Cross Sectional Study on the Prevalence of Tuberculosis among the District ofSudhnuti, Azad Jammu and Kashmir

ABSTRACT

Globally, tuberculosis (TB) is a major health risk that is mostly caused by Mycobacterium tuberculosis, a member of the Mycobacterium Tuberculosis Complex (MTC). Ten million cases of tuberculosis and 1.3 million deaths from the disease occur each year, making Mycobacterium tuberculosis one of the leading causes of death globally. Pakistan is ranked fifth among high-burden countries for tuberculosis (TB) and is expected to rank fourth for the prevalence of multi-drug resistant (MDR) TB. As a result, tuberculosis poses a serious threat to public health in Pakistan. Tuberculosis is a common occurrence in Azad Jammu and Kashmir.

Aims: The current study aimed to find out the prevalence of tuberculosis in the defined population.

Study design: The study was conducted in the District and Tehsil Headquarters Hospitals of District Sudhnuti AJK.

Place and Duration of Study: Samples were collected from all the District and Tehsil headquarters hospitals of Sudhnuti district from January 2019 to December 2019.

Methodology: Samples of sputum from suspected cases were gathered from district Sudhnuti hospitals and TB centers from January 2019 to December 2019.All thesuspected cases were examined by sputum smear microscopy and then bacteriologically positive cases were further confirmed by GeneXpert. All positive cases were examined for multi-drug *resistance* by using GeneXpert.

Results: In the current study during the year 2019, 201 TB cases were reported from district Sudhnuti out of which 107 (53.23%) were males and 94 (46.76%) were females. The value of *P*=0.51 which is >0.05 is insignificant shows that Tuberculosis has no selective effect on a specific gender. Pulmonary cases were 131 in number with 81 bacteriologically positive and 50 clinically diagnosed negative cases. Extra Pulmonary cases were 70 in number with 1 bacteriologically positive and 69 clinically diagnosed negative cases.Only 2 (0.99%) MDR cases were diagnosed and the case notification rate during 2019 was 66.

Conclusion: The current study shows that males are slightly more prone to TB in district Sudhnuti AJK as compared to females. Individuals with age >64 are more susceptible to TB when compared to individuals with age <15. The CNR during 2019 is 66 which is far away from the WHO set criteria. The CNR indicates that there is a need for improvement in the surveillance system.

Keywords: Tuberculosis; Multi drug Resistance Tuberculosis; Case Notification Rate; Male to Female Ratio; Contact Tracing.

1. INTRODUCTION

Globally, tuberculosis (TB) is a major health risk that is mostly caused by Mycobacterium tuberculosis, a member of the Mycobacterium Tuberculosis Complex (MTC) (1, 2). Since ancient times, tuberculosis has been known by several names in many historical eras and nations. Its core characteristics, notably its deteriorating impact and destructive character, have always been known, although it has frequently been perplexed with certain other disorders. TB affects not just one organ but also several organs and tissues in the body (3). Humanity has witnessed the transformation of tuberculosis (TB) from an incurable illness to a treatable one (4). The worldwide persistence of tuberculosis is mostly due to poverty. Some people view it as a social disease with

potential health risks (5). Ten million cases of tuberculosis and 1.3 million deaths from the disease occur each year, making Mycobacterium tuberculosis one of the leading causes of death globally (6, 7). Pakistan is ranked fifth among high-burden countries for tuberculosis (TB) and is expected to rank fourth for the prevalence of multi-drug resistant (MDR) TB (8, 9).In many countries, the emergence of drug resistance to anti-TB treatments, which are used to treat tuberculosis (TB), particularly multidrug-resistant TB (MDR-TB), has emerged as a serious public health concern and a challenge to effective TB control(10, 11).Tuberculosis poses a serious threat to public health in Pakistan (12). Azad Jammu and Kashmir (AJK) is an independent state in Pakistan with 4.045 million people living there as of the Planning and Development Department's 2017 census, which yielded an 88:12 rural-urban ratio. Azad Jammu and Kashmir consists of ten districts and these districts are divided into northern and southern regions. The northern region of Azad Jammu & Kashmir comprises five districts (Bhimber, Mirpur, Kotli, Pallandri, and Rawalakot) and the southern region comprises five districts (Haveli, Bagh, Muzaffarabad, Hattian, and Neelum). Tuberculosis imposes a serious health concern in AJK. According to WHO guidelines for 2014, the incidence rate of tuberculosis (TB) in AJK is 270 per 100,000, a significantly higher rate than in other developing nations (13). It is impossible to control tuberculosis (TB) without establishing a reliable surveillance system that can track the progression of the disease and evaluate the effects of control efforts on the disease (14). The surveillance system in AJK does not meet WHO criteria. The main focus of the study is case notification as the essential strategy for tuberculosis prevention and treatment.The annual reported number of tuberculosis cases divided by the total population in the designated area per 100,000 is the case notification rate.Geographic variations exist in tuberculosis case notification rates (CNR)(15-17).Data analysis shows that each TB patient could be a source of infection for approximately10 people a year on average and that the case detection rate in nearly all AJK districts is around 46% of their targets (13). There is no previous study on the prevalence of tuberculosis in district Sudhnuti AJK. This research aims to ascertain the tuberculosis prevalence rates in the district of Sudhnuti, AJK. The current study holds significant importance for the scientific community as it highlights a substantial disparity between the case notification rate and the incidence rate criteria established by the World Health Organization (WHO) for tuberculosis (TB) in AJK. The current study paves the way for future research to find out the reason for the low case notification rate. This research not only sheds light on a pertinent issue but also sets the stage for future inquiries aimed at elucidating the complex dynamics influencing TB surveillance and reporting in the region.

