ACTAS MÉDICAS (ECUADOR)
actasmedicas.ec

ORIGINAL ARTICLE

Incidence of multidrug-resistant pulmonary tuberculosis in HIV-positive patients. A single-center observational study.

Anthony Josua Cortez Lainez [1ID] *, Janeth Anavela Moya April [1ID], Roberto Leonardo Briones Jiménez [1ID].
1. Medical Degree, Faculty of Health Sciences, Catholic University of Santiago de Guayaquil (Universidad Católica de Santiago de Guayaquil), Guayaquil, Ecuador.

Abstract

Introduction: The objective of the present study was to identify the incidence of multidrug-resistant pulmonary tuberculosis in HIV-reactive patients aged 20 to 64 years in the pneumology area of the Guasmo Sur General Hospital (HGGS) from 2019 to 2020.

Methodology: This observational study was conducted at Guasmo Sur General Hospital in Guayaquil, Ecuador, from January 2019 to December 2020. Records of patients older than 19 years of age with HIV/multidrug-resistant pulmonary TB coinfections were included. The variables were age, sex, patient status, incidence, and mortality. Descriptive statistics were used.

Results: Ninety patients with coinfections were included, of whom 25 had multidrug resistance (27.8%) and were analyzed. There were 23 men (92%) between 20 and 34 years of age (56%), and 21 living patients (84%). During 2019, there were 14 new cases of MDR-TB from a population at risk of 69 patients, which indicates an incidence rate of 203 per thousand patients treated during this period. In 2020, out of a population at risk of 46 patients, 11 new cases of MDR-TB were presented, which translates to an incidence rate of 239 per thousand patients.

Conclusions: Between 2019 and 2020, the incidence of multidrug-resistant tuberculosis (MDR-TB) among HIV-positive patients increased from 203 to 230 cases per 1,000 patients. This risk was significantly higher for men, whose incidence was 232 per 1,000 in 2019 and 256 per 1,000 in 2020, than for women. Although the most affected age range changed from 35–64 years in 2019 to 20–34 years in 2020, the general mortality associated with MDR-TB in this population also increased from 143 to 182 deaths per 1,000 patients, suggesting a progressive worsening of clinical outcomes for coinfected patients.

Keywords:

Human immunodeficiency virus, tuberculosis, coinfection, multidrug resistance.

Abbreviations

TB: Tuberculosis.
HIV: Human immunodeficiency virus.

Supplementary information

No supplementary materials are declared.

Acknowledgments

We thank the staff and patients of the Guasmo Sur General Hospital, where the study was conducted.

Authors' contributions

Anthony Josua Cortez Lainez: Conceptualization, Research, Writing—original draft, Resources, Software, Supervision.

Janeth Anavela Moya Abril: Conceptualization, Research, Writing—original draft, Resources, Software, Supervision.

Roberto Leonardo Briones Jiménez: Methodology, data curation, formal analysis, acquisition of funds, project administration, validation, visualization, writing - review and editing.

Financing

The authors financed the costs of this research.

Availability of data and materials

The datasets used and analyzed during this study are available to the corresponding author upon reasonable request.

Introduction

Tuberculosis (TB) is considered a major public health problem. Despite efforts to control it, TB continues to disproportionately affect populations with fewer economic resources. The primary cause of the disease is the bacterium *Mycobacterium tuberculosis*, which is transmitted through droplets expelled during coughing or sneezing. Although TB can affect multiple organs, its most common form is pulmonary tuberculosis (P-TB). The World Health Organization (WHO) estimates that approximately one-quarter of the global population is infected with bacillus [1].

The emergence of multidrug-resistant tuberculosis (MDR-TB), a form of disease that does not respond to first-line drugs such as isoniazid and rifampicin, complicates treatment, increases the risk of mortality, and facilitates the transmission of resistant bacillus. Several studies have sought to identify factors that can predict the presence of MDR-TB, enabling the initiation of appropriate early treatment [2]. Persistent fever after two weeks of therapy with first-line drugs has proven to be a strong predictor of MDR-TB, suggesting a poor therapeutic response. The cavernous radiographic pattern, in particular, is significantly associated with MDR-TB, and multiple or large lesions are strongly correlated with resistance.3].

