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(RESEARCH ARTICLE)

Epidemiology and biological diagnosis of tuberculosis in Beni-Mellal

Hajiba Azza [1, 2, *], Ouijdane Kajjoune [1, 3], Lamiae Arsalane [1, 3], Said Zouhair [1, 3] and Youssef El kamouni [1, 3]

[1] *Bacteriology-Virology Laboratory of Avicenna Military Hospital, Marrakech, Morocco.*
[2] *Faculty of Medicine and Pharmacy of Agadir, Ibn Zohr University, Morocco.*
[3] *Faculty of Medicine and Pharmacy of Marrakech, Cadi Ayyad University. Morocco.*

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Abstract

Introduction : Tuberculosis remains a major public health problem, particularly worrying in developing countries such as Morocco. The aim of this study is to describe and analyze the epidemiological and microbiological data of tuberculosis in Beni Mellal during the year 2020.

Methods : This is a retrospective descriptive and analytical study, conducted at the Center for the Diagnosis and Treatment of Tuberculosis and Respiratory Diseases (CDTMR) in Beni-Mellal. It is a study carried out over 12 months between January 1, 2020 and December 31, 2020, and based on declarative data from the CDTMR of BENI-MELLAL.

Results : Our work involved a total of 700 samples, including 140 cases of tuberculosis have been confirmed. Tuberculosis affected all age groups, especially adults between 35 and 54 years (57.9%), males were the most dominant (75.71%) with a sex ratio of 3.12, and 61.4% of our patients were of urban origin. Immunodeficiency was present in 26.3% of cases, and the notion of tuberculosis contagion was found in 16.1% of cases. Most patients were clinically symptomatic (92.6%), and radiological examination was performed in 83.1% of cases. Pulmonary involvement was the most dominant (85%). Tuberculosis was confirmed by basilloscopy (BAAR research) in 69.3% of cases, and by GèneXpert in 45.85% of cases. Rifampicin resistance was found in 4 patients with a rate of 4.26%. We recorded 5 patients lost to follow-up, which represented 3.6% of the total number of patients declared positive. Pulmonary tuberculosis significantly affected patients with a history of immunosuppression ($p = 0.004$), and the notion of contagion ($p < 0.001$) more than others. The results of our study are consistent with those found at the regional and national levels.

Conclusion : Despite these remarkable results, progress in the fight against tuberculosis in Morocco remains largely influenced by several socio-economic and environmental determinants. A combination of efforts within a multisectoral framework, in line with the national strategy aimed at eradicating this scourge by 2030, remains essential

Keywords: Tuberculosis; Epidemiology; Diagnosis; Associated factors

1. Introduction

Tuberculosis is a contagious bacterial infection caused primarily by the species Mycobacterium tuberculosis (Koch's bacillus) but also by Mycobacterium africanum and Mycobacterium bovis. These are slow-growing, aerobic bacteria of the genus Mycobacterium in the family Mycobacteriaceae that spread through the air. It is a major public health problem worldwide.[1].

According to the World Health Organization (WHO), tuberculosis is one of the top 10 causes of death worldwide, along with 1.6 million deaths in 2021 (including 187,000 among people affected by HIV), and nearly 9 million new cases of

* Corresponding author: Hajiba Azza

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tuberculosis each year. Tuberculosis is present in all countries and all age groups. However, it is curable and preventable [2].

Despite the decrease in the incidence of this disease, the still high morbidity and mortality are partly explained by a high frequency of co-infection with the human immunodeficiency virus (HIV) and by the emergence of resistant strains [2]. The COVID-19 pandemic has reversed years of progress in delivering essential services to end tuberculosis and reducing the burden of this disease [1].

In Morocco, despite free therapeutic care for patients and widespread vaccination coverage with the Calmette-Guérin tuberculosis (BCG) vaccine, tuberculosis remains a health problem. In 2020, the number of recorded cases was 29,018 cases, all forms combined, corresponding to a reported incidence of 80/100,000 habitants. Although the incidence estimated by the WHO fell by 34% between 1990 and 2020, this decline remains slow and below national expectations, as the determinants of the disease are multiple and relate, essentially, to socio-economic conditions [3, 4].

Our work was devoted to describing and analyzing the epidemiological and microbiological data of a series of 700 individuals in the province of Beni Mellal during the year 2020.

2. Materials and Methods

- Type and scope of the study: This is a retrospective descriptive and analytical study, conducted at the Center for Diagnosis and Treatment of Tuberculosis and Respiratory Diseases (CDTMR) in Beni-Mellal. It is a study carried out over 12 months between January 1, 2020 and December 31, 2020. The data collection is done from medical records, the register of suspected cases of tuberculosis disease at the CDTMR of Béni Mellal during the year 2020, The declaration forms produced by the officials of the Anti-tuberculosis Fight (LAT) of Béni Mellal, and the declaration register of new cases of tuberculosis of the prefecture of Béni Mellal.

