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Original article

Epidemiological, clinical, therapeutic, and evolutive profile of multi-resistant tuberculosis in the city of Bukavu from January 2020 to December 2024.

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Abstract

Introduction
Multi-resistant tuberculosis is a silent health emergency in many countries with limited resources, including the Democratic Republic of Congo. This is an important threat to controlling tuberculosis. The objective is to describe the epidemiological, clinical, therapeutic, and evolving profile of multi-resistant tuberculosis in the city of Bukavu.

Methods
This is a multicentric, retrospective, documentary, descriptive, and analytical study conducted in five general reference hospitals in the city of Bukavu, with TB-MR units, over a period of five years, from 2020 to 2024. The analyses were made using the SPSS software.

Results
The prevalence was 1.3 %; The most represented age group was 35-44 years, or 36.7 %. The symptoms most presented during admission were cough, Fever, physical asthenia, anorexia, and nocturnal sweat. The nutritional state was characterized by thinness with a BMI <18.5 to 53.0%; The history of tuberculosis was noted in 75.5%. Alcohol and tobacco consumption were found, respectively, in 42.8% and 32.6%. A short therapeutic scheme was administered at 81.6 %; Levofloxacin, amikacin (91.8 %) were the most administered drugs; Healing was observed in 59.2%, and death in 16.3%; Young age was associated with a favorable evolution of TB-MR patients with a p p-value <0.002). The history of TB is associated with an unfavorable evolution of TB-MR patients (p-value = 0.015). HIV infection was associated with an unfavorable development (p-value <0.001). Family and/or community support was associated with a favorable evolution of TB-MR patients (p value = 0,000).

Conclusion
Multi-resistant tuberculosis remains frequent in the city of Bukavu and constitutes a diagnostic and therapeutic challenge. The involvement of all actors: health authorities, caregivers, and the community in the management of sensitive cases and the proper use of anti -anti-tuberculosis drugs remains essential.

Keyword: *Epidemiological, Clinical, Therapeutic, Evolutionary, Multi-resistant, Bukavu profile*
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Introduction

Tuberculosis (TB) remains one of the deadliest infectious diseases in the world, despite progress in diagnosis, prevention, and treatment [1]. Its multi-resistant form (TB-MR), defined as a form of TB resistant to at least rifampicin and isoniazide (the two most powerful anti-tuberculosis drugs), constitutes a global public health problem [2]. Africa represents approximately 25 % of global TB-MR cases, even though the region only has 3 % of global resources devoted to tuberculosis [3]. TB-MR is a silent health emergency in many countries with limited resources, including the DRC. Although the country has a structured national program for controlling tuberculosis, the challenges remain numerous: low rapid diagnostic coverage, inaccessibility to second-line sensitivity tests, lack of treatment monitoring, drug stock breaks, and overload of management units [4,8]. The Democratic Republic of the Congo (DRC) is one of the 30 countries with a high burden of tuberculosis and TB-MR according to the WHO [3]. According to the National Program to Combat Tuberculosis (PNLT), the number of notified TBPR cases was increasing (1236 in 2021 and 1614 in 2022). It was noted that 55 % of PR TB patients diagnosed in 2022 were new cases; the proportion of TBPR cases among new patients increased from 52 to 55 % while it

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regressed for reprocessing cases [4]. This problem represents a major health issue due to its long treatment (up to 24 months), toxicity, expense, and often poor tolerance by patients. In addition, its diagnosis is based on specialized tools (Genexpert MTB/RIF, second-line molecular tests, and crops), often unavailable in rural or peripheral zones [5].

In an urban context with high population density, such as Bukavu, factors such as poverty, promiscuity, malnutrition, interruption or irregularity of treatment, and HIV co-infection contribute to the spread and the selection of resistant strains [6]. However, few local studies have deeply analyzed the epidemiological, clinical, and therapeutic profile of TB-MR cases in the city's health structures. The sub-declaration of TB-MR cases, combined with frequent therapeutic irregularity, would contribute to the dissemination of resistant strains [9]. The absence of a clear epidemiological and clinical profile of TB-MR cases in local structures obstructs the implementation of targeted preventive strategies. A better understanding of the socio-demographic, clinical, and therapeutic characteristics of TB-MR patients is therefore essential to guide response, improve the quality of care, and reduce community transmission. This study intends to fill this void by analyzing, over a period of 5 years, the cases of TB-MR identified in five general reference hospitals of Bukavu: Panzi, Ciriri, Cub, Kadutu, and Nyamugo, to better understand the epidemiology, the presentation, typical clinic, applied therapeutic patterns, and evolution in victims. Is to determine the epidemiological, clinical, therapeutic, and scalable profiles of TB-MR patients in the five hospitals in Bukavu.

