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Original Research Article

Association between Tuberculosis and Chronic Kidney Disease in Mayurbhanj District: A Study in Tertiary Care Teaching Hospital

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Conflict of interest: Nil

Abstract

Background: Tuberculosis remains a significant burden on Tribal population of India. Prevalence of CKD is also higher in some tribal populations.

Aim of the study: The aim is to detect clinical spectrum of TB & CKD, co-occurrence and its treatment outcome in tribal population.

Method: This is a Descriptive Observational Study, carried out in PRM MCH, Baripada, Mayurbhanj, and Odisha during the period between February 2022 to January 2023. Clinical characteristics and outcomes of anti Tb treatment in patients of Tuberculosis with CKD were collected and studied**.**

Results : In 52 cases of TB-CKD co existing cases , the chief complains of patients in this study is cough(80.76%) with maximum cases as Pulmonary tuberculosis with most common associated stage of CKD is stage 4(71.15%) with Mean Age 55.3±11.2 years; Male : Female ratio= 9.4:1; Mean BMI= 17.6±3.2 kg/m^2; The patients had Anaemia associated with TB-CKD which is statistically significant. There is a borderline non-significant association between CKD stage and TB treatment outcome, in this study.

Conclusion: This study highlights a high burden of undernutrition and advanced CKD among TB patients in tribal regions. While BMI and CKD stage showed potential clinical relevance to outcomes, statistical significance was not achieved-likely due to limited sample size.

Keywords: Pulmonary Tuberculosis; Extra Pulmonary Tuberculosis; Chronic Kidney Disease; Tribal Community; Body Mass Index.

Introduction

Tuberculosis (TB) remains a significant public health challenge in India, especially among vulnerable population such as tribal community. There is almost near complete absence of data when it comes to tribal populations that constitutes 8.6 percent of India's population.[1] These communities often experience disproportionate burden of infectious disease due to socioeconomic disadvantages and limited access to health care .

Chronic kidney disease (CKD) a growing non-communicable health problem further complicates this burden.[2] Emerging evidence suggests a complex bi directional association between TB & CKD. Immunosuppression in CKD particularly in ESRD or patients undergoing dialysis increases susceptibility to latent TB reactivation and active TB disease. [3] At the same time TB itself can lead to renal complications further worsening kidney function. [4]

In tribal population where health disparities are more pronounced the co-existence of TB & CKD causes a dual burden with potentially severe clinical & socioeconomic consequences. Early identification integrated care strategies and culturally appropriate intervention are essential to address this co morbidity. This study aims to detect the clinical spectrum of TB &CKD co-occurrence, in a tribal population, of Mayurbhanj district, done at PRM

Medical College & Hospital, Baripada, Mayurbhanj, Odisha, India.

Material and Methods

Study Design: Descriptive Observational Study (Cross sectional study), hospital based.

Study Population: CKD patients diagnosed with tuberculosis.

Study Period: April 2022 – March 2023.

Study Place: Dept of Respiratory Medicine, Pandit Raghunath Murmu Medical College & Hospital, Baripada.

Inclusion Criteria:

1. All CKD cases diagnosed with Tuberculosis fulfilling the criteria as per the standard guidelines.
2. Patients receiving Modified ATT regimen.
3. Patients with age ≥ 18years.

Exclusion Criteria:

1. Patients not giving consent.
2. Pregnant & Lactating women.
3. Pre-existing liver diseases.
4. Renal transplant patients.
5. HIV positive cases.

All patients of CKD with tuberculosis diagnosed as per standard guidelines which is as follows-

Criteria for inclusion of TB cases: (according to NTEP Guidelines) [5]

Microbiologically confirmed TB: Presumptive TB patient with biological specimen positive for AFB or positive for MTB on culture or positive for TB through molecular testing.

Clinical Diagnosed TB case: A presumptive TB patient who is not microbiologically confirmed , but diagnosed with active TB by a clinician on basis of imaging , histopathology or clinical signs with a decision to treat the patients with a full course of anti TB treatment.