Our work involved a total of 700 samples of different nature (4 different samples) collected during the year 2020 : 640 pulmonary samples (sputum and gastric tubing), and 60 extra-pulmonary samples (pleural biopsy and lymph node biopsy).

- Type of examinations carried out: The identification of the Mycobacterium tuberculosis germ was demonstrated by two biological tests: direct examination by Ziehl Neelson staining and the molecular biology technique (GèneXpert).
- Inclusion and exclusion criteria: all patients suspected of having tuberculosis disease and who were treated at the CDTMR of Beni-Mellal during the period of our survey.
- Data analysis: the study variables are represented by sociodemographic characteristics (age, sex and place of residence), history, clinical-biological data and patient follow-up. Text and data entry was done using Word and Excel version 2019. Statistical data was processed using SPSS 21.0 software. Descriptive analysis allowed us to present the general data. In bivariate analysis, we compared the proportions of qualitative variables using the Chi-square test or the Fisher exact test, depending on the conditions of application of each test. A P threshold of less than 0.05 was considered significant.
- Ethical considerations: during all stages of the study, the data were treated anonymously and confidentially and were only used for the purposes assigned to this study.

3. Results

3.1. Descriptive results

Sociodemographic characteristics of patients: during the study period, among the 700 suspected and registered patients, 140 cases of tuberculosis were confirmed. We recorded a predominance of the male sex with a percentage of 75.71% of men and 24.29% of women with a male/female sex ratio: 3.12 in favor of the male sex. Almost two thirds of tuberculosis cases (61.4%) lived in urban areas. Tuberculosis affected all age groups, especially adults between 35 and 54 years with a percentage of 57.9% followed by the age group between 15 and 34 years with a percentage of 19.3% (Figure 1).

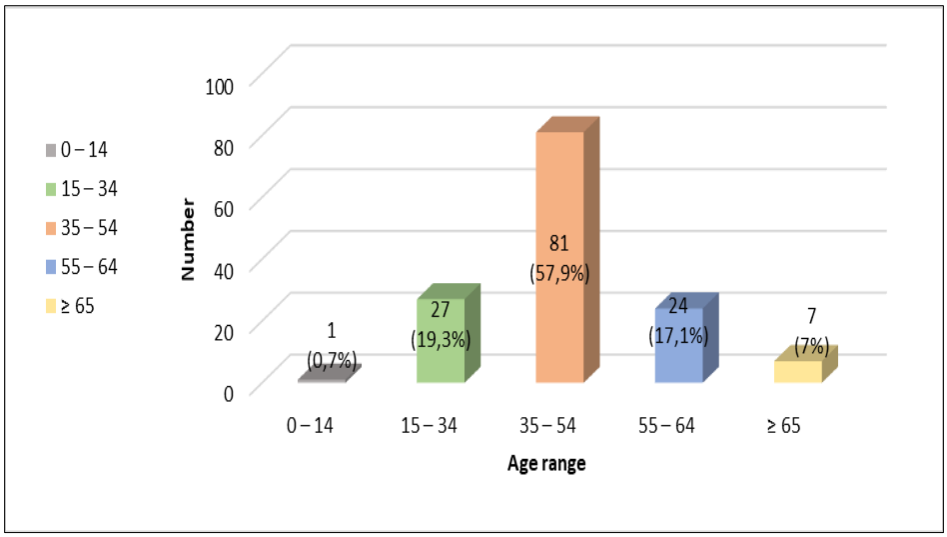

Figure 1 Distribution of tuberculosis cases by age (N=140)

Table 1 Summary of descriptive results

Variable	**Effective**	**Percentage (%)**
Immunosuppression field:		
Yes	184	26.3
No	516	73.7
Concept of tuberculosis infection:		
Yes	113	16.1
No	587	83.9
Clinically:		
Symptomatic	648	92.6
Asymptomatic	52	7.4
Type of collection:		
Sputum	638	91.14
Gastric tubing	2	0.29
Pleural biopsy	45	6.43
Lymph node biopsy	15	2.14
Location :		
Pulmonary	119	85
Extra-pulmonary	21	15
Direct examination:		
Positive	97	13.14
Negative	603	86.86
GeneXpert:		

Do :	203	29
Positive	94	46.3
Negative	109	53.7
Not done	497	71
Rifampicin resistance:		
Yes	4	4.3
No	90	95.7
Biological monitoring:		
Yes	135	96.4
No	5	3.6

Clinical data, types of samples and biological diagnosis : In our series, 184 patients had immunodeficiency (mainly diabetes) or 26.3%, the notion of tuberculosis contagion in the family or close circle was found in 113 cases (16.1%) and 18 patients were already treated for tuberculosis (2.6%). Most patients were clinically symptomatic (92.6%). We did not have sufficient detailed data regarding the clinical examination (respiratory and extra-respiratory signs).