HIV coinfection further aggravates the tuberculosis situation. Immunosuppression caused by HIV not only increases the risk of developing active TB but can also influence the progression and presentation of the disease. In addition to clinical and radiological factors, MDR-TB research has explored the relationship between MDR-TB and age. Although the results are heterogeneous, some studies suggest that MDR-TB may be more prevalent in young patients. In contrast, in others, age is not a statistically significant factor.4]. The objective of the present study was to identify the incidence of multidrug-resistant pulmonary tuberculosis in HIV-reactive patients aged 20 to 64 years in the pneumology area of the Guasmo Sur General Hospital (HGGS) from 2019 to 2020.

Materials and methods

Study design

The present study is observational. The source is retrospective.

Scenario

The study was developed in the Guasmo Sur General Hospital, of the Ministry of Public Health of Ecuador, located in Guayaquil, in the province of Guayas (Ecuador), during the period from January 1, 2019, to December 31, 2020.

Participants

Records of patients older than 19 years of age with HIV/multidrug-resistant pulmonary TB coinfection were included. Patients with one of the positive diagnoses but not confirmed, pregnant women, and patients with miliary tuberculosis were excluded.

Variables

The variables were age, sex, patient status, incidence and mortality.

Data sources/measurements

The source was indirect; an electronic form was used to collect the data for the institutional medical history. For the investigation of the cases, multiple searches of patients diagnosed with HIV with the following ICD-10 diagnoses and derived diagnoses were performed: HIV B20-B24; for tuberculosis, the ICD-10 codes were A15-A19.

Bias

Observation and selection bias were avoided by applying the participant selection criteria. To avoid possible interviewer, information, and memory biases, the principal investigator kept the data at all times using a guide and records approved in the research protocol. Two researchers independently analyzed each record in duplicate, and the variables were recorded in the database once their agreement was verified.

Study size

The sample was probabilistic. In 2024, 49,000 patients will have HIV in Ecuador. In the province of Guayas, 31.68% of the cases are national cases, corresponding to 15,523 cases. Ninety percent of cases occurred in people over 14 years of age, corresponding to 13,970 cases in the study population. With an 80% confidence level, a 5% confidence limit, and an expected frequency of 13.3%, the calculated sample size was 75 cases. Epi Info ™ version 7.2 was used (CDC, Atlanta, March 9, 2025).

Quantitative variables

Descriptive statistics were used. The results are expressed as frequencies and percentages. Variables in the scale were not converted to categorical variables.

Statistical analysis

The qualitative variables were analyzed as frequencies and percentages. The statistical package used was IBM Corp. (released in 2018). IBM SPSS Statistics for Windows, Version 26.0. Armonk, NY: IBM Corp.

Results

Participants

Data were collected from a total of 90 patients who met the inclusion criteria, which met 100% of the sample calculation. Among the 90 patients, 25 had multidrug-resistant pulmonary tuberculosis (27.8%) (Table 1).

Table 1. HIV+ patients diagnosed with Pulmonary-TB (P-TB) vs. MDR-TB per year.

n=90	# P-TB cases	#MDR-TB Cases	95% CI for the proportion
Año 2019	55	14 (25.5%)	13.9%-37%
Año 2020	35	11 (31.4%)	16%-46.8%

CI: confidence interval. PTB: Pulmonary tuberculosis. MDR-TB: Multidrug-resistant tuberculosis.

Characteristics of the study group

There were 23 men (92%) between 20 and 34 years of age (56%). Twenty-one patients survived (84%) (Table 2).

Table 2. General description of HIV+ patients diagnosed with MDR-TB for each year.

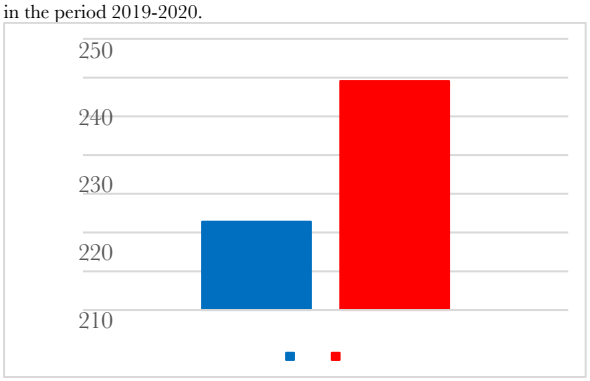
n=25	# Casos-2019 N=14	# Casos-2020 N=11	Total n=25
Sex			
Male	13	10	23 (92%)
Female	1	1	2 (8%)
Age Range			
20-34	5	9	14 (56%)
35-64	9	2	11 (44%)
Patient Status			
Alive	12	9	21 (84%)
Deceased	2	2	4 (16%)

MDR-TB: Multidrug-resistant pulmonary tuberculosis.

