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Original Article

Microbial Pattern of Infection of a Post PTB Patient in Cumilla Region

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ABSTRACT

Introduction*: Pulmonary tuberculosis (PTB) remains a significant public health challenge in Bangladesh. Post-treatment complications and the emergence of antimicrobial resistance complicate patient management. This study aims to investigate the microbial infection patterns, demographic characteristics, and antimicrobial resistance in post-PTB patients in Cumilla, Bangladesh.* ***Methods & Materials****: This observational study was conducted from January 2022 to December 2023 at Mynamati Cantonment General Hospital, Cumilla. A total of 83 post-PTB patients aged 20 years and above participated. Data on demographics, clinical characteristics, and comorbidities were collected using a pre-structured questionnaire. Standard Culture and Sensitivity (C&S) tests were performed to determine antimicrobial sensitivity and resistance patterns. Data were analyzed using SPSS version 25.* ***Results****: The majority of participants were aged 51-70 years (60.25%) and predominantly male (66.27%). Common occupations included farming (40.96%) and private jobs (31.33%). Family income was mostly between 5000 and 10000 BDT per month (51.81%). Comorbid conditions included COPD (36.14%), diabetes (25.30%), and hypertension (20.48%). Biochemical parameters showed mean WBC count of 11036.34±4770.48, platelet count of 196528.00±72250.40, and ESR of 31.42±12.15. Antimicrobial sensitivity was highest for levofloxacin (33.73%) and ciprofloxacin (26.51%). High resistance was noted for cefixime (48.19%), cefuroxime (46.99%), and azithromycin (42.17%).* ***Conclusion****: The study highlights significant comorbidities and high antimicrobial resistance in post-PTB patients, emphasizing the need for integrated care approaches and continuous surveillance of antimicrobial susceptibility. Tailoring treatment protocols based on local epidemiological data is crucial for improving patient outcomes and managing multidrug-resistant TB effectively.*

Keywords: *Pulmonary Tuberculosis, Antimicrobial Sensitivity, Antimicrobial Resistance*

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INTRODUCTION

Tuberculosis (TB) continues to be a significant global health challenge, with an estimated 10 million new cases and 1.5 million deaths annually, making it one of the top 10 causes of death worldwide. In Bangladesh, TB remains a major public health issue, with high incidence and prevalence rates, particularly in rural and urban slums where healthcare infrastructure is often inadequate to meet the needs of the population [1,2]. The burden of TB is exacerbated by factors such as poverty, overcrowding, and limited access to healthcare, which contribute to the spread of the disease and hinder effective management and treatment [3]. Despite the implementation of various TB control programs, the country still faces challenges in achieving early diagnosis, prompt treatment, and effective management of TB cases, especially in rural areas [4,5]. The management of TB in Bangladesh involves a network of public and private healthcare facilities, with the National Tuberculosis Control Program (NTP) playing a pivotal role in coordinating efforts to control the disease. However, the effectiveness of these programs is often compromised by issues such as underreporting, inadequate implementation of infection prevention and control measures, and delays in diagnosis and treatment initiation [6,7]. Studies have highlighted the need for better implementation of TB infection control guidelines and improved healthcare worker training to enhance the effectiveness of TB control measures in Bangladesh [6,8]. The successful '9-month Bangladesh regimen' for multidrug-resistant TB has shown promise in improving treatment outcomes, but challenges remain in ensuring consistent and effective implementation across all healthcare settings [9]. Post-tuberculosis (PTB) sequelae, which include a range of pulmonary and extrapulmonary complications, are a significant concern for patients who have completed TB treatment. Residual lung damage, chronic respiratory issues, and persistent inflammation are common among PTB patients, making them more susceptible to secondary infections [10]. Studies have documented various complications such as bronchiectasis, chronic pulmonary aspergillosis, and recurrent bacterial infections in PTB patients, highlighting the need for ongoing monitoring and management of these individuals [11,12]. The presence of multidrug-resistant pathogens further complicates the management of secondary infections in PTB patients, underscoring the importance of targeted antimicrobial therapy based on local epidemiological data [13]. Understanding the local epidemiological patterns of microbial