Methodology

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Study setting/area

The study was carried out in the Democratic Republic of Congo, in five hospitals in the city of Bukavu, in the province of South Kivu. The health situation in the city of Bukavu is affected by infectious diseases (epidemics of diseases such as malaria, cholera, typhoid fever are frequent, and it is precarious sanitary conditions and limited access to drinking water that exacerbate these health problems). Efforts are made to improve health, but challenges are still persistent.

Each of these health structures is found in one of the municipalities constituting the city of Bukavu. These are: HGR de Panzi (commune of Ibanda); Hgr Dr Rau de Ciriri (commune of Bagira); Hgr of Kadutu (commune of Kadutu); Ch. Cebca Nyamugo (commune of Kadutu); Bukavu University clinics (commune of Kadutu).

The choice of these centers is based on their ability to diagnose and process TB-MR as well as the availability of patient medical data.

Study design

This is a multicenter, retrospective, documentary study with descriptive and analytical purposes, which took place in the 5 health structures of the city of Bukavu, over a period of 5 years going from January 01, 2020, to December 31, 2024.

Study population

All patients diagnosed with TB-MR, confirmed by Genexpert or culture, and treated during the study period.

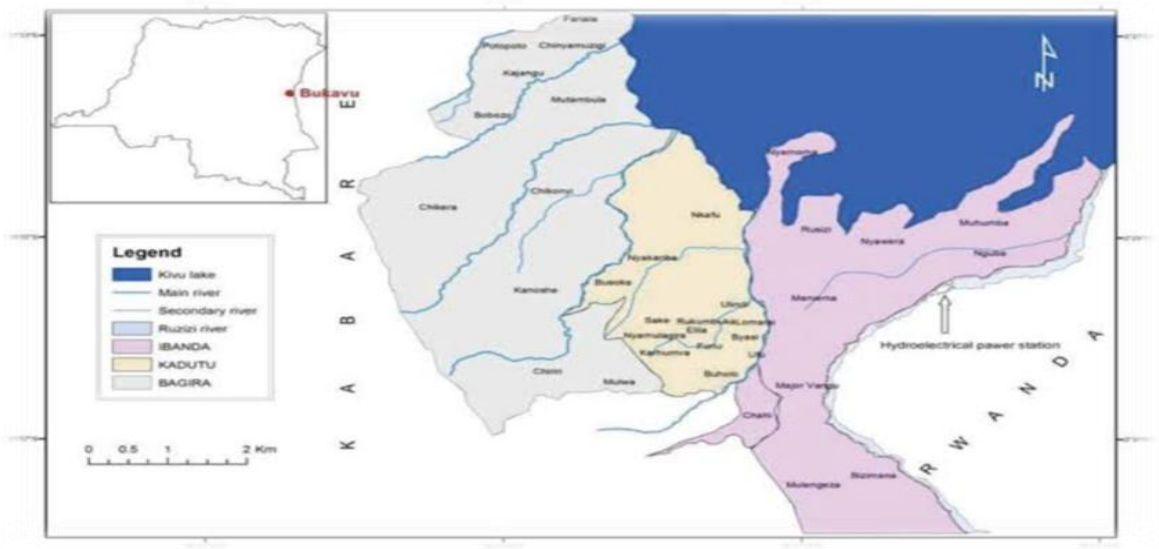

Figure 1 : Representation spaciale de la ville de Bukavu

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Sampling

The study opted for exhaustive sampling. The sample takes up patient files in which the sensitivity test has revealed resistance to isoniazide and/or rifampicin, and whose files contain sufficient data.

Criteria of Inclusion

The study included TB-MR cases confirmed by a positive test and patients with complete medical records.

Exclusion criteria

The study excluded cases that presented only a sensitive TB and cases for which no medical records were found.

Data collection techniques and instruments

The data was collected using an anonymous collection sheet established beforehand from the Laboratory TB-MR registers and medical records. The information not found in the files was obtained by telephone call or by appointment with patients.

The dependent variable

Evolutionary modality

Independent variables

Age, sex, matrimonial situation, profession, comorbidities, symptoms presented at admission, nutritional state, HIV status, TB history, alcohol and tobacco consumption, therapeutic scheme, effects, secondary, therapeutic outcome, family support or community in care, difficulties reported in access to treatment.

Data analysis

After encoding, the data were processed with Excel 2010 and analyzed using SPSS software. It was a question of determining the frequencies and percentages for descriptive analyses and as well as the factors associated with evolution (through the correlation tests between our dependent and independent variables), using the exact Fisher test. A regression was made to determine certain dependencies.

Ethics considerations

This study had authorization from the ethics committee of the official University of Bukavu, registered in the 020/2025 number, and followed the principles required for its realization. All research stages have been carried out in accordance with national and international ethical directives, in particular those stated in the Helsinki declaration.