Criteria for inclusion of CKD cases [6]: Eiether any of the following present for ≥ 3 months

Markers of kidney damage (one or more):

a) Albuminuria (AER ≥ 30mg/24 hrs; ACR ≥ 30mg/g[≥ 3mg/mmol])
b) Urine sediment abnormalities
c) Electrolyte and other abnormalities due to tubular disorders
d) Abnormalities detected by histology
e) Structural abnormalities detected by imaging
f) History of kidney transplantation

OR

Decreased GFR: GFR < 60ml/min/1.73m^2

EGFR calculated using the CKD EPI Equation:

$$GFR = 141 * \min(Scr/\kappa,1)^{\alpha} * \max(Scr/\kappa, 1)^{-1.209} * 0.993^{Age} * 1.018 \text{ [if female]} * 1.159 \text{ [if black]}$$

S cr is serum creatinine (mg/dL), κ is 0.7 for females and 0.9 for males, α is -0.329 for females and -0.411 for males, min indicates the minimum of Scr/κ or 1, and max indicates the maximum of Scr/κ or 1.

Sampling Procedure: Convenience sampling method.

Sample Size: 52 TB-CKD co existing patients.

Human Subject Protection:

The Declaration of Helsinki's ethical criteria was adhered all times. The protocol of Research was submitted to the Institutional Ethics committee of PRM MCH, Baripada and was initiated after getting approval via letter no-32/6th IEC, dt-21-02-2022; Reg no-EC/NEW/INST/2020/975, dt-28 Oct 2020.

Data Collection Procedure:

The baseline demographic and descriptive data were collected using pre designed, pre tested semi-structure questionnaire.

These patients were initiated with the anti-tuberculosis (ATT) therapy after calculating the creatinine clearance using the CKD EPI equation given above. Medical history will be taken with emphasis to present tubercular symptoms and duration of CKD. Detailed clinical examination done.

The study cases were subjected to following investigations-

a) Routine blood investigations (CBC/RFT/LFT/FBS/2hPPbs/HbA1C/Viral markers)
b) Sputum examination for AFB; CBNAAT /TRUENAT
c) Chest Xray (PA view)
d) USG KUB
e) Special investigations as and when required (CT Thorax/CT brain/CT abdomen and pelvis/MRI Brain & Spine)
f) Pleural fluid/Ascitic fluid /CSF analysis.
g) FNAC /CBNAAT of tissue specimen.

All patients were followed up till the end of the treatment and outcomes classified according to the NTEP guidelines [5].

Statistical Analysis: Data collected was entered and analyzed using IBM SPSS 26. Stastical analysis included descriptive statistics (frequency, percentage, mean and standard deviation), cross tabulations, chi-square tests and independent t -tests to identify associations between clinical parameters and outcomes. $p < 0.05$ is considered significant.

Results

Table 1: Demographic Characteristics & Clinical Presentations of the Study Participants

Characteristics	**Frequency (%)**
Mean Age	55.3 ± 11.2
Male : Female ratio	9.4:1
Mean BMI	17.6 ± 3.2
Diabetes	4 (7.69)
Alcoholic	37 (71.15)
Smokers	6 (11.53)
Hypertension	20 (38.46)
Clinical Presentation	**Frequency (%)**
Decreased appetite	39 (75)
Fever	28(53.84)
Weight loss	32 (61.5)
Cough	42 (80.76)
Dyspnoea	38 (73.07)
Chest pain	7 (13.46)
Haemoptysis	10 (19.2)
Lymph node swelling	2 (3.84)
Back pain	2 (3.84)
Abdominal swelling	2 (3.84)

Table 1, Mean age of the patients is 55 ± 11.2 years (mean ± S.D), Male to female ratio is 9.4: 1, mean BMI 17.6 ± 3.2 kg/m^2. The patients with associated co morbidities having diabetes (7.69%), Alcoholic (71.15%), Smokers (11.53%) and hypertension (38.46%). The table shows 39(75%) have decreased appetite, 28(53.84%) cases with fever, 32(61.5%) cases with weight loss, 32(80.76%) cases with cough, 38(73.07%) cases with dyspnoea, 7 (13.46%) cases with chest pain, 10 (19.2%) with haemoptysis, 2 (3.84%) cases with lymph node swelling, 2 (3.84 %) cases with back pain and 2 (3.84%) cases with abdominal swelling.