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infections in PTB patients is crucial for effective treatment and management. Regional studies in Bangladesh have provided valuable insights into the common pathogens and their resistance patterns, which can inform treatment protocols and improve patient outcomes [14,15]. Research on the healthcare-seeking behavior of TB patients in rural Bangladesh revealed significant delays in diagnosis and treatment, often due to economic barriers and lack of awareness, which contribute to the persistence and spread of TB [4,5]. The importance of localized epidemiological data cannot be overstated, as it enables healthcare providers to tailor treatment strategies to the specific needs of the population. In Bangladesh, efforts to decentralize TB treatment and manage drug-resistant TB through community-based programs have shown success in increasing treatment enrollment and adherence, reducing delays, and improving cure rates [9,16]. These initiatives demonstrate the potential for community-based approaches to enhance the effectiveness of TB control programs and address the unique challenges faced by different regions. In conclusion, while significant progress has been made in TB control in Bangladesh, numerous challenges remain, particularly in managing post-tuberculosis complications and secondary infections. The healthcare infrastructure, though extensive, requires further strengthening and optimization to effectively address these challenges. The implementation of comprehensive TB infection control measures, improved training for healthcare workers, and the use of localized epidemiological data are critical steps toward improving TB management and patient outcomes in Bangladesh. Continued research and investment in healthcare resources are essential to sustain and build upon the gains made in the fight against TB and its associated complications.

METHODS & MATERIALS

This observational study was conducted at Mynamati Cantonment General Hospital, Cumilla, Bangladesh, from January 2022 to December 2023. A total of 83 patients who had recovered from Pulmonary Tuberculosis (PTB) were included. Participants were required to be 20 years or older and willing to participate; those under 20 or unwilling were excluded. Standard Culture and Sensitivity (C&S) tests were performed on sputum samples from all patients to assess antimicrobial sensitivity and resistance patterns. The tests were conducted in the hospital's microbiology lab using the Kirby-Bauer disk diffusion method. Demographic and baseline data, including age, gender, socioeconomic status, smoking history, duration of TB treatment, and comorbidities, were collected via a pre-structured questionnaire. The data were organized and analyzed using SPSS version 25. Descriptive statistics summarized the demographic characteristics and microbial patterns. Chi-square tests were used to identify associations between demographic variables and microbial

RESULTS

Table – I: Distribution of baseline characteristics among the participants (*n*=83)

Baseline Characteristics	Frequency	Percentage
Age		
≤40	14	16.87%
41-50	10	12.05%
51-60	24	28.92%
61-70	26	31.33%
>70	9	10.84%
Sex		
Male	55	66.27%
Female	28	33.73%
Occupation		
Private Job	26	31.33%
Housewife	19	22.89%
Farmer	34	40.96%
Others	4	4.82%
Family Income		
<5000	12	14.46%
5000-10000	43	51.81%
10000-20000	24	28.92%
>20000	4	4.82%

The age distribution showed that 16.87% of participants were 40 years old or younger, 12.05% were between 41 and 50 years, 28.92% were between 51 and 60 years, 31.33% were between 61 and 70 years, and 10.84% were over 70 years old. The majority of the participants were male, accounting for 66.27%, while females comprised 33.73%. Regarding occupation, 40.96% were farmers, 31.33% had private jobs, 22.89% were housewives, and 4.82% were engaged in other occupations. In terms of family income, 14.46% of participants earned less than 5000 BDT per month, 51.81% had an income between 5000 and 10000 BDT, 28.92% had an income between 10000 and 20000 BDT, and 4.82% earned more than 20000 BDT per month.

Table – II: Distribution of participants by observable clinical characteristics and comorbidities (*n*=83)

Variables	Frequency	Percentage
Chronic Obstructive Pulmonary Disease	30	36.14%
Smoking	15	18.07%
Hypertension	17	20.48%
Diabetes	21	25.30%
Edema	3	3.61%

Among the 83 participants, 36.14% had Chronic Obstructive Pulmonary Disease (COPD), 18.07% were smokers, 20.48% had hypertension, and 25.30% had diabetes. Additionally, 3.61% of the participants experienced edema. Somke patients had multiple presentations.

Table – III: Mean±SD biochemical parameters among the participants (*n*=83)

Biochemical Parameters	Mean±SD
WBC	11036.34±4770.48
Platelet	196528.00±72250.40
ESR	31.42±12.15
Hb (%)	11.17±1.47
RBS	7.27±0.61
DC-Neutrophils	71.21±7.35
DC-Lymphocytes	18.80±5.66

The biochemical parameters of the 83 participants revealed the following mean values with standard deviations (SD): White Blood Cell (WBC) count was 11036.34±4770.48, platelet count was 196528.00±72250.40, and Erythrocyte

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Sedimentation Rate (ESR) was 31.42±12.15. Hemoglobin (Hb) levels averaged at 11.17±1.47%, while Random Blood Sugar (RBS) levels were 7.27±0.61 mmol/L. Differential Count (DC) showed neutrophils at 71.21±7.35% and lymphocytes at 18.80±5.66%.