Confidentiality

Participants' data have been strictly respected. However, throughout the realization of this work, we scrupulously observed the following scheme: obtain authorization from the official university of Bukavu via the Faculty of Medicine to conduct this study, and on the ground, obtain the informed consent of participants beforehand.

Results

Out of a total of 3596 tuberculous patients admitted to the HGR of Panzi, Ciriri, Kadutu, Nyamugo, and CUB, having made the sensitivity test during our study period, 49 multi-resistant patients were listed; Or a prevalence of 1.3 % of multi-resistant tuberculosis in the population of tuberculous patients. (Figure 2)

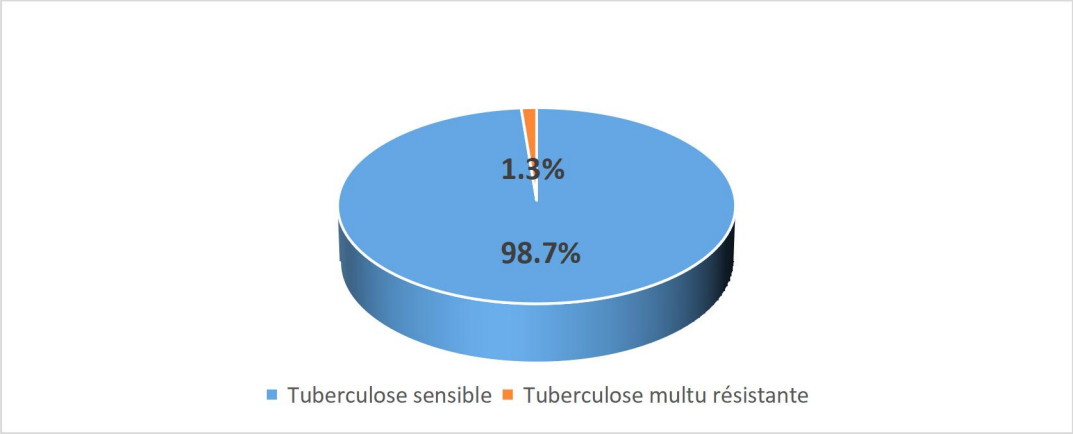

Figure 2. Prevalence of TB-MR

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Presentation of the socio-demographic characteristics of patients

In this study, the majority of respondents, 73.4 % were of male sex, with the masculinity ratio (m/f) equal to 2.7; the age group of 35 to 44 years or36.7 % was the most affected; Married people were the most represented, 69.3 %, followed by singles, 26.1 %. Most patients were 48.9% off without employment, and had a primary education level, 36.7 %, others had no level of education, or 26.5 %. Depending on the number of people living in the same household, the majority of our patients lived with six or more people, at 61.2 %.

Table 1. Socio-demographic characteristics of patients

VARIABLES	EFFECTIVES	POURCENT
Sex		
Feminin	13	26.5 %
Masculin	36	73.4 %
Age group		
15 à 24	7	14,2 %
25 à 34	15	30,6 %
35 à 44	18	36,7 %
45 à 54	6	12,2 %
>55	3	6,1 %
Marital status		
Single	12	24,4 %
Divorced	1	2,0 %
Married	34	69,3 %
widowed	2	4,1 %
Occupation		
Civil servant	4	8,1 %
unemployed	24	48,9 %
Informal worker	18	36,7 %
student	3	6,1 %
Education level		
No education	13	26,5 %
Primary	18	36,7 %
Secondary	10	20,4 %
Higher education	8	16,3 %
Number of people previously living in the same household.		
< à 6	19	38,7 %
≥ à 6	30	61,2 %

Clinical data

The results show that the majority of patients had pulmonary localization tuberculosis, 95.9%; The symptoms presented during admission had shown a cough> 2 weeks at 97.9%, fever 95.9%, physical asthenia 91.8%; The most presented symptoms is 24.4%dyspnea; Comorbidities that were associated with TB-MR was often malnutrition in 26 patients or 53.0%, diabetes in 8 patients or 16.3%; IH/AIDS in 7 patients or 14.2%, hypertension in 6 patients or 12.2%, and no other pathology in 19 patients or 38.7%; The majority of patients had a nutritional state characterized by thinness with BMI <18.5 or 53.0%.