Since tuberculosis is primarily a pulmonary disease, pulmonary samples were the most predominant (91.4%) at 640 samples, with sputum samples being the most common (91.1%) since they are easier to collect. Only 8.5% of the samples were extrapulmonary at 60 samples, where pleural biopsies were the most common (75%).

During the study period, pulmonary involvement was the most dominant (85%) compared to 15% of cases of extrapulmonary tuberculosis.Tuberculosis was confirmed by basilloscopy (acid-alcohol-resistant bacilli research) in 69.3% of cases, and by GèneXpert in 45.85% of cases. Rifampicin resistance was found in 04 patients with a rate of 4.26%. We recorded 05 patients lost to follow-up which represented 3.6% of the total number of patients declared positive (Table 1).

3.2. Analytical results

The statistical analysis was carried out by calculating the ''p'' value of significance for each of the factors studied, to be able to determine those that were significantly associated with each of the psychometric scales used in our study ($p < 0.05$).

Risk factors associated with tuberculosis disease: Pulmonary tuberculosis significantly affected patients with a history of immunosuppression ($p = 0.004$) and the notion of contagion ($p < 0.001$) more than others (Table 2).

The impact of gender and environment on tuberculosis disease: More than 75% of patients with tuberculosis disease were male, although there was no statistically significant relationship ($p = 0.808$). Urban residents developed pulmonary tuberculosis more than rural residents (61.4% vs. 38.6%). However, this difference was not statistically significant ($p = 0.747$) (Table 2).

Correlation between age and GeneXpert positivity: Our study showed a statistically significant relationship between age and GeneXpert positivity (Table 2):

- In the 15-34 age group, the possibility is multiplied by 4 ($p=0.038$).
- In the age groups 34-54 and 55-64, it is multiplied by 6 ($p=0.003$ and $p=0.011$).

The impact of the epidemiological profile on rifampicin resistance: We did not find a statistically significant relationship between epidemiological profiles (age, sex and environment) and rifampicin resistance (Table 2).

Table 2 Summary of analytical results

Risk factors associated with tuberculosis disease			
	Odds ratio GOLD	**95% confidence interval IC**	**p-value**
Immunocompromised terrain	1,867	1.2 - 2.8	0.004
TBK counting concept	2,634	1.5 - 4.4	< 0.001
Already Treated for TBK	1,466	0.5 - 4.2	0.48 (NS)
The impact of gender and environment on tuberculosis disease in our study			
	Odds ratio GOLD	95% confidence interval IC	p-value
Sex	1,056	0.682 - 1.634	0.808 (NS)
Medium	0.700	0.474 - 1.035	0.074 (NS)
Correlation between age and GeneXpert positivity in our study			
	Odds ratio GOLD	**95% confidence interval IC**	**p-value**
0-14	NS	NS	1 (NS)
15-34	4,282	1,086 – 16,891	0.038
35-54	6,788	1,882 – 24,484	0.003
55-64	6,161	1,521 – 24,952	0.011
≥ 65	__	__	__
The impact of epidemiological profile on rifampicin resistance in our study			
	Odds ratio GOLD	**95% confidence interval IC**	**p-value**
Age	-	-	0.998 (NS)
Sex	-	-	0.997 (NS)
Medium	1,576	0.157 – 15.794	0.699 (NS)

4. Discussion

During the study period spread over 12 months (between January 1, 2020 and December 31, 2020), we recorded 140 cases of tuberculosis. In our study, men (75.7%) were more affected than women by all forms of tuberculosis (24.3%). The sex ratio was 3.12 men for one woman. Our results are comparable to those of national and international studies conducted on the epidemiology of pulmonary tuberculosis [5,6,7]. This clear predominance could be explained by the different lifestyles between the two sexes (activity, travel, etc.), but also by toxic habits (smoking, alcoholism, etc.) which are much more frequent in men. All age groups were affected, which indicates the contagious nature of this disease, particularly young people between 35 and 54 years old (57.9%), reaching the most active population of society. Our results are discordant with national and international studies which show that the most affected age group is between 15 and 40 years old [5,6]. However, other studies agree with our results, showing that the age group most affected by pulmonary tuberculosis represents the active contingent of society [8]. This is explained by the significant exposure to the external environment, but also to the working and housing conditions imposed by the different areas of professional activity.