BMI=Body mass index.

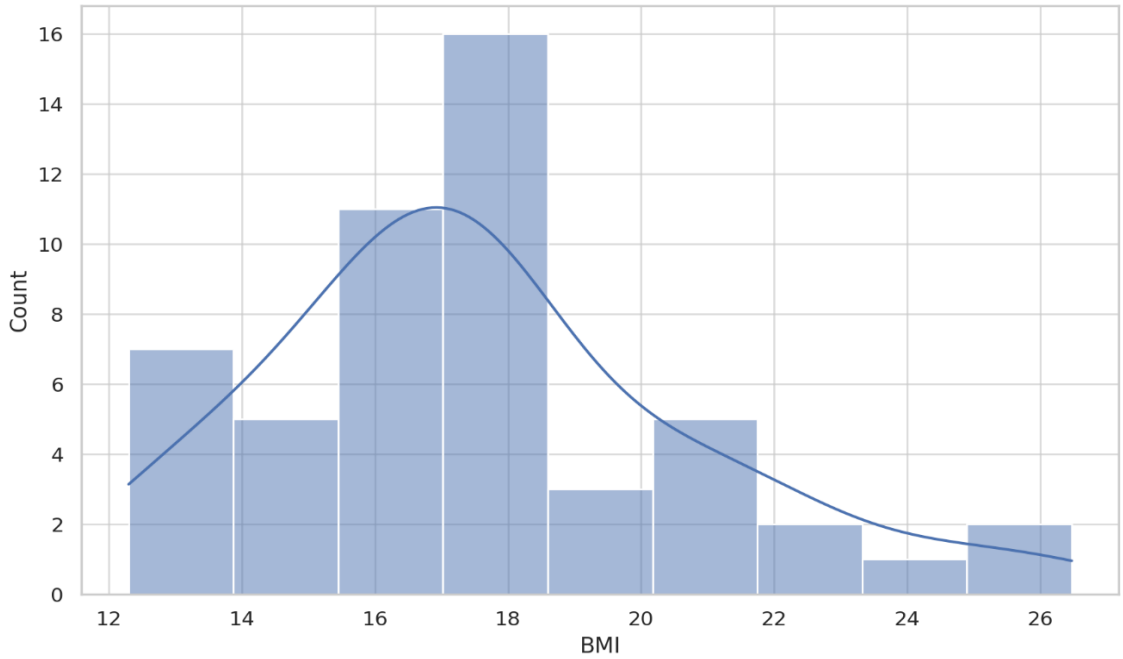

Figure 1: BMI Distribution:

Table 2: Laboratory Investigations

Investigation	Mean	Std. Dev.
CBC	11643.6	4322.8
Hb	9.0	1.8
Urea	72.2	34.1
Creatinine	3.1	1.7
Cr cl	20.2	7.5
Sodium	129.8	10.1
Potassium	3.4	0.6
Calcium	13.1	26.8
FBS	95.6	18.1
HbA1c	6.5	0.1

CBC=Complete blood count; Hb=Haemoglobin; Cr cl= Creatinine clearance; FBS= Fasting blood sugar; HbA1C= Glycosylated haemoglobin.

Table, shows statistically significant co relation with hemoglobin (anemia) with Chi-Square Statistic: 26.06 and p-value of 0.0105.

