ORIGINAL ARTICLE

Analysis of the Therapeutic Approach to Drug-Sensitive Tuberculosis in Morocco: Retrospective Study from 2014 to 2017

Fadia Bejja[1*], Badreddine Dahou[2], Fatiha Aboulhoda[3], Abdelrhani Mokhtari[4], Abdelmajid Soulaymani[5]

ABSTRACT

In countries like Morocco, drug-sensitive tuberculosis remains a major public health burden. Effective management of this condition is crucial, not only to achieve positive therapeutic outcomes for patients but also to curb its emergence and transmission. This study presents a detailed analysis of the therapeutic approach to drug-sensitive tuberculosis in Morocco.

This retrospective study provides an overview of the therapeutic protocol used to treat drug-sensitive tuberculosis. The study examined all tuberculosis patients registered at the Tuberculosis and Respiratory Diseases Diagnostic Center in Kenitra from 2014 to 2017. A total of 5207 tuberculosis cases were recorded, with men comprising the majority of patients (63%) in this group, with a sex ratio of 1.7. The most affected age groups were 15 to 24 years and 25 to 34 years. Urban areas had a representation of 53%. The study revealed that 54% of cases were pulmonary, and extrapulmonary tuberculosis accounted for 46%. There were two main stages to the treatment regimens recommended by the WHO. During the initial phase, 96% of patients received a two-month quadritherapy (for new cases), 3% received a three-month regimen (for retreatment cases), and 2% received a three-drug therapy (for those under 15 years). This phase was followed by a continuation phase (bitherapy) lasting four to ten months. 82% of cases showed positive progression, 13% of patients experienced loss to follow-up, 1% had transfers out, and 2% of patients died.

The study emphasizes the importance of integrating patient support, education on treatment, and the use of new technologies to enhance the monitoring and follow-up of tuberculosis patients. These measures could help reduce the morbidity and mortality associated with tuberculosis, contributing to overall health improvement.

Keywords

Tuberculosis, Management, Protocol, Treatment, Drug-sensitive, Morocco

I. INTRODUCTION

Tuberculosis (TB) is a disease that has been present in human history for millennia. It was long considered incurable and fatal, but advances in medicine now allow for the treatment and cure of most cases of tuberculosis. However, the fight against this disease remains a major challenge in many countries, especially in regions with limited medical resources[1].

Mycobacterium tuberculosis is a bacterium that causes the infectious disease TB. While it predominantly affects the lungs, it can also spread to other parts of the body, such as lymph nodes, bones, joints, and the central nervous system[2]. It continues to be a significant global public health concern, with approximately 10 million new cases and 1.5 million deaths reported in 2022[3]. Morocco is classified as a country with a moderate incidence of tuberculosis, with an estimated 35,000 reported cases in

1. Fadia Bejja, Laboratory of Biology and Health, Faculty of Science, Ibn Tofail University, Kenitra, Morocco
2. Badreddine Dahou, Laboratory of Biology and Health, Faculty of Science, Ibn Tofail University, Kenitra, Morocco
3. Fatiha Aboulhoda, Laboratory of Biology and Health, Faculty of Science, Ibn Tofail University, Kenitra, Morocco
4. Abdelrhani Mokhtari, Laboratory of Biology and Health, Faculty of Science, Ibn Tofail University, Kenitra, Morocco
5. Abdelmajid Soulaymani, Laboratory of Biology and Health, Faculty of Science, Ibn Tofail University, Kenitra, Morocco

Correspondence

Badreddine Dahou, Laboratory of Biology and Health, Faculty of Science, Ibn Tofail University, Kenitra, Morocco.
Email: badreddine.dahou@gmail.com

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2021, resulting in an incidence rate of 94 per 100,000 population[4].

The treatment of tuberculosis is effective when administered properly. The World Health Organization (WHO) advises administering four drugs—isoniazid, rifampicin, pyrazinamide, and ethambutol—over the course of six months as the standard treatment for drug-sensitive tuberculosis[5-6].

However, despite the effectiveness of treatment, there are still major challenges in the fight against tuberculosis in Morocco. Early diagnosis of the disease remains a problem, often resulting in delayed patient management. Additionally, there is a high prevalence of multidrug-resistant tuberculosis, meaning some patients do not respond to first-line drugs and require longer and more expensive treatments[7]. The Moroccan government and health organizations are working collaboratively to address the lack of awareness and knowledge about tuberculosis among the population, aiming to strengthen screening, improve access to healthcare, and raise awareness about prevention and treatment.