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Table 2. Patient clinical data

Variables	Effectifs	Pourcentage %
Type of TB-MR		
Extra pulmonary	2	4,0 %
Pulmonary	47	95,9 %
Symptoms at admission		
cough >2 weeks	48	97,9 %
Hémoptysis (coughing blood)	11	22,4 %
Weight loss	44	89,7 %
Night sweats	39	79,5 %
Fever	47	95,9 %
Dyspnea (shortness of breath)	12	24,4 %
Chest pain	29	59,1 %
Physical weakness	45	91,8 %
Anorexia (loss of appetite)	43	87,7 %
Associated diseases		
None	19	38,7 %
Diabetes	8	16,3 %
Hypertension	6	12,2 %
Malnutrition	26	53,0 %
HIV/AIDS	7	14,2 %
Nutritional status		
BMI< 18,5	26	53,0 %
Normal BMI	16	32,6 %
Not recorded	7	14,2 %

History

These results show that the majority of patients, 75.5 % had a history of tuberculosis; Of all the patients, many previously had sensitive pharmacological tuberculosis, or 83.7%. The results show that 27 patients, or 72.9% had irregular follow-up of the previous treatment, and 16.2% had stopped the previous treatment. Only 30.6 % of patients had a family history of TB, and 42.8% of patients consumed alcohol and/or drugs; 32.6% of patients had a concept of current or past smoking.

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Table 3. The history of patients

Variables	Effectifs	Pourcentage %
History of TB		
No	12	24,4 %
Yes	37	75,5 %
Type previous TB		
unknown	2	5,4 %
Resistant	4	10,8 %
Sensitive	31	83,7 %
Adherence to previous treatment		
stopped	6	16,2 %
Irregular	27	72,9 %
Not specified	2	5,4 %
Régular	2	5,4 %
Family history of TB		
No	34	69,3 %
Yes	15	30,6 %
Alcohol or drug use		
No	28	57,1 %
Yes	21	42,8 %
Current or past smoking		
Non	33	67,3 %
Oui	16	32,6 %

Therapeutic data

The results show that of the 49 patients with TB-MR, more than 8/10 were under a short therapeutic regimen, 81.6%; Levofloxacin was the most administered drug at 93.8%; Good therapeutic observance was found in 36 patients, or 73.4%. Healing was observed in 29 patients (59.2%), death in 8 patients (16.3%), therapeutic failure in 6 patients (12.2%), 4 patients lost in view (8.2%), and 2 patients in treatment (4.1%).

Table 4. Therapeutic data of patients

Variables	Effectifs	Pourcentage %
Type of therapeutic regimen received		
Short regimen	40	81,6 %
Long regimen	9	18,3 %
Medications received		
Bedaquiline	24	48,9 %
Levofloxacin	46	93,8 %
Clofazimine	30	61,2 %
Linezolid	16	32,6 %
Amikacin	45	91,8 %
Ethambutol	43	87,7 %
Pyrasinamide	33	67,3 %
Therapeutic adherence		
good	36	73,4 %
poor	13	26,5 %
Evolution		
Death	8	16.3 %
Still on treatment	2	4.1 %
Cured	29	59.2 %
Lost to follow-up	4	8.2 %
Treatment failure	6	12.2 %

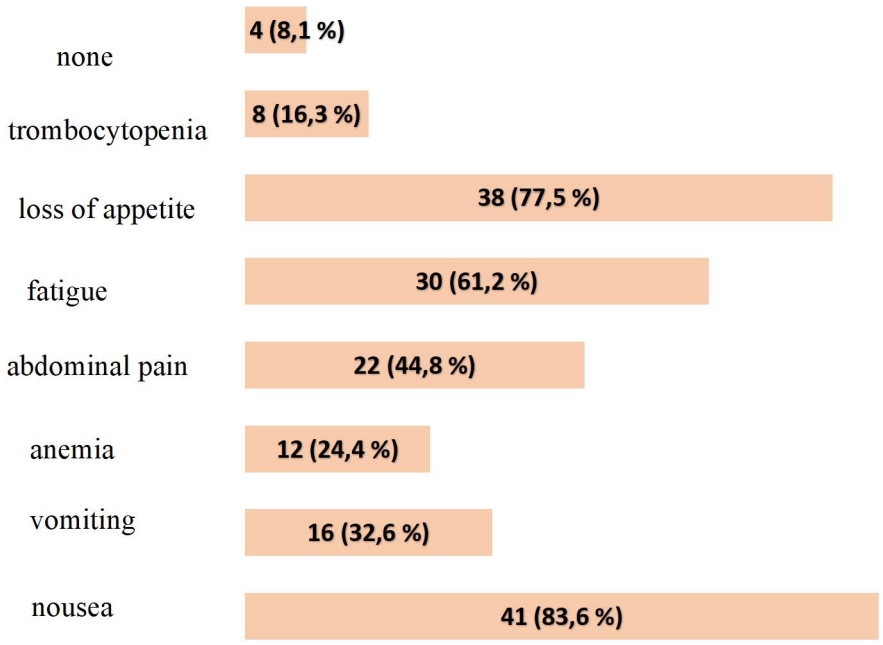

Figure 3. Répartition selon les effets secondaires rapportés chez 49 patients traités pour TB-MR

These results show that nausea (83.6 %) and loss of appetite (77.5 %) were the most reported side effects by patients.