Incidence of MDR-TB in HIV+ patients

During 2019, there were 14 new cases of MDR-TB from a population at risk of 69 patients, which indicates an incidence rate of 203 per thousand patients treated during this period. On the other hand, during 2020, of a population at risk of 46 patients, there were only 11 new cases of MDR-TB, which translates to an incidence rate of 239 per thousand patients treated during this period (Figure 1).

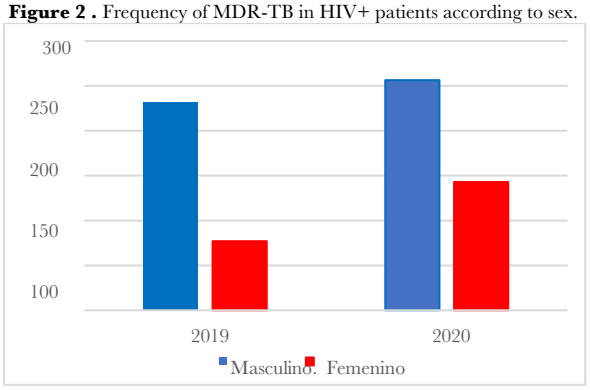
Figure 1. Incidence of MDR-TB in HIV+ patients between 20 and 64 years in the period 2019-2020.



Frequency of MDR-TB among HIV+ patients according to sex

The frequency of occurrence with respect to sex is represented by the incidence rate calculated based on the number of patients of each sex who contracted the disease in 2019 and 2020, such that the frequency of occurrence of MDR-TB in HIV+ patients with respect to females was 77 per thousand patients in 2019 and 142 per thousand patients in 2020. Regarding males, the frequency of disease occurrence was 232 per thousand patients in 2019 and 256 per thousand patients in 2020. These results demonstrate a clear predominance of males in terms of MDR-TB occurrence frequency, as well as a notable increase in frequency over time (Figure 2).

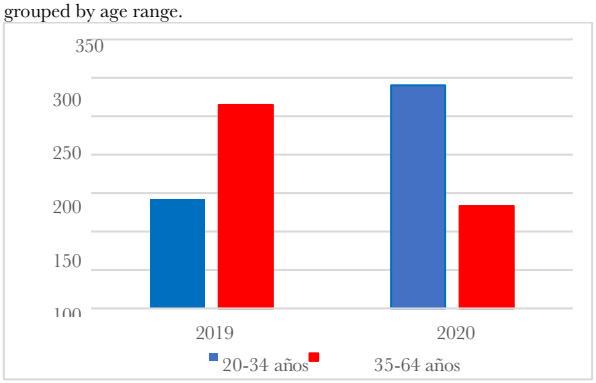
Figure 2 . Frequency of MDR-TB in HIV+ patients according to sex.



Frequency of MDR-TB among HIV+ patients grouped by age range

When the frequency of MDR-TB in HIV+ patients according to age was grouped into previously established age ranges, the frequency of disease onset in the age range of 20–34 years was 143 per thousand patients in 2019 and 290 per thousand patients in 2020, which reflects a clear trend toward an increasing incidence rate. In contrast, in the 35–64 year age range, the frequency of occurrence was 265 per thousand patients in 2019 and 133 per thousand patients in 2020, indicating a decrease in the incidence rate, unlike that reported in the previous study. another age range (Figure 3).

Figure 3. Frequency of MDR-TB in HIV+ patients according to age grouped by age range.



Frequency of MDR-TB among HIV+ patients grouped by age range

With respect to mortality during 2019, of the 14 new cases of MDR-TB, 2 patients died, which corresponds to a mortality rate of 143 per thousand patients treated during this period. With respect to 2020, of the 11 new cases of MDR-TB, 2 patients died, which translates to a mortality rate of 182 per thousand patients treated during this period. The results were calculated from the quotient between the number of patients with MDR-TB who died and the total number of patients who developed MDR-TB during each time period.

