35.6%) were diabetic, 27 (36.9%) were prediabetic, and 20 (27.3%) were non-diabetic controls. The results show that patients in the diabetic group (Group 1) had a significantly increased risk of death compared to the control group, with a hazard ratio (HR) of 3.8 (95% CI 3.1-4.6, p<0.001). Similarly, the prediabetic group (Group 2) had an HR of 2.3 (95% CI 1.9-3.0, p<0.001) for death, indicating a substantial risk compared to controls. Compared to prediabetics, diabetic patients had an HR of 1.6 (95% CI 1.2-2.1, p<0.001), indicating a higher risk of death. Regarding treatment failure, diabetic patients had an HR of 3.5 (95% CI 2.7-4.7, p<0.001), while prediabetics had an HR of 2.5 (95% CI 1.9-3.3, p<0.001) compared to controls. Compared to prediabetics, diabetics had an HR of 1.4 (95% CI 1.1-1.9, p=0.01) for treatment failure. Regarding the treatment success outcome, controls showed a higher likelihood of cure with an HR of 0.6 (95% CI 0.4-0.8, p=0.001), followed by prediabetic patients with an HR of 1.4 (95% CI 1.1-1.8, p=0.02), while diabetic patients had the highest HR of 2.2 (95% CI 1.8-2.7, p<0.001). The comparison between the diabetic and prediabetic groups revealed an HR of 1.6 (95% CI 1.2-2.1, p<0.001) for cure, indicating that diabetic patients had a lower chance of recovery.

Conclusion: Our results show the impact of diabetes on treatment outcomes, highlighting the need for special attention to drug interactions, strict glycemic control, and support for treatment adherence.

Keywords: Diabetes mellitus; Pulmonary tuberculosis; Progression; Brazzaville

INTRODUCTION

Tuberculosis (TB) is an infectious, contagious disease that is both endemic and epidemic, transmitted from person to person. It is a major public health problem. It is estimated that about one-third of the world's population is infected with Mycobacterium tuberculosis.[1] In 2021, the World Health Organization (WHO) estimated that there were 10.6 million new cases of tuberculosis, of which 1.5 million resulted in death. Over 95% of these deaths occurred in developing countries. In Congo-Brazzaville, tuberculosis is a major concern. The prevalence is approximately 462 cases per 100,000 inhabitants, with an incidence of 382 cases per 100,000 inhabitants per year.1 Several risk factors for the outbreak of tuberculosis have been identified, among which diabetes mellitus is significant. The International Union Against Tuberculosis and Lung Disease (IUATLD) estimates that 16% to 46% of tuberculosis patients also suffer from diabetes.[2] Diabetes is a metabolic disease characterized by chronic hyperglycemia, which results either from a deficiency in insulin secretion (insulinopenia), an abnormality in insulin action on target cells (insulin resistance), or a combination of both mechanisms. The chronic hyperglycemia induced by diabetes leads to a decrease in the body's defense mechanisms, particularly delayed cell-mediated immunity against infections, and facilitates the occurrence of bacterial infections such as tuberculosis.[2,3] Diabetes is a common condition worldwide. The International Diabetes Federation (IDF) estimates that 537 million adults globally are living with diabetes, including 24 million in Africa. The number of people with diabetes is expected to reach 643 million by 2030 and 783 million by 2045.[4,5] In Congo, the prevalence of diabetes is 7%.[6] Literature data show that tuberculosis in diabetic patients has a different clinical and paraclinical profile, often with a more unfavorable progression.[7] Thus, due to the increasing prevalence of diabetes, this combination has the potential to trigger a significant public health crisis. In Congo, few studies are available on the specific characteristics of this association.[6] The objective of this study was to contribute to the improvement of tuberculosis management.

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METHODS

Study Design and Participants

We conducted a longitudinal study from February 2023 to October 2023 at the Anti Tuberculosis Center in Brazzaville in charge of over 5000 patients (Figure 1). The study included 73 patients with bacteriologically confirmed pulmonary tuberculosis. The patients were divided into three groups: (1) Diabetic patients, (2) prediabetic patients, and (3) non-diabetic control patients. The inclusion criteria were consenting patients aged 18 years or older with bacteriologically confirmed pulmonary tuberculosis. Patients with extrapulmonary tuberculosis, clinically diagnosed pulmonary tuberculosis, known HIV infection, those undergoing immunosuppressive therapy or long-term corticosteroid treatment, and pregnant women were excluded from the study.