Our study aimed to provide a comprehensive analysis of therapeutic approaches related to drug-sensitive tuberculosis in the province of Kenitra, Morocco.

II. Materials and Methods:

a. *Objective:*

This study aims to analyze the therapeutic procedure used to treat drug-sensitive tuberculosis, with a focus on the therapeutic protocol followed in Morocco from 2014 to 2017.

b. *Study Population:*

During this period, all notified and monitored cases of drug-sensitive tuberculosis in the province of Kenitra were included in a comprehensive sample, excluding cases of drug-resistant tuberculosis.

c. *Variables:*

The studied variables included age, gender, place of residence, therapeutic history (new or retreatment cases), type of tuberculosis (pulmonary or extrapulmonary), therapeutic regimens, and treatment outcomes. Data were collected from patients' medical records and statistically analyzed to determine trends and factors associated with treatment effectiveness. The results of this study will enhance understanding of the therapeutic management of drug-sensitive tuberculosis in Morocco and identify potential gaps in the healthcare system. This could contribute to improving public health policies and optimizing treatment protocols for this disease.

d. *Data Analysis:*

The Statistical Package for the Social Sciences (SPSS) version 20.0 (trial version) was used for data analysis. Descriptive analysis was employed to describe the characteristics of the study population. We examined categorical variables using frequency distributions and evaluated quantitative variables by assessing measures of central tendency and dispersion.

e. *Ethical Considerations:*

All data were treated confidentially and securely, following current data protection regulations. Measures were taken to ensure the confidentiality of information and prevent unauthorized disclosure.

f. *Conflicts of Interest:*

The authors declare no conflicts of interest.

III. Results:

Therapeutic regimens for tuberculosis vary depending on the type of disease, patient age, and therapeutic history. These variations are based on scientific evidence demonstrating that tailored treatment regimens are more effective and result in fewer complications.

a. *Type of Disease:*

The localization of the disease plays a crucial role in

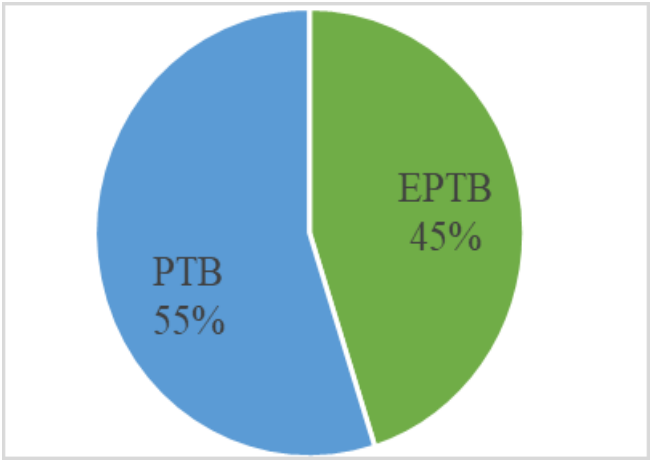

Figure 1: Distribution of Tuberculosis Patients According to the Tuberculosis Form

determining the therapeutic regimen. Among the 5207 recorded tuberculosis cases, 2860 were pulmonary tuberculosis, while 2347 were extrapulmonary tuberculosis, according to sociodemographic data. It is noteworthy that tuberculosis is distributed fairly evenly between the two types of disease, emphasizing the importance of considering different disease types in prevention and treatment strategies.

Men accounted for 62.9% (3273 individuals) of affected subjects, while women represented only 37.1% (1934 individuals) of affected subjects. These results indicate a strong male predominance. Among individuals with active tuberculosis, bacteriological confirmation accounted for 52% of cases, with 3% having extrapulmonary localization. In contrast, 48% of patients initiated antibacterial treatment based solely on clinical or histological examination without bacteriological confirmation (42% of cases). This was primarily observed in cases of extrapulmonary tuberculosis.

b. Patient Age:

Children may face challenges in assimilating medications. For these individuals, triple therapy is often recommended for a duration of six months. The average age was 37.1 ± 18.4 years among patients with drug-sensitive tuberculosis. The youngest recorded age is 4 months, while the oldest age is 99 years. It is noteworthy that drug-sensitive tuberculosis primarily affects individuals aged 15 to 34 years, with this age group representing half of the patients. Additionally, a prevalence of males among these cases is noteworthy (Figure 2).

