Research Article

A five-year epidemiological study of tuberculosis and its related risk factors in northwestern Algeria

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Submitted: August 2024
Accepted: October 2024
Published: November 2024

ABSTRACT

Introduction: Tuberculosis (TB) is a worldwide emergency and a leading cause of death. Algeria reported an incidence rate between 53 and 88 per 100,000 in 2017. This study aimed to highlight TB's clinical and therapeutic characteristics at the Pulmonology Unit in Sidi Bel Abbes, Algeria.

Method: This retrospective and descriptive study analysed patient records from 2015 to 2020. Data collected included sociodemographic data, clinical characteristics, type of TB, and therapeutic evolution after each patient's treatment period. Data were processed using SPSS.

Results: Of the 649 TB patients, 57.3% had extra-pulmonary TB, with a higher proportion of females affected. Pulmonary TB cases were predominantly male, and bi-therapy with isoniazid and rifampicin was the most common treatment. Just over half of cases (55.2%) achieved treatment success.

Conclusion: Although TB incidence gradually declined over the study period, increased attention to extra-pulmonary TB and adherence to treatment protocols are recommended.

Keywords: bi-therapy, lymphadenitis, tuberculin intradermal reaction, tuberculosis, Algeria.

Introduction

Tuberculosis (TB) is an infectious disease caused by Mycobacterium tuberculosis (MTB) or Koch's bacillus.[1] It remains a global public health emergency and a leading cause of death. In 2022, it ranked as the second leading cause of mortality from a single pathogen after COVID-19, far exceeding deaths caused by HIV/AIDS.[2] Algeria reported an incidence rate between 53 and 88 per 100,000 in 2017.[3]

Pulmonary TB, the most contagious form,[4] coexists with extra-pulmonary TB, which accounts for about 20-25% of global cases.[5] This study investigated the clinical characteristics of TB in Sidi Bel Abbes, focusing on epidemiological trends and therapeutic outcomes between 2015 and 2020.

Citation: Hamri et al, A five-year epidemiological study of tuberculosis and its related risk factors in northwestern Algeria, South Sudan Medical Journal, 2024;17(4):173-178 DOI: https://dx.doi.org/10.4314/ssmj.v17i4.4

The treatment implements concurrently four first-line anti-tubercular medications: isoniazid (H), rifampicin (R), ethambutol (E), and pyrazinamide (Z).[6] According to the latest WHO guidelines, the recommended 6-month therapy regimen is based on short-course therapy with H, R, E, and Z for two months, followed by four months of H and R.[2] A feared complication of anti-TB therapy is multi-drug-resistant TB, which is distinguished by its resistance to first-line medications H and R.[7]

As TB is a serious disease in Algeria,[8] it is necessary to determine the epidemiology according to the specific geographical conditions. We conducted this retrospective study to investigate underlying factors (including age, sex, region, and related diseases) over five years (between 2015 and 2020). This is the first TB-based retrospective study examining the clinical and therapeutic characteristics of TB in northwestern Algeria.

Methods

This retrospective study was conducted at the Pulmonology Unit of the hospital-university centre in Sidi Bel Abbes province, northwestern Algeria, which has a population of 713,377.

We included all tuberculous patients declared at the diagnostic unit from January 2015 to December 2020. Patients with incomplete files were excluded. Data collected included socio-demographic data (age, sex, place of residence), clinical characteristics, type of TB (pulmonary, extrapulmonary), and therapeutic evolution (healing, failures, death) after each patient's treatment period.

Data were processed using SPSS version 27.0. The qualitative variables were summarized in percentages, and the Chi-square test was used to compare the categorical variables, with statistical significance set at a p-value ≤ 0.05.

Ethical clearance was obtained from the Pulmonology Unit, and patient identities remained confidential.

Results

Epidemiological Trends

649 TB cases were recorded during the study period, with the incidence declining from 19.21 per 100,000 in 2015 to 14.30 in 2020 (see table 1). However, a slight increase was observed in 2018. Pulmonary TB cases were more common in males (64.3%), while extra-pulmonary TB predominated in females (73.1%).

Table 1. Incidence of all forms of TB per 100,000 inhabitants between 2015-2020

Year	Total (N=649) n (%)	Incidence per 105
2015	133 (20.5)	19.21
2016	109 (16.8)	15.68
2017	101 (15.6)	14.39
2018	108 (16.6)	15.24
2019	95 (14.6)	13.31
2020	103 (15.9)	14.30

Patient Characteristics

The mean patient age was 36.6 years, with the 20-29 age group most affected (26.3%). Most patients (88.4%) resided in urban areas (see table 2). Co-morbidities included hypertension (5.5%), bronchial asthma (4.0%), and diabetes mellitus (2.9%). A tuberculin test was conducted on 53.6% of patients, with a 57.5% positivity rate.