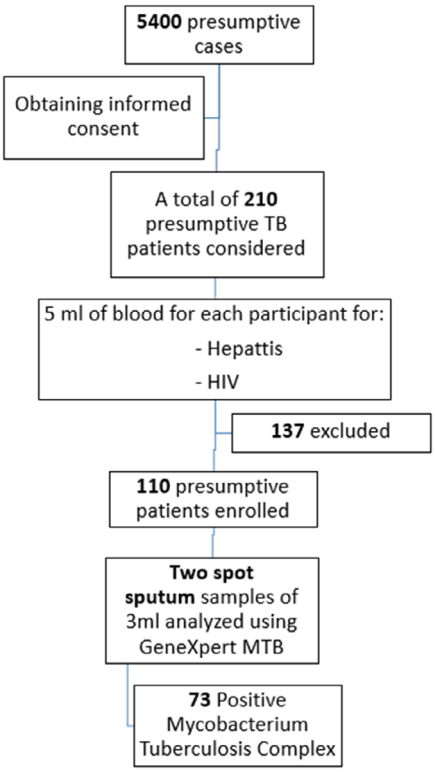

Figure 1: Patient recruitment process at the Anti-tuberculosis Center in Brazzaville

Follow-up and Outcome Assessment

The patients were followed for 9 months during their tuberculosis treatment. They were assessed at months 2, 4, and 6 (M2, M4, M6) according to the guidelines for TB management. At month 9 (M9), clinical and radiological sequelae were evaluated. Therapeutic success was determined based on the following outcomes: Cure, treatment failure, death, or loss of follow-up. Data were collected using a pre-tested semi-structured survey form, which included epidemiological, clinical, and microbiological information.

Sample Collection and Laboratory Analysis

Samples were collected on-site from the patients, depending on the diagnostic needs, and examined under a microscope after Ziehl Neelsen staining to detect Acid Fast Bacilli (AFB). Detection of Mycobacterium tuberculosis complex and rifampicin resistance in sputum samples was performed using the Xpert® MTB/RIF test (Cepheid, Sunnyvale, CA, USA). For samples that were resistant to rifampicin, further testing was conducted using the Line Probe Assay (LPA: GenoType® MTB DR sl assay; Hain Life Science, GmbH, Germany) to identify resistance to fluoroquinolones and second-line injectable drugs, including amikacin, kanamycin, and capreomycin. Bacteriologically confirmed tuberculosis cases were identified when the biological sample tested positive by smear microscopy, culture, or an Xpert MTB/RIF test.

Blood Glucose Measurement and Diabetes Classification

Capillary blood glucose was measured in all study participants, and diabetes mellitus was diagnosed when fasting blood glucose was ≥ 1.26 g/l on two occasions. Prediabetes was defined as fasting blood glucose between 1.10 g/l and 1.25 g/l on two occasions.

Statistical Analysis

Categorical variables were reported as percentages, while continuous variables were presented as medians with Interquartile Ranges (IQR) or means with standard deviations (± SD). Differences in distributions between two or more groups were assessed using the Mann Whitney U test or the Kruskal Wallis test. The Chi-square test or Fisher's exact test was employed for comparing categorical variables. Survival analysis using Cox proportional hazards regression was conducted to compare therapeutic success among the three groups, allowing for the identification of factors associated with treatment outcomes. All statistical analyses were performed using R software, with a p-value of <0.05 considered statistically significant.

Ethical Considerations

Each participant provided written informed consent before participating in this study. For participants under 16 years of age, informed consent was obtained from their legal representatives.

RESULTS

Sociodemographic Characteristics

Among the 73 patients included in the study, 83.6% (n=61) had a history of tuberculosis exposure, while 16.4% (n=12) did not. The history of tuberculosis exposure was found in 53.8% (n=14) of diabetic patients, 55.6% (n=15) of prediabetic patients, and 50.0% (n=10) of the control group (p=0.7). The average consultation delay was 56.7 days ± 38.2 days, with a median of 30 days and a range of 7 days to 365 days. The mean consultation delay was 68.4

