

Study of Secondary Bacterial Pathogens infecting Patients of Pulmonary Tuberculosis at Tertiary care center

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Abstract

Background: Pulmonary Tuberculosis (TB) is a potentially serious infectious disease caused by Mycobacterium tuberculosis. Secondary bacterial infection is one of the most important complications in these patients. Secondary bacterial infection causes worsening of clinical course in TB patients and this ultimately leads to higher mortality among pulmonary TB patients. So it become important to study secondary bacterial pathogens commonly encountered in patients with pulmonary tuberculosis.

Materials and Method: In this single centre hospital based observational study, 115 hospitalised pulmonary tuberculosis patients aged above 14 years, with suspicion of secondary infection clinically or having complaints of fever, productive cough, chest pain, shortness of breath, and increased sputum purulence, in spite of taking antitubercular therapy or pulmonary tuberculosis patients with high total leucocyte counts were included.

Results: 115 sputum samples examined for pyogenic culture, out of them 100 patients were infected with

secondary bacterial pathogens which were as follows- Staphylococcus (31.30%), followed by Pseudomonas (17.39%), Streptococcus (12.17%), Escherichia coli (10.43%), Enterobacter (7.83%), Klebsiella (6.09%), Acinetobacter (0.87 %) and Bukholderia (0.87 %). In remaining patients, candidial contamination was present in 6 (5.22%) patients, no pathogenic growth in 6 (5.22%) patients and commensals in 3(2.61 %) patients.

Conclusion: Secondary bacterial infections are common in pulmonary tuberculosis patients. Treatment of co-infection helps in early recovery and decreased complications hence lesser morbidity and mortality in pulmonary tuberculosis patients.

Keywords: Pulmonary Tuberculosis, Secondary bacterial infection, Pyogenic culture, Sputum specimen.

Introduction

Tuberculosis (TB) is one of the common infectious diseases that may affect lungs, lymph nodes, pleura, nervous system, abdomen, bones and joints, genito-urinary tract, skin etc. Lungs are the most common organ involved in TB.

Pulmonary TB may be associated with various complications like secondary pyogenic infections, fungal infections, haemoptysis, pneumothorax, respiratory failure and cor pulmonale. Secondary bacterial infection is one of the important complication in patients with pulmonary tuberculosis.¹⁻² Infection with two pathogens would always be worse than infection with one. Secondary bacterial infection is a cause of hospital admission, morbidity and mortality in these patients.³ Co-infection of TB and bacterial pathogen is common in TB endemic areas.⁴⁻⁶ Previous studies have noted several pathogenic bacteria like Streptococci, Staphylococci, Pneumococci, H. Influenzae, Moraxella catarrhalis, K.pneumoniae, P.aeruginosa, Actinomyces and Diptheria like bacilli in patients of tuberculosis.⁷ Streptococcus pneumoniae was frequently identified in previous studies,⁸ but Gram negative bacteria were commonly isolated from adults hospitalized with secondary bacterial infection in recent studies.⁸⁻⁹ Gram negative bacteria were commonly isolated in abnormal lung architecture following previous TB or respiratory infection.¹⁰⁻¹¹ The possible reason for secondary infection in TB patients is the inhibition of human defence mechanism during the active tuberculosis.^{1,12} Secondary bacterial infection causes worsening of clinical course in TB patients and this ultimately leads to higher mortality among pulmonary TB patients. For diagnosis and treatment of the secondary bacterial infection, strong index of suspicion and additional diagnostic testing are required.¹³ The aim of the study to detect commonly encountered bacterial pathogens among cases of secondary bacterial infections in pulmonary tuberculosis patients.

Methods

The study was approved by institutional ethical committee and research review board. This was a hospital based observational study, carried out on 115 pulmonary tuberculosis patients hospitalized in our institute with suspicion of secondary infection during year 2018-19. Diagnosis of pulmonary tuberculosis was made by sputum microscopy and CBNAAT. Patients less than 14 year of age, drug resistant TB, extrapulmonary TB and HIV-TB co-infection were excluded from study. Patients with fever, cough, chest pain, shortness of breath, increased sputum production and purulence in spite of taking antitubercular therapy or pulmonary tuberculosis patients with high total leucocyte counts were screened for secondary bacterial infection. Secondary bacterial pathogens were identified by microscopy, colony characteristics and various biochemical tests. Blood Agar, MacConkey's Agar, and Nutrient Agar media routinely used for bacterial culture.

Results

Table 1: Socio-demographic variables

	Male	Female	Total
Age Groups (In Years)			
14 - 40	22	19	41(35.65%)
41-60	42	5	47(40.86%)
> 60	26	1	27(23.47%)
Residence			
Rural	63	13	76(66.09%)
Urban	27	12	39(33.91%)
BMI (in Kg/m ²)			
Underweight (< 18.5)	75	22	97(84.35%)
Normal (18.5-24.9)	15	3	18(15.65%)
Total	90	25	115

A total of 115 patients admitted with diagnosis of pulmonary tuberculosis with secondary infection were included in the study. 90 (78.26%) subjects were male and 25 (21.73%) were female. Majority (40.86%) of the participants were aged 41-60 years. 76 subjects (66.09%) were from rural residence. 97 patients (84.35%) were underweight.