2. MATERIAL AND METHODS

2.1 Study Area

The current study was conducted in Sudhnutidistrict one of ten districts of AJK,comprises of four Tehsils (Pallandri, Mong, Balauch, and Tarrar Khal).This is a hospital-based study which was conducted from January 2019 to December 2019. To sample tuberculosis patients, surveys were conducted in the Tehsil headquarters (THQ) and the district headquarters (DHQ) hospitals of Sudhnutidistrict.

2.2 *Sample Collection, Slide Preparation and Observation*

Sputum samples were collected from suspected cases, and then smears were prepared on slides using wooden sticks. Slides were air-dried for 30 minutes, fixed over a flame for 4 seconds, then covered with Ziehl's Nelson 1% carbol-fuchsin solution and heated. Excess stain was rinsed off, slides treated with 25% sulfuric acid for 3 minutes, then counterstained with 0.1% methylene blue. Acid-fast bacilli displayed varied morphology and stained red against a blue background when observed under a microscope. The confirmation of all bacteriologically positive TB cases was also done by using GeneXpert. Confirmation of TB cases and rifampicin resistance tuberculosis (RR-TB) cases on GeneXpert was done by utilizing MTB/RIF assay. For this purpose, a 50 ml

falcon tube was taken in which 4 ml of Xpert MTB/RIF sample reagent and 2 ml of clinical sample were shaken and incubated for 15 minutes. Following the manufacturer's instructions, 2 ml of the 6 ml mixture was transferred to the Xpert MTB/RIF cartridge. The cartridge was then placed into the device. The system automatically displayed the result after one hour and fifty minutes. The results were confirmed by the experts.

Inclusion criteria for the current study encompass individuals who have tested positive for tuberculosis through bacteriological methods such as sputum smear microscopy and GeneXpert. Individuals diagnosed with tuberculosis based on clinical evaluation, radiological findings, and histopathological examination, in the absence of bacteriological confirmation were also included. Exclusion criteria for the current study encompass individuals diagnosed with diseases other than tuberculosis and cases with missing or incomplete demographic, clinical, or laboratory information necessary for analysis.

3. RESULTS

In the year 2019, 201 cases were reported from four tehsils of district Sudhnuti, 54 (26.86%) in tehsil Baluch, 8 (3.98%) in tehsil Mong, 90 (44.77%) in tehsil Pallandri and 49 (24.37%) in tehsil Tarar Khal. Out of 201 cases, 186 (92.53%) were new cases, 5 (2.48%) were relapse cases,and 4 (1.99%) were treatment-after-failure (TAF) cases. In 201 cases, 107 (53.23%) were males and 94 (46.76%) were females. A Chi-square test was applied to find out the effect of TB on gender. The value of P=0.51, which is >0.05, is insignificant showing that tuberculosis has no selective effect on a specific gender.Pulmonary cases are 131 (65.17%), with 81 bacteriologically positive and 50 clinically diagnosed negative cases. Extra Pulmonary cases are 70 (34.82%), with one bacteriologically positive and 69 clinically diagnosed negative cases. The population details of district Sudhnuti and individual population details of all tehsils during the year 2019, as provided by the planning and development department of AJK, are shown in (Table 1). Duringthe 2019 study, the population was divided into distinct age groups. Notably, 2 cases (0.99%) occurred in the 0-4 age group, 8 cases (3.98%) in the 5-15 age group, 48 cases (23.88%) in the 15-24 age group, 43 cases (21.39%) in the 25-34 age group, 21 cases (10.44%) in the 35-44 age group, 16 cases (7.96%) in the 45-54 age group, 23 cases (11.44%) in the 55-64 age group, and 40 cases (19.90%) in the >64 age group. The current investigation reveals that individuals <15 years old exhibit lower susceptibility to tuberculosis (TB), while those >64 years old demonstrate higher susceptibility. Intriguingly, the highest incidence of TB was observed in the 15-24 age group are shown in (Table 2). Additionally, individuals aged >14 are predominantly affected by TB in the current study, whereas the occurrence of TB among children is relatively infrequent.