days ± 45.3 days for diabetic patients compared to 46.3 days ± 30.2 days for non-diabetic patients (p=0.023). The average age of study participants was 39.5 years ± 14.2 years, with 18 subjects (24.7%) being under 30 years old, 7 (9.6%) between 31 years and 35 years, 12 (16.4%) between 36 years and 40 years, 10 (13.7%) between 41 years and 45 years, 13 (17.8%) between 46 and 50 years, and 13 (17.8%) over 50 years old. The socio-economic status was low in 74.0% of cases (n=54) and medium in 26.0% (n=19). The socio-economic status was low in 69.2% (n=18) of diabetic patients, 74.1% (n=20) of prediabetic patients, and 55.0% (n=11) of the control group (p=0.227). The sample consisted of 35.6% (n=26) diabetic patients, with Type 1 and Type 2 diabetes representing 11.5% (n=3) and 88.5% (n=23), respectively. The average age of diabetes diagnosis was 46.6 years ± 11.2 years, with a median of 47 years and a range from 17 years to 63 years. The average duration of diabetes was 6.3 years ± 6.5 years, with a median of 3 years and a range of 1 year to 20 years. Our sample included 26.9% (n=7) of patients on oral antidiabetic medication and 73.1% (n=19) on insulin. Therapeutic adherence was poor in 34.6% (n=9) of cases and good in 65.4% (n=17). Demographic and anthropometric data by sex are detailed in Table 1. Women were comparatively younger than men (39.5 years ± 14.2 years vs. 45.2 years ± 15.8 years; p=0.023). The average BMI of women was significantly higher than that of men (20.1 kg/m² ± 3.9 kg/m² vs. 22.4 kg/m² ± 3.8 kg/m²; p=0.015). There was no significant difference in waist circumference or systolic blood pressure, while diastolic blood pressure was higher in men than in women (85.3 mmHg ± 10.2 mmHg vs. 80.7 mmHg ± 9.8 mmHg; p=0.019). No sex differences were observed in place of residence (urban vs. rural). About 11.5% of men reported regular smoking, and 30.8% were former smokers (Figure 2).

Table 1: Demographic and anthropometric characteristics of the study population

Variables	Diabetic (n=26)	Prediabetic (n=27)	Control (n=20)	P-value (Group comparison)
Age (years)	45.2 ± 15.8	39.5 ± 14.2	32.7 ± 13.1	0.023
Sex (Men/Women)	14-Dec	15-Dec	12-Aug	0.227
BMI (kg/m²)	22.4 ± 3.8	20.1 ± 3.9	18.7 ± 4.5	0.015
Waist circumference (cm)	85.3 ± 12.4	78.2 ± 11.7	72.8 ± 13.2	0.031
Systolic blood pressure (mm Hg)	130.2 ± 15.1	125.4 ± 14.3	120.7 ± 13.7	0.041
Diastolic blood pressure (mm Hg)	85.3 ± 10.2	80.7 ± 9.8	76.9 ± 9.5	0.019
HbA1c (%)	7.7 ± 1.2	6.3 ± 1.0	5.5 ± 0.8	0.045
Total cholesterol (mmol/L)	5.4 ± 1.1	4.9 ± 0.9	4.2 ± 0.8	0.032
Urea (mmol/L)	4.5 ± 1.3	4.1 ± 1.2	3.7 ± 1.0	0.027
Creatinine (umol/L)	73.4 ± 15.0	69.8 ± 13.2	64.5 ± 12.4	0.041
Place of residence				
- Urban	18 (69.2%)	20 (74.1%)	11 (55.0%)	0.227
- Rural	8 (30.8%)	7 (25.9%)	9 (45.0%)	0
Occupation				
- Employed	14 (53.8%)	16 (59.3%)	16 (80.0%)	0.104
- Unemployed	8 (30.8%)	6 (22.2%)	4 (20.0%)	0
- Housewife	2 (7.7%)	4 (14.8%)	2 (10.0%)	0
- Student	2 (7.7%)	1 (3.7%)	0 (0.0%)	0
Smoking				
- Regular	3 (11.5%)	2 (7.4%)	0 (0.0%)	0.071
- Occasional	1 (3.8%)	1 (3.7%)	0 (0.0%)	0
- Former smokers	8 (30.8%)	7 (25.9%)	5 (25.0%)	0
Outcome				
- Cure	16 (61.5%)	18 (66.7%)	14 (70.0%)	0.041
- Failure	6 (23.1%)	5 (18.5%)	4 (20.0%)	0
- Death	2 (7.7%)	2 (7.4%)	2 (10.0%)	0
- Lost to follow-up	2 (7.7%)	2 (7.4%)	0 (0.0%)	0