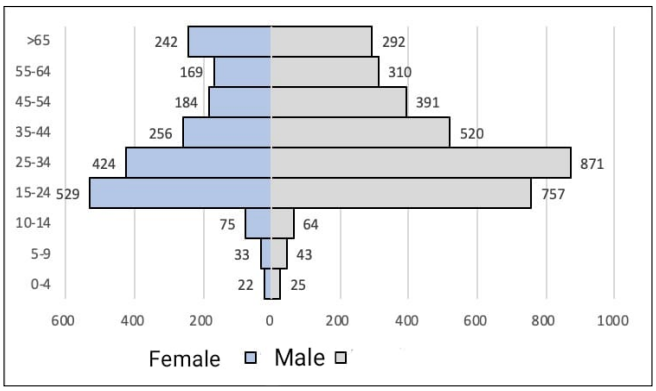

Figure 2: Distribution of Patients According to Age Groups and Gender

The geographical distribution of patients included in our study is as follows: 53% of patients come from urban areas, 45% from rural areas, and 2% from correctional facilities.

c. Therapeutic History:

The majority of study subjects, approximately 94% of patients, are individuals who have never had tuberculosis before. There are 2206 cases of extrapulmonary tuberculosis and 2705 cases of pulmonary TB. However, 377 individuals have previously been infected with the disease, with 237 experiencing a relapse; 112 with EPTB and 125 with the pulmonary form; 30 have resumed treatment after an interruption; 20 EPTB and 10 PTB; 10 patients have been considered cases of therapeutic failure; 4 EPTB and 6 PTB; and 19 individuals with a therapeutic history of unknown nature; 5 EPT and 14 PTB.

Table 1: Presentation of Cases According to Patient Categories

Patient Category	EPTB	PTB	Total
New Patient	2206	2705	4911
Relapse	112	125	237
Previously Treated	20	10	30
Unknown Treatment History	5	14	19
Therapeutic Failure	4	6	10
Total	2347	2860	5207

d. Therapeutic Regimens:

For children and individuals weighing less than 25 kg, it is recommended to use a triple therapy RHZ at the beginning of the treatment, then switch to a dual therapy RH in the continuation phase. For adults and individuals weighing over 25 kg, it is recommended to use quadruple therapy (RHZE) in the initial phase of treatment. In situations involving relapse, therapeutic failure, or resumption, the duration of the initial treatment phase is extended to three months. For situations requiring retreatment, it is generally recommended to use a combination of two drugs, with a treatment duration ranging from 5 to 7 months. For severe forms of tuberculosis, such as osteoarticular, meningeal, or disseminated tuberculosis, it is sometimes necessary to extend the treatment duration to 9 to 12 months (Table 2).

Table 2: Distribution of Patients According to Therapeutic Protocol

	Therapeutic Protocol	Frequency	Percentage
Triple therapy	2 RHZ/10 RH	2	0,04%
	2 RHZ/4 RH	73	1,40%
	2 RHZ/7 RH	10	0,19%
Quadruple therapy	2 RHZE/ 7RH	1	0,02%
	2 RHZE/10 RH	26	0,50%
	2 RHZE/4 RH	4740	91,03%
	2 RHZE/5 RH	1	0,02%
	2 RHZE/6 RH	15	0,29%
	2 RHZE/7 RH	191	3,67%
Retreatment	3 RHZ /4 RH	1	0,02%
	3 RHZE/5 RH	145	2,78%
	3 RHZE/7 RH	2	0,04%
Total		5207	100

e. Therapeutic Outcome:

The therapeutic success rate of drug-sensitive tuberculosis in our study is 82%, corresponding to 4263 individuals who successfully completed their treatment. In contrast, 14% were lost to follow-up, and 124 cases resulted in death. These results highlight a marked difference between therapeutic success rates and cases of death. This disparity emphasizes the need to improve patient follow-up measures and optimize treatment strategies to reduce the number of tuberculosis-related deaths.