3.1 Case Notification Rate

The case notification rate (CNR) of TB during 2019 in district Sudhnuti was 66. The details of the total population, reported TB cases, and CNR from 2014-2019 areshown in (Table 3).

3.2 Contact Tracing and MDR Cases

Information about the total number of outpatient department**(**OPD) cases, presumptive TB cases tested by AFB microscopy or GeneXpert, number of positive TB cases verified by GeneXpert, number of cases tested for MDR, number of MDR TB cases identified, number of bacteriologically positive cases whose contacts were screened, number of contacts of bacteriologically positive cases screened and number of TB cases identified by contact tracing during the year 2019 are listed in (Table 4). In the year 2019, 522 contacts of 82 bacteriologically positive cases were traced and 22 (10.94%) TB cases were reported by contact tracing. In the year 2019, only 2 (0.99%) MDR cases were detected.

Table 1: Summary of TB Patients in District Sudhnuti during Year 2019

District Sudhnuti		Summary of all Cases of TB in Year 2019						Pulmonary			Extra Pulmonary		
Tehsils	Popullation	Total	M	F	New	Relapse	TAF	Total	+ve	-ve	Total	+ve	-ve
Balauch	90774	54	32	22	48	4	2	31	20	11	23	1	22
Mong	40588	8	4	4	8	0	0	4	3	1	4	0	4
Pallandri	119866	90	45	44	81	7	2	57	46	11	33	0	33
Tarar Khal	53528	49	26	24	49	0	0	39	12	27	10	0	10
Total	304756	201	107	94	186	11	4	131	81	50	70	1	69

Table 2: Age Wise Summary of all Cases in Year 2019

Age Group	Tehsil Balauch	Tehsil Mong	Tehsil Pallandri	Tehsil Trar Khal	Total
	TB cases	TB cases	TB cases	TB cases	TB cases
0-4	1	0	1	0	2
5-14	2	1	3	2	8
15-24	15	1	22	10	48
25-34	12	2	16	13	43
35-44	7	1	6	7	21
45-54	2	0	9	5	16
55-64	2	0	14	7	23
>64	12	4	18	6	40
Total	53	9	89	50	201

Table 3:District Sudhnuti Population, Reported TB Cases and Case Notification rate from 2014-2019

Year	Population	Reported TB Cases	Case Notification Rate
2014	283268	248	88
2015	287962	281	98
2016	292733	285	97
2017	297584	282	95
2018	302435	235	78
2019	304756	201	66

Table 4: MDR Cases, Contact Tracing and Identified TB Cases by Contact Tracing in 2019

District Tehsils	Total OPD	Presumptive TB Cases Tested by AFB /xpert	B +ve Cases Identified Tested by xpert	Number of Cases Tested for MDR	MDR TB Cases Identified	B +ve TB cases whose contacts are traced	No of Contacts of B +ve Cases Screened	No of TB Cases Identified by Contact Screening
Balauch	31257	247	21	19	1	21	119	11
Mong	9658	46	3	3	0	3	17	0
Pallandri	76304	643	46	59	1	46	314	9
Tarar Khal	15850	122	12	12	0	12	72	2
District	133069	1058	82	93	2	82	522	22

4. DISCUSSION

The current study presented a detailed picture of TB cases in district Sudhnuti, AJK, by combining AFB microscopy and GeneXpert detection method. In various regions across the globe, the male-to-female ratio (MFR) varies significantly in tuberculosis cases(18). The current study shows a slightly higher number of male TB cases with a 1.13:1.00 MFR. A Study conducted by Faiz et al. (19)shows certain regions in the world where the ratio of males is higher than that of females such as in Europe with 2.16:1.00 MFR, America with 1.49:1.00 MFR, Southeast Asia with 2.03:1.00 MFR, and Africa with 1.35:1.00. In contrast to these regions there are certain other regions in the world where the ratio of females is higher than males such as Iran with 0.90:1.00 MFR, Lebanon with 0.70:1.00 MFR and Afghanistan with 0.50:1.00 MFR. The results of the current study are relatable to the regions with higher male ratios and are not relatable to the regions with higher female ratios as shown by a study conducted by Faiz et al. (19). The MFR can be different within the same country as in Eastern provinces of Pakistan, the MFR is 1.27:1.00 in Sindh, 1.12:1.00 in Punjab, and in Western provinces, the MFR is 0.70:1.00 in Baluchistan and 0.74:1.00 in Khyber Pakhtunkhwa (20). The current study concerning MFR shows similarity with the Eastern provinces of Pakistan. A study conducted by Faiz et al. (19)in district Haveli shows 0.53:1.00 FMR and a study conducted by Saleem et al.(21) in district Kotle shows 1.16:1.00 MFR. The results of this study regarding MFR are not similar to the research conducted by Faiz et al.(19)in district Haveli (Southern region) AJK, but these results are similar to the study conducted by Saleem et al.(21) in district Kotle (Northern region) AJK. The current study also reveals the difference in MFR in the Northern and Southern regions of AJK.