The majority of patients were from urban areas (61.4%) versus (38.6%) from rural areas. These results are consistent with those in the literature, particularly those of Chahboune Maroc [5], and Amadou "Niger"[9], while in Sobh's series "Egypt" [10], we found that patients from rural areas represent the majority with 52.24%. This predominance of the urban environment is due on the one hand, to the simple fact that the place of this study is deployed in the heart of the urban commune of Bénimellal, but also because it is a reference center for tuberculosis care for the entire region. On the other hand, it could be explained by high promiscuity, immunodepression (Context of chronic diseases : Diabetes, chronic renal failure, HIV...) and low socio-economic level.

In this study, pulmonary involvement was the most dominant. Indeed, it affected 85% of cases compared to 15% of cases of extrapulmonary tuberculosis. This result is consistent with the results found by other authors [11,10]. This high frequency of pulmonary localization could be explained on the one hand, by the fact that Mycobacterium tuberculosis has a particular predilection for the pulmonary parenchyma, and on the other hand, by the underdiagnosis of

extrapulmonary forms, which often requires invasive techniques. Indeed, in extrapulmonary forms, the lesions being paucibacillary [12,13] and since samples are difficult to obtain in the majority of cases, the diagnosis is often less easy and requires imaging, microbiological analyses, anatomopathological examinations and clinical examinations, which remain misleading in many cases and the diagnosis often remains purely presumptive [14]. Also, the morbidity and mortality of extrapulmonary tuberculosis remains high, particularly in cases of multifocal involvement [15]. Thus, we may lose people affected by such forms before even diagnosing them. Furthermore, in our country, the practice of autopsies is not the rule, and therefore the number of cases of extrapulmonary tuberculosis can only remain low.

In our study, tuberculosis was confirmed by basilloscopy (acid-alcohol-resistant bacilli research) in 69.3% of cases. These results are consistent with those of the Amadou (Niger) and Shandong "China" series with 64.7% and 52% of cases respectively [7,9], unlike those of the Chahboune series (Morocco) with a rate of 84.09% [5]. As for GeneXpert, it confirmed pulmonary tuberculosis in 45.85% of cases. This result is comparable to those reported in the literature [16,17]. Rifampicin resistance was reported in 04 patients with a rate of 4.26%. This is consistent with the study carried out at the pulmonology department at the Marrakech University Hospital and with that of the Fann University Hospital in Senegal [16,17].

In our series, the immunodeficiency background (mainly diabetes) and the notion of tuberculosis contagion are risk factors associated with tuberculosis disease. This result is almost comparable to those in literature, in particular the two studies carried out in Italy (G. Ferrara) [18], and in Toronto, Canada (Takashi Hirama) [19]. However, there was no statistically significant relationship between sex and tuberculosis disease ($p = 0.808$), the same thing regarding geographical origin ($p = 0.074$). This was discordant with the study of CDTMR of Settat and that of Bamako in Mali [5,20]. The lack of a significant relationship between sex and tuberculosis disease in our series may be explained by the limited sample size. We also showed in this study that there was no statistically significant relationship between the epidemiological profile and rifampicin resistance, the "p" value was greater than 0.05. This result is almost comparable to those reported in the literature [21,22].

5. Conclusion

Tuberculosis is one of the most widespread infectious diseases in the world, which is endemic. In Morocco, it still constitutes a public health problem despite the means implemented for its eradication, including anti-tuberculosis vaccination and well-codified anti-bacillary treatment. A disease of poverty and poor hygiene conditions, tuberculosis can be partially eradicated through the improvement of living conditions, economic conditions, housing and through health education of the population. Indeed, lost to follow-up represents one of the main problems hindering success of the national tuberculosis control program. This can be improved by the proper supervision of treatment and the notification of the addresses of patients, which must be verified, so they can be found easily. In order to improve the management of this pathology in Beni Mellal, the establishment of a well-equipped laboratory becomes a necessity for early detection of tuberculosis cases. This laboratory must allow to carry out in addition to the direct examination and the GeneXpert; culture, quantiferon and antibacillogram to increase the confirmation rate of tuberculosis disease, thus limiting the incidence and unfavorable evolution and detection of resistance to antituberculosis drugs.

Compliance with ethical standards

Disclosure of conflict of interest

The authors declare no conflict of interest.

Statement of ethical approval

The protocol is designated as a non-interventional study in accordance with Moroccan Law 28-13 on the protection of persons involved in biomedical research, and therefore does not require ethics committee review or IRB approval.

Statement of informed consent

Informed consent was obtained from all individual participants included in the study.

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