Table – IV: Antimicrobial sensitivity pattern among the participants (*n*=83)

Sensitivity to antibiotics	Frequency	Percentage
Amoxicilin	6	7.23%
Amoxiclay	0	0.00%
Amikacin	16	19.28%
Erythromycin	0	0.00%
Azithromycin	0	0.00%
Cotimoxazole	5	6.02%
Chloramphenicol	11	13.25%
Gentamycin	0	0.00%
Levoflaxicin	28	33.73%
Ciprofloxacin	22	26.51%
Cephradine	6	7.23%
Cefuroxime	6	7.23%
Cefixime	0	0.00%
Ceftriaxone	5	6.02%
Imipenam	6	7.23%
Meropenam	17	20.48%
Netilmycin	6	7.23%
Colistin	11	13.25%

The antimicrobial sensitivity patterns among the 83 participants revealed varied resistance and susceptibility to different antibiotics. Sensitivity to Amoxicillin was observed in 7.23% of participants, while none showed sensitivity to Amoxiclay, Erythromycin, Azithromycin, Gentamycin, or Cefixime. Amikacin showed sensitivity in 19.28% of participants, Cotrimoxazole in 6.02%, and Chloramphenicol in 13.25%. Levofloxacin had the highest sensitivity rate at 33.73%, followed by Ciprofloxacin at 26.51%. Sensitivity to Cephradine, Cefuroxime, and Imipenem was each noted in 7.23% of cases, while Ceftriaxone and Meropenem showed sensitivity in 6.02% and 20.48% of participants, respectively. Additionally, 13.25% of participants were sensitive to Colistin, and 7.23% to Netilmicin.

Table – V: Antimicrobial resistance pattern among the participants (*n*=83)

Resistance to antibiotics	Frequency	Percentage
Amoxicilin	11	13.25%
Amoxiclay	34	40.96%
Amikacin	17	20.48%
Erythromycin	12	14.46%
Azithromycin	35	42.17%
Cotimoxazole	0	0.00%
Chloramphenicol	17	20.48%
Gentamycin	23	27.71%
Levoflaxicin	6	7.23%
Ciprofloxacin	17	20.48%
Cephradine	11	13.25%
Cefuroxime	39	46.99%
Cefixime	40	48.19%
Ceftriaxone	34	40.96%
Imipenam	11	13.25%
Meropenam	5	6.02%
Netilmycin	0	0.00%
Colistin	0	0.00%

The antimicrobial resistance patterns among the 83 participants indicate significant resistance to various antibiotics. Amoxicillin showed resistance in 13.25% of participants, while Amoxiclay and Azithromycin exhibited high resistance rates of 40.96% and 42.17%, respectively. Resistance to Amikacin and Chloramphenicol was found in 20.48% of cases each, and Erythromycin showed resistance in 14.46%. Gentamycin had a resistance rate of 27.71%, while resistance to Levofloxacin was relatively lower at 7.23%. Ciprofloxacin and Cephradine showed resistance in 20.48% and 13.25% of participants, respectively. Cefuroxime and Cefixime demonstrated high resistance rates of 46.99% and 48.19%. Resistance to Ceftriaxone and Imipenem was observed in 40.96% and 13.25% of participants, respectively, whereas Meropenem had a lower resistance rate of 6.02%. Notably, no resistance was observed for Cotrimoxazole, Netilmicin, or Colistin, indicating their potential effectiveness in this patient population.