Discussion

In the present report, 90 patients were reactive to HIV with a diagnosis of pulmonary tuberculosis, 27.8% of whom were HIV-TB patients. Multidrug resistance is often related to factors ranging from the inappropriate use of medications, either by dose, duration or even adherence to treatment, to the molecular characteristics of the bacillus strain and even the presence of underlying diseases such as HIV. In general, TB can occur at any stage of HIV disease and with any CD4 count. However, as the CD4 cell count decreased, the incidence of tuberculosis increased, as did the incidence of mycobacteremia and/or comorbidities.

The incidence of MDR-TB was estimated to be 217 per thousand patients treated in the health home chosen for the research, which represents 21.73% of our population analyses performed in a hospital in Guayaquil, in which it is estimated that the incidence rate of this disease in the study population is only 103 per thousand inhabitants, which represents 10.6% of its chosen population.

According to the data obtained by analyzing the established sample, male patients diagnosed with HIV tend to develop MDR-TB more frequently than HIV-reactive female patients do. These results are consistent with data obtained in other international studies, as observed in a study conducted in Peru, where the risk factors associated with MDR-TB were analyzed in patients at a hospital in Callao. The study estimated that 61.2% of patients who developed MDR-TB were male. These results are in agreement with data obtained in an investigation at the Infectious Diseases Hospital of Guayaquil, in which 83% of patients with MDR-TB were male [5, 6].

With respect to the age range in which the onset of the disease predominates, according to the data analyzed in the present investigation, the estimated range is 20 to 34 years. These results differ from the data obtained in other studies in which the prevalence of MDR-TB ranged from 36 to 45 years [7].

The mortality rate associated with MDR-TB among HIV+ patients in the present research during 2019 was 142 per thousand patients, while the mortality rate associated with MDR-TB among HIV+ patients during 2020 was 181 per thousand patients. every thousand patients. "The infection produces a gradual deterioration of the immune system, leading to "immunosuppression", which contributes to the increase in morbidity and mortality of patients who develop the disease in question."

According to the WHO, pulmonary tuberculosis is one of the leading causes of death worldwide. With nearly 8 million new cases annually and over 1 million deaths each year, TB remains a significant public health issue. Although morbidity has decreased, reports indicate that both morbidity and mortality stay high due to HIV coinfection and the rise of drug-resistant bacilli [7].

Factors such as poverty, HIV, and drug resistance have been identified as the main contributors to the resurgence of the global tuberculosis pandemic. Drug-resistant microorganisms have become major public health problems worldwide. In the case of tuberculosis, the first global investigation of drug resistance, published in 1997, reported MDR-TB in most participating countries. "Shortly thereafter, the treatment

strategy "DOTS" (Directly Observed Treatment, Short Course) was introduced for the programmatic management of MDR-TB in low- and middle-income countries because only a fraction of MDR-TB cases are people." diagnosed and treated worldwide.

Future studies should evaluate multiresistance in various scenarios, such as renal failure and diabetes [8,9].

Conclusions

Between 2019 and 2020, the incidence of multidrug-resistant tuberculosis (MDR-TB) among HIV-positive patients increased from 203 to 230 cases per 1,000 patients. This risk was significantly higher for men, whose incidence was 232 per 1,000 in 2019 and 256 per 1,000 in 2020, than for women. Although the most affected age range changed from 35–64 years in 2019 to 20–34 years in 2020, the general mortality associated with MDR-TB in this population also increased from 143 to 182 deaths per 1,000 patients, suggesting a progressive worsening of clinical outcomes for coinfected patients.

References

1. Soto-Hernández JL. Multiresistant Tuberculosis and Its Paradoxical Manifestations. Infect Chemother. 2016 Sep;48(3):225-226. doi: 10.3947/ic.2016.48.3.225. PMID: 27704732; PMCID: PMC5048005.

2. Perfecto B, Sánchez JR, González AI, López I, Dorronsoro I. Brote de tuberculosis multirresistente [Outbreak of multiresistant tuberculosis]. An Sist Sanit Navar. 2000 May-Aug;23(2):257-63. Spanish. doi: 10.23938/ASSN.0774. PMID: 12886310.