Distribution by TB Type and Location

Extra-pulmonary TB accounted for 57.3% of cases, with lymphadenitis TB being the most common (39.8%), followed by pleural TB (8.6%) (see Table 3). Among pulmonary TB cases, 64.3% were male, while 73.1% of extra-pulmonary TB patients were female.

Treatment Regimens

Bi-therapy with isoniazid and rifampicin (RH) was prescribed to 46.1% of patients, followed by quadruple therapy (RHZE) in 22.2% of cases (see table 4). Treatment duration varied, with a two-month regimen applied to 55.6% of cases. Treatment success was reported in 55.2% of cases, with pulmonary TB patients showing better outcomes (81.6%) than extra-pulmonary TB patients (35.5%).

Relapse and Mortality

Relapse occurred in 4% of cases, predominantly in pulmonary TB patients (6.1%). The overall mortality rate was 1.5%, higher among pulmonary TB cases (2.5%) than extra-pulmonary cases (0.8%) – see table 5.

Discussion

TB remains a serious public health problem. In 2022, an estimated 1.3 million TB deaths were registered by WHO

globally.[2] In developing countries, such as Algeria, this disease is highly endemic. Our analysis highlighted that TB morbidity had decreased by 25.56% (from 19.21 to 14.30 per 100,000 population) in Sidi Bel Abbes from 2015 to 2020, with average annual morbidity of 15.36/100,000, far lower than that reported in Algeria in 2017 (32.70 per 100,000 population),[9] which was closely linked to the local policies to control the incidence of TB.

In the current study, 57.2% (n=371) of the patients were females; of those, 272 (73.3%) had extra-pulmonary TB. The disaggregated gender differences show that women are a high-risk group for various forms of extra-pulmonary TB. Ben Ayed et al. reported that males were more likely to develop TB than females (54.4% vs. 45.6%). In contrast, the extra-pulmonary TB form was more common in females, notably lymphadenitis TB.[10] A similar study done in China reported that extra-pulmonary TB is predominant in women compared to pulmonary TB (39.7% vs. 29.9%, OR = 1.37).[11] Likewise, a two-year cohort study by Khan et al. revealed that the incidence of TB is 1.31 times higher in females, indicating that biological sex is an important determinant of health because gender disparities in genetic, epigenetic, and hormonal regulation alter the prevalence and manifestation of TB.[12]

Most of our patients were young adults aged 20 to 49 years. Similar findings were noted in a study conducted in the Maghreb countries by M. Adnaoui et al., where 70% of those affected by TB were between 20 and 45 years

Table 2. Characteristics of TB cases

Variables	Total (N=649) n (%)
Sex	
Male	278 (42.8)
- Pulmonary TB	178 (27.4)
- Extra-pulmonary TB	100 (15.4)
Female	371 (57.2)
- Pulmonary TB	99 (15.3)
- Extra-pulmonary TB	272 (41.9)
Age range	
3-9 years	17 (2.6)
10-19 years	65 (10.0)
20-29 years	171 (26.3)
30-39 years	139 (21.4)
40-49 years	112 (17.3)
50-59 years	82 (12.6)
60-69 years	39 (6.0)
70-79 years	18 (2.8)
≥ 80 years	6 (0.9)
Environment	
Urban	574 (88.4)
Rural	75 (11.6)
Co-morbidities	
Anaemia	18 (2.8)
Bronchial asthma	26 (4.0)
Diabetes	19 (2.9)
Goiter	12 (1.8)
Hypertension	36 (5.5)
Lupus erythematosus	3 (0.5)
Tuberculin test	
Negative IDR	148 (22.8)
Positive IDR	200 (30.8)
Not done	301 (46.4)

IDR: tuberculin intradermal reaction. TB: tuberculosis.