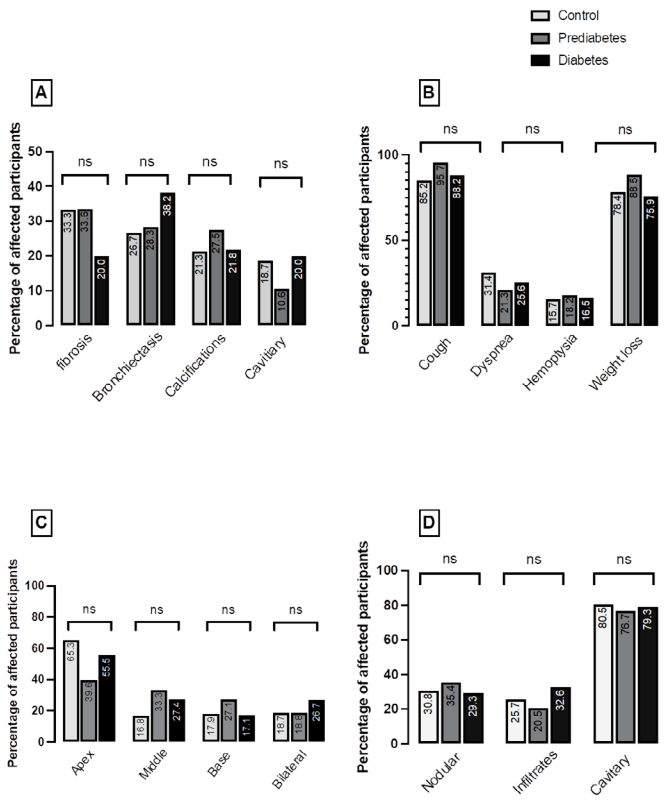

Figure 2: Percentages of participants affected by parenchymal sequelae (A), Clinical signs (B), parenchymal localization of lesions (C), type of parenchymal lesions at the beginning of the study (D) Prevalence of Diabetes and Prediabetes in Patients with Tuberculosis

Among the 73 patients, 26(35.6%) were diabetic, and there was no significant difference in the prevalence of diabetes between men and women [35.6% vs. 35.7%; χ^2=0.000, p=0.991]. The prevalence of prediabetes was 27(37.0%), also without a significant difference between sexes [35.6% in men vs. 39.3% in women; χ^2=0.065, p=0.799]. The prevalence of Isolated Fasting Hyperglycemia (IFG) was 5 (6.8%), that of Isolated Glucose Intolerance (IGT) was 8(11.0%), and both IFG and IGT were present in 2 (2.7%) of the subjects. No significant difference was noted between men and women in the prevalence of the different prediabetes categories. Finally, 20 (27.4%) of the patients were in the control group, with an equally non-significant distribution between sexes [28.9% in men vs. 25.0% in women; χ^2=0.095, p=0.758] (Table 2).

Risk Factors Associated with Diabetes and Prediabetes in Tuberculosis Patients

Multinomial logistic regression analysis revealed several factors significantly associated with diabetes and prediabetes in tuberculosis patients. For diabetes, advanced age (especially in patients over 50 years), a family history of diabetes, sedentary occupation, and high waist circumference were significant predictors. For instance, patients over 50 years of age had a Relative Risk Ratio (RRR) of 24.7 (95% CI 9.73-62.7, p<0.001) for developing diabetes compared to patients under 30 years of age. Moreover, a family history of diabetes increased the risk by 3.08 times (95% CI 1.73-5.5, p<0.001). Regarding prediabetes, age was also a key factor, with an RRR of 6.96 (95% CI 3.3-14.7, p<0.001) for patients aged 41 to 45 compared to those under 30 years of age. A high waist circumference (≥ 90 cm for men and ≥ 80 cm for women) and smoking habits were also associated with an increased risk of prediabetes, with RRRs of 3.05 (95% CI 1.35-6.9, p=0.007) and 1.92 (95% CI 1.12-3.28, p=0.017), respectively. Table 3 presents the results of multinomial logistic regression for diabetes compared to non-diabetics, while Table 4 shows the results for prediabetes compared to non-diabetics.