Table 3: Distribution of Tuberculosis Patients According to Therapeutic Results

	Frequency	Percentage
Death	124	2
Cure	1907	37
Not assessed	117	2
Lost to follow-up	703	14
Treatment completed	2356	45
Total	5207	100

IV. DISCUSSIONS

The results of this study highlight significant gender differences in the prevalence of tuberculosis. Men are notably more affected, representing 62% of patients, while women constitute only 37%. This trend aligns with numerous previous studies that have also observed a higher frequency of tuberculosis among men in different regions worldwide[6]. The pronounced male preference in this study may be attributed to social, economic, and behavioral factors specific to the studied population. Previous studies have emphasized that men are often exposed to an increased risk of tuberculosis due to risky behaviors, unfavorable living conditions, and limited access to healthcare services[8-9]. It is crucial to understand the underlying factors contributing to this higher prevalence among men in tuberculosis cases in order to implement tailored prevention and awareness measures for this group.

The use of bacteriological confirmation in only 52% of patients with active tuberculosis raises concerns regarding diagnosis and treatment. Bacteriological confirmation is crucial for proper management as it allows for accurate identification of the pathogen and contributes to selecting the most effective treatment[10]. Relying on treatments based solely on clinical or histological examinations without bacteriological confirmation, as observed in 48% of patients, can lead to misdiagnoses and compromise treatment effectiveness. Furthermore, the history of previous tuberculosis treatments has been identified as the primary independent risk factor for drug-resistant TB[11].

The differentiated therapeutic phase approach varies based on patients' weight and age and is in line with current WHO recommendations[12]. This customization aims to optimize treatment effectiveness while reducing undesirable side effects through the use of combined formulations. According to accepted clinical procedures, the duration of treatment for severe cases of tuberculosis may increase by nine to twelve months. Previous studies, including that of Modi et al.[13], have also shown that longer treatments may be necessary for more severe forms.

The standard treatment for tuberculosis has demonstrated improved clinical and functional outcomes, resulting in patient recovery[14]. While the 82% success rate is positive, the 14% of cases lost to follow-up and 124 deaths underscore persistent gaps and challenges in

tuberculosis management. Previous studies, including Abubakar's in 2019, have shown that treatment interruptions are linked to housing absence and a lack of awareness of the disease's severity, suggesting an improvement in patient education and emphasizing the importance of close monitoring and measures to minimize treatment interruptions[15].

The disparity between positive outcomes and negative consequences highlights the importance of improving therapeutic approaches. It is conceivable to reduce these disparities by using treatments that promote patient cooperation, enhance medical follow-up, and address risk factors associated with loss[13,14]. The importance of considering sociocultural factors in prevention programs is emphasized by mentioning the male preference in tuberculosis cases. Research such as Hertz's has shown that a thorough understanding of social determinants is necessary to design effective treatments[9]. This is particularly crucial in the case of extrapulmonary tuberculosis, where concerns are raised about the limited use of bacteriological confirmation in diagnosis and treatment[16].

Despite progress in treatment, challenges remain in tuberculosis management, such as cases of patients lost to follow-up and deaths[17]. To make treatment plans better, we need to look at the whole picture. This includes educating the community about the disease, reducing the stigma surrounding tuberculosis, setting up mental health and social support services, and using mobile health interventions to improve DOTS surveillance [18]. Moreover, it is crucial to strengthen collaboration among different healthcare stakeholders, such as healthcare professionals, non-governmental organizations, and government agencies, to ensure effective coordination in the fight against tuberculosis. By combining these efforts, it is possible to enhance tuberculosis management and reduce loss rates.

V. CONCLUSION

This study highlights the complexity of tuberculosis management, shedding light on both encouraging results and persistent challenges that require an integrated and personalized approach. Continuous improvement in the quality of care, easy access to treatments and healthcare services, and the promotion of patient education are essential elements to maximize the effectiveness of tuberculosis treatment. The treatment of this disease plays a crucial role in the overall measures aimed at ensuring effective tuberculosis control. Taking these factors into account can lead to a significant reduction in progressive tuberculosis cases and an overall improvement in public health in Morocco.

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Authors's contribution:

Data gathering and idea owner of this study: Bejja Fadia

Study design: Bejja Fadia

Data gathering: Fadia Bejja, Badreddine Dahou, Fatiha Aboulhoda, Abdelrhani Mokhtari, Abdelmajid Soulaymani.

Writing and submitting manuscript: Bejja Fadia

Editing and approval of final draft: Bejja Fadia

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