Table 3. Distribution of all forms of TB patients based on location

Forms of tuberculosis	Total (N=649) n (%)
Type	
Pulmonary	277 (42.7)
Extra-pulmonary	372 (57.3)
Localization	
Skin	13 (2.0)
Lymphadenitis	258 (39.8)
Miliary	10 (1.5)
Osteoarticular	3 (0.5)
Parotid	1 (0.2)
Peritoneal	19 (2.9)
Pleural	56 (8.6)
Pulmonary	267 (41.1)
Genito-urinary	5 (0.8)
Uveitis	16 (2.5)
Ear Nose and Throat (ENT) sphere	1 (0.2)

Table 4. CVR Analysis for Health Behaviour (HB) Construct

Anti-tuberculosis treatment	Total (N=649) n (%)	Pulmonary TB (N=277) n (%)	Extra-pulmonary TB (N=372) n (%)	p-value
FDC drugs				
RH	299 (46.1)	122 (44.0)	177 (47.6)	
RHE	15 (2.3)	4 (1.4)	11 (3.0)	0.225
RHZ	191 (29.4)	84 (30.3)	107 (28.8)	
RHZE	144 (22.2)	67 (24.2)	77 (20.7)	
Duration				0.990
2-month regimen	361 (55.6)	154 (55.6)	207 (55.6)	
4-month regimen	288 (44.4)	123 (44.4)	165 (44.4)	

(*) percentages were compared with the Chi-square test, and p ≤ 0.05 was considered significant.

FDC: Fixed-dose combination; R: rifampin; H: isoniazid; Z: pyrazinamide; E: ethambutol.

Table 5. Distribution according to therapeutic outcomes

Anti-tuberculosis treatment	Total (N=649) n (%)	Pulmonary TB (N=277) n (%)	Extra-pulmonary TB (N=372) n (%)	p-value
Healing	358 (55.2)	226 (81.6)	132 (35.5)	
Positive biopsy	265 (40.8)	34 (12.3)	231 (62.1)	0.001*
Relapses	26 (4.0)	17 (6.1)	9 (2.4)	
Death	10 (1.5)	7 (2.5)	3 (0.8)	0.079

(*) percentages were compared with the Chi-square test, and p ≤ 0.050 was considered significant. TB: tuberculosis.

old. The study was done in Tunisia, Morocco, and Algeria, which are all middle-income countries. Considering this is a major economically productive age group, the economic and social impact of TB is massive.[13]

Increasing attention should also be focused on patients over 60, whose immunity has generally weakened and are thus prone to infection or relapse. Interestingly, some researchers demonstrated that the TB vaccine was more likely beneficial for patients under 50 years old and less effective for older patients, with an average efficacy of only about 50% for the latter.[14]

Most of our cases were from urban regions. These results are in line with current literature, which shows that TB is easily spread among overcrowded areas such as universities, supermarkets, and stadiums.[15] The exposure risk of TB follow-up with no surveillance may result in a delay in the diagnosis of TB and thus cause its outbreak.

Extra-pulmonary TB accounted for 57.3% of all cases recorded during the study period. This value is higher than those reported in previous studies, in which 45.2%, 43.8%, 33.4%, and 13.1% of cases had localized at the extra-pulmonary level found in Turkey, Algeria, China, and Malaysia, respectively.[4,8,11,12] In contrast, this value was similar to that reported in 59.5% of extra-pulmonary TB cases found in Tunisia.[10] Extra-pulmonary TB is usually not an infectious disease. However, it can cause death if undiagnosed or untreated. Lymphatic and pleural involvement are the most frequent clinical forms of extra-pulmonary TB, as also found in other studies.[4,8,12] Indeed, there is an unexplained resurgence of the extra-pulmonary forms, especially lymphadenitis and pleural effusion, with a relative frequency reaching up to 40%.[16] In this study, the mortality rate was 1.5%. Surprisingly, this rate is lower than that found in an epidemiological survey by Boualam et al.[17]

A noteworthy discovery from this research is that most pulmonary and extra-pulmonary TB cases were treated with a bi-therapy regimen for two to four months. Undeniably, these recommended regimens are specifically able to treat TB sustained by both drug-susceptible and drug-resistant strains without interfering with other drugs. The adoption of multiple drug combinations can improve the prognosis.[18]

Conclusion

TB incidence in northwestern Algeria has decreased, but the disease remains a serious public health concern. Particular attention should be given to extra-pulmonary TB and urban residents, with efforts to improve public education and treatment adherence. Monitoring and strengthening local TB control strategies are essential to sustain progress and address emerging challenges.

Acknowledgments: We thank the members of the Pulmonology Unit who participated in this work.

Conflict of interest: None.

Funding sources: None.

Author contributions: WHH contributed to the data collection, analysis, and study design and wrote the manuscript. FZH contributed to data collection and interpretation and edited the paper. MD supervised this research and reviewed the scientific context. All authors approved the final manuscript.

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