Biomedical and Biopharmaceutical Research
Abbreviation: Biomed. Biopharm. Res.
Volume: 09: Issue: 02 |Year: 2012
Page Number: 01-06

Comparasion of Clinical Bacteriological Radiological Profile and Treatment Outcome of Smokers and Non Smokers Suffering from Pulmonary Tuberculosis

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Article Received:05-05-2012

Article Accepted:22-06-2012

ABSTRACT

Background: Smoking is a major risk factor for pulmonary tuberculosis (TB), influencing disease severity, bacteriological burden, and treatment outcomes. This study compares the clinical, bacteriological, radiological profile, and treatment outcomes between smokers and non-smokers with TB.**Methods :**A hospital-based prospective study was conducted from September 2007 to March 2012, including 64 sputum-positive TB patients registered under RNTCP. Patients were categorized into smokers and non-smokers, and their sputum AFB grading, radiological severity, and treatment outcomes were analyzed. **Results:** Smokers (65%) had more severe disease than non-smokers (35%).Higher bacillary loads (3+) were more frequent in heavy smokers (>300 smoking index, 44.4%).Smokers had significantly more advanced radiological findings ($p<0.0001$), with higher rates of cavitary lesions (75%).Sputum conversion was lower in smokers (90%) compared to non-smokers (100%) ($p=0.0008$).Treatment success was lower in smokers (89.7%) vs. non-smokers (95.2%), decreasing with increasing smoking index.Lost to follow-up was higher in smokers (10.2%) vs. non-smokers (4.7%), highest in smoking index >300 (22.2%). **Conclusion:** Smoking is associated with worse clinical and radiological presentation, higher bacillary loads, delayed sputum conversion, and lower treatment success in TB patients. These findings highlight the need for integrating smoking cessation into TB management to improve outcomes.

Keywords: Pulmonary Tuberculosis, Smoking, Treatment Outcomes, Sputum Conversion, Radiological Severity

INTRODUCTION

Globally, tuberculosis (TB) remains a significant public health issue, causing approximately two million deaths annually. Each year, an estimated 8.8 million new TB cases emerge, posing a persistent challenge, particularly in developing nations[1,2,3]. In parallel, smoking is recognized as a major health risk, contributing to the mortality of one in ten adults[4]. The World Health Organization (WHO) has identified tobacco use as the second leading cause of death worldwide and one of the top ten risk factors affecting global health.[5,6]

Research indicates that both active and passive smoking elevate the risk of developing TB[7,8]. Several studies highlight a strong correlation between cigarette smoking and TB susceptibility. Meta-analyses suggest that smoking influences TB infection rates, disease progression[7,9], and overall mortality[10]. However, the precise impact of smoking on drug resistance patterns and clinical TB manifestations remains inconclusive. While some studies establish a significant relationship others fail to confirm any strong association[9-13]. Hence, further research is warranted to explore these connections more comprehensively.

This study aims to compare the clinical presentation and drug resistance patterns of TB patients based on their smoking status, distinguishing between non-smokers, former smokers, and passive smokers.

AIMS AND OBJECTIVES

This study was conducted to assess the association between smoking and pulmonary tuberculosis (TB) in patients from September 2007 to March 2012.

1. To determine the association between smoking and tuberculosis.
2. To evaluate the impact of smoking on treatment outcomes.

MATERIALS AND METHODS

*Study Design:*This was a hospital-based prospective study conducted from September 2007 to March 2012.

Sample Size :A total of 64 sputum-positive pulmonary TB patients were enrolled in the study based on inclusion and exclusion criteria. All patients were administered Category 1 Anti-Tuberculosis Therapy (CAT 1 ATT) under the Revised National Tuberculosis Control Program (RNTCP).

Inclusion Criteria:

1. Patients willing to participate in the study.
2. Adults ≥18 years of age with symptoms suggestive of tuberculosis (cough >2 weeks plus one or more symptoms such as night sweats, fever, or unintentional weight loss).

Exclusion Criteria

1. Presumptive extra-pulmonary tuberculosis.
2. Multi-drug resistant (MDR) tuberculosis.
3. Pregnant women.
4. Patients with HIV/AIDS.

Procedure

The study was conducted among 64 consecutive patients aged ≥18 years who were registered under RNTCP as pulmonary TB cases between September 2007 and March 2012.