DISCUSSION

The study conducted at Mynamati Cantonment General Hospital, Cumilla, Bangladesh, revealed several key findings regarding the demographic characteristics, clinical profiles, and antimicrobial sensitivity and resistance patterns among post-PTB patients. This discussion aims to contextualize these findings by comparing them with existing literature to provide a comprehensive understanding of the local epidemiological trends and their implications for TB management and treatment strategies. The age distribution of the participants in our study showed that the majority were between 51 and 70 years old, with a notable male predominance (66.27%). This aligns with global patterns, where TB incidence is higher among older adults and males [1,2]. Studies in Taiwan and Australia have similarly reported higher TB rates in older age groups and a higher prevalence among males, indicating that gender and age are significant risk factors for TB worldwide [17]. Occupationally, a significant proportion of our participants were farmers (40.96%), followed by private job holders and housewives. This occupational distribution reflects the rural setting of the study and highlights the vulnerability of agricultural workers to TB, as also observed in studies from Turkey and Bangladesh, where similar occupational patterns were noted [18,19]. The majority of participants had a family income between 5000 and 10000 BDT per month, underscoring the socio-economic challenges faced by TB patients in this region. Comparable findings were reported in studies from Pakistan and Rajshahi, Bangladesh, where low-income levels were prevalent among TB patients, impacting their access to healthcare and treatment adherence [4,20]. Clinically, the study found that 36.14% of participants had Chronic Obstructive Pulmonary Disease (COPD), 18.07% were smokers, 20.48% had hypertension, 25.30% had diabetes, and 3.61% experienced edema. These comorbidities are common in TB patients and significantly affect their prognosis and treatment outcomes. Studies in Iran and South India have similarly highlighted high prevalence rates of comorbid conditions such as hypertension and diabetes among COPD patients, emphasizing the need for integrated care approaches for TB and chronic diseases [21,22]. The biochemical parameters revealed a mean WBC count of 11036.34±4770.48, a mean platelet count of 196528.00±72250.40, and a mean ESR of

31.42±12.15. These values are consistent with findings in other studies, which reported elevated inflammatory markers in TB patients, indicative of ongoing immune responses and potential secondary infections [23,24]. The mean Hb level was 11.17±1.47%, which is lower than normal, reflecting the anemia often observed in TB patients due to chronic inflammation and nutritional deficiencies [25]. The mean RBS level of 7.27±0.61 mmol/L suggests impaired glucose metabolism, likely due to diabetes comorbidity. Antimicrobial sensitivity and resistance patterns in our study showed varying levels of resistance to commonly used antibiotics. Notably, high sensitivity was observed to Levofloxacin (33.73%) and Ciprofloxacin (26.51%), whereas significant resistance was noted for Cefixime (48.19%), Cefuroxime (46.99%), and Azithromycin (42.17%). These findings are consistent with other studies that reported high resistance rates to cephalosporins and macrolides among TB patients, reflecting widespread antimicrobial resistance [26,27]. For instance, a study in Shandong, China, highlighted high resistance rates to ceftriaxone and ciprofloxacin among TB pathogens, underscoring the challenge of treating multidrug-resistant TB [28]. Similarly, research in Nepal reported high resistance levels to imipenem and amikacin, which are critical in treating severe infections [29]. The observed resistance patterns emphasize the need for continuous monitoring of antimicrobial susceptibility and the judicious use of antibiotics to prevent the escalation of drug-resistant TB strains [30]. In conclusion, the findings from our study are consistent with global and regional trends, highlighting the complex interplay between demographic factors, comorbid conditions, and antimicrobial resistance in the management of post-PTB infections. The high prevalence of comorbidities, coupled with significant antimicrobial resistance, underscores the need for comprehensive care strategies that integrate TB treatment with the management of chronic diseases. Additionally, localized epidemiological data are crucial for tailoring treatment protocols and improving patient outcomes. Continuous surveillance and judicious use of antibiotics, informed by sensitivity patterns, are essential to combat the growing threat of drug-resistant TB. The comparative analysis with existing literature reinforces the importance of targeted interventions and policy measures to address these challenges effectively.

Limitations of The Study

The study was conducted in a single hospital with a small sample size. So, the results may not represent the whole community.

CONCLUSION

This study conducted at Mynamati Cantonment General Hospital, Cumilla, Bangladesh, provides crucial insights into the demographic characteristics, clinical profiles, and antimicrobial resistance patterns among post-PTB patients. The findings indicate a significant burden of comorbid conditions such as COPD, diabetes, and hypertension, which complicate the management of TB. The observed high levels of antimicrobial resistance, particularly to commonly used antibiotics like cefixime and cefuroxime, underscore the urgent need for continuous monitoring and judicious use of antibiotics. Effective TB management strategies should integrate comprehensive care for comorbid conditions and rely on localized epidemiological data to tailor treatment protocols. These measures are essential to improve patient outcomes and combat the growing threat of multidrug-resistant TB in the region.

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