Table 3: Distribution of Diagnostic Investigation:

Mode Of Diagnosis	Frequency (%)
Chest X ray	
Normal	8(15.4)
Pleural effusion	6(11.54)
Pulmonary infiltrations	22(42.3)
Consolidation	3(5.7)
Cavitations	17(32.7)
Microbiology	
SPUTUM AFB	24 (46)
CBNAAT/TRUENAT	26 (50)
Special Investigations	
Lymph node aspirate cytology	2 (3)
Pleural fluid analysis	6 (11)
Ascitic fluid analysis	2 (3)
MRI Spine	2 (3)
CT Chest	7 (13)

Table 3, depicts that the most common finding in Chest imaging is pulmonary infiltrations(42.3%) followed by cavitations(32.7%) ; 26 (50%) cases are diagnosed by means of CBNAAT /TRUNAT ; 24 (46%) cases were diagnosed by means of Sputum AFB ; 2 (3%) cases was diagnosed by lymph node aspirate ; 6 (11%) cases was diagnosed with pleural fluid analysis ; 2 (3%) cases was diagnosed with Ascitic fluid analysis; 2 (3%) cases diagnosed with MRI Spine and 7 (13%) cases diagnosed with CT Chest. [CBNAAT-Cartridge based nucleic acid amplification test]

Table 4: Co-Relation of Stage of Ckd with Site of Tuberculosis:

		Type Of Tb		Treatment Outcome				
Stage	**Frequency (%)**	**Ptb**	**Eptb**	**Cure**	**Complete**	**Ltfu**	**Change To Dr Tb Regimen**	**Died**
1								
2								
3	3 (5.7)	1	2		2			1
4	37 (71.15)	29	8	16	11	5		5
5	12 (23.07)	12	0	5		4	1	2

Table 4, show 3(5.7%) cases are in Stage 3 CKD, 37 (71.15%) cases are in stage 4 CKD and 12 (23.07%) cases are in stage 5 CKD. In stage 3 (1 PTB and 2 EPTB); in stage 4(29 PTB and 8 EPTB) and in stage 4 all 12 cases are PTB cases. shows in TB- CKD 3, 2 cases completed treatment and 1 case died .In TB-CKD 4 , 16 cases declared cure, 11 cases treatment completed ,5 cases are loss to follow up and 5 cases died. In TB -CKD 5, 5 cases are declared cure, 4 cases are loss to follow up, and 1 case has change to DR-TB regimen and 2 cases died. Table 4, has chi square statistic: 13.3719, with p value 0.0997 (Co relation with outcome with CKD-TB case)

PTB = Pulmonary tuberculosis; EPTB = Extrapulmonary tuberculosis; LTFU= Loss to follow up case.

Discussion

Tuberculosis remains a significant public health challenge in India.

In this study(Table 1) the mean age of presentation is 55.3 ± 11.2 years similar to a study done by Pradhan et al.[7] where mean age is 50.92 ± 17.98(S.D). But in other similar studies done by Vikrant S[8] where mean age is 46.9 ± 16 years, Meghanathan A et al.[9], Gownathan A et al.[10] mean age is 40years and by Dodani et al. [11], the mean age is 34.68 ± 16.7(S.D) yrs. This study has a male to female ratio 0f 9.4:1, whereas in other similar studies, by Meghanathan A et al.[9] and Gownathan A et al.[10] the ratio is 3: 1; in Dodani et al.[11] it is 2.6 : 1. The discrepancy in our study may be due to low health seeking behaviour of tribal females. The mean BMI in this study is 17.6 ± 3.2 (S.D) kg/m2. Similar study done by Alemu A et al. [12] have 75.3% cases with normal BMI range (18.5- 24.9kg/m2).

The low BMI in our study may be due to poor nutrition and socio cultural factors. Cough (80.8%) is the most common symptom in this study, similar to a study done by Meghanathan A et al.[9] where cough (45.5%), is the predominant symptom . A study done by Pradhan R et al.[7] and Alemu A et al.[12] showed the m.c symptom is decreased appetite 85.7% and 89.5% respectively. Another study done by Dodani et al.[11] showed fever (53.7%) to be the most common symptom. In our study cough is most common because majority of the patients are pulmonary tuberculosis.