3. Maitre T, Aubry A, Jarlier V, Robert J, Veziris N; CNR-MyRMA. Multidrug and extensively drug-resistant tuberculosis. Med Mal Infect. 2017 Feb;47(1):3-10. doi: 10.1016/j.medmal.2016.07.006. PMID: 27637852.

4. Yew WW. Management of multidrug-resistant tuberculosis and extensively drug-resistant tuberculosis: current status and future prospects. Kekkaku. 2011 Jan;86(1):9-16. PMID: 21401001.

5. Schön T, Miotto P, Köser CU, Viveiros M, Böttger E, Cambau E. *Mycobacterium tuberculosis* drug-resistance testing: challenges, recent developments and perspectives. Clin Microbiol Infect. 2017 Mar;23(3):154-160. doi: 10.1016/j.cmi.2016.10.022. Epub 2016 Nov 1. PMID: 27810467.

6. Nimmo C, Millard J, Faulkner V, Monteserin J, Pugh H, Johnson EO. Evolution of *Mycobacterium tuberculosis* drug resistance in the genomic era. Front Cell Infect Microbiol. 2022 Oct 7;12:954074. doi: 10.3389/fcimb.2022.954074. PMID: 36275027; PMCID: PMC9585206.

7. Poulton NC, Rock JM. Unraveling the mechanisms of intrinsic drug resistance in *Mycobacterium tuberculosis*. Front Cell Infect Microbiol. 2022 Oct 17;12:997283. doi: 10.3389/fcimb.2022.997283. PMID: 36325467; PMCID: PMC9618640.

8. Alemán-Iñiguez J, Alemán-Iñiguez P. Lumbalgia atípica por plasmocitoma óseo solitario coexistente con absceso de psoas: dos entidades distintas en una misma localización. Comunicación del primer caso. Rev Hematol Mex 2014;15(3): 129-136. Medigraphic/52627.

9. Alemán-Iñiguez J, Alemán-Iñiguez V, Alemán-Iñiguez P. Higher prevalence of diabetic peripheral neuropathy associated with secondary hyperparathyroidism. Revista Portuguesa de Endocrinologia, Diabetes e Metabolismo 2023;18(3-4):143-148. Doi: 10.26497/AO210011.

Statements

Ethics committee approval and consent to participate

The study was approved by the Bioethics Committee of the Faculty of Medical Sciences at the Catholic University of Santiago de Guayaquil.

Consent for publication

This information was not needed because the present study did not publish images, radiographs or specific studies of patients.

Conflicts of interest

This research has no financial interests or conflicts of interest.

Author information

Anthony Josua Cortez Lainez, Medical Doctor at the Catholic University of Santiago de Guayaquil (Guayaquil, 2022).
Email:josua_cortez10@hotmail.com
ORCID https://orcid.org/0009-0001-8611-2294

Janeth Anavela Moya Abril, Medical Doctor at the Catholic University of Santiago de Guayaquil (Guayaquil, 2022).
Email:anavelamoya@hotmail.com
ORCID https://orcid.org/0009-0009-1728-7072

Roberto Leonardo Briones Jiménez, Doctor of Medicine and Surgery. School of Medical Sciences of the State University of Guayaquil (Guayaquil 2002). Doctor of Education Sciences, specialization in Educational Administration. Javeriana Polytechnic School of Ecuador (Quito, 2003). Doctor of Educational Sciences from the University of Havana (Cuba, 2019).
Email: robertobriones@cu.ucsg.edu.ec
ORCID https://orcid.org/0009-0009-2528-0823

Editor's Note

The Journal Actas Médicas (Ecuador) remains neutral with respect to jurisdictional claims in published maps and institutional affiliations.

Received: April 12, 2025.
Accepted: August 1, 2025.
Published: August 14, 2025.
Editor: Dra. Mayra Ordoñez Martínez.

How to cite:

Cortez A, Moya J, Briones R. Incidence of multidrug-resistant pulmonary tuberculosis in HIV-positive patients. A single-center observational study. Actas Médicas (Ecuador) 2025; 35 (2): 121-126.

Correspondence: Anthony Josua Cortez Lainez, Correo: Josua_cortez10@hotmail.com

Address: Av. Pdte. Carlos Julio Arosemena Tola km 1.5, Vía a Daule-Guayaquil. School of Health Sciences. ZIP Code 090615. Guayaquil - Ecuador. Telephone: [593] 4-220-6950.