In our study, only 0.99% of tuberculosis cases developed drug resistance. However, in specific regions of AJK, Baber et al.(22) documented 9% of TB cases exhibiting drug resistance. Similarly, in various regions of Punjab, Javaid et al.(23) and Ullah et al.(24) reported rates of at least one drug-resistant TB at 11.3% and 11.5%, respectively. Among presumptive drug-resistant tuberculosis patients, the rate of rifampicin (RIF) resistance varies around the world, with rates as high as 27% in Southeast Asia and 2.7% in the Americas and Africa(25). Bangladesh and Nepal have high RIF resistance rates of 50% and 86.5%, respectively(26, 27). According to a recent survey about MDR challenges in Pakistan, the estimated rate of MDR-TB among TB cases that were newly reported was 4.3%, but it increased to 19.4% among those who had previously been treated(25). In India, studies conducted by Kumar et al.(28), Sharma et al.(29), and Desikan et al. (30)utilizing line probe detection (LPA) reported MDR-TB rates of 25.8%, 22%, and 10.6%, respectively. In our study, only 0.99% of tuberculosis cases developed drug resistance. In the current study, the number of drug resistance TB cases is low which may be due to awareness about drug resistance in the studied population or maybe cases are not reported properly within the studied population.

CNR plays an important role in the control of TB cases but in the current study, the CNR was 66/100000. The TB incidence rate in AJK, as per WHO criteria for 2014, is 270 per 100,000, which is considerably high compared to other developing countries (13). The CNR from 2014 to 2019 as shown in (Table 3) is far away from the WHO set criteria. The CNR from 2014 to 2019

shows an alarming situation concerning surveillance systems that may be not effective in reporting the exact number of TB cases or cases may be treated hiddenly without being registered. The current study, a study conducted by Faiz et al.(19)in district Haveli (Southern region) AJK, and a study conducted by Saleem et al.(21) in district Kotle (Northern region) AJK show low CNR as compared to WHO set criteria. If the cases are not treated privately or hiddenly then these studies urge on WHO to revise its policy regarding the set criteria of incidence rate in AJK by viewing different factors such as total population and the number of emigrants. Factors such as total population and the number of emigrants will help WHO in defining the new criteria for the incidence rate of TB in AJK. The current study mainly focuses on prevalence and case notification rate which are the main factors in the cure and prevention of TB.

5. CONCLUSION

The current study shows that males are slightly more prone to TB in district Sudhnuti AJK as compared to females. Individuals with age >64 are more susceptible to TB as compared to individuals with age <15. The CNR during 2019 is 66 which is far away from WHO set criteria. The CNR indicates that there is a need for improvement in the surveillance system. The current study mainly focuses on prevalence and case notification rate which are the main factors in the cure and prevention of TB.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

AUTHORS' CONTRIBUTIONS

This research work was carried out in collaboration among all authors. Authors MS, MN, ZS, and MH designed the study, wrote the protocol, performed the sampling, analysis, and literature review, and wrote the first draft of the manuscript. Author ZS performed microscopy and GeneXpert for the detection of TB. Authors MHK and NS performed the data collection and arrangement. All authors read and approved the final version.

CONSENT

Before enrollment, written informed consent was acquired from all participants, as well as from the parents or legal guardians of all participating children.

ETHICAL APPROVAL

The current study was approved by the Ethical Committee of District Hospital Pallandri AJK.

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DEFINITIONS

1. **Outpatient Department (OPD) Cases**: The total number of cases attending outpatient services for health related concerns.

2. **Presumptive TB Cases Tested**: Individuals presenting symptoms suggestive of TB who underwent diagnostic tests, including AFB (acid-fast bacilli) microscopy or GeneXpert.

3. **Positive TB Cases Verified by GeneXpert**: The number of cases confirmed positive for TB through GeneXpert testing.

4. **Multidrug-Resistant (MDR) TB Testing**: The number of cases tested specifically for multidrug-resistant TB.

5. **Identified MDR TB Cases**: The count of confirmed cases exhibiting resistance to multiple TB drugs.

6. **Screening of Contacts of Bacteriologically Positive Cases**: The process of tracing and screening individuals who have had contact with confirmed bacteriologically positive TB patients.

7. **Number of Contacts Screened**: The total count of individuals who were screened due to contact with bacteriologically positive TB cases.

8. **TB Cases Identified by Contact Tracing**: The number of TB cases detected as a result of contact tracing efforts.