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A Prospective Observational Study on Prevalence and Prognostic Indicators among Tuberculosis and Multidrug Resistance Tuberculosis Patients in Tertiary Care Teaching Hospital

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Authors' contributions

This work was carried out in collaboration among all authors. Authors AN, BB and KM designed the study, collected the data from patient's case sheets and performed the statistical analysis. Author BMI wrote the first draft of the manuscript and analyzed the study data. Author LSSR Proof read the manuscript. Author REU Final approval of the manuscript with spell check, grammatical and plagiarism checking. All authors read and approved the final manuscript.

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ABSTRACT

Tuberculosis (TB) is a communicable systemic infectious disease with high morbidity and mortality associated with it. Resistance to medications used to treat tuberculosis has been on the rise in recent years. (multidrug-resistant tuberculosis) (MDR-TB) is a significant challenge to (TB) control around the world. An observational research was conducted in a tertiary care teaching hospital to determine the interim pharmacological and microbial results of Rifampicin resistance TB patients. Data from Santhiram Medical College and General Hospital, Nandyal, Kurnool Dist. Andhra Pradesh were obtained from Aug 2020 to Feb 2021, after receiving ethical approval from the Institutional Ethics Committee. The effects of the regimen are determined in terms of cure, finished treatment, treatment failure, number of patients moved to MDR-TB, number of patients who died in

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long-term MDR-TB regimen patients. Microsoft Excel 2007 was used to analyse the data. There were 82 male and 23 female out of 105 patients included in the study. Of these 75 patients were from rural areas and 40 from urban areas Using the Chi-square test and X2=12.1026, p=0.0005, which was important, the correlation between geographical spread and treatment result was determined. Out of 115 patients, 99 (86.09 percent) were cured of their disease, 06 (5.22 percent) died, 10 (8.69 percent) developed MDR-TB, and 2 (1.74 percent) were deemed medication errors. Males between the ages of 51 and 70 are more vulnerable to TB than females, according to our results. Compared to females of the same age, male patients over 40 years of age are more vulnerable to MDRTB. this was not part of the research objectives, emphasis should not be placed on this as either conclusion or recommendation.

Keywords: Multidrug resistance Tuberculosis; Santhiram Medical College; prospective study.

1. INTRODUCTION

Tuberculosis (TB) is a chronic infectious disease caused by the *Mycobacterium tuberculosis* complex group of acid-fast bacteria. [1,2] The tubercle bacilli have been recognized and defined for decades, and with a consensus agreement on the treatment guidelines [3]. Despite major developments in patient diagnosis and treatment, including the advent of rapid diagnostic strategies such as the GeneXpert MTB/RIF method TB remains one of the most common infectious disease and top ten causes of death in the developing world [4,5]. The elevated risk of TB morbidity and mortality is due in part to a higher prevalence of drug-resistant *Mycobacterium tuberculosis*, which results in more expensive and difficult treatment choices [6]. Poverty, civil unrest or conflict in some countries, internally displaced persons, and more recently, the SARS-CoV-2 pandemic have all led to a poorer standard of life. Furthermore, inadequate infrastructure, overcrowding, malnutrition, and the failure to receive proper health services further lead to a rise in the burden of illness and poor treatment outcome [7].

Multidrug-resistant TB (MDR-TB) known as resistance to isoniazid and rifampicin two most potent TB drugs is reported has been a record of a high prevalence of drug-resistant TB around the globe across the past few decades [8]. With over 500,000 estimated multidrug-resistant TB (MDR-TB)/rifampicin resistance cases in 2018, MDR-TB is emerging as a major challenge to (TB) regulation [9]. Worse, only 57 percent of patients on traditional care treatment attain treatment success, contrary to a global goal of 75 percent. This is partly because the latest therapy for DR-TB is long, difficult, costly, poorly tolerated, and limited in efficacy [10,11].

HIV co-infection, diabetes, cancer, low albumin, anemia, psychiatric illness, heart failure, a fluoroquinolone or second-line aminoglycoside tolerance, tobacco smoking, alcohol consumption, cavitary disease, extensively drug-resistant (XDR) TB, prior exposure to second-line medications (SLDs), and adverse drug consequences are predictors of bad treatment outcomes (ADEs).

The goal of this research was to prospectively evaluate the prevalence of MDR-TB and its related factors in patients attending the Santhiram Medical College & General Hospital tuberculosis clinic and treatment center between August 2020 and Feb 2021.

2. MATERIALS AND METHODS

2.1 Study Design and Site

This was a prospective observational study in which all TB patients at Santhiram Medical College & General Hospital, Nandyal, Kurnool Dist. Andhra Pradesh, India, had their history and laboratory findings checked. The research period extends from August 2020 to February 2021.