- Sputum Examination: Two consecutive sputum smear samples were collected and examined for acid-fast bacilli (AFB) using the Auramine-Rhodamine staining technique at the start of treatment and at follow-ups, as per RNTCP recommendations.
- Treatment: All patients received Category 1 ATT under RNTCP.
- Grouping: Patients were categorized into smokers and non-smokers, and their clinical and radiological characteristics were evaluated separately.
- Sputum Grading: The AFB smear grading was performed according to World Health Organization (WHO) guidelines.
- Radiological Severity: Disease severity was assessed using the National Tuberculosis Association of the USA guidelines at presentation and at the end of treatment.
- Treatment Outcomes: Recorded as per RNTCP guidelines.
- At the time of enrollment, all patients underwent sputum microscopy and chest X-ray investigations.

OBSERVATIONSAND RESULTS

The study was conducted among 64 consecutive patients aged ≥18 years, who were registered cases of pulmonary tuberculosis (TB) under the Revised National Tuberculosis Control Program (RNTCP). All patients received Category 1 Anti-Tuberculosis Therapy (CAT 1 ATT). The majority of the patients were male (73%), while females accounted for 27%. Among males, the most commonly affected age group was 51–65 years, whereas in females, TB was most prevalent in the 18–30 years age group. Most patients presented with a bacillary load of 2+ (40%), followed by 1+ (26.6%) and 3+ (26.6%). Out of 60 patients, smokers accounted for 65%, while non-smokers comprised 35%. Most male patients were smokers (36), followed by females. The smoking index was highest in the 100-299 range (46.15%), followed by <100 (30.76%) and >300 (23.07%). The 100-299 smoking index was most commonly observed in the fifth decade of life, while >300 was more frequent in the sixth decade. Among males, the smoking index 100-299 was the most common, whereas in females, smoking index <100 was predominant.

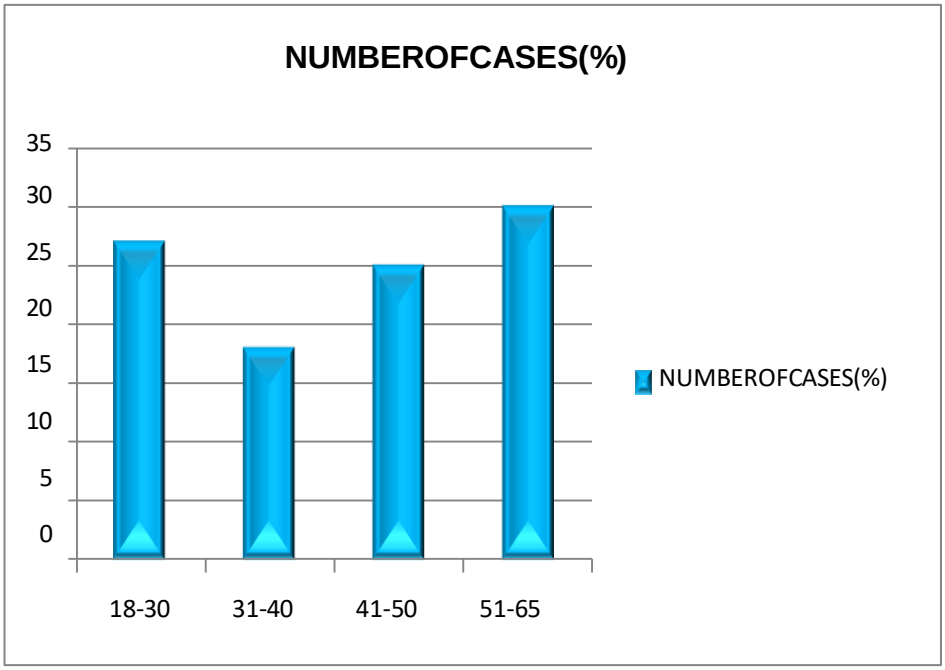
Regarding bacillary load with respect to smoking index, 3+ bacillary load was most commonly observed in smoking index >300, followed by <100 and 100-299. Radiological severity was significantly higher in smokers compared to non-smokers. Among smokers, moderately advanced lesions (51.2%) were the most common, followed by far-advanced disease (28.2%). Far-advanced lesions were most frequently seen in patients with a smoking index >300, followed by 100-299 and <100. Cavities were significantly more common in smokers (75%) than in non-smokers (25%).