Social environment and living conditions

These results show that 28.5% of patients lived in precarious housing and 10.2% in semi-dur housing; Many did not have access to drinking water at 53.0 %; 73.4 % of patients had family and/or community support in management.

Table 5. Social environment and living conditions

Variables	Effectifs	Pourcentage %
Type of housing		
Solid structure	30	61,2 %
Precarious	14	28,5 %
Semi solid	5	10,2 %
Access to drinking water		
yes	23	46,9 %
No	26	53,0 %
Family or community support in care		
No	13	26,5 %
yes	36	73,4 %

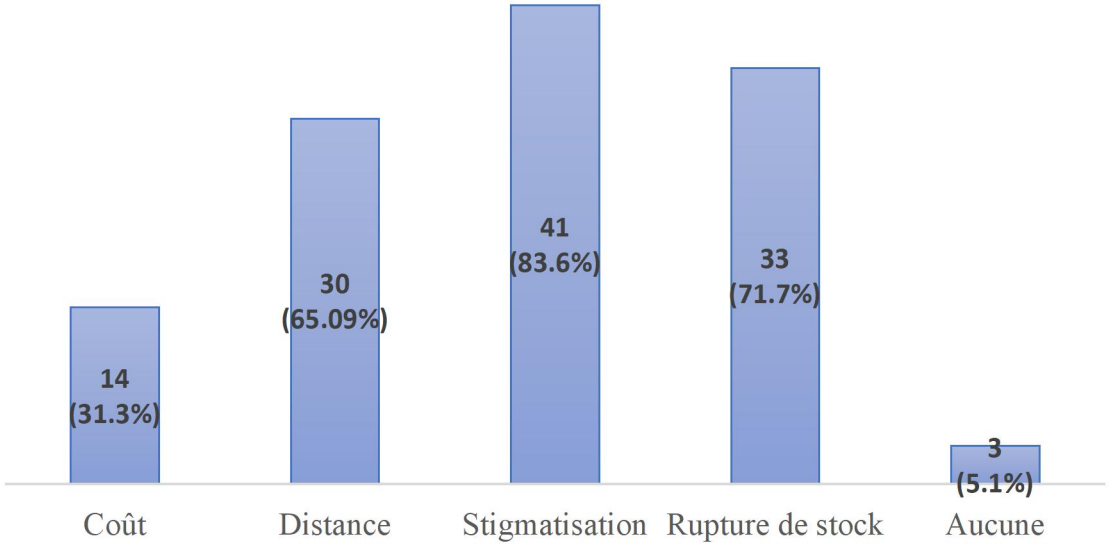

Figure 4. Répartition des patients selon les problèmes d'accès au traitement

According to these results, the stigma, the rupture of stocks, and distance were the most reported problems in access to treatment.

Table 6. Factors associated with the evolution of patients

Variables	Death	Thérapeutic failure	In treatment	Cured	Lost sight of	ddl	P-value
patient age						16	0,002
> 55	6,1%	0,0%	0,0%	0,0%	0,0%		
15 à 24	0,0%	2,0%	0,0%	8,2%	6,1%		
25 à 34	2,0%	0,0%	4,1%	22,4%	0,0%		
35 à 44	4,1%	6,1%	0,0%	24,5%	2,0%		
45 à 55	4,1%	4,1%	0,0%	4,1%	0,0%		
history of TB						4	0,015
Don't have	0,0%	0,0%	4,1%	16,3%	4,1%		
Have	16,3%	12,2%	0,0%	42,9%	4,1%		
HIV history						8	0,001
Inconnu	0,0%	0,0%	0,0%	2,0%	0,0%		
Négatif	4,1%	10,2%	4,1%	57,1%	8,2%		
Positif	12,2%	2,0%	0,0%	0,0%	0,0%		
Family and community support						4	0,000
Had no support	8,2%	8,2%	0,0%	4,1%	6,1%		
Dad support	8,2%	4,1%	4,1%	55,1%	2,0%		

It appears from this table that the young age was associated with the favorable evolution of patients with multi-resistant TB. (p-value <0.001). The history of TB had a significant impact on the unfavorable evolution of patients with multi-resistant tuberculosis. (P = 0.015) HIV infection had an unfavorable impact on the evolution of patients with multi-resistant tuberculosis (p-value <0.001). Family and/or community support in the management of patients with multi-resistant TB contributed significantly to favorable evolution. (P = 0.001).

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Discussion

Epidemiologiqes

The study focused on 49 TB-MR patients, representing 1.3 % of hospitalized tuberculous patients who underwent the sensitivity test during our study period. The prevalence of multi-resistant bacteria is variable according to studies and regions. These results are far lower than those of Frenniere et al. in Canada in 2018, which found (10, 1%) [12].