Table 2: Prevalence of diabetes and prediabetes in patients with tuberculosis

Variables	Diabetes n (percentage) [95% CI]	Prediabetes n (percentage) [95% CI]	IFG n (percentage) [95% CI]	IGT n (percentage) [95% CI]	IFG & IGT n (percentage) [95% CI]	Control n (percentage) [95% CI]
Total (n=73)	26 (35.6%) [18.7, 34.4]	27 (37.0%) [19.6, 35.4]	5 (6.8%) [2.2, 11.0]	8 (11.0%) [4.1, 14.7]	2 (2.7%) [0.6, 6.9]	20 (27.4%) [13.5, 28.2]
Men (n=45)	16 (35.6%) [10.4, 22.6]	16 (35.6%) [10.4, 22.6]	3 (6.7%) [1.0, 8.0]	4 (8.9%) [1.6, 9.3]	1 (2.2%) [0.2, 5.2]	13 (28.9%) [8.0, 19.5]
Women (n=28)	10 (35.7%) [5.8, 15.2]	11 (39.3%) [6.6, 16.1]	2 (7.1%) [0.6, 6.3]	3 (10.7%) [1.0, 7.6]	1 (3.6%) [0.2, 5.0]	7 (25.0%) [3.5, 12.1]
Men vs Women						
Diabetes	χ^2=1.241, p=0.991					
Prediabetes	χ^2=0.065, p=0.799					
Control	χ^2=0.095, p=0.758					

Table 3: Results of multinomial logistic regression (Diabetes vs. Controls)

Variable	Relative Risk Ratio (RRR)	95% CI	P-value
Age (years)			
<30 (reference)	1	0	0
31-35	6.75	(2.36-19.32)	<0.001
36-40	10.46	(3.95-27.7)	<0.001
41-45	18.63	(6.58-52.7)	<0.001
46-50	11.05	(4.31-28.4)	<0.001
>50	24.7	(9.73-62.7)	<0.001
Waist circumference (≥ 90 cm M; ≥ 80 cm F)	2.22	(0.97-5.1)	0.058
Smoking habit	2.1	(1.15-3.84)	0.015
Family history of diabetes	3.08	(1.73-5.5)	<0.001
Sedentary occupation	1.69	(1.10-2.59)	0.016
Monthly income	1.15	(0.68-1.94)	0.05
BMI (kg/m²)			
<18.5 (reference)	1	0	0
18.5-22.9	2.03	(1.32-3.12)	0.001
23-24.9	1.87	(0.95-3.65)	0.068
≥ 25.0	1.44	(0.54-3.8)	0.47

Table 4: Results of multinomial logistic regression (Prediabetes vs. Controls)

Variable	Relative Risk Ratio (RRR)	95% CI	P-value
Age (years)			
<30 (reference)	1	0	0
31-35	1.96	(0.89-4.27)	0.092
36-40	2.24	(1.1-4.55)	0.026
41-45	6.96	(3.3-14.7)	<0.001
46-50	3.44	(1.83-6.48)	<0.001
>50	4.3	(2.25-8.2)	<0.001
Waist circumference (≥ 90 cm M; ≥ 80 cm F)	3.05	(1.35-6.9)	0.007
Smoking habit	1.92	(1.12-3.28)	0.017
Family history of diabetes	2.1	(1.15-3.84)	0.015
Sedentary occupation	1.5	(0.89-2.53)	0.08
Monthly income	0.59	(0.37-0.94)	0.026
BMI (kg/m²)			
<18.5 (reference)	1	0	0
18.5-22.9	1.75	(0.95-3.21)	0.07
23-24.9	1.5	(0.85-2.65)	0.15
≥ 25.0	1.2	(0.70-2.45)	0.32