Sputum conversion at the end of the intensive phase was 100% in non-smokers, while in smokers, it was 90% (p=0.0008). Among different smoking index categories, sputum conversion was highest in smoking index 100-299 (94.4%), followed by <100 (91.6%) and >300 (88.8%), suggesting that higher smoking indices were associated with delayed sputum clearance. Clearance of infiltrates was more frequently observed in smokers (95.2%) than in non-smokers (89.7%), whereas cavity clearance was higher in non-smokers (83.3%) compared to smokers (77.7%).

The treatment success rate was higher in non-smokers (95.2%) compared to smokers (89.7%). Among smokers, the highest treatment success rate was seen in smoking index <100 (100%), followed by 100-299 (88.8%) and >300 (77.7%), indicating that higher smoking exposure was associated with poorer treatment outcomes. The lost to follow-up rate was higher among smokers (10.2%) compared to non-smokers (4.7%) (p=0.164). Among smokers, those with a smoking index >300 had the highest lost to follow-up rate (22.2%), followed by 100-299 (11.1%), suggesting that heavier smokers were more likely to discontinue treatment.

1. Age-WiseDistributionof Patients:

AGE(YEARS)	NUMBEROFCASES	PERCENTAGE(%)
18-30	16	27
31-40	11	18
41-50	15	25
51-65	18	30
TOTAL	60	100



The highest numbers were recorded in 3rd, 5th and 6th decade of life. The maximum incidence of 18 (30%)casesbelongsto6thdecadeoflife,followedby 16 cases (27%) among 3rd decade and 15 cases(25%) among 5th decade of life.

2. Bacillaryloadwithrespect to smokingindexat presentation:

SMOKINGINDEX	SCANTY(%)	1+(%)	2+(%)	3+(%)
<100	8.3	8.3	33.3	50.0
100-299	11.1	38.8	33.3	16.6
>300	0	22.2	33.3	44.4

Bacillaryload3+wasseenmostcommonlywithsmokingindex<100(50%)followedby>300(44.4%).

3. RadiologicalSeverityinSmokersandNonSmokersat Presentation

CHESTXRAYFINDING	SMOKERS	NONSMOKERS
MINIMAL	8(20.5%)	16(76.1%)
MODERATLYADVANCED	20(51.2%)	3(14.2%)
FARADVANCED	11(28.2%)	2(9.5%)
TOTAL	39	21

Out of the 39 smokers, most common lesion s were moderately advanced (51.2%) followed byfar advanced (28.2%) (p value<0.0001).

4. SputumConversion attheendof IntensivePhase

	SPUTUMCONVERSIONTONEGATIVE	PERCENTAGE(%)
SMOKERS	35/39	90
NONSMOKERS	21/21	100

Sputumconversion in smokersis 90%and innon-smokers 100%(p value = 0.0008)

5. SputumConversion withrespecttosmokingindexattheendofIntensivePhase

SMOKINGINDEX	SPUTUMCONVERSIONTONEGATIVE	PERCENTAGE(%)
<100	11/12	91.6
100-300	17/18	94.4
>300	8/9	88.8

Sputumconversion wasmostcommonlyseen insmokingindex 100-299 (94.4%) followed by<100(91.6%).

6. TreatmentSuccessRateattheendofTreatmentwithrespecttoSmokingIndex

SMOKINGINDEX	TREATMENTSUCCESSRATE	PERCENTAGE(%)
<100	12/12	100
100-299	16/18	88.8
>300	7/8	77.7

Treatmentsuccess ratewas mostlyseenwithsmokingindex 100-299(88.8%) followed by>300(77.7%).

7. LosttofollowuprateattheendofTreatment withRespecttoSmokersandnonSmokers**:**

	LOSTTOFOLLOW-UPRATE	PERCENTAGE(%)
SMOKERS	4/39	10.2
NONSMOKERS	1/21	4.7

Lostto follow up ratein smokers was10.2%followedbynon-smokers 4.7%(p value = 0.164).

8. Losttofollowuprateattheendof TreatmentwithrespecttoSmokingIndex

SMOKINGINDEX	LOSTTOFOLLOW-UPRATE	PERCENTAGE(%)
<100	0	0
100-299	2/18	11.1
>300	2/9	22.2

DISCUSSION

The present study was conducted among thepatients attending to the Department of Pulmonary Medicine, Andhra Medical College, Government Hospital, Visakhapatnam for respiratory and communicable diseases. The study was conducted from September 2007 to March 2012, among 60 successive patients who were registered cases of pulmonary TB under the Revised National TB Control Programme (RNTCP) aged more than 18 years. This study aimed to assess the clinical, bacteriological, and radiological differences between smokers and non-smokers with pulmonary tuberculosis (TB), along with treatment outcomes.