An increase in cases according to the years has been observed; this evolution is part of a broader context as described by the Global TB Report 2023 of the WHO [13], which reports a global resurgence of COVVI-9 Post-Pandemia cases, linked to the disruption of health services and the relaxation of therapeutic monitoring. In the series, the study noted a male predominance with a percentage of 73.4 % and a sex-ratio man to woman of 2.7; While other studies have found a male predominance respectively in (61.9 %) and (70.5 %) [14] [15]. This male predominance could be explained on the one hand by the fact that men are more exposed to alcoholic poisoning and especially tobacco, which is a factor promoting the weakening of parenchyma-pulmonary, and on the other hand by the hypothesis that they are less likely to respond to treatment and more likely to receive inadequate treatment. The age group of (35 to 44) was the most represented, with 36.7 %, according to the study by Freniere et al. In 2020 also found an age group of 35 to 44 years respectively in 41.3% [12]; on the other hand, the study by Niang et al. found an age group of 25 to 34 years in 70.0 %. [16]. This observation corroborates with WHO data [13] and with the study by Knuchel et al. In 2016, in Switzerland that the majority of patients infected with TB-MR were young people and were aged between 25 and 44 years [17]. This could be explained by the predisposition of this age group to risk factors for resistance (alcohol, tobacco, etc.) and non-observance of treatment following their numerous concern (study, work, etc.). In our study, the majority of patients had a level of primary education (36.7 %). These results agree with those of Ciza F., who found that the majority had a primary level of education. Most of them, in his series, found that two-thirds of patients were made up of those who attended primary school and were illiterate. This predominance of a low level of instruction among TB-MR patients can be explained by several factors: a limited educational level constitutes a major obstacle to strict compliance with treatment and the recognition of alert signs. In addition, these patients often come from disadvantaged socio-economic environments, which limit their access to care and increase their vulnerability to the disease. In this study, unemployed subjects represented 48.9 % of all cases. In Morocco, the studies carried out have proven that multi-resistant tuberculosis was more frequent in patients without a profession. Indeed, according to the S. Baina series in Rabat, (58%) of patients were without profession [19]. The results were similar to the study of M.elhamdouni in 2019, relating to 101 patients, according to which (49.5%) of patients included were without profession [20].

Clinical data

The study results indicate that pulmonary tuberculosis is the most common form of TB-MR in patients included in the study, representing 95.9 % of cases. A study conducted by Mase et al. (2019) found that (91.3 %) of TB-MR cases were pulmonary [21], which confirms our results. Another study carried out in Senegal by Ndiaye et al. (2020) showed a similar proportion, with 93.8 % of pulmonary TB-MR [22]. These observations confirm that the pulmonary form predominates in TB-MR and that extrapulmonary cases are rare, often underdiagnosed or more difficult to confirm microbiologically. The results show that the most frequent symptoms in patients with multi-resistant tuberculosis (TB-MR)Admission were: cough (97.9 %), fever (95.9 %), physical asthenia (91.8 %), weight loss (89.7 %), anorexia (87.7 %), night sweats (79.5 %), a study conducted in West Africa by Tadjó et al. (2021) [23], reported similar rates: cough (96.5 %), fever (93.2 %), weight loss (85.7 %) and night sweats (78.4 %). These clinical signs are typical of active tuberculosis, whether sensitive or resistant, which underlines the difficulty of clinically distinguishing a TB-MR from a sensitive TB without microbiological tests. According to diseases associated with TB-MR, the results indicate that almost 61.2 % of patients had at least one comorbidity associated with multi-resistant tuberculosis (TB-MR). Malnutrition was the most frequently found comorbidity, defined by a BMI <18.5, affecting more than half of the patients (53.0 %), followed by diabetes (16.3 %), HIV/AIDS (14.2 %), and hypertension (12.2 %). Only 38.7 % of patients do not present any other associated pathology. A study in Nigeria (ONI et al. 2018) [24] showed that malnutrition affected 45 to 60 % of TB-MR patients, results very close to this series. This high rate highlights the bidirectional link between TB and undernutrition. Tuberculosis aggravates malnutrition with hypercatabolia and anorexia, while a precarious nutritional state weakens immunity, promoting infection. HIV is a well-established cofactor in the occurrence and evolution of TB, including TB-MR. IVH immunosuppression promotes therapeutic failure and the selection of resistant strains. Diabetes, in particular, is recognized as a factor of poor prognosis in tuberculosis, promoting drug resistance.

Antecedents

The history of tuberculosis was found in 75.5 % of patients with TB-MR. This result underlines the major role of the history of tuberculosis in the emergence of resistant forms.