Therapeutic Success Assessment

A survival analysis was conducted to assess the risk factors associated with clinical outcomes in tuberculosis patients, considering age, gender, diabetes duration, and other relevant variables. Cox regression analyses were performed separately for three main outcomes: Cure, treatment failure, and death. The results show that patients in the diabetic group (Group 1) had a significantly increased risk of death compared to the control group, with a Hazard Ratio (HR) of 3.8 (95% CI 3.1-4.6, p<0.001). Similarly, the prediabetic group (Group 2) had an HR of 2.3 (95% CI 1.9-3.0, p<0.001) for death, indicating a substantial risk compared to controls. Compared to prediabetics, diabetic patients had an HR of 1.6 (95% CI 1.2-2.1, p<0.001), indicating a higher risk of death. Regarding treatment failure, diabetic patients had an HR of 3.5 (95% CI 2.7-4.7, p<0.001), while prediabetics had an HR of 2.5 (95% CI 1.9-3.3, p<0.001) compared to controls. Compared to prediabetics, diabetics had an HR of 1.4 (95% CI 1.1-1.9, p=0.01) for treatment failure. For the outcome of cure, controls showed a higher likelihood of cure with an HR of 0.6 (95% CI 0.4-0.8, p=0.001), followed by prediabetic patients with an HR of 1.4 (95% CI 1.1-1.8, p=0.02), while diabetic patients had the highest HR of 2.2 (95% CI 1.8-2.7, p<0.001). The comparison between the diabetic and prediabetic groups revealed an HR of 1.6 (95% CI 1.2-2.1, p<0.001) for cure, indicating that diabetic patients had a lower chance of recovery.

DISCUSSION

Tuberculosis and diabetes continue to be significant public health challenges, especially in developing countries, where diabetes is a recognized factor in the reactivation of tuberculosis. Additionally, tuberculosis can exacerbate diabetes, necessitating higher doses of insulin for affected patients. This study was undertaken to examine the epidemiological, clinical, paraclinical, and prognostic aspects of tuberculosis in the context of diabetes. The connection between diabetes mellitus and tuberculosis is well-established, with considerable evidence indicating that diabetes is a key risk factor for tuberculosis.[8] Conversely, tuberculosis can also contribute to glucose intolerance and worsen glycemic control in individuals

with diabetes.[7] This study found that the prevalence of diabetes and prediabetes among tuberculosis patients was 35.6% and 36.9%, respectively. Diabetes was more common in men than in women (53.8% vs. 46.2%), while no significant sex difference was observed in the prevalence of prediabetes. The higher prevalence of diabetes in men may be due to the cumulative effects of other risk factors, such as smoking, tobacco, and alcohol use, which are known to impact both tuberculosis and diabetes. Another contributing factor could be the younger average age of women in the study, as older age is a well-documented risk factor for diabetes.

Research conducted in areas where both tuberculosis and diabetes are prevalent has indicated that the prevalence of diabetes among tuberculosis patients ranges from 14% to 40%.[8,9] A case-control study conducted between 2001 and 2003 identified chronic diseases, particularly diabetes, as significant risk factors for the development of tuberculosis. In this study, diabetes prevalence was 22.2% among tuberculosis patients, compared to 15.9% in non-tuberculosis subjects.[10] Additionally, a secondary analysis of national data estimated that 18.4% of individuals with pulmonary tuberculosis also had diabetes.[9] A retrospective review of two years of data from tuberculosis patients in Saudi Arabia in 1998 found that 27% of these patients were diabetic.[8] Another study from Taiwan reported a diabetes prevalence of 16.9% among tuberculosis patients.[8] These findings collectively suggest that systematic diabetes screening should be prioritized in regions where tuberculosis is highly prevalent.

Alisjahbana et al. provided prospective data from a cohort of tuberculosis patients in Indonesia, where the prevalence of confirmed diabetes among those with tuberculosis was 14.8%, compared to 3.2% in the general population.8 Another study reported that the prevalence rates of diabetes and prediabetes were 10.4% and 8.3%, respectively, figures that are notably lower than those observed in the current study of tuberculosis patients conducted during the same timeframe. In this study, over 60% of tuberculosis patients identified as diabetic had already been diagnosed with diabetes prior to their tuberculosis diagnosis. It is well-established that long-term diabetes can weaken both innate and adaptive immune responses, which are crucial for controlling tuberculosis infection.[10] This may help explain the higher prevalence of diabetes among tuberculosis patients in this study. Additionally, the tuberculosis patients shared common risk factors associated with diabetes.