Because of its location, the hospital serves inhabitants of the surrounding town as well as those from other areas of town and nearby cities. Nandyal is located at 15.4777° north latitude and 78.4873° east longitude of the equator. The patients who were resistant to TB were recommended for MDR-TB therapy.

2.2 Inclusion and Exclusion Criteria

Data from patients of all ages and genders with microbiologically documented TB is eligible and included in the sample population using the GeneXpert MTB/RIF system assay. TB - managed patients who did not have a GeneXpert MTB/RIF system report were omitted from the study.

2.3 Data Collection Procedure and Data Analysis

Data were obtained from the Department of Pulmonology in case record formats after receiving ethical approval . Age, ethnicity, and geographical distribution were the basic demographic details gathered. Treatment protocol effects were calculated in terms of cure, completion of treatment, treatment failure, number of patients switched to the MDR-TB regimen, number of deaths. According to the WHO standards, [12,13] care results have been identified and graded. Cured DR-TB has been described as those who have completed therapy for at least two negative sputum cultures within 18 months to more than 2 years. Completed treatment was defined as patients who completed the anti TB regimen for at least 18 months. Death was defined as patients who died during treatment whatever the cause. Default is a patient who after treatment has interrupted treatment consecutively for more than 2 months.

2.4 Statistical Data Management and Analysis

The data obtained were analyzed using the Statistical Package for Social Sciences (SPSS) version 23.0 (SPSS Chicago Inc., IL, U.S.A) [14]. Continuous variables were expressed as means (standard deviation). The relationship between categorical variables was determined using Pearson chi-square. A p-value equal to or less than 0.05 was considered significant [15].

3. RESULTS

A total of 115 cases were registered from August 2020 and Feb 2021. Out of 115 patients, 167 (79.1%) were males and 44 (20.9%) were females.

Males are more prone to TB than females and delete 51 to 70 years old age groups are more affected with TB. Females with age 51 to 70 years old patients are affected with TB. Both male and females are less affected who are in the age below 40 years. Males are more affected than females with MDRTB who are in the age below 40 years are more affected and more than 40 years of male patients are less affects with MDRTB when compare to female. From Table 2, it is evident that most of TB reported cases were males with BMI in the range of30-40 which falls under the obese category as per WHO [12] followed by BMI more than 40. Most of the MDR-TB cases were reported with BMI more than 40 (Morbid obese). Peculiarly no female MDR-TB cases were reported across the studied age and body weights.

The gender-to-final treatment result correlation was calculated using the chi-square test and was not statistically relevant as $p > 0.05$. Gender and age-wise distribution is shown in Table 3. The research participants ranged in age from 10 to 85 years old, with a median age of 47.5 years. The geographical distribution (rural and urban) of the sample population was also analysed. The number of patients registered was 75 (65.2%) from rural areas and 40 (34.78%) from urban areas. The Chi-square test was used to assess the relationship between geographical spread and treatment outcome, and it was found to be statistically important ($p=0.0005$). This finding indicates that patients living in rural areas are be more vulnerable to TB than patients residing in urban areas.

The treatment outcomes of patients are shown in Table 3. Out of 115 patients registered, 104 (90.4%) were cured of the disease, 8 (6.9%) died, 10 (8.7%) patients shifted to MDR treatment and 6 (5.2%) patients had treatment failures.

Table 1. Age and Gender wise distribution of TB and MDRTB cases

Age group (Years)	TB cases		MDRTB cases	
	Male, N (%)	Female, N (%)	Male, N (%)	Female, N (%)
10-20	4 (4.9)	1 (4.3)	4 (40.0)	0 (0)
21-30	0(0)	1(4.3)	0 (0)	0 (0)
31-40	0 (0)	1(4.3)	0 (0)	0 (0)
41-50	15(18.3)	12(52.2)	1 (10.0)	0(0)
51-60	26(31.7)	5(21.7)	1 (10.0)	0 (0)
61-70	22(26.8)	3(26.8)	4 (40.0)	0 (0)
71-85	15(18.3)	0(0)	0 (0)	0 (0)
Total	82	23	10	0

Table 2. Distribution of TB and MDR-TB as per BMI

sBMI (Kg/m^2)	TB cases		MDR-TB cases	
	Male, N (%)	Female, N (%)	Male, N (%)	Female, N (%)
< 18.5	0 (0)	1 (4.3)	0 (0)	0 (0)
18.5 - 25	0 (0)	1 (4.3)	1 (10.0)	0 (0)
25-30	10 (12.2)	1 (4.3)	0 (0)	0 (0)
30-40	40 (48.8)	12 (52.2)	2 (20.0)	0 (0)
>40	32 (39.0)	8 (34.8)	7 (70.0)	0 (0)
Total	82	23	10	0