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These data are comparable to those reported by Hirama et al., who found a rate of 34.8 % [25] lower than that of Okemba-Okombi et al., who observed an even higher frequency (88.6 %) [26]. This variation could be linked to inclusion criteria, local epidemiological contexts, or the accessibility of diagnostic and therapeutic monitoring services. Two studies carried out in Russia and Brazil have shown that patients with respiratory pathology are more disposed to TB-MR [27] [28]. The history of tuberculosis is indeed a well-documented risk factor for the development of multi-resistant TB. Resistance may result from a premature interruption of treatment, insufficient observance, or unsuitable therapeutic patterns during previous episodes. In our study, the majority of patients with TB-MR had a history of pharmaco-sensible tuberculosis (83.7 %). These results are in accordance with those reported by Olalye et al. (2021). In a study conducted in Kenya, 79.1 % of TB-MR cases had also been preceded by a TB Pharmaco-Sensible [29]. This trend suggests a generalized problem in sub-Saharan Africa, where the insufficiency of therapeutic education of patients, the lack of rigorous monitoring, and frequent treatment interruptions promote the mutation of sensitive strains to resistant forms. In our series, the majority of patients 72.9 % had irregular taking in previous anti -tuberculosis treatment, this observation complies with the results of a study by Nshimiyimana et al. (2020) in Rwanda, which showed that 68.2 % of TB-MR patients had irregular observance [30], this could be explained by the lack of community support, the side effects of drugs, social stigmatization, stock-out of drugs, occupations daily, forgetting medication and poverty during anti -tuberculosis treatment.

According to the results of this study, only (30.6 %) of patients presented family history of tuberculosis, a study carried out in Nigeria by Olleye et al. (2021) reported that (36.8 %) of TB-MR patients had a family member who already contracted the TB [31], although the existence of family history is a significant risk factor, this result confirms that TB can also touch individuals without apparent family history,

In this study, tobacco and alcohol poisoning were found respectively in 32.6 % and 42.8 %. History of these poisonings had been found in different proportions in this study by: Okemba-Okombi et al. [26] (Tobacco: 46.2%, alcohol: 38.5%), Mejri et al. [32] (Tobacco: 75%, alcohol: 30%). Ethyl patients are generally unobservant of their treatment, which promotes the development of resistance to anti -anti-tuberculosis, and also alcohol weakens the immune system and exacerbates comorbidities (hepatitis, HIV ...). On the other hand, tobacco is a well-established risk factor in the appearance, recurrence, and gravity of pulmonary tuberculosis, but opinions diverge about the relationship between smoking and multi-resistance.

Therapeutic data

The results of the study show that 49 TB-MR patients (81.6 %) were put on a short diet; this observation is greater than the results of a study carried out by NGOMBA et al. (2019) in Cameroon, who showed that 75 % of TB-MR patients were treated with the short diet [33]. This predominance of the short diet can be explained by several factors: better observance of the patient thanks to a shorter duration (9–11 months against 18–24 months), less cumulative toxicity, cost reduction for health systems, and recent recommendations in favor of its use in certain contexts. According to the distribution of drugs administered in TB-MR patients. We note that: the most frequently used drugs are: levofloxacin (93.8 %), amikacin (91.8 %) and the least used are: Bedaquiline (48.9 %), Linezolid (32.6 %), a study carried out by Habimana et al. (2021) in Rwanda has shown that the use of Levofloxacin (95 %) and Amikacin (78 %) remained dominant due to limited access to bedaquiline, used in only 30 %of patients [34]. These results reflect a significant use of conventional molecules for TB-MR treatment, although the most recent drugs, such as bedaquiline and linezolid, are less frequent; this can be explained, possibly due to their limited availability or high cost in certain contexts. According to therapeutic observance, 73.4 % of patients had good therapeutic observance, these resultscorroborate with those of Essabah Haraj et al. (2020) in Morocco which found a good therapeutic observance rate in 72 % of TB-MR patients [35], this rate of good compliance can be deemed acceptable, but remains below the target of 90 % recommended by the WHO to ensure therapeutic success. In our series, the side effects reported by patients are dominated by gastrointestinal disorders, including nausea (83.6 %) and loss of appetite (77.5 %), these results agree with those of Ndjeka et al. (2019) in South Africa, which had also identified a high prevalence of nausea (81.2 %) and the loss of appetite among TB-MR patients [36]. These results confirm that TB-MR treatment remains heavy and difficult to tolerate by the majority of patients and underline the need for rigorous monitoring, early management of side effects, as well as suitable nutrition and psychosocial support. The use of tolerated molecules such as Bedaquiline or Delamanid, according to WHO recommendations, should be envisaged to improve treatment for treatment and therapeutic results.