In the current study, common risk factors for diabetes among tuberculosis patients mirrored those found in the general population, including age, BMI, a positive family history of diabetes, and sedentary occupations. However, some risk factors typically associated with diabetes in the general population, such as urban residence and economic status, were not observed in this study. Diabetic tuberculosis patients were generally older than their non-diabetic counterparts and, although they remained underweight relative to the general population, they had a higher BMI compared to non-diabetic tuberculosis patients. The multinomial logistic regression analysis revealed that the Relative Risk Ratio (RRR) for the age group over 50 was significantly higher compared to those under 30 years. A progressive increase in RRR was noted with each successive 5 years age increment. Interestingly, a decrease in RRR was observed in the age group 46-50, likely due to the smaller number of patients in this category. Tuberculosis patients with a BMI of 18.5 kg/m^2-22.9 kg/m^2 were found to have twice the risk of developing diabetes compared to those with a BMI under 18.5 kg/m^2. The limited number of tuberculosis patients in the overweight and obese categories, as defined by Indian guidelines, may explain the lack of a significant association between these categories and diabetes. A positive family history of diabetes was also significantly associated with diabetes, showing an RRR of 3.08. Additionally, age, waist circumference, and smoking emerged as independent risk factors significantly linked to prediabetes among tuberculosis patients, with the highest RRR observed in the age group 41-45, as well as with increased waist circumference and smoking. The connection between diabetes and pulmonary tuberculosis, particularly in smear-positive cases, aligns with the findings of Stevenson et al.[11] However, this study did not evaluate the predominance of diabetes development among urban tuberculosis patients, as reported by Stevenson et al.[11]

The data on tuberculosis treatment outcomes in patients with diabetes remain inconclusive. Some studies suggest that diabetic individuals have better tuberculosis treatment outcomes compared to non-diabetic patients under the same treatment regimen.[12] However, research conducted among Indonesian tuberculosis patients has shown poorer treatment outcomes in those with diabetes.8 The link between diabetes and tuberculosis may be due, in part, to poor glycemic control and the impaired production of non-specific antibodies, resulting from deficiencies in both innate and adaptive immune responses in diabetic individuals. These factors can contribute to the reactivation of previous infections and the emergence of new tuberculosis cases in diabetic patients. In our study, the majority of known diabetic cases (92.4%) were receiving regular diabetes treatment, with approximately 70% using oral hypoglycemic agents. However, glycemic control was suboptimal, with only about 34% of patients achieving well-controlled diabetes (HbA1c<7%). Over 40% of diabetic patients had an HbA1c level of ≥ 9.0%, indicating inadequate glycemic control despite treatment. There was no significant difference in the rates of relapse, treatment failure, and abandonment across varying levels of glucose intolerance. It is important to note that no definitive conclusions can be drawn from this study on this issue, as it was not specifically designed to address it. Several recent studies highlight the need to address the rising prevalence of diabetes, which is

likely to impact the co-endemicity of tuberculosis.[13] Given the increasing trend in diabetes and the significant burden of latent tuberculosis infection within the Indian population, it is crucial to emphasize the diagnosis of latent tuberculosis and diabetes screening, along with ensuring effective metabolic control in those diagnosed with diabetes. The potential role of chemoprophylaxis for diabetic individuals with latent tuberculosis warrants careful consideration and evaluation due to the substantial burden it represents.

Furthermore, enhanced collaboration between the National Tuberculosis Program (PNLT) and the National Program for the Prevention of Diabetes and Cardiovascular Diseases in the Republic of Congo is essential to establish protocols and guidelines that effectively address the dual burden of these diseases. Considering the strong association between tuberculosis and dysglycemia-where half of tuberculosis cases involve diabetes or prediabetes-and the fact that more than one-third of diabetes cases among tuberculosis patients were newly diagnosed, universal diabetes screening for individuals with tuberculosis seems highly appropriate, particularly in the Republic of Congo, where the dual burden is significant. The limited resources and infrastructure for diabetes prevention and care at the primary level underscore the importance of strengthening and utilizing the health resources and infrastructure for tuberculosis control to also promote the prevention, early detection, and treatment of diabetes in tuberculosis patients, especially in the Republic of Congo. Although these services may be available only during the tuberculosis treatment period, the intensive engagement through the DOTS (Directly Observed Treatment, Short-course) initiative can provide a solid foundation for long-term diabetes management, thereby reducing the risks of treatment failure, reinfection, and relapse.

CONCLUSION

This study revealed that about half of the tuberculosis patients had either diabetes or prediabetes. Furthermore, those with diabetic tuberculosis were more likely to have the infectious form of tuberculosis. These findings present a significant challenge for the control of diabetic tuberculosis in the Republic of Congo.

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None.

CONFLICT OF INTEREST

The author's declared that they have no conflict of interest.

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