Table 3. Treatment outcome of TB and MDR-TB patients

Month & Year	Total registered, N (%)	Cured, N (%)	Treatment completed, N (%)	Died, N (%)	Failure, N (%)	Switched to MDR, N (%)
Aug 2020	13 (11.3)	10 (9.9)	10 (10.6)	2 (25.0)	1 (16.7)	0 (0)
Sep 2020	11 (9.6)	10 (9.6)	9 (9.6)	1 (12.5)	1 (16.7)	0 (0)
Oct 2020	23 (20.0)	20 (19.8)	23 (24.5)	0 (0)	2 (33.3)	2 (20.0)
Nov 2020	13 (11.3)	13 (12.9)	7 (7.4)	3 (37.5)	1 (16.7)	2 (20.0)
Dec 2020	20 (17.4)	19 (18.8)	18 (19.1)	0 (0)	0 (0)	1 (10.5)
Jan 2021	28 (24.3)	24 (23.8)	20 (21.3)	1 (12.5)	0 (0)	3 (30.0)
Feb 2021	7 (6.1)	5 (5.0)	7 (7.4)	1 (12.5)	1 (16.7)	2 (20.0)
Total	115	104	94	8	6	10

Cigarette smoking, a modifiable poor prognostic predictor, was established as a risk factor for an unsuccessful treatment outcome in a dose-dependent manner among the poor prognostic indicators. HIV infection and diabetes mellitus were both strong predictors of TB and MDR-TB. In the general population, NON American variant consider using anemia, regardless of age, ethnicity, and cardiovascular disease, is a known independent indicator of all-cause mortality. Anemia has been reported to predict negative care outcomes for TB patients, close to our finding. TB patients with anaemia are at risk for other diseases and have compromised immune systems that may lead to the delayed conversion of the sputum, worsening of the disease, and death. Besides, the number of TB patients with co-morbid conditions was observed as shown in Table 4.

4. DISCUSSION

M. tuberculosis, the TB agent first described by Robert Koch in 1882, has been around for more than a century [16]. Globally, TB remains a health crisis and a health security threat due to a lack of early identification to interrupt the chain of transmission, poor medication adherence, and the evolution and dissemination of multidrug-resistant TB (MDR-TB) strains. Largely, under-reporting is a key factor associated with the TB epidemics and militating its control or prevention in many countries (reference). It is widely known that the under-reporting of TB cases is attributed to a lack of awareness and concerns with the warning flow carried out by health professionals.

The prevalence and clinical results of MDR-TB patients with low prognostic factors were examined in this research. Predictors of treatment success and mortality were further determined. Treatment effectiveness was 90.43 percent, 8.7 percent of enrolled patients were moved to MDR-TB, 6.9% of patients died. Loss-to-follow-up and lack of therapy were 4.8 percent and 5.2 percent, respectively.

A more recent meta-analysis by Kibret et al. showed that 63.5 percent of patients had a good result, but that the success rate was lower for patients treated with conventional second-line regimens relative to those treated with individualised regimens [17]. Both patients are treated with generic second-line medications according to the PMDT guideline in the current report. We also found that patients in urban had a better success rate than those in rural areas. The Chi-square test showed an important correlation between spatial spread and the actual clinical outcome of patients. Rural patients had a low success rate (53 percent vs. 33 percent) and a high default rate in another Indian study by Agarwalla et al. [18]. (23 percent vs. 30 percent). There are certain limitations to this study. As it is

Table 4. Distribution of prognostic indicators among TB patients

Co-morbid condition	Total reported	%
Hepatic dysfunction	8	6.9
Nephro dysfunction	3	2.6
Hyper lipidimic	2	1.7
HIV co-infection	15	13.0
Alcohol use	7	6.0
Diabetes	13	11.3
Cigarette smoking	22	19.1
Severe Anemia	11	9.5
Psychiatric symptoms or mental illness	2	1.7
Pregnancy	7	6.0
Previous exposure to second line drugs	9	7.8
Cancer	0	0
Cardiac Patients	5	4.3
Others	11	9.5

a prospective study, we could not collect much data about the life style of individual patients like tobacco smoking, alcohol which can cause many side-effects with a long-term regimen for MDR-TB [18].

5. CONCLUSION

Drug resistance is a serious issue of concern. Tuberculosis can be managed by identifying anti-TB drug resistance early, according to recommendations for programmatic drug resistance management. It also indicated fewer rates of success in rural areas. This may be attributed to a lack of knowledge, awareness, and education about tuberculosis. As a consequence, it is important to improve the program in rural areas. As this was a prospective analysis, we were unable to gather personal patient data that could help figure out the root cause of higher TB care failure rates in the rural community.

CONSENT

As per international standard or university standard, patients' written consent has been collected and preserved by the author(s).

ETHICAL APPROVAL

Ethical approval for this study was obtained from the Institutional Ethical committee bearing no:IEC/2020/090.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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