Table 2 of this study shows among the laboratory findings, anaemia is associated with TB-CKD which is statistically significant whereas in the study done by Pradhan et al.[7] found TB-CKD patients are more anaemic, but it is statistically insignificant.

Table 3 of this study has, bacteriologically confirmed cases by means of sputum AFB (46.2%) and CBNAAT/Truenat (50%). This finding is similar to a study done by Dodani et al. [11] where microbiological confirmed cases are 45.5%. Other studies done by Pradhan R et al. [7] shows bacteriologically confirmed cases are 12.3% similar to study by Alemu A et al.[12] where 10.5% cases are bacteriologically positive cases. Studies by Gownathan A et al.[10] and Meghanathan A et al.[9] shows 23.6% positive by sputum AFB and 3.6% cases are positive by gene expert testing. As maximum cases in our study is PTB, so there are more bacteriologically confirmed cases. In this study, chest imaging depicts 42.3% with infiltrations, 32.7% with cavitations, 11.53% with pleural effusion and 5.7% with consolidation with tree in bud. Similar study done by Meghanathan A et al. [9], shows consolidation is 23.6% and cavitation is 18.2%.

Table 4, in this study has 71.2% TB cases are associated with CKD 4. Similar studies done by Gownathan A et al.[10] and Meghanathan A et al.[9] showed maximum tuberculosis patients are in stage 5. Another study done by Pradhan R et al. [7] showed TB is more in stage 5 CKD. A study done by Alemu A et al. [12] shows TB is more in CKD stage 3 .This study shows 80.72% cases with PTB and 19.23% cases with EPTB similar to the study done by Pradhan R et al. [7] where PTB IS 69.1% and studies done by Meghanathan A et al.[9] and Gownathan A et al.[10] where incidence of PTB cases are 63.6%. In study done by Vikrant S [8] ,70 % cases are EPTB and by Xiao Jing et al. 41.4% cases are EPTB .The incidence of PTB is more in our study may be due to active Case finding under NTEP programme, along with increased molecular testing.

In this study, 40.38% declared cure, 25% treatment completed, 17% Loss to follow up case, 1.9% cases of change of regimen to DR-TB and death is in 15% cases. Study done by Vikrant S [8]93% completed treatment and 7% died. Study done by Meghanathan A et al. [9] treatment completed (50.9%); cured (32.7%); defaulter (5.5%) and treatment failure (1.8%). Study done by Gownathan A et al. [10] shows treatment completed (28%); cured (18%); defaulter (3%); treatment failed (1%). Study done by Dodani et al. [11] treatment success (80.7%); death (14.7%) and LTFU (4.6%).All the above studies including this study, studied the outcome at end of treatment. But a study done by Pradhan R et al. [7] found the outcome at end of two months of treatment completion i.e. Improved (59.2%); Death (28.6%); Loss to follow up (4%) and no improvement in 8.2%.

The p-value is greater than 0.05 but less than 0.10, indicating a borderline non-significant association between CKD stage and treatment outcome, in this study. This suggests there might be a trend, but the relationship is not statistically strong enough at the conventional 5% significance level. The limited sample size (n=52) may contribute to this lack of statistical power.

Conclusion

In this study, 52 cases of Tuberculosis with CKD were found in a single centre, at tertiary care hospital of Mayurbhanj district of Odisha in one year. This may be tip of the iceberg. So, this needs urgent vulnerability mapping, active case finding (ACF) and TB vulnerability reduction through TB preventive therapy specific to tribal area. This study highlights a high burden of undernutrition and advanced CKD among TB patients in tribal regions.

This study found association of pulmonary TB more than EPTB probably due to lack of awareness, limited diagnostic tool, poor health seeking behaviour. The tuberculosis cure rate were reasonably good with timely follow up and monitoring.

Limitation: Since the study was cross-sectional we could not calculate the incidence of tuberculosis in patients with CKD. Adherence to therapy could not be stringently verified, since the patients received modified ATT drug dosages, which again is a challenge under NTEP as drugs are in fixed dose combination form. The sample size of this study is low.

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