Table-2: Distribution of subjects according to Gram's staining of sputum

Gram's Staining of Sputum	Male n (%)	Female n (%)	Total n (%)
Gram Positive Cocci	39 (33.91%)	11 (9.57%)	50 (43.48%)
Gram Negative Bacilli	41 (35.65%)	9 (7.83 %)	50 (43.48%)
Others	10 (8.70%)	5 (4.35%)	15 (13.04%)
Total	90 (78.26)	25 (21.74)	115 (100)

Gram positive cocci and gram negative bacilli were found equally in 50 smears(43.48%). In 15 smears (13.04%) pus cells, epithelial cells, budding yeast cells were seen.

Table-3: Organism detected in sputum pyogenic culture of subjects

Organism	Number	Percent (%)
Staphylococci	36	31.30 %
Pseudomonas	20	17.39 %
Streptococci	14	12.17 %
Escherichia Coli	12	10.43 %
Enterobacter	9	7.83 %
Klebsiella	7	6.09 %
Candida	6	5.22 %
No pathogenic organism	6	5.22%
Commensal bacterias	3	2.61 %
Acinetobacter	1	0.87 %
Bukholderia cepacia	1	0.87 %
Total	115	100.00

Staphylococci detected in 36 (31.30%) sputum pyogenic culture specimens followed by Pseudomonas 20 (17.39%) and Streptococci 14 (12.17%) specimens. No pathogenic organism grown in 6 (5.22%) sputum specimens, Candida and commensal grown in 6(5.22%) & 3(2.61%) specimens respectively. Acinetobacter (0.87%) and Bukholderia cepacia (0.87%) each detected in only one sample.

Discussion

Mean age group of patients was 46.69 ± 16.40 years including males with mean age of 51.02 ± 14.13 years and females with 31.08 ± 14.63 years. In a recent study conducted in Cambodia by Attia et al.⁹, tuberculosis patients with bacterial infection was in age range of 45-62 years with a median age of 52 years. Gohil et al.¹⁴ found most patients in the age group of 45-60 years (38%) and less than 30 years age group was affected less commonly (12%). In the study of Mujahid et al.¹⁵ commonly affected age group was 41-50 years (33.82%) and least common affected group was 21-30 years (7.35%).

In our study most of the patients were male. 78.26% were male and 21.74% were female. Our result coincides with the studies conducted by Attia et al.⁹, Gohil et al.¹⁴, Mujahid et al.¹⁵, Ilyasu et al.¹⁶, Khan et al.¹⁷, Hasan et al.¹⁸. The reason for this may be that males are commonly exposed to external environmental agents.¹⁸

Most of the subjects in our study were from rural residence in comparison to urban area (Rural v/s Urban - 66.09% v/s 33.91%). This may be because of malnutrition, poor hygiene and low social economic status.

In our study most patients were in underweight category. 84.35% patients had BMI less than 18.5. Mean BMI was 16.01 ± 2.45 kg/m². This can be

explained by the fact that tuberculosis is more common in persons with low BMI which is also a risk factor for secondary infection. Normal BMI persons have decreased risk of TB.¹⁹

In sputum Gram staining, gram positive cocci and Gram negative bacilli each were seen in 43.48% patients. In our study, Staphylococcus was the most common pathogen isolated from 36 (31.30%) sputum specimens followed by Pseudomonas from 20 (17.39%) specimens and Streptococcus from 14 (12.17%) specimens in sputum pyogenic culture of pulmonary tuberculosis patients. These findings are similar to the study conducted by **Langbang et al.**¹In their most common bacterial pathogen found was Staphylococcus in 32 % subjects followed by Pseudomonas in 16 % subjects while least common pathogen isolated was Klebsiella in 4 % cases. **Mujahid et al.**¹⁵ in their study found that Staphylococcus aureus (36%) was the most common isolate causing secondary infection in TB patients. **Attia et al.**⁹observed in their study, patients who were infected with both TB and bacteria had Klebsiella in their sputum culture commonly. Streptococcus pneumonia (44.7%), followed by Staphylococcus aureus (10.6%), Escherichia coli 26 (18.4%) and Klebsiella spp. were 25 (17.7%) in the study conducted by **Ilyasu et al.**¹⁶.**Shaddock et al.**²⁰ in their study found Klebsiella as most common isolate. But difference was that they included HIV positive subjects also. **Khan et al.**¹⁷also found Klebsiella as most common pathogen isolated. In the study conducted by **Hasan et al.**¹⁸ they observed Pseudomonas (35.1%) as commonly isolated followed by Bacilli spp.,(29.7%), Vibrio (13.5%), Staphylococcus and Klebsiella (10.8% each).

Conclusion

Secondary bacterial infections are common in pulmonary tuberculosis patients. Detailed evaluation with sputum culture for early identification of secondary bacterial pathogen and prompt treatment may help in early recovery and decreased complications hence lesser morbidity and mortality in pulmonary tuberculosis patients.

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