Our findings demonstrate that smokers present with more severe disease, higher bacillary loads, and lower treatment success rates compared to non-smokers.

In our study, the highest TB incidence was observed in the 6th decade (30%), followed by the 3rd (27%) and 5th decades (25%). This differs slightly from Marjani et al.[1], where smokers with TB were found to be younger than non-smokers. However, Wang et al.[8] reported that smokers affected with TB were older than non-smokers, suggesting that age-related variations in TB prevalence may depend on regional and demographic factors.

Our results indicate that higher bacillary loads (3+) were most commonly observed in those with a smoking index <100 (50%) and >300 (44.4%). This suggests that even light smokers may exhibit high bacterial loads at presentation. Similarly, Marjani et al.[1] and Leung et al.[13] reported that smokers exhibited higher degrees of sputum smear positivity, reinforcing the idea that smoking impairs pulmonary immune defenses, thereby increasing bacillary loads and infectivity. Additionally, Chiang et al.[7] highlighted that smoking is linked with a higher risk of acquiring drug-resistant TB, though we did not assess drug resistance in our study.

Radiological severity was significantly higher in smokers than non-smokers ($p<0.0001$), with 51.2% of smokers showing moderately advanced disease and 28.2% presenting with far-advanced TB. In contrast, 76.1% of non-smokers had minimal disease. This aligns with Marjani et al.[1], who found that smokers were more likely to have extensive pulmonary involvement and cavitary lesions. Similar findings were reported by Masjedi et al.[15] and Leung et al.[13], where smokers had a significantly higher rate of cavitary TB, indicating greater disease burden and potential for transmission.

Our study showed a significantly lower sputum conversion rate in smokers (90%) compared to non-smokers (100%) ($p=0.0008$). Among smokers, conversion was lowest in those with a smoking index >300 (88.8%), reinforcing the notion that higher smoking intensity delays bacterial clearance. Marjani et al.[1] also reported that smokers exhibited slower sputum clearance, likely due to chronic lung damage and altered immune responses. Similarly, Wang et al.[8] and Bates et al.[9] found that smokers had prolonged bacterial positivity and delayed treatment response compared to non-smokers.

The treatment success rate in our study was highest among non-smokers (100%), followed by smokers with a smoking index <100 (100%), whereas those with a smoking index >300 had the lowest success rate (77.7%). These findings support the conclusions of Slama et al.[10] and Gajalakshmi et al.[11], who demonstrated that smoking negatively impacts TB treatment success and increases the likelihood of relapse and failure. The higher failure rates in heavy smokers (>300 index) suggest a dose-dependent effect of smoking on TB treatment outcomes.

The lost to follow-up rate was higher in smokers (10.2%) compared to non-smokers (4.7%), though the difference was not statistically significant (p=0.164). Within smokers, those with a smoking index >300 had the highest default rate (22.2%), highlighting the negative impact of heavy smoking on treatment adherence. Marjani et al.[1] also found that smokers had a higher default rate, which was supported by Altet-Gómez et al.[16]. Smoking is often associated with lower health awareness, socioeconomic barriers, and concurrent substance use, all of which contribute to higher treatment dropout rates.

Our findings highlight the urgent need for integrating smoking cessation strategies into TB treatment programs. As suggested by Marjani et al.[1], Wang et al.[8], and den Boon et al.[17], smoking cessation interventions may improve TB treatment outcomes, reduce disease severity, and lower infectivity. Patients, particularly those with a high smoking index (>300), should receive intensive counseling and adherence support to enhance treatment success.

CONCLUSION

In summary, our study confirms that smokers with TB exhibit more severe disease, higher bacillary loads, greater radiological severity, slower sputum conversion, and lower treatment success rates compared to non-smokers. Smoking is an independent risk factor for poor treatment outcomes of Tuberculosis. These effects are more pronounced in heavy smokers (>300 smoking index). These findings align with those of Marjani et al.[1], Chiang et al.[7], Wang et al.[8], Leung et al.[14], and others, reinforcing the negative impact of smoking on TB progression and treatment response. Given these observations, smoking cessation should be an integral part of TB control programs to improve patient outcomes and reduce disease transmission.

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