Depending on the evolutionary methods, 59.2 % of patients had a favorable evolution. This result is lower than that of Okemba-Okombi et al. [26], who found 61.5%. This result could be explained by the specificity of each population studied because the therapeutic regimes are almost the same and have a duration of at least 20 months. We recorded 16.3 % of deaths. This result is higher than that of Ouédraogo et al. [37] in 2014 in Burkina Faso and Anon et al. [38] in 2020 in Côte d'Ivoire, who found respectively (5.1 % and 10.2 %) of deaths. This could be explained by the different PNT action strategies, the delay in

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consultation, the poor hospitalization condition, and the care of patients by health personnel working under difficult conditions (lack of protective means).

Social environment and living conditions

The results according to the quality of the housing indicate that almost 38.7 % of patients lived in precarious or semi-dur housing. A study conducted in Burkina Faso (Zida et al. 2017) revealed that 42 % of tuberculous patients lived in precarious dwellings [39]. These results show that inadequate housing conditions can not only increase the transmission of tuberculosis but also compromise the observance of treatment and promote relapses.

This series of studies shows that 73.4 % of patients had benefited from family and/or community support, according to the study by Sarr et al. (2021). In Senegal, 68 % of TB-MR patients declared to benefit from regular family support [40]. Support during treatment is recommended in all strategies to combat TB-MR by the WHO because this support improves therapeutic observance, reduces the risk of relapse or abandonment of treatment, and contributes to the patient's psychological well-being.

Factors associated with the evolution of patients

Depending on the evolution of patients with TB-MR, we found that the healed patients were in the age groups of 25-34 years and 35-44 years and (37.5%); A statistically significant association between the age and the evolution of the patient (P-Value of 0.002), according to the study by Chang et al. (2015) in China: showed that the maximum therapeutic success rate observed in the age group 25–44 years (> 70 %) and that patients> 60 years were 2 times more risk of failure or death [41]. This could be explained by the fact that young adults (25-44 years old) generally have less comorbid, better tolerance for treatment, stronger therapeutic membership and better social and economic support while the elderly (> 55 years): Present associated pathologies (diabetes, hypertension, kidney failure), fewer immune reserves, more risk of iatrogenic complications, less access to care or social support. In our population, according to the evolution of patients with TB-MR, the history of TB was significantly associated with an unfavorable evolution (p = 0.015). A study carried out by Kibret et al. (2017) reported that patients with TB history had a risk 2 to 3 times higher of developing TB-MR and have a bad prognosis [42]. These results can be explained by the fact that patients with TB history have often been exposed to previous anti-tuberculosis treatments, sometimes poorly conducted (interruption, non-observance, bad dosage, etc.). This promotes the emergence of resistant strains that are difficult to treat and are responsible for therapeutic failures.

Depending on the evolution of patients with TB-MR, we found that 96.5% of healed patients were HIV negative and (75.0%) of deaths were positive HIV, hence a statistically significant association between HIV status and the evolution of TB-MR (P-Value <0.001), the study by Lawn et al. (2011): has shown that TB/HIV co-infected patients have up to 5 times more risk of death than non-infected [43]. These results can be explained by the fact that HIV weakens cellular immunity, making defense against Mycobacterium tuberculosis difficult. In our evolution of patients with TB-MR, we found that 93.1% of healed patients had family and/or community support in management; Statistically significant values in relation to family and/or community support in care were observed (P-value of 0.001). A study done in South Africa (Loveday et al. 2018) has shown that TB-MR patients enjoying structured family and/or community support had a successful therapeutic rate greater than 70 %, compared to 45 % without support [44]. This can be explained by the fact that family support facilitates treatment adherence, reduces stigma, and allows regular monitoring. But without support, patients can: abandon treatment (loss of sight), poorly follow it (therapeutic failure), or develop complications (death or relapse).

Generalization of results

Logically, these results do not apply to the entire DRC. However, the study environment was selected taking into account its variety and relevance in relation to the research objective.

Conclusion

Multi-resistant tuberculosis remains frequent in the city of Bukavu and constitutes a diagnostic and therapeutic challenge. Several factors are associated with the evolution of the patient victim; like young age (P-Value <0.001); the tb history (p = 0.015); HIV infection (p value <0.001); and family and/or community support in the management of patients with multi-resistant TB (p value = 0.001); Thus the involvement of all actors: health authorities, caregivers, and the community in the management of sensitive cases and the proper use of drugsanti -tuberculeux remains essential.

Study limits

- Collective bias:
- Measuring errors that have a negative impact on data quality
- There was incompleteness in certain medical records
- The lack of detailed biological data, in particular on secondary resistance.

- A selection bias, linked to the retrospective character of the study.

Contribution of authors

All the authors have read and approved the final manuscript. However, since the start of the development of the research protocol until the conclusion, the entire team (group members) has participated in each stage.

Data availability

Data is available upon request from the author.

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